MATERNAL MORTALITY AND MATERNAL HEALTH SERVICE UTILIZATION IN EASTERN ETHIOPIA: THE CASE OF KERSA DISTRICT

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Reproductive Medicine

School of Medicine and Public Health

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October 2019

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By signing below, I confirm that Gezahegn Tesfaye Girma has contributed to the following published papers included in this thesis in the conception and design of the studies, designing methodology, developing research tool, data collection, carrying out statistical analysis of the data, interpretation of results, and write-up of the manuscripts.

1. Tesfaye G, Chojenta C, Loxton D, Semahegn A, and Smith R: Delayed initiation of Antenatal Care and Associated Factors in Ethiopia: A systematic review and meta-analysis. *Reproductive health, 2017; 14(150).*
2. Tesfaye G, Loxton D, Chojenta C, Assefa N, and Smith R: Magnitude, trends, and causes of maternal mortality among reproductive-aged women in Kersa Health and *Demographic Surveillance System, eastern Ethiopia. BMC Women's health, 2018; 18(198).*
3. Tesfaye G, Chojenta C, Smith R, and Loxton D: Application of the Andersen-Newman Model of Health Care Utilization to understand Antenatal Care use in Kersa District, eastern Ethiopia. *PLoS ONE, 2018; 13(12)*
4. Tesfaye G, Chojenta C, Smith R, and Loxton D: Magnitude and correlates of Postnatal Care utilization among reproductive-aged women in a rural district in eastern Ethiopia: a Cross-sectional study. *Midwifery, 2019; 70, 22-30*
5. Tesfaye G, Chojenta C, Smith R, and Loxton D: Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study. Accepted for publication in *Women and Birth, 2019*

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List of publications included as part of the thesis

Chapter 3

Tesfaye G, Chojenta C, Loxton D, Semahegn A, and Smith R: Delayed initiation of antenatal care and associated factors in Ethiopia: A systematic review and meta-analysis. Reproductive Health, 2017; 14(150).

Chapter 5

Tesfaye G, Loxton D, Chojenta C, Assefa N, and Smith R: Magnitude, trends, and causes of maternal mortality among reproductive-aged women in Kersa Health and Demographic Surveillance System, eastern Ethiopia. BMC Women's Health, 2018; 18(198).

Chapter 6

Tesfaye G, Chojenta C, Smith R, and Loxton D: Application of the Andersen-Newman Model of Health Care Utilization to understand antenatal care use in Kersa District, eastern Ethiopia. PLoS ONE, 2018; 13(12)

Chapter 8

Tesfaye G, Chojenta C, Smith R, and Loxton D: Magnitude and correlates of postnatal care utilization among reproductive-aged women in a rural district in eastern Ethiopia: a cross-sectional study. Midwifery, 2019; 70, 22-30

Chapter 9

Tesfaye G, Chojenta C, Smith R, and Loxton D: Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study. Accepted for publication in *Women and Birth, 2019*

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List of papers submitted for publication

Chapter 7: Predisposing, enabling, and need factors associated with skilled delivery care utilization among reproductive-aged women in Kersa district, eastern Ethiopia. *Submitted to Reproductive Health and is currently under review.*

Acknowledgments

I gratefully acknowledge the University of Newcastle, Australia, for providing me with the opportunity to study my PhD through the International Postgraduate Research scholarship, and thanks to the Deputy Vice-Chancellor (Research and Innovation) for partially supporting the research. I would like to sincerely thank my supervisors Professor Deborah Loxton, Dr Catherine Chojenta, and Laureate Professor Roger Smith for all the dedicated support, continuous professional guidance, and encouragement. You have all been tremendous mentors throughout my studies. My PhD undertaking has been a truly life-changing experience for me, and it would not have been possible to realize this without the help and directions from my supervisors. I feel extremely lucky, and it was very fantastic to have had the opportunity to study my PhD under your supervision.

Deb, you opened up the opportunity to join the University of Newcastle, an internationally renowned institution in which I'm very proud to be a postgraduate student. You were very positive and welcoming the first time I requested your supervision as an international student via email. I remember how happy I was when you accepted my supervision request. I understand that it could be difficult to accept a supervision request from someone whom you do not know in person. But you were optimistic about me and accepted my supervision request without hesitation, and thank you very much for believing in me. I also can't thank you enough for your patience and continuous motivation to improve my research skills throughout my studies. Thank you, Deb, for allowing me to grow as a researcher along the way in my PhD career. Cath, I would like to thank you for your insightful advice, invaluable comments, and encouragement at many stages in the course of this research project, which benefited to improve all aspects of the thesis. You are always supportive of my work and motivate me to work more which gave me strength throughout my study. You are always there to assist me in any aspect of the research project with no time and place restrictions. Your positive outlook and confidence in my research inspired me a lot and gave me more courage. Roger, you have been very enthusiastic about my research, and thank you for unreserved guidance and inspiration. I appreciated your continuous follow up on the research project and for all the insightful thoughts that you added starting from the inception of the project to the final thesis write-up. I learned a lot from your way of thinking, and you have positively influenced me on how to view and gradually approach the target when facing a new research topic. Your

vision and passion for research have urged me a lot during my PhD candidature.

I also would like to thank Kersa Health and Demographic Surveillance System coordinating office, Ethiopia, for their permission to access and extract the secondary data for the first study. This PhD study would not have been possible without the cooperation and support extended by the research assistants, community members, and local administrators in the study district. I want to extend my deep appreciation to the moderators, interviewers and the supervisor whose excellent work during data collection has made an invaluable contribution towards my PhD. I am also indebted to all study participants without whom this research would have been impossible to reach this level. The participants' patience during the data collection; while undertaking many focus group discussions, and also during the long hour household surveys is very much appreciated. I greatly appreciate the very welcoming local community and villagers in the study district who helped me feel comfortable throughout the survey in the fieldwork, and you made my field stay very unforgettable and easy. Our field car driver, village-level facilitators, local coordinators and Health Extension Workers also deserve my heartfelt thanks.

I wish to extend my appreciation to Dr Ryan O'Neill for your language revisions, including proofreading of the final thesis draft. Your careful editing enormously contributed to the production of this thesis. Many thanks to all staff and my fellow students at RCGHA and MBRC for providing me with the moral and emotional support during my study; your friendship and warmth made me feel comfortable and helped me keep things in perspective. Of course, I am thankful to Mr. Ryan Tuckerman for your enormous assistance for any issues related to IT during my candidature.

I also would like to thank my family. I am short of words to express my gratitude to my beloved mother. Mom, thank you very much for the sacrifices that you have made for me since my childhood. Your prayers are what keeps me strong throughout my studies. Thanks a lot for your unconditional love and consistent support throughout my life. I would also thank my father, sisters, and brothers; your encouragement cheered me up during the difficult times. Finally, I wholeheartedly thank Almighty God and the Holy Virgin Mary, for letting me finish my study with great strength. I have experienced your guidance in my daily life. I will keep on trusting you for my future life.

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Acronym and abbreviations

ANC: Antenatal Care

AOR: Adjusted Odds Ratio

CI: Confidence Interval

COR: Crude Odds Ratio

CSA: Central Statistical Agency

DEFF: Design Effect

GNI: Gross National Income

HDSS: Health Demographic Surveillance Survey

MDG: Millennium Development Goal

MMR: Maternal Mortality Ratio

Mmrate: Maternal Mortality Rate

MPH: Master of Public Health

OR: Odds Ratio

PNC: Postnatal Care

PRISMA-P: Preferred Reporting Items for Systematic Reviews and Meta-analyses Protocols

ICD: International Code of Diseases

SDG: Sustainable Development Goal

SPSS: Statistical Package for Social Sciences

USD: United States Dollars

WHO: World Health Organization

Abstract

Background: In Ethiopia, the maternal mortality ratio is among the highest in the world. The high burden of maternal mortality is associated with the non-use of maternal health services. Although there have been notable improvements in the uptake of maternal health services, the rate remains unacceptably low. The purpose of this thesis is to synthesize existing literature on delayed antenatal care use in Ethiopia, and to investigate maternal mortality and maternal health service utilization at the community level in eastern Ethiopia.

Methods: In order to determine the magnitude and predictors of delayed initiation of antenatal care, systematic review and meta-analyses were conducted. To explore the magnitude, trends, and causes of maternal mortality, a secondary surveillance data analysis was performed. To examine the level of, and factors associated with maternal health service utilization, a community survey was conducted. The community survey involved both quantitative and qualitative studies. For the quantitative study, a total of 1320 eligible women were recruited to complete an interviewer-administered house-to-house survey. Bivariate and multivariate logistic regression analyses were carried out to measure associations. For the qualitative study, thirteen focus group discussions were conducted with a total of eighty-eight participants to assess delaying factors for maternal health service utilization. The qualitative data were imported into NVIVO version 11 and analyzed thematically.

Results: The systematic review and meta-analyses show that the pooled prevalence of delayed antenatal care in Ethiopia was 64% (95% CI: 57%, 70%). The secondary data analysis reveals that the maternal mortality ratio from 2008 to 2014 was 324 per 100,000 live births (95% CI: 256, 384). The most common direct cause of maternal death was postpartum haemorrhage, followed by hypertensive disorders of pregnancy. The secondary data analysis further indicates that only 26% of the deceased mothers had attended at least one antenatal care visit. The community survey findings demonstrate that 53.6%, 30.8%, and 7.3% of women attended antenatal, skilled delivery, and postnatal care for the index child, respectively. Best friend's use of maternal care, wealth index, husband's attitude towards care, and awareness of pregnancy complications were strong predictors of antenatal care utilization. Presence of an educated family member, receipt of maternal health education, prior use of skilled delivery care, best friend's use of maternal care, place of residence, pregnancy intention, and use of antenatal care were associated with skilled delivery care attendance. Similarly, receipt of maternal health education, best friend's use of maternal care, living in the female-headed household, and experience of postpartum complications predicted postnatal care utilization.

The qualitative study identified a range of contextual delaying factors for maternal health service utilization. These delaying factors were generally linked to restrictive socio-cultural practices, the poor social status of women, and underdeveloped community and health infrastructures.

Conclusion: The magnitude of maternal mortality remains high in Ethiopia. The direct causes of maternal mortality include haemorrhage and hypertension, both of which can be prevented and treated using maternal health services. Yet, the uptake of maternal health services remains low, and, as a result, maternal mortality remains high. The current study demonstrates that education, best friend's use of care, receiving education on maternal health, women's social and economic empowerment, husband's involvement, quality of maternal care, and Health Extension Workers' home visits can increase service use and therefore decrease maternal mortality. Context-specific interventions should focus on targeting these factors to reduce maternal mortality in the future.

Chapter 1

General introduction

1.1 Introduction

Across the globe, the deaths of reproductive-aged women, particularly during the natural and life-enhancing process of pregnancy or childbirth, is one of the greatest preventable health burdens of humankind (1). No woman should lose her life while giving life. The vast majority of maternal deaths can be prevented by timely availability and proper utilization of maternity care (2, 3). Yet, every day in 2015, an estimated 830 women died due to pregnancy and childbirth-related causes worldwide (4); nearly all of these deaths occurred in developing countries. Despite only constituting a little over 1% of the world's population, in that same year, Ethiopia contributed to more than 4% of the world's maternal mortality burden (5, 6). The focus of this research is to systematically review the existing literature on antenatal care initiation patterns in Ethiopia; and to investigate maternal mortality and maternal health service utilization at the community level in eastern Ethiopia. This chapter presents an introduction to, trends in, causes of, and contributing factors for maternal mortality, maternal health in Ethiopia, relevant facts about the population and culture of Ethiopia as a country, and the conceptual models used in the thesis. In this thesis, 'developing countries' refers to those with a Gross National Income (GNI) per capita which falls under the low income (less than $1035) and middle income ($1035 to $12,616) ranges, and 'developed countries' are those whose GNI falls within the high income (more than $12,616) category (7).

1.1.1 Maternal mortality

As defined by the WHO, maternal death refers to "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes" (8). Globally, an estimated 303,000 maternal

deaths occurred in 2015. Developing countries accounted for approximately 99% of these deaths; sub-Saharan Africa alone accounted for roughly 67% of deaths (5). These figures highlight the huge disparity in maternal health outcomes between rich and poor regions of the world. The estimated adult lifetime risk of maternal mortality in women from sub-Saharan Africa was the highest at 1 in 39, in contrast to 1 in 130 in Oceania, 1 in 160 in Southern Asia, 1 in 290 in South-eastern Asia and 1 in 3800 among women in developed countries (9). In Ethiopia, the lifetime risk of maternal death was 1 in 52 (10).

In 2015, an estimated 13,000 maternal deaths occurred in Ethiopia (5), which places the country amongst the nations with the highest burden of maternal mortality in sub-Saharan Africa. Ethiopia was among the ten countries that contributed to 58% of the global maternal deaths in 2013 (10). Maternal mortality is often said to have been the 'tip of the iceberg' as the burden of maternal morbidities are left hidden (11). For every woman in less developed countries who dies due to pregnancy and related causes, there are several women who suffer from near-miss events, long-term morbidities, chronic diseases and maternal disabilities that affect women for the rest of their lives (11, 12). Maternal mortality has potential demographic, socio-economic and psychological repercussions for children, families and households, communities, and society at large (13, 14). It is the purpose of this thesis to systematically review existing literature on antenatal care initiation in Ethiopia; and to investigate maternal mortality and the patterns of maternal health service utilization at the community level in eastern Ethiopia with the aim of developing and informing locally applicable and practical strategies to reduce the burden of maternal deaths.

1.1.2 Trends in maternal mortality

In the year 2000, the international community made a historic commitment to achieve eight Millennium Development Goals (MDGs). These eight MDGs signify a globally united front with international political support (15). Particularly, MDG 5 called for an improvement in maternal health, thereby reducing the maternal mortality ratio (number of maternal deaths per 100,000 live births) by 75% in 2015 from its 1990 level. Worldwide the Maternal Mortality Ratio (MMR) declined from 385 in 1990 to 216 in 2015, representing almost a 43.9% reduction, a figure which while an improvement, still remains

below the set goal. Organized by region, the smallest decline was observed in Western Asia (43%) and sub-Saharan Africa (45%) with the greatest decline occurring in Eastern Asia (72%) and Southern Asia (67%) (4, 5).

In addition to the variation in the reduction of MMR between different regions, where the maternal mortality ratio in the developing regions is 14 times higher than the developed regions (16); there are also variations between countries within these regions. For instance, in sub-Saharan African countries, the least progress was observed in Sierra Leone with a maternal mortality ratio of 1360 per 100,000 live births, whereas the highest decline occurred in Cape Verde with an MMR of 42 per 100,000 live births in 2015 (5). According to WHO estimates (5), even though the magnitude of the MMR in Ethiopia was high, the level has shown a steady decline from 1250 in 1990 to 352 in 2015 (Figure 1.1). However, the country was unable to meet the target of reducing the MMR to 267/100,000 live births by 2015 (17).

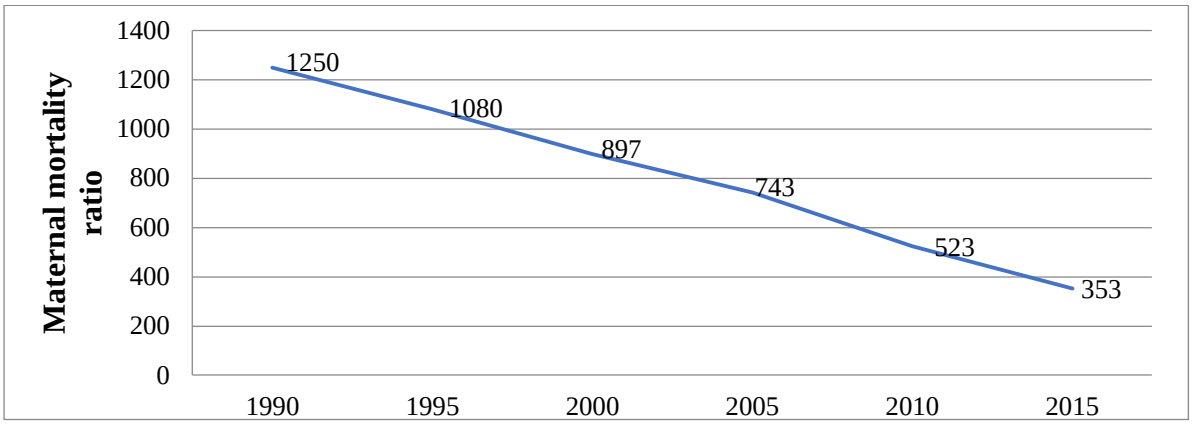

Figure 1.1. Maternal mortality trends in Ethiopia from 1990-2015 (5)

Despite the achievements gained so far, ending preventable maternal mortality remains an unfinished agenda, and one of the world's most critical public health challenges. The year 2015 marked the end of the allotted time frame for MDGs and the beginning of Sustainable Development Goals (SDGs). The intention then became reducing the global MMR to less than 70 per 100,000 live births by 2030 and ensuring no country would have a MMR over 140 per 100,000 live births (3). In order to accomplish this, the global MMR would need to decrease by approximately 7.5% per year between 2016 and 2030, a much faster decline than the mean 2.3% annual reduction rate observed in the years 1990 and 2015 (3, 5, 18).

Although a reduction in MMR across all global regions has been observed, there is still a huge disparity between developed and developing countries. The disparity in the decline of MMR between different regions; and countries within each region; was partly linked to existing inequalities in the availability and utilization of maternal health services (4). This link reflected by evidence in sub-Saharan Africa, which showed that in all countries that recorded a significant reduction in maternal mortality, there was a corresponding gradual increase in maternal health service utilization (19).

1.1.3 Causes of maternal mortality

1.1.3.1 Direct causes

Direct causes of maternal death are those that are attributable to complications of pregnancy or birth (20). Worldwide, the major direct causes of maternal deaths in 2010 were estimated to have been haemorrhage (23%), hypertensive disorders (18%), abortion (15%), sepsis (9%), obstructed labour (4%) and 'other' direct causes (10%) (21). According to the WHO (20), worldwide, around 73% of the maternal deaths that occurred from 2003 to 2009 were due to direct causes, of which more than a quarter were due to hemorrhage, followed by eclampsia and sepsis. The specific direct causes of maternal deaths varied in different regions of the world. In a systematic review conducted by the WHO, it was shown that hemorrhage was the most common cause of maternal death in Africa and Asia; and hypertensive disorders of pregnancy were the leading causes of death in Latin America and the Caribbean (22). The study consequently concluded that hemorrhage and hypertensive disorders of pregnancy were the major causes of maternal mortality in developing nations; compared to cesarean section and anesthesia complications, which were the most common cause of maternal death in developed countries. The worldwide distribution of maternal morbidities was dominated by two regions (sub-Saharan Africa and South Asia), which accounted for more than 80% of the world's maternal mortality burden. A higher percentage of maternal deaths (500 deaths per 100,000 live births) in sub-Saharan Africa and 300 deaths per 100,000 live births in South Asia occurred due to the three most prevalent direct causes of maternal death (hemorrhage, preeclampsia, and sepsis) (22, 23).

Those countries with a pre-existing quality health service delivery system registered a remarkable reduction in the proportion of maternal deaths that were caused by hemorrhage and sepsis (22). Hemorrhage is recognized as one of the major causes of maternal death in sub-Saharan Africa (23) with women from this region accounting for nearly 50% of the 166,000 maternal deaths from hemorrhage worldwide in 2006.

A systematic review of eighteen facility-based studies showed that the major direct causes of maternal mortality in Ethiopia between the years 2000-2012 were obstructed labour (36%), hemorrhage (22%), eclampsia (19%) and sepsis (13%). The review acknowledged that unsafe abortion remained the prominent cause of maternal death in the decades before the year 2000 (24). The liberalization of abortion laws and expanded provision of safe abortion services in the country post-2000 saw this mortality rates drop dramatically (24). In Africa, the majority of maternal deaths occurred outside of health facilities (25) and were due to a lack of appropriate health services, coupled with a high incidence of women delaying leaving home to access these services. This indicates the efficacy of maternal health services and emergency care in the case of obstetric complications is time-sensitive (2).

1.1.3.2 Indirect causes

Indirect causes of maternal death are those that result from pre-existing health conditions or illness developing during pregnancy, not directly caused by the pregnancy, but aggravated by it (20). Nearly a quarter of all global maternal deaths resulted from indirect causes in 2010 (21). These deaths were attributable to the confounding effects of pregnancy on pre-existing maternal medical conditions such as HIV, malaria, tuberculosis, anemia, heart disease, and other existing medical conditions (20, 26). HIV/AIDS was a major indirect cause of maternal death in countries where HIV prevalence was high (20). A systematic review of maternal deaths in Ethiopia (27) found that HIV/AIDS alone caused between 3% and 4% of all maternal deaths. The review added that malaria caused between 0.05% and 23.3% of all maternal deaths. Another study based on retrospective data from Tanzanian health and demographic centre found that deaths from HIV/AIDS combined with fatalities from tuberculosis accounted for 39% of all deaths among

reproductive-aged women. Malaria (11%), anemia (8%), and acute febrile illness (5%) accounted for the other indirect maternal deaths in Tanzania (28). In Nigeria, the most common indirect causes of maternal death were hepatitis (19%), anesthetic complications (15%), anemia during pregnancy (15%), meningitis (12%), HIV/AIDS (11%) and renal failure (8.0%) (29).

1.1.3.3 Incidental or accidental causes

Women's deaths due to incidental or accidental causes during the pregnancy, delivery or postnatal period have not been considered in the traditional measures of maternal mortality (8, 30, 31). However, some evidence suggests that injury-related deaths could be responsible for a high portion of maternal deaths. For instance, in a facility-based retrospective study in Mozambique, researchers identified a combination of violence (suicide, homicide), accidents, and injuries as the fourth leading cause of maternal deaths (32). A study in Mexico also showed that 15% of all pregnancy-related deaths were due to violence (30). Similarly, in a Tanzanian study, injury alone accounted for 2% of all the maternal deaths during a five-year study period (28). Even though there is scant research with regards to the impact of violence against pregnant women and new mothers in developing countries, available data (31) suggests this violence is a health burden in many developing countries, necessitating further investigation. Nonetheless, violence is currently excluded as a cause of maternal death in official maternal mortality statistics (30, 31).

Many of the direct and indirect causes of maternal death are preventable. The specific clinical causes of maternal deaths are linked to poor availability and utilization of existing maternal health services. The interventions that have the potential to avoid deaths due to the major causes of maternal mortality have been well established (26, 33, 34), and could be accessible to those who most need them even in resource-poor setups (35). It is important to examine the status of maternal health service utilization and avoidance to suggest the development of socially contextualized interventions that could be implemented in a range of cultural settings.

1.1.4 Contributing factors for maternal mortality

Although taking steps to curb maternal morbidity and mortality, developing countries are burdened with the challenge of addressing these problems with very limited personnel and material resources (36). Ethiopia has one of the world's highest rates of maternal deaths and disabilities. More than 50% of all maternal deaths occurred in only six countries, including Ethiopia (the others being India, Nigeria, Pakistan, Afghanistan, and the Democratic Republic of Congo) (36, 37). The higher burden of maternal mortality is an indicator of poor socio-economic development of a country; and an inadequate quality of obstetric care due to a failing health system, which contributes to diminished maternal health status (38).

The highest number of maternal deaths have been reported in countries where women are least likely to deliver their babies with the assistance of a skilled health worker (2); and where women are less likely to take up antenatal care (ANC) services during their pregnancy (39). Indeed, many countries have successfully reduced the rate of maternal mortality by increasing the number of births assisted by skilled health workers (23, 40). A skilled health worker is defined as *"an accredited health professional such as a midwife, doctor or nurse who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth, and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns"* (34). In addition to using accessible maternal health services, women's health during pregnancy and post-delivery is determined by an interplay of various factors. These might be related to socio-cultural and economic factors, such as economic dependency, educational status, age at marriage, rural residence, social status of women, and gender discrimination (39, 41, 42).

In many countries, it is the women who live in rural areas (4, 39), at the lowest wealth quintile (2, 4), and with a lower level of education (2, 39) who would be most susceptible to maternal mortality. High maternal mortality levels are also an indication of deep-rooted gender imbalances that hinder women's ability to exercise decisions about household resources, which in turn could limit women's ability to get social support and access to maternal health services (43). In Ethiopia, the prevalence of Female Genital Mutilation is high at 65% (44). Societal knowledge about the practice of Female Genital Mutilation is very poor, and most community members perceive it as a 'normal procedure' that is

considered inherent to the culture (45). However, the practice has short and long term physical consequences that could affect women's reproductive health outcomes (46).

1.1.5 Maternal health in Ethiopia

Most commonly, maternal health is referred to as the health of a mother during the pregnancy, delivery, and the post-natal period. Even though this maternity period is usually expected to be fulfilling for mothers, it is, sadly, a time of suffering, illness, and death for many women around the globe, but especially for those in developing countries (47). In Ethiopia, although the majority of maternal deaths could be prevented through utilizing appropriate reproductive health services before, during, and after pregnancy, only a quarter of all deliveries are currently attended by skilled health workers (17). In Ethiopia, reducing maternal mortality and improving maternal health is one of the key priority health programs in the national Health Sector Transformation Plan (48). One aim of the Health Sector Transformation Plan regarding maternal care is to increase the skilled delivery care utilization rate to 95%. Expanded provision of maternal health services is the best strategy to reduce maternal morbidity and mortality, particularly in places where the general health status of women is low (49). Implementing maternal health services provides opportunities for delivering health information and services that can significantly promote the health of women and their infants.

The implementation of the WHO Safe Motherhood Program (including the provision of appropriate antenatal, delivery and postnatal care services) is estimated to avert 80% of maternal deaths by ensuring women go safely through the pregnancy, birth and postnatal period (12, 50, 51). In Ethiopia, although there is improved availability of maternal health services over the past decade, the magnitude of maternal mortality remains high. In Ethiopia, 36 women died every day due to pregnancy and childbirth-related causes in 2015 (5). Inspired by the SDGs, the Ethiopian government plans to reduce the MMR to 199 deaths per 100,000 live births by the year 2025 (48). The strategies to achieve the reduction of MMR to the intended level include improving access to and utilization of high impact maternal health interventions such as antenatal, skilled delivery, and postnatal care.

At the national level, the uptake of antenatal, skilled delivery, and postnatal care has shown significant but unsatisfactory improvement in the past decades and reached 62%, 28%, and 17% respectively in 2016 (44, 52-54) (Figure 1.2). If the present low rates of maternal health service utilization remain static, the country may continue to lag below the desired level of MMR reduction. In addition to the socio-economic inequalities in rates of maternal health service use in Ethiopia, there exist huge disparities by region, geographical area and socio-cultural group (44, 55, 56). For instance, the rate of skilled delivery care utilization ranges from 96.8% in Addis Ababa to 16.4% in Afar region, and 80.1% in urban areas to 21.2% in rural areas (44). It is important to understand these regional variations in the uptake of maternal health services to assess the suitability of innovative strategies to reduce MMR against the geographic, cultural, and demographic features of each region. One aim of the present study is to understand the context-specific geographic, demographic, and cultural factors responsible for differences in the uptake of maternal health services, in order to inform the development of appropriate programs and policies.

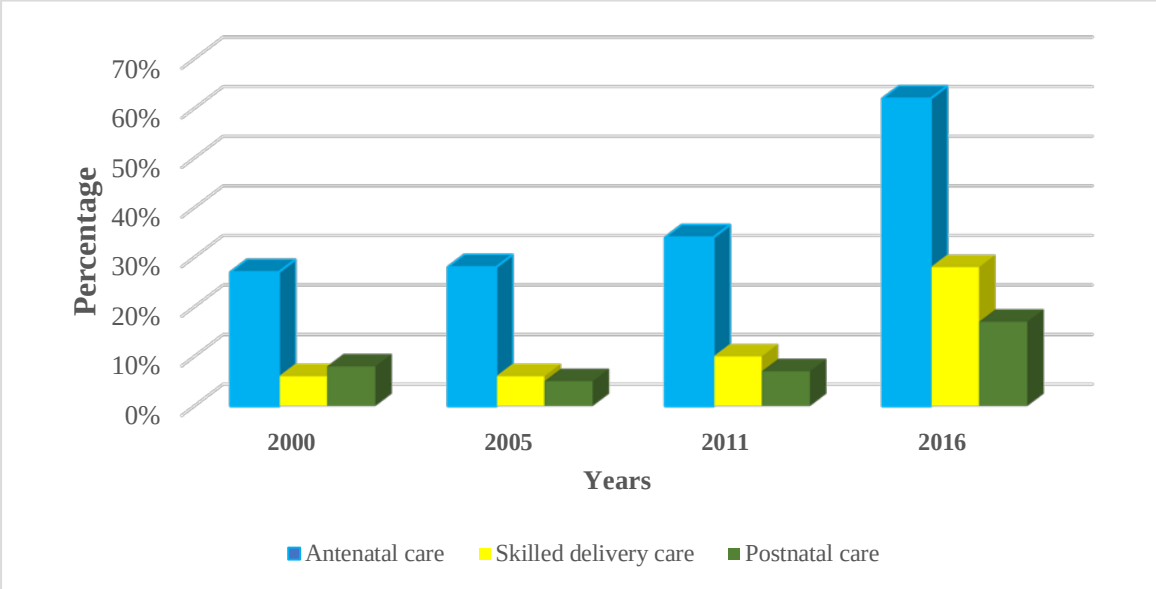

Figure 1.2. Trends of maternal health service utilization from 2000-2016 in Ethiopia

1.2 Ethiopia: Country profile

1.2.1 Geography

Ethiopia is the tenth largest country in Africa, covering a land area of 1,104,300 Km^2. It is a landlocked nation bordered to the north by Eritrea, to the east by Djibouti and Somalia, to the south by Kenya, and to the west by Sudan (Figure 1.3) (https://commons.wikimedia.org/wiki/File:Ethiopia_regions_map.png). Ethiopia is a country of great geographical diversity; there are mountains ranging up to 4,550m above sea level and a depression 110m below sea level (17). The country's topography is largely characterized by a range of landforms and rugged terrain (57). The climate is broadly classified into three zones based on topography: the "*Qolla*" or hot lowland which is located up to 1,500 m above sea level; the "*Wayna Dega*" with a medium temperature situated between 1,500-2,400 m above sea level; and the "*Dega*" or cool temperate highlands which sit 2,400 m above sea level (53).

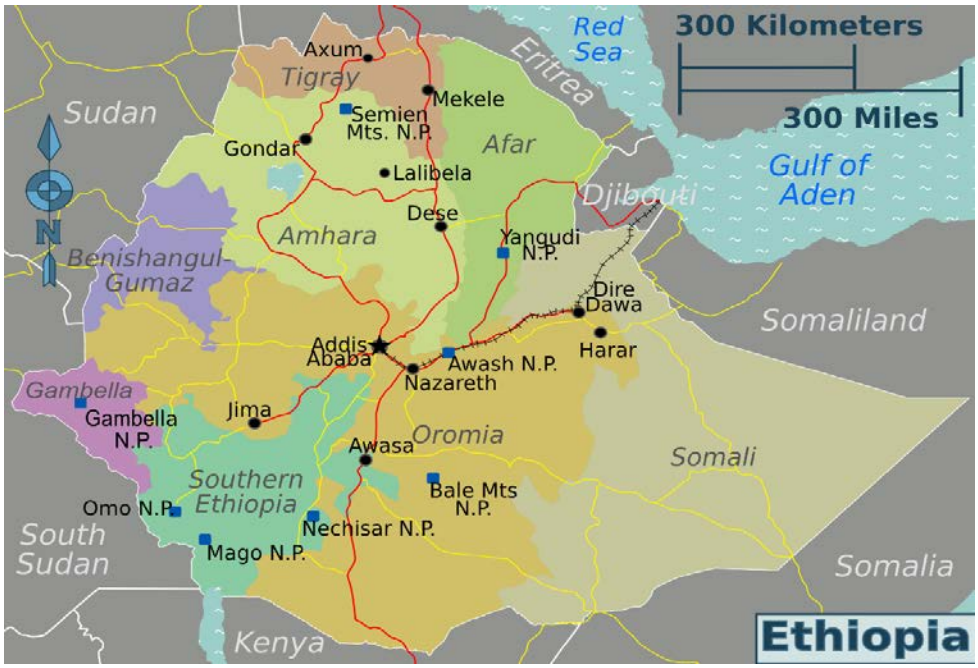

Figure 1.3. Location and borders of Ethiopia (Source (58))

The capital city of Ethiopia is Addis Ababa, which boasts a population of 4.4 million (2018 estimate) (57). Administratively, Ethiopia is a Federal Democratic Republic consisting of nine regional states and two independently administered cities. The nation

contains 817 districts (59), which are basic decentralized administrative units consisting of sub-districts called "*kebeles*" (*the lowest level of administrative unit in Ethiopia consisting of around 1000 households, or an approximate population of 3000 to 5000*) (17). Oromia is one of the nine regional states in Ethiopia with a total population of 35 million, covering an area of 286,612 square kilometres, making it the largest state in population and size in the country (60). Oromia region has a total of 180 districts. Kersa district, where the study population for the present study was sourced, is one of the districts in the region located in the eastern part of Ethiopia.

1.2.2 Traditions and culture

Ethiopia has a rich culture with diverse traditions, religions, and customs (61). It is a multiethnic and multilingual country containing more than 70 ethnic groups speaking more than 80 languages (62). In Ethiopia pregnancy is usually not discussed openly until it becomes physically noticeable (63). During delivery at home, women are helped by their mothers and other female family members, friends, Traditional Birth Attendants, and neighbours (64). Traditional Birth Attendants are "*traditional attendants, independent of the health system, non-formally trained to proficiency in the skills necessary to manage or refer obstetric complication and are sole community-based providers of care during pregnancy, childbirth and the postnatal period for many women*" (34, 38). In Ethiopia, if the pregnancy is the woman's first, she will go to her parents' home in the eighth month to relax and prepare for the birth (65). There is a belief that a mother can be exposed to the 'evil eye' if she leaves home within ten days of childbirth (64). It is not culturally acceptable for a woman to be pregnant and unmarried because it will bring shame to the family (65, 66), and therefore women may resort to unsafe abortion. Though there are regional variations in prevalence (44), harmful traditional practices such as female genital mutilation, early marriage, and abduction are common in Ethiopia (52), all of which highlight the status of women and their vulnerability during pregnancy and birth.

1.2.3 Country demographic and health profile

Ethiopia is the second-most populous country in Africa, having a population of more than

100 million, with 81% of its population living in rural areas (67). The majority of the Ethiopian population is young with 43.2% below the age of 15 years (68); with a male to female ratio of 0.99. In Ethiopia, the median age at first birth is 25-29. The literacy rate of females (41.1%) is lower than that of males (57.2%) (57). About 23.4% of women are in the *reproductive age category*, defined as women whose age is between 15-49 years and able to give birth. Ethiopia is one of the sub-Saharan African countries with the worst health indicators. In Ethiopia, the total health expenditure per capita is $73 and the percentage of health expenditure from the total Gross Domestic Product was 4.6% in 2014. With a total fertility rate of 4.6 children per woman and a median birth interval of 34.5 months, the contraceptive prevalence rate reached 36% in 2016 (44). The life expectancy in Ethiopia was 65 (67 female and 63 male) in 2015 (69). In terms of major child health indicators, Ethiopia has an infant mortality rate of 48 deaths per 1,000 live births, under-five mortality of 67 deaths per 1,000 live births, and a neonatal mortality rate of 29 deaths per 1,000 live births (44). In 2014, the primary health care service coverage of the country had reached around 93% (59). Though health service coverage is improving through time, the overall performance in terms of uptake was not the same among different health sector programs (70).

The Ethiopian health care delivery system is a three-tier system with primary, secondary, and tertiary health care levels (48). At the base level is the Primary Health Care Unit, the district level health delivery system which consists of a primary hospital serving up to an average of 100,000 people; a health centre (serving up to a population of 25,000); plus five satellite health posts which serve up to 5,000 people. The second tier contains the general hospital, which serves a population up to 1.5 million. The third level features the specialized hospital covering an average of five million people (Figure 1.4). Full packages of maternal health services are provided from the health centre level upwards, with an ever-increasing capacity of facilities in terms of human and health resources capable of responding to an obstetric emergency.

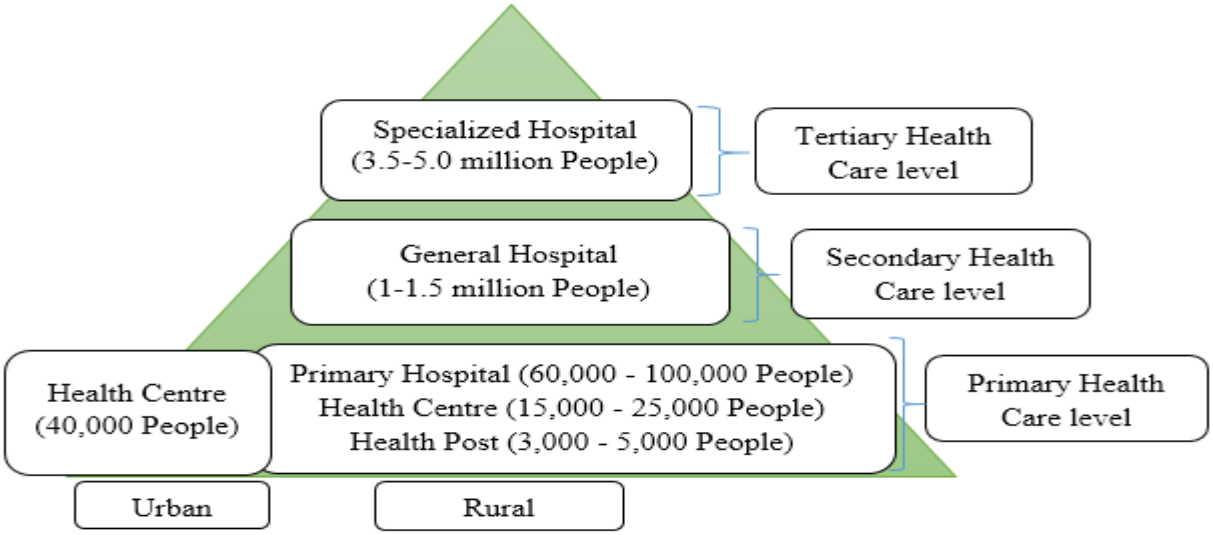

Figure 1.4. The Ethiopian three-tier health care delivery system (48)

Implementation of the universal Primary Health Care approach is a core strategy of the Ethiopian national health policy, which focuses on disease prevention and health promotion (17). As part of the effort to accelerate the uptake of basic Primary Health Care services in Ethiopia, the government established a community-based Health Extension Program, which decentralized health service delivery to the village level through the provision of community-based health services, in 2003. This Program facilitated the training of around 30,000 women who had completed a 10th or 12th-grade education. These salaried Health Extension Workers were given one year of training to enable them to primarily provide preventive and promotive health services packages at the community level (59). The Health Extension Workers are primarily based at health posts (which are constructed in almost all *kebeles* country-wide) to provide community health services through the implementation of the sixteen Health Extension packages (71). The Health Extension package has four major components; family health, health education and communication, hygiene and environmental sanitation, and disease prevention and control. The Health Extension Workers provide maternal health services under the umbrella of the family health program. Health Extension Workers are also responsible for the training of the Women's Development Army leaders on the Health Extension packages, and the leaders then pass their knowledge onto other families in their network (72). The Women's Development Army is made up of a group of five households that are led by one person from a model family who advises them on matters relating to health and influences other women to practice a healthy lifestyle and adopt Health Extension packages (73). Thus, the Health Extension Program, supported by a strong Women's Development Army network

at the community level, could significantly improve community and health system linkage, thereby increasing access to and utilization of health services (48). However, despite these initiatives, the factors that drive women to take up services and those that prevent services use have not been explored in detail.

1.3 Conceptual models underpinning this thesis

In this thesis, two theoretical frameworks that have been widely used in the study of health care utilization have been applied to attempt to determine the factors that motivate women to utilize maternal health services in Ethiopia. The first is a conceptual model informed by the Andersen-Newman behavioral model of health care utilization (74, 75), which is used in the selection and examination of the variables associated with maternal health service utilization in the quantitative survey. The second is the Three Delays model, which is used to streamline the factors that contribute to delays in maternal health service utilization in the qualitative study.

1.3.1 Andersen-Newman behavioral model

The Andersen-Newman behavioral model of health care utilization (74, 75) has been adapted in this thesis to conceptualize the factors associated with maternal health service utilization in Ethiopia. The model proposes that individual-level factors that determine health care utilization are categorized into three different groups: predisposing, enabling, and need factors (Figure 1.5). Predisposing factors encompass socio-demographic factors; attitudes towards health services; and knowledge about the benefits of health services. Enabling factors create supporting conditions for health services utilization and encompass economic status; the availability of community and health development resources; and the accessibility and availability of services. Need factors are linked to the actual illnesses that require health services; and encompass perceived susceptibility to the health problem, knowledge and experience of complications or symptoms; and general health status. To successfully utilize this model, the interpretation of predisposing, enabling, and need factors need to be considered in light of the context-specific conditions of the society.

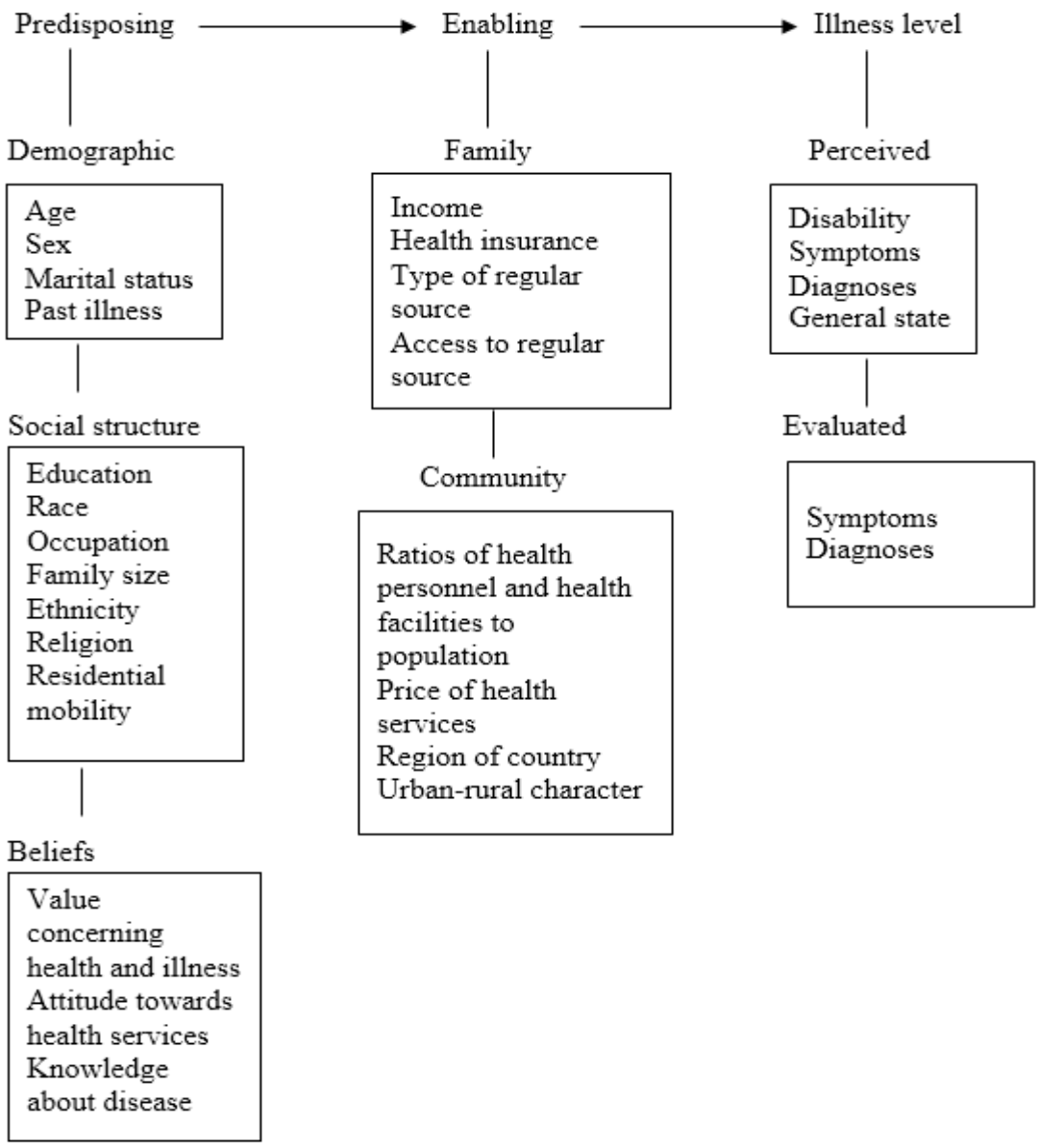

Figure 1.5. Individual determinants of health care utilization based on the Andersen-Newman behavioral model (75).

Previously, scholars have criticized the original model for overemphasising "need characteristics" relative to other factors of interest (76) to the detriment of focus on community factors that influence health service use (e.g. culture, social capital, and social networks) (77), creating a weighted focus on individual-level determinants of health service utilization (75). We now understand community determinants tend to be contextual and have an equal or greater impact on people's health-seeking behavior compared to individual factors. Based on the criticism, the updated model included socio-cultural and social network-related factors into the predisposing component of the model. The model further stipulates that contextual characteristics are those relating to health care providers

and health service delivery system factors measured at an aggregate level. These factors are divided in the same fashion as the individual level factors in terms of predisposing, enabling, and need contextual factors (78).

The model has also received criticism for paying too much attention to "health care utilization" rather than the "health outcomes" of health service utilization. The most recent version of the model (78) has addressed this criticism by including health outcomes of health services utilization, such as "consumer satisfaction" and "quality of life". The measurement of the health outcomes is beyond the scope of the current research.

Regardless, the Andersen-Newman model is a popular theoretical framework applied in empirical studies of health care seeking behavior in many international settings, including Ethiopia (56), Nigeria (79), Sudan (80), Tanzania (81), and China (82). As the model provides an appropriate basis to inform the present research, it was used to organize the analysis for the quantitative study. The variables that were eventually used in the study were selected, contextualized, and structured into these components of the model based on the available literature.

There are several advantages to applying this model in these types of studies. First, the model was built to permit the use of highly mutable (easily modifiable) factors within the framework (78), which is important for developing, justifying, and implementing policy interventions. Second, the model allows the theoretical concepts that determine health care utilization patterns to be expanded to different social settings (74, 83). In this study, the model was used to contextualize and structure the factors that were identified in the literature review as influencing maternal health service use in Ethiopia. Third, the model allows for the framing of the predictors of health care service use at different levels; and the delineation of the relative merit of these factors for service uptake (75). The model identifies the factors that influence individual decisions to use (or not use) health care services and offers a fuller understanding of these variables.

1.3.2 The Three Delays model

The Three Delays model developed by Thaddeus and Maine (84) is widely used to identify

deterrent factors to obstetric care utilization, and to design appropriate interventions that mitigate those factors (Figure 1.6). The model states that maternal mortality is caused by delays at three levels; and that these delays are directly linked to the utilization or non-utilization of obstetric care. The first delay is in seeking health services, which occurs when a pregnant woman is unable to make an early decision to use obstetric services. This might be due to poor knowledge about the available services, late recognition of health problems, socio-cultural characteristics, or family-related factors. The second delay is in identifying and physically reaching a facility early enough to receive obstetric services; where access could be confounded by transportation unavailability or unaffordability, road infrastructure problems, or inaccessibility of facilities. The third delay is in receiving obstetric services once a pregnant woman arrives at a care facility. This might be due to poor staffing; the unavailability of medical supplies; or rules and procedures that dictate the quality and timeliness of care. The Three Delays model was used in this thesis to identify the driving factors of service uptake at the community level.

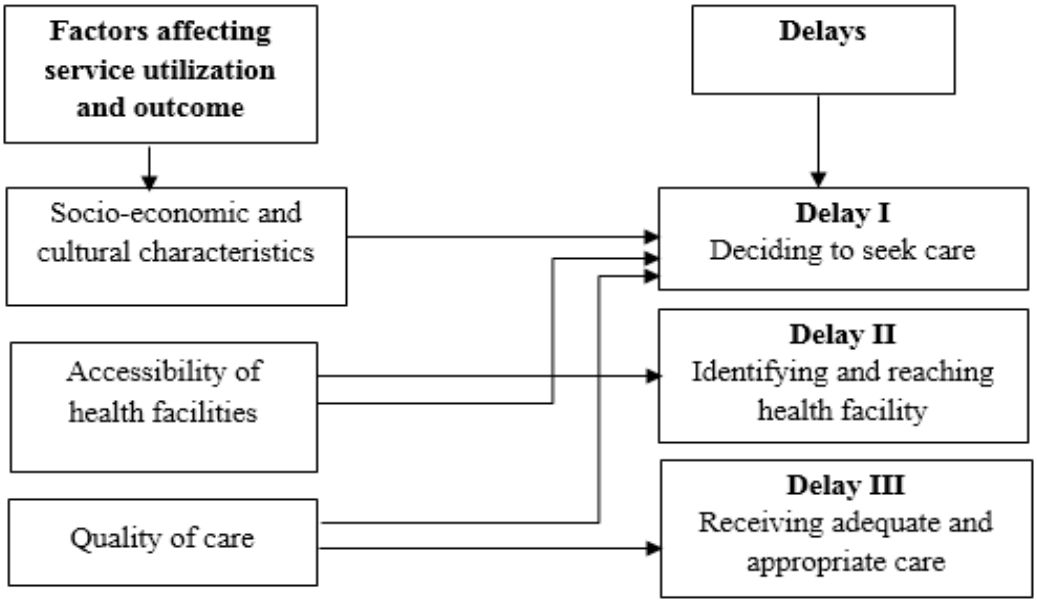

Figure 1.6. The Three Delays model (84)

The Three Delays model focuses on identifying barriers that contribute to the poor utilization of obstetric services during the period between the onset of obstetric morbidity and its final prognosis. The time gap between the occurrence of obstetric complications and the receipt of obstetric services is the key factor that determines the rate of maternal

death (84, 85). Without optimal obstetric intervention, women generally die within two to twelve hours of experiencing hemorrhage, within one day of uterine rupture, within two days of hypertensive disorders of pregnancy, within three days of prolonged labour, and within six days of sepsis (85). Interventions should be tailored to the phase at which delay occurs; and the typical time gap between the onset of complications and death.

The qualitative study in this thesis provides insights into planning interventions that could specifically target these factors at each phase of delay to improve maternal health service utilization and reduce maternal death. In order for maternal death to occur, women need to pass through four sequential stages on a pathway to maternal death: a stage of being a healthy, non-pregnant, reproductive-aged woman; a stage of normal pregnancy or birth; a stage of maternal morbidity (the experience of obstetric complications); and, finally, maternal mortality (86). In the first stage, the focus of interventions should be on preventing unwanted pregnancies using family planning programs. Routine maternal health services, such as ANC, are mostly administered during the second stage to prevent complications. In the third stage, interventions aim to avert maternal deaths that could result from grave obstetric complications using Basic Emergency Obstetric Care services.

The original framework of the Three Delays model is implicitly aimed at identifying factors that influence avoidance of obstetric emergency services utilization (also termed as deterrents of “care-seeking for emergency services”), as it focuses on the third stage of the pathway to maternal death (84). Gabrysch and Campbell (87) in their literature review criticized the Three Delays model for emphasising the identification of barriers to seeking emergency obstetric services rather than seeking precautionary obstetric care. The basic assumption of these critics is that whilst the same factors are involved in both “preventive obstetric care-seeking” and “emergency obstetric care-seeking”, the relative role of these factors is likely to differ. For instance, the authors argued that “cost of transport” is a strong barrier for “preventive” rather than “emergency” obstetric care-seeking. Based on this criticism, the authors have expanded the model and used it to frame the determinants of routine delivery care service utilization.

A further criticism of the model is that it can be difficult to categorize the factors identified into three distinct levels of delays, as some factors could contribute to one or more delays. For instance, the quality of care could be considered to contribute to the third delay, but

women may decide not to attend health facilities because of their negative experience of obstetric services in their previous health facility visit (Delay I). By the same token, inaccessibility of health facilities (long-distance) is not only a disincentive to seeking obstetric care (Delay I) but also a barrier to reaching health facilities (Delay II), reflecting a dual influence on both phases of delays. Therefore, careful consideration of the shortcomings of the model is important in developing maternal health programs that aim to target potential factors in all three phases of delays.

1.4 Summary

The overall purpose of this thesis is to systematically synthesize existing evidence on the timing of antenatal care use at a national level; and investigate maternal mortality and maternal health service utilization at a community level, in eastern Ethiopia. The information contained in this thesis could be used to improve maternal health programs or reproductive health policies in the country by identifying priority areas to target through interventions. Determining the local level estimates of maternal mortality and its causes could also inform the design of appropriate local level interventions. Finally, understanding factors associated with under-utilization of maternal health services could assist in implementing preventative measures that target vulnerable women with modifiable factors, and recognizing areas of action to focus on to improve maternal health.

In Chapter 2, the review of the literature on the uptake and correlates of maternal health service is discussed. Chapter 3 describes a systematic review and meta-analysis that was performed by retrieving relevant literature to examine in detail current knowledge about antenatal care in Ethiopia. Chapter 4 outlines the methods applied in the thesis; these include the following mixed methods: (a) a secondary data analysis that used surveillance data extracted from the Kersa Health and Demographic Surveillance System (HDSS); (b) an interviewer-administered house-to-house survey that was conducted at the community level; and (c) a qualitative study that involved focus group discussions. This is a thesis by publication, Chapters 3, 5, 6, 8, and 9 are published, and Chapter 7 is a submitted paper. Chapter 3 provides a systematic review of studies on the delayed initiation of antenatal care and associated factors in Ethiopia. Chapter 5 examines the magnitude, trends, and causes of maternal mortality in Kersa HDSS. Chapter 6 presents findings on antenatal care

utilization through the application of Andersen-Newman behavioral model. Chapter 7 describes the predisposing, enabling, and need factors associated with skilled delivery care utilization among reproductive-aged women. Chapter 8 depicts the magnitude and correlates of postnatal care utilization among reproductive-aged women. Chapter 9 portrays delaying factors for maternal health service utilization. Lastly, Chapter 10 presents the general discussion and conclusion of the thesis.

Chapter 2

Literature Review

In this section, a review of the literature regarding the general conditions of maternal health service utilization in Ethiopia is presented. A synthesis of the literature on the utilization of the major components of maternal health services and their correlates, using the Andersen-Newman behavioral model of health care utilization (74, 75) is also presented. The relevant facets of the existing literature have also been reviewed in specific papers (Chapter 3, and Chapter 5 through Chapter 9). The definition of maternal mortality "*the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes*" (8) described in Chapter 1 (Section 1.1.1) was adopted for the purpose of this thesis and was used throughout the literature review and thereafter.

In order to conduct the literature review, computer-based search engines and databases were used to collect relevant articles, reports, books, and other references, using keywords. These keywords included: *maternal health services*, *pregnancy complications*, *pregnancy outcome*, *prenatal care*, *prenatal care use*, *antenatal care use*, *skilled delivery care*, *intrapartum care*, *postnatal care*, *postpartum care*, *predictors*, *associated factors*, *home delivery*, and *Ethiopia and developing countries*. The search terms were used alone or in combination with each other (for example, *maternal health services* and *pregnancy outcomes*, *maternal health services* and *Ethiopia*, and *maternal health service use* and *associated factors*). In addition to direct searching of Google and Google scholar, electronic databases such as PubMed (Medline), EMBASE, and CINAHL were used in the literature search. The reference lists of the articles found in the search results were also used to source additional literature. The main criteria used to select the literature included topic relevance (focuses on maternal health and services), year of publication (not more than 15 years old), study design (mainly community or facility-based observational studies), and setting (Ethiopia, other sub-Saharan African and developing countries).

2.1 Maternal health service utilization

Maternal health services are potentially the most effective interventions to prevent maternal mortality (49). Increased uptake of maternal health services is an immediate determinant for reduced maternal mortality and morbidities (88). Maternal health services largely involve the provision of preventive services to mothers, and the mothers may not have a health problem when they visit a health facility to receive such services (89). The lack of health issues on presentation might make these services prone to underutilization (poor or non-use of available services). Underutilization of maternal health services has been found to be more severe in developing countries due to the poor socio-economic conditions, restrictive cultures, and inadequate availability of health services (90). In developing regions, despite progress in extending antenatal care (ANC) coverage (91), many countries, particularly in sub-Saharan Africa and Southeast Asian still perform unsatisfactorily in increasing uptake of services (80, 92, 93). Furthermore, despite a growing trend for delivery care in other low and middle-income countries from the 1990 level, many sub-Saharan Africa countries are not reflecting this same trend; with skilled delivery care use still below 30% in Ethiopia, Chad and Niger, among others (91).

In Ethiopia, one explanation for poor health outcomes among women was the non-use of modern health care services by a large proportion of women in the country (94). Compared to the situation in the past decade (2000-2010) (52, 53), there have been notable improvements in the uptake of maternal health services in the country. This increase may be partly attributable to the government's innovative Health Extension Program, which is supported by the formation of the Women's Development Army at the grassroots village level (17, 95). Despite this, maternal health service utilization in the country is still unacceptably low. Moreover, large intra-country variation was apparent in the utilization of all maternal health services in Ethiopia (44, 96), which indicates the importance of running district-level studies to inform the development of locally-appropriate interventions.

2.1.1 Quality of maternal health services

While increased utilization of maternal health service is an important goal, increased service use alone is insufficient to bring about a reduction in maternal mortality. A large number of women die while they are at health facilities to receive maternal health services due to poor quality of care (97). Lack of quality care at the point of health service is one of the factors influencing an insignificant reduction in maternal mortality in settings where there is improved utilization of skilled delivery care (34). The components of quality of care encompass equitability, accessibility, efficiency, effectiveness, acceptability, and safety (98). One of the strategic aims of the WHO is to address inequalities of accessibility and quality of maternal health services in order to end preventable maternal mortality (4). The WHO also recommended an urgent implementation of interventions that focus on improving the quality of intrapartum care in all settings to improve maternal, foetal and newborn outcomes (99). Countries with very high maternal mortality would particularly need to focus on strategies that improve the minimum quality of service in health facilities (3).

Ethiopia is among the nine countries supported by the WHO which launched a network for improving the Quality of Care for maternal, newborn and child health care, the so-called "(QoC network)" (97). The vision of the network is that "*every mother and newborn receives quality care throughout pregnancy, childbirth or postnatal period*". In Ethiopia, in order to provide quality of care and improve maternal health it is highly recommended that there should be an efficient health care delivery system that has sufficient medical supplies, lifesaving drugs, and trained and skilled health workers; along with an effective system for the early referral and transport of complicated emergency cases (27). Improved quality of care is essential not only to prevent maternal deaths due to the third delay but also to attract and retain women to use the service for their succeeding pregnancies/births (84, 87). Women often avoid maternal health care when the services are substandard, not culturally sensitive, when the women lack trust in the service, or when their needs remain unmet (38). Ensuring the quality of care is one of the best strategies to improve service uptake and reduce maternal deaths; but requires improving the clinical care provision at health facilities, improved availability of supplies and medicines, creating a safe and fulfilling clinical environment, and deploying culturally competent health workers with the

necessary skill sets and professional ethics.

2.1.2 Major components of maternal health services

The major components of maternal health services are antenatal, skilled delivery, and postnatal care, which are all fundamental to prevent, manage and treat complications in a timely manner in order to prevent maternal deaths and promote women's health. ANC plays a critical role in reducing maternal deaths due to eclampsia, through monitoring the blood pressure of expectant mothers. ANC also helps with the early detection and management of other pregnancy-related complications (50). However, not all causes of maternal deaths can be prevented by ANC, especially those resulting from complications arising during labour, delivery, and the immediate postpartum period, where the majority of the maternal deaths are clustered (23). The next sections provide a review of the literature regarding the utilization of these components of maternal health services in Ethiopia and other developing countries.

2.2 Antenatal care (ANC)

2.2.1 Antenatal care packages and guidelines

Antenatal care (sometimes called prenatal care) refers to the regular follow up of an apparently healthy pregnant woman so as to detect disorders or pregnancy complications that could endanger the health of the woman or the foetus, and to provide health information about safe motherhood, nutrition, lifestyle, pregnancy and birth (100). The recommended interventions for pregnant women in African countries can be offered through ANC. These include Tetanus Toxoid vaccination, early identification, and treatment of Sexually Transmitted Infections including HIV/AIDS, and provision of insecticide treated bed nets and prophylaxis medication for malaria (101). Furthermore, the package involves prompt identification and management of complications during pregnancy such as antepartum haemorrhage, anaemia, and nutritional problems.
Even though there has been conflicting evidence (33) about the contribution of ANC to the

reduction of maternal mortality, generally there has been agreement that ANC has a positive influence on improving maternal health (33, 39, 50). The optimal timing, frequency, and content of ANC remain under debate, with resource and culture reflective variations between countries. In the 1990s, the accepted model of ANC service - called the 'risk approach' - consisted of more frequent, up to 16 visits (101). The risk approach assumes that more frequent ANC visits are essential to differentiate women with high or low risk of developing obstetric complications, to best plan their package of care. However, women in many developing countries are unable to optimally use this model of service because frequent travel to a health facility is not practical. The approach is also criticized for placing greater emphasis on 'quantity' rather than 'quality', and for being a poor predictor of high-risk mothers (102). This traditional risk approach was therefore replaced by a new model of 'focused antenatal care' in 2002.

In 2002, the WHO recommended all pregnant women undergo a minimum of four 'focused antenatal care check-ups' with the supervision of skilled health workers (103, 104). Focused ANC views all pregnant women as being potentially at risk of developing obstetric complications. The aim is to minimize pregnancy-related health risks and problems that lead to life-threatening situations and to convey necessary advice about safe childbirth and the postpartum period. The minimum four ANC visits should be scheduled as follows: the first visit during early pregnancy (0-12 weeks); the second visit around 26 weeks of gestation; the third visit between 28 and 36 weeks of gestation; and the fourth and last visit after 36 weeks. During the first visit, all pregnant women are assessed for the presence of any conditions or risk factors that could potentially endanger the pregnancy or foetus. The women are then classified into groups to receive basic or specialized care. Pregnant women who have certain risk factors or encounter obstetric complications may require more visits and can be enrolled in specialized care (103).

Ethiopia's ANC guidelines are based on the WHO focused ANC model. These recommended packages of pregnancy services were then adapted in terms of content, frequency, and timing of the service to reflect the country's maternal health program priorities and available resources (103, 105). Despite the fact that developing countries have difficulty in successfully implementing the Focused ANC visits, in 2016, the WHO (106) introduced a new ANC model comprising eight visits scheduled at different gestational ages. The change in the WHO ANC recommendation is related to evidence

which shows that less frequent visits are associated with increased levels of perinatal deaths, and reduced levels of maternal satisfaction, irrespective of the resource setting (106, 107).

2.2.2 Overall uptake of antenatal care

Although there is a huge variation between countries, there has been good progress in ANC utilization in developing countries where the majority (80%) of women have received at least one check-up (91). However, there are insufficient levels of utilization of four ANC visits; only a small proportion (40%) of pregnant women in these countries have attended the recommended number of visits (4). In sub-Saharan Africa and Southeast Asia, many women wait until the second or third trimester of a pregnancy before initiating ANC (91). The underlying explanation for this has not yet been adequately investigated.
Some small-scale studies covering limited areas in different parts of Ethiopia showed a fairly high level of utilization of at least one ANC check-up. Ayele et al. surveyed 495 reproductive-aged women who were living in rural and urban kebeles of Kombolcha district, eastern Ethiopia (108). The study found that 86% of the respondents had attended at least one ANC visit during their most recent pregnancy, though the authors did not clearly describe how the outcome variable was measured. In a cross-sectional survey involving 691 participants conducted using an interviewer-administered questionnaire in Hadiya zone, South Ethiopia, it was found that 86% of the study subjects had at least one ANC visit (109). In that study, however, a woman was said to have used ANC if she visited the health facility at least once during her last pregnancy for any reason, which may have overestimated ANC uptake.

In another quantitative study using the interview method to explore the utilization of maternal health services in the town of Hossaina, Southern Ethiopia, it was found that 88% (n=623) of women used ANC at least once (110). The high percentage of ANC utilization in the study might be related to the inclusion of married urban-dwelling women who are more likely to attend services that are more widely available in urban settings (55, 88). Afework et al. carried out a house to house survey of 2296 reproductive-aged women in the context of HDSS in Butajira, Southern Ethiopia (111). It was found that 81% of these women used ANC at least once, with the greater number of ANC users being from the

Kebeles which are under health and demographic surveillance. Furthermore, Aregay et al. surveyed 574 reproductive age married women in Enderta district, Northern Ethiopia, and found 70% of the participants had used ANC at least once (112). This study also included urban-dwelling married women who possibly have greater access to maternal health services (55, 113).

In most of the studies (108, 110-112, 114) there was reported to be a higher result for the use of at least one ANC visit. The higher uptake may reflect the widening of the definition of ANC use. These studies used a broad definition of ANC services as those provided by 'skilled health workers', 'Health Extension Workers' and other 'trained community health agents'; contrary to the national Demographic and Health Survey (44) which only counts ANC services that are provided by skilled health workers (34). When strictly adhering to the DHS definition, the number of pregnant women attending at least one ANC check-up dropped to 62%.

2.2.3 Frequency and timing of antenatal care use

Even though most of the reviewed studies (108, 110-112, 114) reported a higher rate of utilization of at least one ANC service, when further scrutinized on the exact number of visits made during the whole pregnancy period, in most of the studies there was reported less than the recommended four ANC visits. For instance, Ayele et al. (108), Dutamo et al. (110), Afework et al. (111) reported only 38%, 37%, and 38% of women attended the WHO recommended four ANC visits respectively. The same was true in the recent Ethiopian Demographic Health Survey (44) where only 32% of pregnant women studied received four ANC services. In a research article, Melaku (115) showed that 76% of the pregnant women attended at least one ANC check-up, but only 6% of women had made four or more ANC visits. In Ethiopia, the utilization of the recommended four ANC visits is very low. This was true especially in rural areas where the ANC service uptake was lower at 27% compared to 63% in urban areas (44). Evidence suggests that women's non-attendance of the minimum number of ANC visits is associated with poor pregnancy outcomes (such as low birth weight) (116). This warrants undertaking further study of factors that deter women from using ANC services in subsequent visits once they enroll in care, particularly among women in a rural setting.

As with other sub-Saharan African countries (91), in Ethiopia, women tend to initiate ANC attendance late in their pregnancy (i.e., the commencement of the first ANC visit after the first trimester). This was revealed in a study in Ethiopia (49), where more than 50% of the women initiated the ANC attendance after 24 weeks of gestation. Additionally, in a facility-based study conducted in Debrebirhan, Ethiopia, it was found that among those pregnant women who had ANC follow up, 74% had their first ANC visit late in the second trimester (117). Therefore, pregnant women not only failed to attend the recommended four ANC visits but also initiated the service late in the course of pregnancy. These findings were reflected in the Ethiopian national Demographic and Health Survey report (96), where 82% of women initiated their first ANC attendance after 16 weeks of gestation. A similar pattern was observed in other developing countries with regards to the frequency and timing of ANC initiation (80, 92, 93) where there is extremely low utilization of four visits and very late initiation. Why most women who use ANC service are enrolled late in their pregnancy remains under investigated.

ANC is best utilized during early pregnancy to generate the maximum benefits, including early identification and prevention of pregnancy complications and facilitating timely referrals (117). It has been documented that early initiation and regular use of ANC helped to raise uptake of skilled delivery care (118-120), which in turn was associated with better maternal health outcomes (33). Using evidence from a study conducted using HDSS data in Bangladesh, researchers showed that those women who made less than or equal to one ANC visit doubled their risk of perinatal mortality, compared to women who made greater or equal to three ANC visits (121). Similarly, a health facility-based retrospective study in Libya showed that more complications were seen in women who had initiated ANC late and attended less frequently (122). In a secondary data analysis performed in the United States, it was shown that the late initiation of ANC use or its total non-use was strongly associated with an increased risk of pregnancy complications such as premature rupture of membranes and preterm birth (123). However, little is known about the underlying factors that facilitate or impede timely initiation and regular use of antenatal care services in Ethiopia.

These cited and reviewed studies exhibit several flaws. In general, most studies reported a relatively higher level of ‘at least one’ ANC visit attendance due to their common

methodological flaw of defining ‘skilled health workers’ who provide the service. Hence, women who said to have received check-ups from Health Extension Workers or any other trained community health agents were counted as ANC users in those studies.
Additionally, some of the studies did not present the approach they have implemented to measure the outcome and other relevant variables of interest. Moreover, there have been inconsistent definitions of the timing of first ANC visit whereby delayed initiation of ANC was considered to occur when a woman started to use the service after the 16th week of gestation in some studies and after the 12th week of gestation in others.
Furthermore, the studies use a reference period of five years to assess the variables, which could introduce recall bias. Some studies also measure the use of ANC even when the woman visits the health facility for any other reason other than for pregnancy follow-up, which might overestimate the ANC uptake.

Overall, attendance at ANC in Ethiopia is well below the recommended level. Among women who do attend, there is late and infrequent use of ANC services. The contextual factors that contribute to the underutilization of ANC, and the late and infrequent use of this service, have not yet been adequately investigated. Thus, an examination of the context-specific factors that play a role in deterring ANC utilization in Ethiopia is required.

2.3 Skilled delivery care

2.3.1 Delivery care with skilled health workers

Skilled delivery care refers to “the care provided to a woman and her newborn during childbirth by an accredited and competent health care provider who has at her/his disposal the necessary equipment and the support of a functioning health system, including transport and referral facilities for emergency obstetric care”(34). All pregnancies can be threatened by risks which may not always be identified using the routine ANC follow up (124). The presence of a skilled health worker during birth remains a crucial factor for the improvement of obstetric outcomes (124). Skilled delivery care can reduce maternal morbidity and mortality that results from pregnancy and birth complications (2).

International agencies (WHO, United Nations Population Fund, and World Bank) at different global meetings (Millennium Summit and Inter-agency meetings) agreed to utilize skilled delivery care attendance as one of the leading proxy indicators used to track progress towards the MDG 5 (improving maternal health by reducing maternal mortality ratio by 75% and achieving universal access to reproductive health) in developing countries (15, 125, 126). The common features of countries that were successful in reducing the MMR to less than 100 per 100,000 live births were that they all have a high rate of skilled delivery care utilization (127). Up to one-third of maternal mortality could be prevented by the appropriate management of birth complications by skilled health workers during birth (40). An estimated 50% of maternal deaths that result from sepsis could be averted through the use of safe and sterile techniques during birth (128). Similarly, an estimated 47% of hemorrhage-related deaths could be prevented through active management of the third stage of labour (the period between the birth of the baby and the expulsion of the placenta) using procedures such as controlled cord traction and administering misoprostol (128). Hence, promoting skilled delivery care attendance at health facilities is a necessary strategy to prevent maternal mortality (23, 33).

Reducing maternal deaths that occur during childbirth due to hemorrhage and obstructed labour requires access to health services and skilled practice at the time of labour and delivery in well-established facilities with available equipment and supplies (129, 130). A woman may give birth at various places such as her own or her parents' home; on the way to a health facility; or at a lower level or ill-equipped health facility (health post, health centre, hospital) depending on service accessibility and availability. According to the WHO (1), although facility-based delivery is preferred, there is no strictly recommended place of birth. It has been explicitly indicated that if the woman has been assisted by a trained and equipped health practitioner and referral facilities are in place, out of health facility birth (like home birth) may be a suitable option for normal delivery.

However, in Ethiopia and other developing countries, births that took place out of health facilities were not often attended by skilled health workers, and referral of obstetric emergencies to a higher level of care was also difficult (108, 112, 131, 132). Consequently, facility-based delivery with the assistance of skilled health workers was the preferred strategy of the government to have better maternal outcomes. A review of the Demographic and Health Survey reports from thirty-six countries in sub-Saharan Africa

(133) has shown that higher utilization of facility-based skilled delivery care services was correlated with low MMR in the regions examined. In the same way, in a review of studies in Ethiopia, Birhan et al. (134) identified that a lack of facility-based skilled delivery care attendance was among the chief risk factors for high maternal mortality. In fact, mothers who delivered 'out of health facility' but who were assisted by skilled health workers do not receive skilled care to the full degree (135). In recent times, however, there has been growing calls for professional assistance during childbirth out of a facility. Although promoted as an interim measure, delivery out of facility with skilled care is more realistic and appropriate for attempting to lower maternal mortality in settings such as Ethiopia (136). Hence in this thesis, the measurement of skilled delivery care utilization considered those women who have received skilled care during delivery, regardless of the place of birth (both in and out of health facilities).

Globally, in 2014, around 71% of the births were assisted by skilled health workers (16) and, recently, increased uptake of skilled birth attendance was observed in North Africa and South Asia (2). Despite this global trend, there exists a huge gap in terms of skilled delivery care use across different regions and countries. In developing countries, more than 40 million births were not attended by a skilled health worker, of which about 90% were in sub-Saharan African and South Asian countries (137). Furthermore, skilled delivery care attendance at a health facility is low in most developing countries and even worse in sub-Saharan African countries (138) where the majority of the maternal deaths occur (2).

In particular, skilled delivery care attendance in sixteen of the sub-Saharan African countries is less than 50% (129). These countries are Ethiopia, Burundi, Chad, Eritrea, Guinea, Guinea-Bissau, Kenya, Mali, Mozambique, Niger, Nigeria, Sierra Leone, Somalia, Tanzania, Uganda, and Zambia; nations which account for more than half of the sub-Saharan population. In Ethiopia, according to a recent Demographic and Health Survey report, the proportion of women who utilized skilled birth assistance during delivery was 28% (44). This is well below the goal set by the global community to reach 60% utilization of skilled delivery care attendance during birth for countries with the highest maternal mortality rates, such as Ethiopia; and 90% at a global level, by the year 2015 (139). Though the rate of skilled delivery care utilization in Ethiopia showed a significant improvement from 2005 (8%) to 2016 (28%) (44, 52, 53, 96), the increment was not optimal. With the current upward but a sluggish trend in the uptake of skilled

delivery care, there is little likelihood of a substantial decrement in the high maternal mortality in the country.

In Ethiopia, there was overwhelming evidence demonstrating a very low level of facility-based skilled delivery care uptake. For instance, a study in Tigray, Ethiopia (115) showed that only 27% of women gave birth with the assistance of a skilled health worker at a health facility. In a study in central Ethiopia (140) it was also found that only 18% of women gave birth to their last baby in health facilities under the supervision of a skilled health worker. The study considered facility-based deliveries only for the outcome variable measurement, which could have underestimated the result. In an interviewer-administered survey that was conducted in a largely rural district in Northern Ethiopia (141) it was shown that among the 373 women who took part in the survey, the overall skilled delivery care utilization was nearly 19%. A study in western Ethiopia found that among the participants, even though the majority (81%) of the respondents had heard about skilled delivery care, only 40% of them had actually used the service (142). This indicates that women's awareness of skilled delivery care was not sufficient to ensure the use of the service.

In a study conducted in three selected districts in northern Ethiopia, it was shown that the majority (85%) of women had visited a health facility for their last pregnancy to attend ANC; however, only 5% had attended delivery care services for that particular birth (143). This indicates that even women who have formal contact with the health care system through ANC may still decline to use skilled delivery care services. Further exploratory research to investigate the association between attending ANC and subsequent utilization of skilled delivery care is required. A household survey that was conducted in two different districts in Ethiopia indicated that, overall, 25% of women received assistance from skilled health workers, even though a high percentage (45%) of these women decided the place of delivery by themselves or jointly with their partner (48%). This evidence highlights the fact that even when women felt free to seek and access health care, they may fail to do so, which again highlights the need for further in-depth studies to uncover the reasons behind such decisions (144). Dhaka et al. (145) also argued that those women who did visit health facilities for delivery care were using the service because of facing intrapartum complications, not because they wanted to give birth attended by skilled health workers.

In general, many district-level studies in Ethiopia, particularly in rural areas, have found a range of relatively low proportion of skilled delivery care utilization. The reviewed evidence also demonstrates the existence of socio-economic, regional, and geographical inequalities in uptake of skilled delivery care utilization. There is a paucity of evidence as to why women tend to give birth out of health facilities without the assistance of a skilled health practitioner.

2.3.2 Delivery with unskilled birth attendants

Delivering without a skilled birth attendant continues to be a cause of mortality in developing countries (146). According to Crowe et al. (147), in sub-Saharan Africa and South Asia, more than 130 million births were assisted by non-skilled birth attendants between 2011 and 2015; 90% of these births were in rural areas of these regions. In Ethiopia, more than 72% of women gave birth without the assistance of a skilled health worker (44).

In understanding how individual women access maternal health services, it is important to consider the complex influences in society such as customs, beliefs, social norms, relationships, and social networks. Culturally specific expectations are embedded around major life events such as childbirth and have the potential to significantly influence women's choice of place of delivery (64, 148). In a qualitative study in rural Ethiopia (149) it was found that women are influenced by the inherent culture and norms in their community related to choosing the place of delivery. In Ethiopia, attending a health facility is generally advised for problems occurring during delivery such as prolonged labour or for sickness in some cultures in Oromia, Amhara, and Tigray regions (150).

A study conducted in Bangladesh and Uganda (146) has identified that autonomy over the decision-making process, barriers to health service access, and social customs about a delivery place as well as making a prior selection of a place of delivery are key factors that influence where pregnant women deliver. In the study, the decision-makers are mostly the women's partner, their relatives and traditional birth attendants. A study in Ethiopia (151) found that the decision of place of delivery is mainly made by the husband, and most

husbands prefer their wives to give birth at home as they do not want to spend money on the associated transportation to health facility and services costs.

In many communities in Ethiopia, traditional birth attendants ("Yelimd Awalaj") attend birth when the woman delivers out of a health facility (112, 131, 132, 152-155). These studies indicate that a large proportion of women who delivered out of a health facility continue to be assisted by traditional birth attendants in Ethiopia. This evidence highlights the need for training of traditional birth attendants in the future to include basic skills that are necessary for early identification and referral of complicated cases; as well as awareness of danger signs in pregnancy and labour. This has been suggested as a good strategy for rural and remote communities that have poor access to health facilities (156). Traditional births attendants are believed to be socio-culturally closer to women, as well as being more sympathetic to women during labour and delivery than health workers (149, 152) and often enjoy the full trust of the women to whom they are providing delivery care during labour (131, 151). It is not just women in the community who hold traditional birth attendants in higher regard than health professionals when it comes to the provision of the maternal health service (49, 152), but also health care workers themselves (157). The societal acceptability of, and a long-held trust in, traditional birth attendants within the community suggests women will continue to choose traditional birth attendants and out of facility mode over more clinical delivery settings and supports (158).

Traditional birth attendants already exist in many communities in developing countries. With targeted training, they may be able to pre-empt complications, provide skilled birthing support, or encourage the uptake of other skilled services. However, evidence shows that the training of traditional birth attendants to provide delivery care has failed to reduce maternal mortality in developing countries like Guatemala (34). Static mortality rates post training raises the question of whether the inability to achieve an expected reduction in maternal mortality might be related to the failure of the training strategy of traditional birth attendants, or a myriad of other reasons - such as lack of health infrastructure (159). Evidence from Timor-Leste showed that traditional birth attendants have become effective in raising women's awareness of, and demand for, maternal health services as well as referral through home visits (156). This is a result of the systematic integration of traditional birth attendants into the formal health care delivery system. Primarily tasking traditional birth attendants with raising awareness of health services, and

promoting positive maternal health care related behaviors, rather than providing care during delivery, might be an effective strategy to lower mortality rates (160).

While some of these studies on skilled delivery care utilization appear to be precise, they fail in defining or conceptualizing the outcome variable. There is inconsistency in the definition of 'skilled delivery care use', with some studies defining it as delivery with the assistance of skilled health personnel irrespective of the place of birth. Other studies consider 'skilled delivery care use' as a delivery that took place with the assistance of skilled health personnel only at health facilities. Studies that used the later definition are likely to exclude women who were assisted by a skilled health worker but did not deliver at a health facility. Comparing studies with a different approach to measure skilled delivery care may lead to wrong conclusions.

In addition, the definition of a 'skilled attendant' at birth is another common area of inconsistency within the reviewed studies. For instance, the Demographic and Health Survey report of Ethiopia presumes that 'skilled health workers' includes Health Extension Workers' whilst other small scale studies did not consider Health Extension Workers as skilled attendants. The other inconsistency when comparing these studies rests on their definition of the venue of the delivery. Some studies consider 'institutional delivery' as all births that took place at all levels of health facilities including health post; whilst others count births that took place at higher tier hospitals or health centres only.

Despite these study limitations, it is clear that skilled delivery care attendance in Ethiopia was extremely low, particularly among women in rural areas and in some cultural settings. There was limited evidence as to what personal, social, and community factors motivated large numbers of pregnant women in Ethiopia to avoid delivering their babies at health facilities assisted by skilled health workers. Consequently, it is imperative to further investigate why women, especially in rural parts of Ethiopia, continue to avoid using skilled delivery care.

2.4 Postnatal care (PNC)

The first six weeks following the birth of the baby is referred to as the postnatal period and

is a critical time during which the health status of the mother and newborn is determined (161). Postnatal care is "*the care given to the mother and her newborn baby immediately after birth and for the first six weeks of life*" (162). Postnatal care services aim to assess, conserve, and promote the health of the postpartum mother and the newborn. In a developing country setting, apart from early detection and management of postpartum complications (53), PNC also includes the provision of health messages with regards to exclusive breastfeeding and complementary feeding, promoting continuous skin to skin contact for neonates (for low birth weight and preterm), promoting use of insecticide-treated bed nets to prevent malaria, birth spacing and family planning counselling, safer sex, provision of contraceptives and child immunization (160, 163).

Furthermore, as the postnatal period is a potentially stressful time, counseling and emotional support should be offered to lessen the risk of postnatal depression (160, 161). In addition to missed opportunities to acquire health promotive information and behaviors, deprivation of PNC can lead to maternal mortality due to undetected and untreated postpartum complications (161). The majority of maternal deaths occur during the postnatal period (33). Proper utilization of PNC immediately after birth, through the first 24 hours and into the days after delivery, has the potential to avert the majority of postnatal maternal deaths (164).

The recommended '*frequency and schedule*' of PNC visits at a health facility has gone through several revisions based on different evidence-based studies, producing updated and standardized guidelines (164). The WHO updated the guidelines for PNC for mothers and newborns based on the available evaluative research evidence as well as technical consultations. The guideline recommends the mothers and newborns receive PNC for the first 24 hours after birth if the delivery is at a health facility. If the delivery is at home, the mother should attend care as early as possible within the first 24 hours after birth. Regardless of the delivery place, all mothers and newborns should attend at least three additional postnatal check-ups. The additional visits were recommended as follows; on day 3 (48-72), within 7 to 14 days of birth, and at 6 weeks after birth (160, 165).

Depending on the country's priorities for maternal health and available resources, different countries adopt different PNC schedules. In Ethiopia, for normal and uncomplicated deliveries, it is recommended that the mother should attend PNC at a health facility within

24 hours, plus other subsequent visits scheduled for 1-2 days, 3-7 days, and 8-42 days after delivery (96). The visits within the first seven days are considered early PNC visits, and the schedule is disaggregated as 0-2 days, 2-3 days, 4-7 days (166) for health management information purposes (162, 167).

The postnatal period is generally overlooked in many developing countries (164). Most women, women's families, and even health care workers themselves do not appear to recognize the health risks during this period (23). Evidence from developing countries has shown that around 40% of mothers encounter postnatal complications, and 15% face potentially life-threatening health conditions such as hemorrhagic shock, infection, and anemia (168).

Along the continuum of maternity care, PNC service utilization has decreased in developing countries compared to other maternal health services (169), and is said to be the weakest component of maternal health services. According to WHO estimates, among developing nations, the overall level of PNC utilization is below 30% and even lower for those women who delivered outside of a health facility (170). A study that analysed data drawn from Demographic and Health Survey reports of 30 different developing countries indicated that only 28% of the women who delivered outside of health facility received PNC service within the first three days postpartum (171). In the sub-Saharan African region, a review of Demographic and Health Survey reports from different countries found that only 13% of women who delivered outside of a health facility received PNC within two days of birth and that, irrespective of the place of delivery, a large number of mothers did not receive PNC (161). In Ethiopia, the percentage of mothers who utilize PNC services was lower than most sub-Saharan Africa countries with only 17% of women receiving the services of skilled health workers within the first two days after birth, regardless of the place of delivery (44).

Further evidence reinforced the very low PNC attendance rates in Ethiopia. A study that involved interviews of 725 reproductive-aged women who had children aged less than five years old showed that a very small proportion (5%) of women received at least one PNC visit (143), though using the five year reference period could have led to recall bias and an underestimation of service uptake. Regassa (172) found that nearly 37% of women reported using at least one PNC. That study, however, considered child immunization use

and child illness consultations to count toward the number of PNC users, perhaps artificially increasing the numbers of women who received PNC specific care during these contacts. A study in Hossana, Southern Ethiopia (110) showed that around 51% of women obtained at least one postnatal check-up. The reported high number of PNC users in that study might also be attributed to the implementation of a highly sensitive measurement of the outcome variable.

In the same fashion, a study in northern Ethiopia undertaken by Tesfahun et al (173) showed a high proportion (67%) of PNC users. However, the majority (98%) of the participants believed that a mother should attend PNC to receive vaccinations for their children, leaving only 1% of participants who attended specifically to receive advice on obstetric danger signs. Even when asked the reason they visited a health facility during the postnatal period, more than 60% of the participants acknowledged that they came for the immunization of their children. This unexpected result could, therefore, be a result of the inclusion of mothers who visited the health facilities for non-maternal health services, leading to measurement error. According to a survey in two districts under HDSS in the north and southern Ethiopia (174), 88% of the women self-reported attending PNC. However, when further questioned, only 4% of participants reported having attended the service within 24 hours after birth, highlighting the poor utilization of PNC during the early postnatal period.

There seems to be no uniform definition of the timing and number of PNC visits across many of the previous studies. Moreover, there are methodological inadequacies in the studies in describing the number, schedule and overall measurement of PNC attendance. One repeatedly encountered problem in most of the previous studies is the measurement of PNC whereby services other than PNC such as child health services were counted as a PNC visit. Additionally, some studies (143, 172) have excluded those women whose last pregnancy outcome was a stillbirth from the PNC measurement. Additionally, most studies have not differentiated the percentage of women who use postnatal care services at each recommended schedule of postnatal care; they only reported the sum of users during the six-week period after birth. It is highly important to know what proportion of women access each recommended postnatal care visit for that particular birth. Taking this into considerations, this thesis was designed to measure PNC with a high degree of validity.

2.5 Evidence summary and knowledge gaps

The health reforms by the Ministry of Health of Ethiopia have contributed to increased coverage of antenatal, skilled delivery and postnatal care services, including in peripheral areas of the country (95, 134, 175). Nevertheless, the reviewed evidence demonstrated that there were large disparities in the rates of antenatal, delivery, and postnatal care utilization among women in different socio-cultural settings, economic groups, regions, and geographic areas. The reviewed evidence also demonstrated that the overall uptake of antenatal, skilled delivery and postnatal care in Ethiopia is well below the WHO recommended level. So far, there has been no consistent measurement of the utilization of these services across different studies in Ethiopia. In particular, many studies have introduced measurement errors in defining PNC service use and its initiation time, leading to the inaccurate measurement of PNC uptake. There is also a dearth of research examining the context-specific factors associated with the uptake of antenatal, skilled delivery and postnatal care. In particular, few studies have addressed the factors that contribute to delayed and less frequent use of ANC using the same study population. To bridge these gaps in the literature, the current research undertakes an examination of antenatal, skilled delivery, and postnatal care in Kersa district (a largely rural area in eastern Ethiopia), including the contextual barriers associated with the uptake of these services. Next, current knowledge concerning the correlates of service use is presented.

2.6 Correlates of maternal health service use

In the previous sections, findings of studies examining the uptake of antenatal, skilled delivery, and postnatal care in Ethiopia were reviewed. Although most of these studies involved an assessment of the factors that influence service uptake, their main focus was on examining women's socio-demographic and socioeconomic characteristics as determinants of service use. In contrast, individual behaviour, belief, social support, and social network related factors were not adequately examined. The social determinants of maternal health service utilization, such as culture and societal belief systems, also received less attention. Based on the review of the literature, the correlates of antenatal, skilled delivery and postnatal care utilization were summarized using a conceptual

framework described in Chapter 1 (Subsection 1.3).

2.6.1 Conceptual framework of the study

The conceptual framework of the study was developed based on the Andersen-Newman behavioral model of health care utilization (74, 75) and considered some elements introduced by Sheikh and Kwaak (176). The adapted version of the Andersen-Newman behavioral model of health care utilization is illustrated in Figure 2.1. The variables included in the model were selected based on a broad review of the literature and are used to structure the analysis of the quantitative data in this thesis. Sheikh and Kwaak argue that demand and supply related factors determine the rate of maternal health service utilization where the demand side concerns the women's initiation to use the service based on their perceived needs; and the supply side concerns the service delivery system. According to Andersen and Newman, a person's decision to use available health services is influenced by a set of three factors: predisposing, enabling, and need factors. The *predisposing* factors are those socio-cultural characteristics of the individual that exist prior to their condition or illness. The *enabling* factors reflect the means or logistics to obtain the services. The *need* factors are the most immediate cause of health service use and reflect the perceived health status, as indicated by the severity of the morbidity conditions or the number of morbidities. How pregnant women view their health and functional state, as well as how they experience symptoms of illness, pain, and worries about their health; as well as whether or not they judge their problems to be of sufficient importance, all influence their decision to seek professional help.

According to Fosu (177), the presence of predisposing and enabling components might not be enough for a pregnant woman to seek health care. She must perceive the pregnancy condition as being serious and believe that treatment will provide the expected benefits. On the other hand, since maternal health service use is a proximate determinant of maternal morbidities and mortalities (178), poor or low service utilization would subject women to high risks that lead to unfavorable consequences and increase the likelihood of maternal morbidity, mortality, and disability. There are also problems that prevent proper utilization of maternal health services on the supply side. The responsiveness of the health system in terms of availing skilled personnel, rendering fee-free quality services, plus

providing adequate emergency obstetric facilities and referral linkage, can hugely affect maternal health service utilization (94, 152).

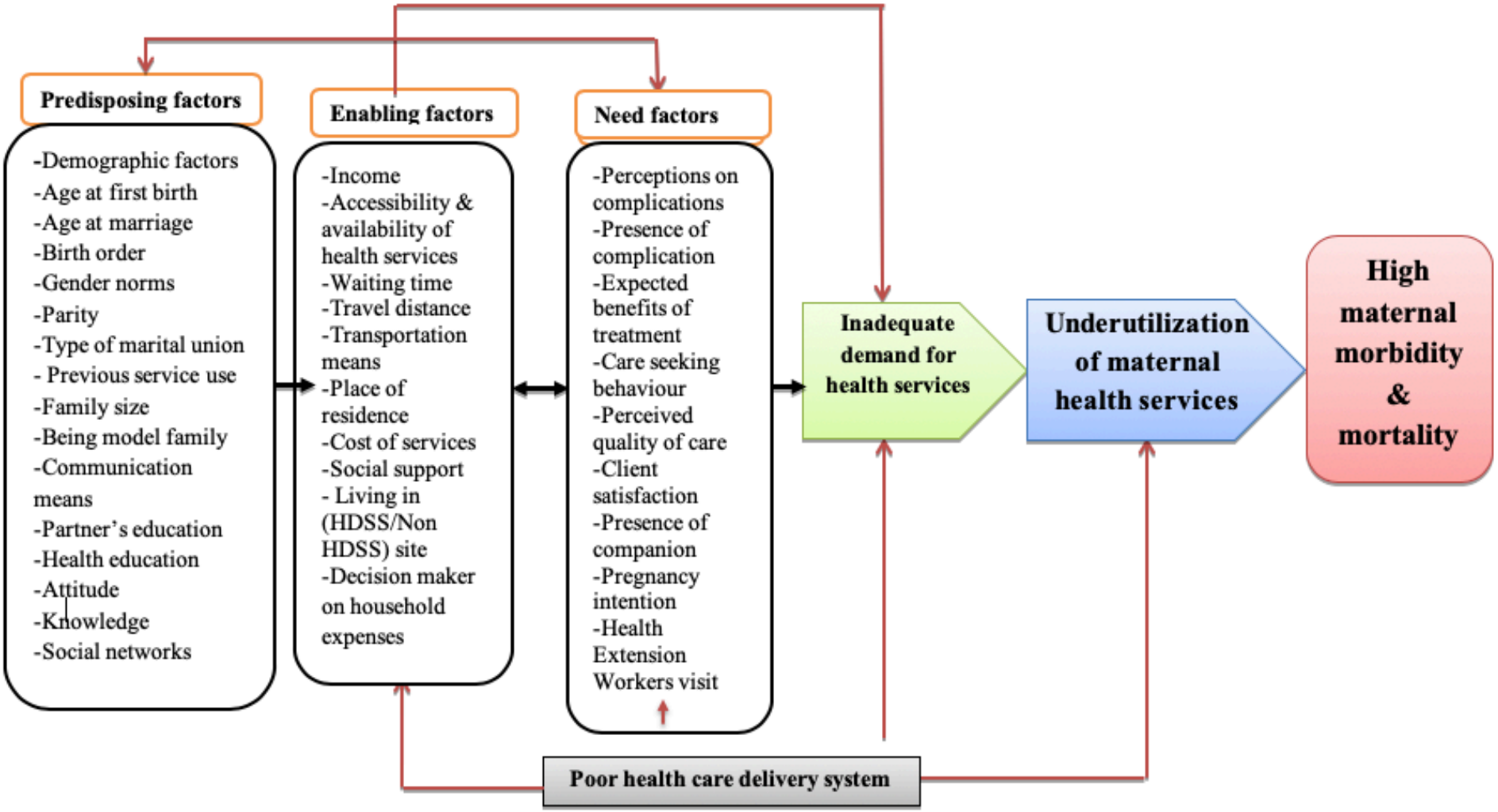

Figure 2.1. Interaction of several predisposing, enabling, and need factors that lead to low utilization of maternal health services and ultimately to high maternal mortality (adapted from Andersen-Newman (74, 75), and Shiekh & Kwaak (176)).

2.6.2 Predisposing factors

Predisposing factors are the demographic and socio-cultural characteristics of an individual that exist before the occurrence of their illness (74) (refer to Figure 2.2.). These include socio-demographic, social structure, attitude and belief factors that directly or indirectly influence the likelihood the women needs, and uses, maternal health services. Among socio-demographic factors, the educational status of women is one of the most commonly cited factors positively correlated to ANC and skilled delivery care utilization (110, 111, 132, 140, 172, 179-181) and PNC services (92, 110, 182-184). Literate women are better aware of health services as they generally have better access to written information, are more confident, and have higher earnings, factors which all increase their service use (87). Education is thought to be a very important factor in influencing behavior, as well as changing the attitudes of individuals (185).

Women's levels of educational attainment in Ethiopia are much lower than men, as evidenced by a national survey (53). Nearly half of the reproductive-aged women in Ethiopia are illiterate (44). The resulting inability to independently access information could explain resistance to behavioral change and be one of the main reasons for the poor utilization of available maternal health services in the country. Women's education not only increases their empowerment but also transforms their social value, enabling them to better contribute to the economy of the country (186). An increase in social value may also result in an improvement in health care access, and thus the ability to utilize maternal health services; ultimately reducing maternal mortality. Evidence shows that education and empowerment of women has a substantial impact on reducing maternal mortality (33). Occupational status is another factor associated with maternal health service use (115, 187). Women who are involved in income-generating occupations were more likely to use maternal health services than others. In further studies (187, 188) it has been shown that unemployed women are less likely to use delivery care as compared to those who are employed. This suggests that those women with some earning status or economic independence were better placed to utilize maternal health services.

Being in a polygamous marital union (a husband having two or more wives) was significantly associated with non-use of maternal health service use (80, 172). The authors

argued that the husband's attention was divided among his wives, leaving him with little time to be involved in maternity care (80). This means that the husband would not help or encourage his wife to get to the services on time and would not fully participate in sending or accompanying his partner while she visited the health facility. Moreover, in a study in southern Ethiopia (172) it was also found that women in monogamous marital unions were more likely to use PNC than those in polygamous unions. As there may be rivalry among the co-wives, women in polygamy have less capacity to access household resources including money to cover costs associated with visiting health facilities and are unable to decide to seek or receive care during pregnancy, delivery, and after birth (189). Additionally, a study in Ethiopia showed that those women who never married and who were widowed were less likely to use ANC compared to those women who were married (132).

Some studies found that high maternal age (49, 115, 172) and high parity (49, 110, 172) were associated with under-utilization of ANC in Ethiopia. In another study, however, it has been shown that high parity is not only associated with the use of ANC but also with the use of delivery care (115). Maternal age and parity are interrelated as older aged women are mostly multiparous and in most studies these factors showed a similar influence on maternal health service utilization (190, 191). Older women could have more childbirth experience with more children (high parity) and may tend to avoid using maternal health service for subsequent births. The proportion of women who receive antenatal and skilled delivery care tends to decrease as the women's age increases; the lowest proportion of women who attended these services was observed in the age group of 35-49 years (44). On the other hand, in a study in Pakistan based on a multiple indicators survey, researchers showed that a woman's age at first marriage was significantly associated with ANC coverage (192). A further study in Ethiopia (120), emphasized the importance of woman's age at first marriage; in particular, those women who first get married at the age of 15 to 19 and those from 20-24 were found to be much more likely to use health facility delivery than others. Furthermore, in other studies (193, 194), women younger than 18 years old at their first pregnancy were more likely to use antenatal and skilled delivery care than their counterparts. Young women may, in general, belong to more modern cohorts and thus are more likely to use health care services than older women (113).

The size of the family and birth order of children are important factors for women's use of maternal health services. In a survey in northern Ethiopia (112), women who have a large family were found to be less likely to use delivery care than women with smaller families. This could mean that the larger the family, the lower the attention given to the health of the women at the household level (by the women herself or her partner); this results in her neglecting use of the services. Moreover, an analysis of the 2011 Ethiopian Demographic Health Survey data (188) shows that birth order is another factor associated with the use of delivery care, where women whose most recent birth is their fourth or more are less likely to use the service than the reference group. A retrospective case-control study in western Ethiopia has also identified birth order as one of the predictor variables for health facility attendance for delivery care (195).

Women may obtain information regarding the importance of maternal care from mass media, community-based health education sessions, previous exposure to health services, or formal schooling. The level of awareness about the benefits of maternal services is a driving factor behind the utilization of the service, where women's high knowledge score was correlated with better use of the service. A study in Ethiopia demonstrated that knowledge of the benefits of ANC services was significantly associated with early utilization of the service (117). Moreover, a different study conducted in Woldia, Ethiopia found that those women who have a good awareness of the importance of delivery care were more likely to use the service than others (196). However, awareness may not be sufficient to ensure service use. For instance, a study in western Ethiopia showed that among women who knew about delivery care services, only half of them were found to use the service (142). Additionally, the national Demographic Health Survey report of Ethiopia showed that more than 60% of women did not consider delivery care necessary (53), highlighting the need for further behavioral change communication programs to improve the uptake of maternal health services in Ethiopia.

Women's health-seeking behavior should also be observed in a wider social context. This was evident in Timor-Leste where women, relatives, friends, and other family members were reliable sources of information regarding pregnancy and delivery related issues (197), thus indicating that existing social networks within which women are already a natural member can play a crucial role in shaping their behavior towards maternal health service utilization. Evidence (198) suggests that women with a good level of social capital

had higher rates of maternal health service uptake than others. This is particularly true among rural women in a developing country setting; what health resources are available are costly or far from home. Similarly, researchers in rural Malawi (199) showed that women's utilization of maternal health services is significantly affected by the practice of other women in the vicinity. In other words, women are more likely to use the service if friends, neighbours and other relatives in their social networks use the services. As a result, the decision-making and health-seeking behavior of women are deeply rooted in the social system of the community where they belong and live, which ultimately facilitates or hinders their access to and utilization of maternal health services (74).
Moreover, in a review of studies conducted on continuous social support, it was found that social support in the community during pregnancy and labour is of paramount importance, increasing not only the psycho-social and physiological health but also the satisfaction in and the ease of woman's childbearing experiences (200). Though the review has not acknowledged this, the finding has a clear implication about the role the family, friends, and other social support groups could play during pregnancy and after the onset of labour until the mother's care is taken over by health care providers in the health facility. Similarly, in studies conducted in Ethiopia (201), Timor-Leste (197), and Kenya (202), researchers demonstrated that social support for women during pregnancy, delivery, and the post-delivery stage is extremely important for women's utilization of maternal health service.

Women's decision-making norms in communities are one of the issues that need to be addressed in order to increase demand for maternal health services (203). Women's decision-making autonomy, that is women's ability to make decisions on matters within the household and outside the home, is determined by the societal gender norms and values in that particular setting. In most communities in Ethiopia, the traditional gender norms are based on a patriarchal power structure which favors male dominance and supremacy (204). Women's decision-making capacity determines their health care decision-making ability, which in turn shapes their care-seeking behavior. In Ethiopia, gender norms impact women's use of health services as they are unable to decide to use services alone depending on their level of autonomy; instead, they usually need their husband's permission before they start to receive the service (64, 205). In one study in Ethiopia, it has been shown that among those women who have access to money, only 38% were able to spend money without the approval of their husbands, and only 44% were

able to autonomously visit health facilities to receive maternal health services (205). In the same study, living in a monogamous marital union with a nuclear family, enjoying a high-income level and having a good knowledge of, and positive attitude towards maternal health services, were positive predictors of having a high women's autonomy score. This has clear implications particularly for those women who live in rural areas, in polygamous marital unions, and who have poor awareness of the benefits of maternal health services as they are most likely be non-autonomous and less likely to utilize the available services. In addition, as husbands are traditionally the ones who decide on household matters and have control over resources in an Ethiopian socio-cultural context, their involvement in advising and caring for their wives can contribute to maternal health service uptake. Generally, it has been shown (49, 173) that a woman's decision making ability and husband's disapproval or approval of service use determines a woman's care-seeking behavior towards maternal health services.

Furthermore, maternal health service seeking behavior patterns among Ethiopian women, particularly those from rural areas, are also linked with many cultural practices, which can be a barrier to accessing services throughout a woman's pregnancy or during childbirth. The prevailing cultural practices in a given community play an important role in the decision to seek care and assistance during pregnancy as well as directly after. This is especially true when a woman decides the place of delivery (64, 206). Several cultural practices are performed on pregnant or labouring women before they are free to seek health care treatment in the facility, including abdominal massage and skin piercing to correct the foetal position and to decrease pain, and these may delay women from seeking medical care (207). Pregnant women may wait for the results of treatment given by a traditional healer and there is a culture of traditional medical practices such as abdominal massaging, using holy water, and praying, all of which are used before turning to modern health care (208). The delays associated with waiting for the traditional treatment to have an effect on the maternal condition may end with loss of life.

2.6.3 Enabling factors

Enabling factors are those that affect the ability of the woman to access health care services at the individual and community level; among these factors are economic status,

place of residence, the price of health services, health insurance, the presence of care centre and caregivers, travel distance and waiting time (74). It has been established that there is a huge difference in the uptake of maternal health services between the rich and the poor (4). Studies (49, 111, 112, 179-181, 188) have demonstrated that women with high economic status are in a better position to use maternal health services. In Ethiopia, as in other sub-Saharan African countries, there is a huge gap in the level of income among women and men, especially in rural parts of Ethiopia, where women are even less empowered to access and control household resources than their urban counterparts (209). The social position of women in most communities in developing countries restricts women's access to household resources, which ultimately influences their capacity to make and act upon decisions about their health.

A review of Demographic Health Survey reports from many developing countries have revealed that household wealth status has a positive association with the utilization of institutional delivery. These surveys show that the use of skilled birth care is highest among the wealthiest group in almost all of the countries studied (91). The recent Ethiopian Demographic Health Survey indicated that the percentage of women with skilled delivery care attendance in the highest wealth quintile was 66.9%, which is very high compared to the national estimate (28%) (44). In a systematic review of literature on inequalities of PNC service utilization in developing countries, it was also shown that the level of wealth index is a strong predictor of PNC utilization (182). Researchers in an Ethiopian study (172) also support the idea that women with a high-income level were more likely to use PNC services than others. Generally, women of lower socio-economic status face challenges when they try to access maternal health services as they lack resources for travel, accommodation, food and clinical services expenses (81). In Ethiopia, even though the maternal health service is free of charge due to government subsidization, it has been observed that nearly two-thirds of health centres charge a fee for some aspect of maternal health services (210) creating a barrier to utilization of health services.
In addition to the socio-economic barriers that women face, distance, and availability of transport infrastructure affect the ability of women to get to the services (197). Evidence (27) indicates that as the distance between the woman's home and the health facility increases, the utilization of maternal health services will decrease. A larger body of literature agrees that the distance to the health facility (112, 173, 208, 211), and the availability of public transportation (211, 212) are potential barriers for utilization of

antenatal, skilled delivery and postnatal care. In Ethiopia, long distances and travel time are stronger disincentive factors for accessing maternal health services in rural compared to urban areas (90). The influence of long-distance on access and use of services becomes more pronounced if there are no means of transportation and poor road infrastructure development (84).

Availability of transportation during pregnancy and delivery is crucial for expectant mothers to access health facilities. Many mothers die at home during labour due to the absence of road infrastructure that will enable a timely transfer to health facilities to receive emergency care. In the majority of cases, rural communities also lack regular public transportation (207). Recently, there have been efforts to increase the availability of ambulances funded by the Ethiopian government in collaboration with donors; the intention is to distribute a large number of modern four-wheel drive ambulances to each district to aid in the emergency transportation of women (134). Nevertheless, in rural Ethiopia, there is still an enormous problem in terms of accessing ambulances in case of obstetric emergency. People in far-off rural areas in Ethiopia use modified stretchers to transfer labouring mothers to nearby health facilities or to major roads to access modern ambulances. This is especially true in districts where the terrain makes travel very difficult (95).

The time gap between the occurrence of a grave pregnancy complication and obtaining emergency obstetric care should be very short to maintain the health status of women and achieve good pregnancy outcomes. Almost all the leading causes of maternal death in Ethiopia such as obstructed labour, hemorrhage, hypertensive disorders, and sepsis, require urgent skilled medical management. For instance, a woman who profusely bleeds during childbirth will die within hours without prompt emergency medical intervention. There is a pressing need for easy accessibility and availability of transport infrastructure (including ambulances), as well as functional all-weather roads to link the mother to the nearest health facility in a timely manner (208). In order to leverage those obstacles (in terms of avoiding distance and transport barriers), the WHO has recommended setting up antenatal home visits to increase the uptake of the service, particularly in rural and low health care access settings (160).

In most developing countries, the accessibility and uptake of maternal health services are

much more limited in rural areas than in urban settings. According to several studies in Ethiopia (115, 140, 173, 181, 213), maternal health service utilization is very low among rural-dwelling women compared to women from urban areas. Women who live in urban areas have a disproportionate share of births which take place in a health institution. Children born in an urban setting are almost six times more likely to be delivered in health facilities than those born in rural areas (96). In a systematic review in developing countries (182) it was reported that PNC is disproportionately utilized by urban rather than rural-dwelling women. Researchers in other developing countries also demonstrated that living in an urban area is correlated with higher utilization of maternal health service (79, 214, 215). Research tells us that women local to rural areas have poor physical accessibility to health facilities (as mostly the health care facilities and professionals are highly clustered in urban centres); but also live in poor socio-economic conditions with inferior infrastructure development, more prevalent traditional norms, and less exposure to media and health information (55, 88, 113).

In their study, Afework et al. (111) showed that women who lived in HDSS site were more likely to use skilled delivery care than those who did not live in the HDSS site. It is expected that demographic and health surveillance sites are exposed to continuous surveys and health information as there could be regular visits by the field enumerators and researchers which might function as a passive form of health education intervention to the community members.

Enabling factors are the second of three sets of factors that influence maternal health service utilization. The reviewed studies have identified several enabling factors including place of residence; physical distance to a health facility; availability of transport to a health facility; women's economic status; availability of health services; and a women's participation in household decision making.

2.6.4 Need factors

Need factors are proximal factors that inhibit or promote women's utilization of health services. These factors may include perceived susceptibility to health problems, the perception of health complications, and understanding of an aspect of health services

through creating demand for the service (74). It has been established that pregnancy intention, awareness, and experience of obstetric complications, Health Extension Workers' home visits, perceived benefit of the care, and history of poor pregnancy outcomes are need factors associated with maternal health service utilization (110, 174, 181, 184).

In an investigation on maternal health service use in Hossana, Ethiopia (110) it was reported that pregnancy intention has been positively associated with both ANC and delivery care utilization. In another study (181), researchers identified pregnancy intention to be associated with only ANC use but failed to prove the association when adjusted for other variables for delivery care attendance. Similarly, in a further study in Ethiopia (117) it was shown that planned pregnancy has a positive association with early initiation of ANC visits. Likewise, a study in Vietnam (216) demonstrated that ANC utilization is higher for women who have intended pregnancy. This study also found pregnancy intention also predicted the use of delivery services.

Maternal knowledge of the danger signs of pregnancy (49, 110, 217) is significantly associated with the use of maternal health services. However, in Ethiopia, the level of awareness of pregnancy danger signs was very low. A study in south-central Ethiopia showed that only 32% of the reproductive-aged women knew the danger signs of pregnancy (218). A qualitative study in a rural area in southern Ethiopia further found that women and their family members who do not recognize the severity of pregnancy complications, especially antepartum hemorrhage, often delay the decision to seek medical attention early (207). In the same study, when asked specifically, most study subjects were unable to name the most important danger signs that occur during pregnancy and labour. A study conducted in Hossana, southern Ethiopia (110) established that women who have a good awareness of pregnancy and birth complications are more likely to use PNC than others. Moreover, having a previous history of obstetric complications was found to increase the likelihood of the utilization of delivery care for subsequent deliveries, as described in a study conducted in Gondar, northern Ethiopia (131). A review of studies in African countries on postnatal care service use and its predictors found that the presence of postnatal maternal health problems has a positive association with the utilization of PNC (184). This is supported by a study conducted in southern Ethiopia which demonstrated that the most commonly mentioned reason for non-use of PNC check-up is women being

apparently healthy (110).

It has been shown that ANC utilization has a strong correlation with skilled delivery care use (49, 115, 119, 181). In a meta-analysis of thirty studies conducted in Ethiopia (219), it has been indicated that women who attended any ANC visit were four times more likely to use facility-based deliveries (Figure 2.2). Furthermore, women who initiated ANC attendance early and used the service regularly were more likely to subsequently choose institutional delivery and PNC than those who initiated late and attended a fewer number of visits (110, 118, 144, 184, 220-222). Gage (199) argues that attending ANC is a good means to increase the utilization of delivery care due to women's interactions with the care provider. Women's contact with the health facility may help them become more confident and familiar with the health care system and health staff; and increase exposure to encouragement from health workers (113). The advice and information women receive about complications, in particular, may increase their risk perception and encourage them to use subsequent maternal health services (93, 132, 218). The above evidence suggests that ANC is the foundation for the utilization of the other aspects of maternal health services, and programs should be designed to strengthen the linkage between maternal health services.

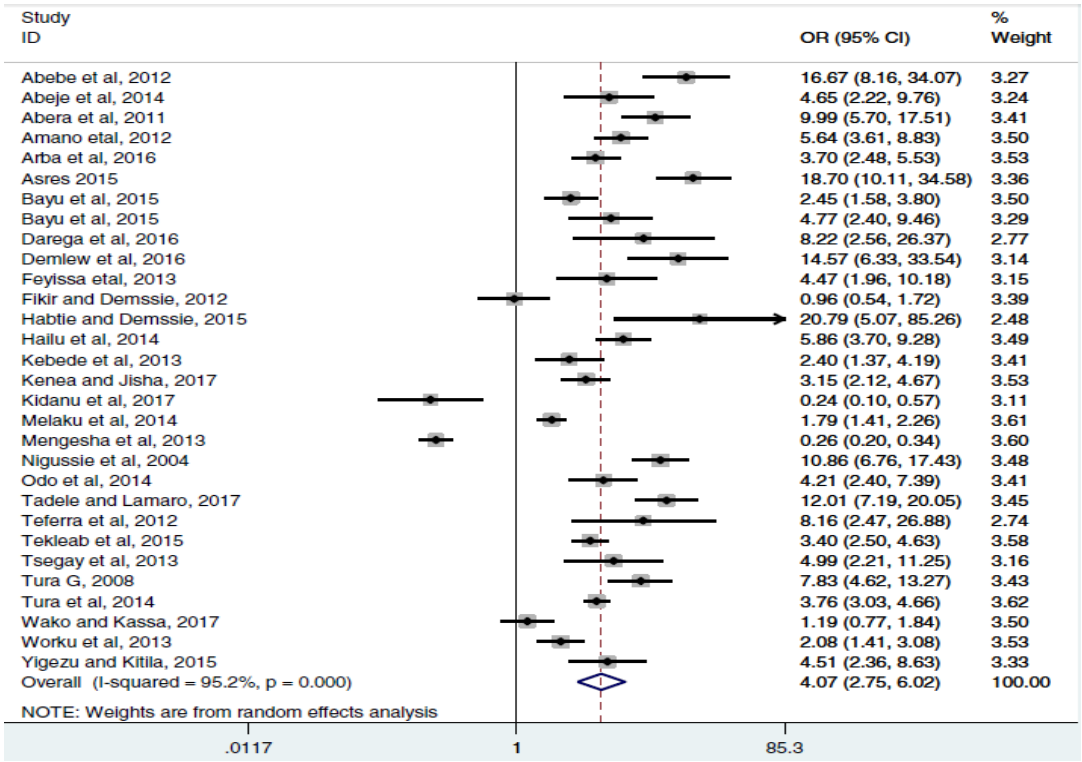

Figure 2.2. A forest plot showing a meta-analysis estimation of the association between ANC and skilled

delivery care utilization in Ethiopia (219).

In a study conducted in southwestern Ethiopia (223), among women who faced pregnancy complications, nearly three-quarters had sought support from skilled health workers in health facilities. Low perceived severity of complications and misperceptions about the benefit of the care were major reasons for not seeking care from skilled providers when complications occur. Apart from low perceived susceptibility (124) to the complications of pregnancy, perceived quality of the service is another important barrier that could discourage women from using maternal health services, and delay their care-seeking (27). Women may assume that the health facility won't have the necessary equipment, nor skilled and respectful professionals, therefore, underestimate the possible benefits of visiting a health facility. In a study in Tanzania, it was shown that a woman's perception of both the presence of medical supplies and drugs, and the care providers attitude, are associated with the choice of place of delivery (81).

Health Extension Workers visiting the home influence the use of maternal health services by the women in the household. In a study conducted in Ethiopia involving 4,949 women who gave birth in the two years prior to the survey, it was shown that those who received at least one visit at home from Health Extension Workers were more likely to use the recommended ANC, skilled delivery and PNC services. This was in comparison to those who did not receive a home visit (174). In summary, the reviewed studies indicate that a range of need factors are associated with the underutilization of antenatal, skilled delivery, and postnatal care services. Specifically, factors such as perceptions about, and experiences of, obstetric morbidity; perceived benefits of care; pregnancy intentions; Health Extension Workers' home visits; and poor pregnancy outcomes play a significant role in determining antenatal, skilled delivery and postnatal care uptake in many settings across Ethiopia.

Overall, the findings of the reviewed studies show a plethora of influencing factors that operate at the individual, household, and community level to hinder or facilitate antenatal, skilled delivery, and postnatal care utilization. The relative influence of these socio-economic, cultural, and health system factors on antenatal, skilled delivery and postnatal care use varies across different geographical and social contexts, including within the same country. For instance, in some communities in Ethiopia, giving birth in health facilities is

strictly prohibited, and in some rural areas, women are even made to give birth in the bush (64, 224). In addition, the reviewed studies did not yield a consistent pattern of association between the influencing factors and maternal health service utilization. The magnitude and nature of these associations appear to differ across social settings, highlighting the need to design interventions that are tailored to specific social contexts. This research aimed to identify factors that are associated with maternal health service utilization in a largely rural setting, despite there being both relatively good access to health care; and subsidized and or free maternal health care available. The findings of this study can be used to guide maternal health planners and policymakers in amending existing programs or developing contextually appropriate interventions aimed towards improving maternal health care. Improving women's utilization of antenatal, skilled delivery, and postnatal care services is the recommended strategy for reducing maternal mortality in Ethiopia. Given that there is a relatively low uptake of antenatal, skilled delivery, and postnatal care, there has been little evidence that comprehensively investigates the contextual factors that influence the uptake of maternal health services. In addition, whilst some research has been undertaken, there has been little qualitative investigation into the societal and cultural factors that contribute to delayed use of maternal health care services.

The research aims of the studies that comprise this thesis were formulated based on the results discovered during this literature review. The overall aims of this thesis are:

Aim 1: To determine the level of, and factors associated with, delayed initiation of antenatal care in Ethiopia (Chapter 3)
Aim 2: To investigate the magnitude and causes of maternal mortality and resulting trends among reproductive-aged women in Kersa HDSS (Chapter 5)
Aim 3: To examine antenatal care utilization through the application of Andersen-Newman behavioral model in Kersa (Chapter 6)
Aim 4: To assess the predisposing, enabling, and need factors associated with skilled delivery care utilization in Kersa (Chapter 7)
Aim 5: To explore the magnitude and correlates of postnatal care utilization in Kersa (Chapter 8)
Aim 6: To explore and identify factors that contribute to delayed use of maternal health services in Kersa (Chapter 9)

Chapter 3

Delayed initiation of antenatal care and associated factors in Ethiopia: a systematic review and meta-analysis

3.1 Foreword

A critical proposition of this thesis is that maternal health service uptake in Ethiopia is low, contributing to high maternal mortality. Antenatal care is one vital component of maternal health services; its delayed use results in missed opportunities to enhance maternal and infant health. In Ethiopia, there have been high rates of late attendance at ANC among women who do use this service. The purpose of this paper is to establish the current state of knowledge about the timing of ANC uptake in Ethiopia, with the goal of addressing Aim 1: To determine the level of, and factors associated with, delayed initiation of antenatal care in Ethiopia.

This chapter was published in *Reproductive Health:*
Tesfaye G, Chojenta C, Loxton D, Semahegn A, and Smith R: Delayed initiation of antenatal care and associated factors in Ethiopia: A systematic review and meta-analysis. *Reproductive Health, 2017; 14(150).*

Abstract

Background: Antenatal care uptake is among the key indicators for monitoring the progress of maternal outcomes. Early initiation of antenatal care facilitates the timely management and treatment of pregnancy complications to reduce maternal deaths. In Ethiopia, antenatal care utilization is generally low, and delayed initiation of care is very common. We aimed to systematically identify and synthesize available evidence on delayed initiation of antenatal care and the associated factors in Ethiopia.

Methods: Studies published in English from 1 January 2002 to 30 April 2017 were systematically searched from PubMed, Medline, EMBASE, CINAHL, and other relevant sources. Two authors independently reviewed the identified studies against the eligibility criteria. The included studies were critically appraised using the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review instrument for observational studies. Meta-analysis was conducted in RevMan v5.3 for Windows using a Mantel–Haenszel random effects model. The presence of statistical heterogeneity was checked using the Cochran Q test, and its level was quantified using the I^2 statistics. The pooled estimate of the proportion of the outcome variable was calculated. Pooled Odd Ratios with 95% CI were calculated to measure the effect sizes.

Result: The pooled magnitude of delayed antenatal care in Ethiopia was 64% (95% CI: 57%, 70%). Maternal age (OR=0.70; 95% CI: 0.53, 0.93), place of residence (OR=0.29, 95% CI: 0.16, 0.50), maternal education (OR=0.49; 95% CI: 0.38, 0.63), husband's education (OR=0.44; 95% CI: 0.23, 0.85), maternal occupation (OR=0.75; 95% CI: 0.61, 0.93), monthly income (OR=2.06; 95% CI: 1.23, 3.45), pregnancy intention (OR=0.49; 95% CI: 0.40, 0.60), parity (OR=0.46; 95% CI: 0.36, 0.58), knowledge of antenatal care (OR=0.40; 95% CI: 0.32, 0.51), women's autonomy (OR=0.38; 95% CI: 0.15, 0.94), partner involvement (OR=0.24; 95% CI: 0.07, 0.75), pregnancy complications (OR=0.23; 95% CI: 0.06, 0.95), and means of identifying pregnancy (OR=0.50; 95% CI: 0.36, 0.69) were significantly associated with delayed antenatal care.

Conclusion: Improving female education and women's empowerment through economic reforms, strengthening family planning programs to reduce unintended pregnancy and promoting partner involvement in pregnancy care could reduce the very high magnitude of delayed antenatal care in Ethiopia.

PROSPERO registration number:-CRD42017064585

Keywords:-Delayed antenatal care, associated factors, Ethiopia, Systematic review, Meta-analysis

3.2 Background

The burden of maternal mortality remains hugely varied between developing and developed countries (225). In developing countries, the overall lifetime risk of woman's death due to pregnancy and related causes is estimated to be 1 in 180, while for developed countries it is about 1 in 4900 (4). The maternal mortality ratio in Ethiopia is still high at 353 per 100,000 live births in 2015 (5), and it remains among the highest in the world. In developing countries like Ethiopia, obstetric complications during pregnancy and childbirth are the leading causes of death among reproductive-aged women (5, 10). It is generally recognized that a lack of access to, and inadequate utilization of, antenatal care (ANC) during pregnancy contributes to adverse maternal health outcomes such as maternal mortality (23, 49), something which is more common in resource-poor settings. Antenatal care uptake is one of the key indicators for monitoring the progress of improving maternal outcomes. Early initiation of ANC facilitates the timely management and treatment of pregnancy complications to reduce maternal deaths (226).

In Ethiopia, the main direct causes of maternal mortality are hemorrhage, hypertensive disorders of pregnancy, unsafe abortion, and puerperal sepsis (48, 227). These complications can be averted or otherwise treated through providing skilled care during pregnancy, childbirth, and the postnatal period (4). In 2002, the World Health Organization (WHO) recommended that pregnant women make at least four ANC visits (103); in 2016 this recommendation was modified to at least eight visits (106), with the first ANC visit to be undertaken before the 12th week of pregnancy. While there has been marked progress in the uptake of at least one ANC attendance in Ethiopia (44, 52, 53, 108-110), there has been suboptimal attendance of the recommended visits (10, 44, 115, 228). Of even more concern was the substantial proportion of women who delayed their first ANC visit until the second or third trimester of pregnancy (49, 91, 96, 115). According to the National Demographic and Health Survey Report of Ethiopia (96), in 2014 more than three-quarters of pregnant women initiated their first visit after 16 weeks of pregnancy. Early initiation of ANC plays a paramount role in enhancing maternal health as it provides an opportunity for the early screening, treatment, and referral of pregnancy complications (11). Evidence has shown that pregnant women who initiate ANC early were less likely to develop unfavorable obstetric outcomes as compared to women who entered into care after

the first trimester (122, 229).

The key challenges that women face when seeking maternal health services were clearly explained in the Three Delays model (84). This model described the barriers to utilizing maternal health services at three interrelated levels before the occurrence of maternal death. At the first level, the home or community level, women may be delayed from seeking ANC due to factors such as the low social status of women in relation to decision-making; poor awareness of pregnancy or birth complications; previous poor experience of care; traditional or social practices during pregnancy or childbirth; acceptance of maternal death as normal; and financial dependency. In Ethiopia, there is a huge gap in the level of income among women and men especially in rural parts of Ethiopia, and women are less empowered to access and control household resources (209). This could influence their capacity to make decisions about the utilization of maternal care. Moreover, the financial burden associated with transportation to and from the facility, and the costs incurred for the maternal care itself, profoundly diminished the uptake of the care (90). In the second level, there may be a delay in reaching a health facility, which might be due to distance, unavailability of infrastructure (road or transportation), or difficult terrain. The third level of delay (delay in receiving adequate care) might be related to a shortage of or inadequately trained health staff, and unavailability of medical supplies and equipment.

Several studies (114, 230-235) have investigated factors affecting delayed attendance of ANC in Ethiopia. Nonetheless, none of these studies have systematically reviewed the factors to show their overall cumulative effect on delayed initiation of ANC at the national level. In addition, there were inconsistencies in attributing the influence of the factors on the late initiation of ANC across various studies. For instance, there were incongruent findings on the influence of many factors including maternal education (236-239), maternal age (234-236, 238), place of residence (230, 234, 240, 241), maternal occupation (242, 243), marital status (234, 238, 239), husband's education (233, 234, 244), previous experience of using ANC (234, 235, 237); and, history of abortion (233, 234, 245) on delayed initiation of antennal care. Hence, demonstrating a pooled effect of the factors on delayed initiation of ANC was warranted.

Previous systematic reviews conducted in developing (190, 191) and developed (246) countries have mainly reviewed evidence on the adequacy of the utilization of ANC and

its related factors. These reviews covered larger geographical regions and hence failed to reflect country-specific situations. Moreover, these reviews did not centre on delayed initiation of ANC as a primary outcome of interest. The objective of this review is to systematically identify and synthesize existing evidence to understand the delayed initiation of ANC and associated factors among reproductive-aged women in Ethiopia.

3.3 Methods

3.3.1 Development of the review method

The methodology of this systematic review was developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) 2015 Statement (247) and the items in the PRISMA-P checklist were addressed (*Appendix 6*). The four phases that were drawn from the PRISMA flow chart (248) were documented in the results to show the study selection process from initially identified records to finally included studies. The protocol for this systematic review and meta-analysis was registered in the international prospective register of systematic reviews (PROSPERO) and obtained the registration number CRD42017064585.

3.3.2 Search strategy

The literature search was carried out by the primary author (GT). The search was limited to papers published in English from 1 January 2002 to 30 April 2017. The year 2002 was selected, since WHO had introduced the Focused ANC model (103) by this year. We applied MeSH terms, Emtree, CINAHL headings, and combined keywords to identify studies in the databases. Major medical electronic databases such as PubMed, Medline (OVID interface), Excerpta Medica (Embase) (OVID interface), and CINAHL (EBSCO host) were used to identify relevant literature for the review. To cover grey literature, we hand-searched literature using the Google search engine and Google Scholar; official WHO websites; online libraries of academic and government institutions, and references of electronically identified articles. The search strings or terms were stemmed from the

following keywords: delayed initiation, ANC, associated factors, and Ethiopia. The search terms were used to retrieve relevant literature in a combined form adapted to the requirement of the specific database. Further information regarding the search strategy of the selected databases is attached in (*Appendix 7*).

3.3.3 Eligibility Criteria

We included all observational studies as well as Demographic and Health Surveys reports. We considered studies that examined the level and factors associated with delayed initiation of ANC among reproductive-aged women (15-49 years) who were pregnant or gave birth at least once and who live in Ethiopia. We included studies that defined the main outcome variable "delayed initiation of ANC" as entry into care after at least 12 weeks of pregnancy, including studies that defined delayed initiation of ANC as entry into the care after 16 weeks of gestation. Studies that had been conducted in either a community or facility setting, and which involved analysis of primary or secondary data were included. We included studies that had a measure of association statistics or had test statistics that explicitly demonstrated the influence of the predictors on delayed initiation of ANC, or had a crosstab showing the difference in magnitude of the outcome variable in the categories of the predicting variables. We excluded reviews, editorials, case series, and case reports on delayed initiation of ANC. We also excluded studies that only reported qualitative findings on delayed ANC initiation. In studies that reported both quantitative and qualitative results, we only considered the quantitative findings.

3.3.4 Study selection procedure

3.3.4.1 Screening

First studies were identified through applying the search strings and the filters in the databases as well as other relevant sources. The identified studies were exported to the citation manager (EndNote) (249) and duplicates were excluded. The two authors (GT and AS) independently screened the studies based on the information contained in the titles

and abstracts according to the inclusion criteria. Based on this screening, the titles and abstracts of the studies were classified as included, excluded, and undecided. We then obtained the full texts of all the included and the undecided studies for further eligibility assessment.

3.3.4.2 Eligibility of Studies

The two authors (GT and AS) independently reviewed the full texts of the included and undecided categories of the studies against the eligibility criteria for final inclusion. Studies that were not eligible based on the examination of the full-text were excluded and the reasons for the exclusion were described. Disagreements between the two reviewers were resolved through discussion and consensus.

3.3.5 Quality Assessment

All the included studies were critically appraised for their validity. The two authors (GT and AS) checked the methodological robustness and validity of the findings using the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (250). Attention was given to a clear statement of the objective of the study, inclusion criteria, the randomness of subject selection, identification of the study subjects, and preciseness of measurement of outcomes of interest and use of appropriate statistical analysis method, as well as documentation of sources of bias or confounding. Uncertainties were resolved by joint discussion between the reviewers. The level of agreement between the two reviewers was judged using Cohen's Kappa (K) coefficient statistics. To calculate "K" a two by two contingency table was constructed with "High" and "Low" categories of quality assessment provided independently by the two reviewers based on a set of criteria. We obtained a "K" value of (0.80), and thus the level agreement was satisfactory. To minimize publication bias, we searched and included both published and unpublished literature. We obtained unpublished literature (grey literature) through the hand-searching of online libraries of academic institutions, government organizations, and agencies in addition to using Google search engine and Google scholar. We also contacted an author to seek data that was not clearly reported in the article.

3.3.6 Data Extraction Process

A structured data extraction template in the form of a summary table was constructed for the data abstraction. The two authors (GT and AS) systematically used the data extraction template to abstract data. The summary table contained a list of items pertaining to the study characteristics to concisely present all the included studies. The specific list of items included; study year, design of the study, study setting, sample size, study subjects, data collection method, and study-specific predicting factors. A quantitative data of cross-tabulation between the subject's characteristics (predicting factors) and the outcome variable was also systematically abstracted. During the data extraction of the exposure variables, we categorized the individual classifications shown for each variable in the studies into two (exposed with the outcome and non-exposed with the outcome). The non-exposed category was considered as the reference category of the variables (*e.g. for a place of residence, urban was the exposed and rural was the non-exposed category*). We then put the corresponding combined numerical value to make it ready for the quantitative synthesis. During the data extraction, one of the papers (*Bayou et al. 2016*) reported missing and incomplete data, and the principal author of the publication was contacted to request further data via email. We received a response from the author and were provided with the requested data. Disagreements between the two review authors were resolved by face to face discussion and reached a consensus.

3.3.7 Data Synthesis and Statistical analysis

The individual studies were concisely described using a summary table. The summary table particularly described the characteristics of the included studies and the main findings. We conducted the quantitative synthesis using the Cochrane community Review Manager Software (RevMan version 5.3 for windows) (251). Summary statistics (pooled effect sizes) in Odds Ratios with 95% confidence intervals were calculated. We classified the factors that showed significant association with the outcome variable into three groups based on the Three Delays model, though some overlapping exists between them. Forest plots were used to graphically present the meta-analysis results. The presence of statistical heterogeneity was checked by using the Chi^2 test (Cochran Q test) at p-value ≤ 0.05. The level of heterogeneity among the studies was quantified using the I^2 statistics (252) where

substantial heterogeneity was assumed if the I^2 value was ≥ 50%. We conducted meta-analysis using Mantel–Haenszel random effects model when the studies were substantially heterogeneous (I^2 statistic ≥ 50%). The pooled estimate of the magnitude of the primary outcome variable was conducted using *stats direct* (http://www.statsdirect.com) statistical software (253) using Stuart-Ord (inverse double arcsine square root) method. We hypothesized that there could be variation in the factors that lead to delayed ANC between studies that define delayed ANC based on WHO (103) recommendation with (≥12 weeks) and country-specific recommendation (105) (≥16 weeks) due to the obvious difference in magnitude of the outcome variable. Hence, subgroup analysis was conducted based on comparison of outcomes for studies that defined delayed initiation of ANC based on (≥12 weeks) and (≥16 weeks), provided an adequate number of studies were available in the two groups. The result of the review was reported according to the PRISMA guideline for reporting (254).

3.4 Results

3.4.1 Description of the studies

We retrieved 2975 studies through searching the major health and medical electronic databases and other relevant sources. From all the identified studies, 1006 articles were removed due to duplication while 1969 studies were retained for further screening. The remaining 1969 studies were then screened for their eligibility based on the title and abstract. Accordingly, 1867 studies were excluded because of the incompatibility of the content presented in the title and abstract of the studies with our review topic. Hence, the full text of the remaining 102 studies were assessed for eligibility. During the full-text assessment, 80 studies were excluded from the review because of duplication, inconsistent study outcome, or irrelevant target participants. The remaining twenty-two studies were critically appraised and included in the review. After the critical appraisal of the studies, we excluded one study from the quantitative synthesis due to the relatively poor methodological quality and inconsistent statistical report. Finally, twenty-one studies were included for the pooled estimation of delayed initiation of ANC and factor analysis (Figure 3.1).

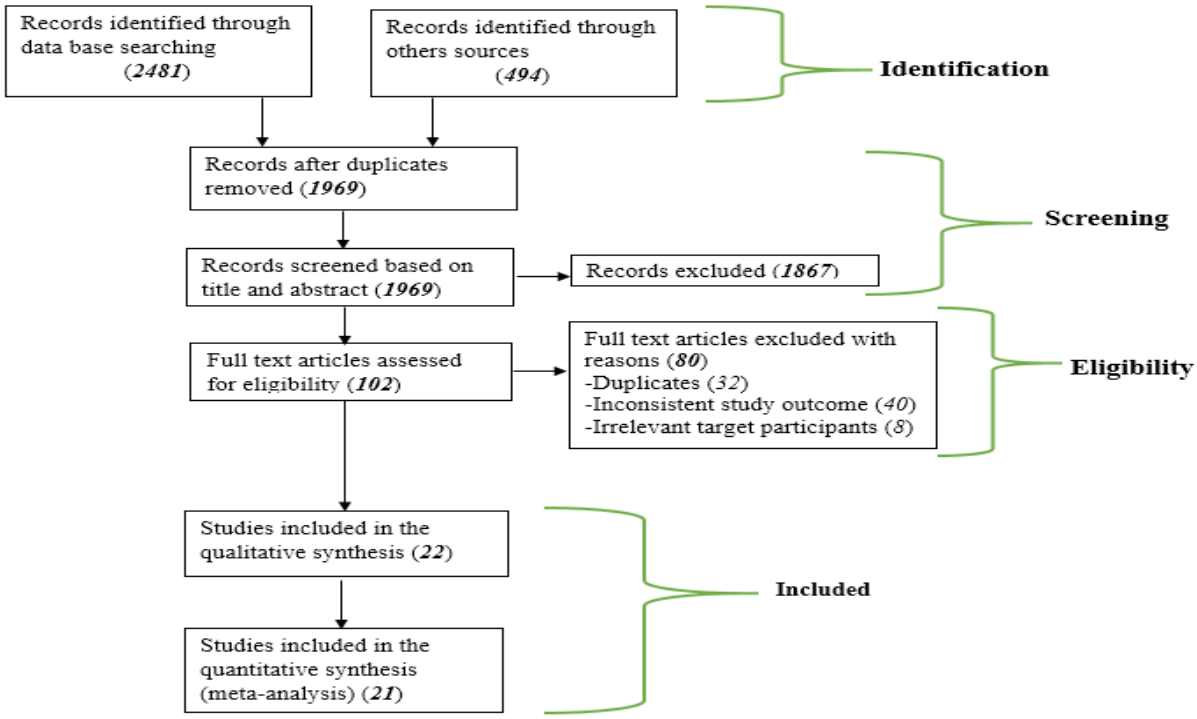

Figure 3.1. Schematic presentation of the PRISMA flow diagram to select and include studies

Among the included studies, there were seventeen published articles, three master theses, and one Ethiopian Demographic and Health Survey report. All the included studies were cross-sectional by design, and seventeen of the studies were conducted in a facility setting (Table 3.1). Ten of the studies included in the quantitative synthesis reported delayed initiation of ANC based on (≥ 12 weeks), and the remaining studies reported it based on (≥ 16 weeks).

Table 3.1. Description of the study characteristics for the included studies in the review

From all the identified studies, 1006 were excluded during screening for duplication and 2953 during title, abstract and full-text assessment

No	Author and year	Setting of the study	Design of the study	Sample size	Study subjects	Data collection method	Primary Outcome of Interest	Delayed ANC (definition)	Study specific predicting factors for delayed uptake of ANC
1	Amentie et al 2015(241)	Community based study	Cross sectional	536	Reproductive-aged women who had at least one birth in the five years prior to the study	Interviewer administered questionnaire	-Utilization of ANC (uptake) -Timing of first ANC initiation	Entry in to care after 12 weeks of gestation	Place of residence (living in rural area)
2	Abosse et al. 2010(114)	Community based study	Cross sectional	710	Reproductive-aged women who had at least one birth in the five years prior to the study	Interviewer administered questionnaire	-Utilization of ANC (uptake) -Timing of first ANC visit	Entry in to care after 12 weeks of gestation	Place of residence (living in rural area)
3	Abuka et al. 2014 (237)	Facility based study	Cross sectional	406	Pregnant women attending health facility	Interviewer administered questionnaire	- Timing of first ANC booking	Entry into care after 12 weeks of gestation	Age (≥20 year), non-attendance of formal education, high parity, perceived that timely ANC is not important, not having information, previous non-use of ANC
4	Bayou et al. 2016 (238)	Community based study	Cross sectional	814	Reproductive-aged women who had at least one birth in the three years prior to the study	Interviewer administered questionnaire	-Early initiation of ANC -At least four ANC visit -Adequacy of ANC	Entry into care after 12 weeks of gestation	Unintended pregnancy and non-attendance of formal education
5	Belayneh et al. 2014 (236)	Facility based study	Cross sectional	369	Pregnant women attending ANC service in health facility	Face-to-face interview technique	-Timing of first ANC booking	Entry into care after 12 weeks of gestation	Non-attendance of formal education, older age (30-49), previous early ANC visit, perceived sufficient number of ANC (4+)
6	Gudayu 2015 (239)	Facility based study	Cross sectional	390	Pregnant women attending ANC service in health facilities	Face-to-face exit interview technique	-Late ANC booking	Entry into care after 12 weeks of gestation	Not obtaining information on right time to initiate, perceived right time to book ANC (12+ weeks), non-autonomy, and use of urine test to identify pregnancy
7	Gudayu et al. 2014(232)	Facility based study	Cross sectional	407	Pregnant women attending health facility	Face-to-face exit interview technique	-Timing of first ANC booking	Entry into care after 12 weeks of gestation	Age (>25), younger age at marriage, pregnancy checking by means other than urine test, perceived right time to start ANC (12+ weeks), and non-autonomy
8	Yilala and Sinishaw 2015(235)	Facility based study	Cross sectional	407	Pregnant women attending antenatal care clinic in health facility	Face-to-face exit interview technique	-Late initiation of ANC	Entry into care after 12 weeks of gestation	Non-attendance of formal education, poor knowledge of ANC, not receiving advice from Health Extension Workers,

									not getting advice on ANC booking , perceived right time of ANC (12+ weeks)
9	Zegeye et al. 2013 (117)	Facility based study	Cross sectional	446	Pregnant women attending health facility	Face-to-face exit interview technique	-Early ANC visit	Entry into care after 12 weeks of gestation	High parity, lack of knowledge of ANC, unintended pregnancy
10	Tariku et al. 2010	Facility based study	Cross sectional	612	Pregnant women attending health facility	Face to face exit interview	-Timing of first ANC booking	Entry into care after 12 weeks of gestation	High parity, unintended pregnancy, obtaining advice on when to book first ANC
11	CSA 2014 (96)	Community based study	Cross sectional	1571	Reproductive-aged women who had at least one birth in the five years prior to the survey	Interviewer administered questionnaire	-Timing of ANC initiation -At least one ANC visit	Entry into care after 16 weeks of gestation	Place of residence (living in rural area)
12	Damme et al 2015 (230)	Facility based study	Cross sectional	379	Pregnant women attending ANC service in health facilities	Face-to-face exit interview technique	-Timing of first ANC booking	Entry into care after 16 weeks of gestation	Non-attendance of formal education, rural residence, low income, having no awareness on timing of ANC
13	Ewenetu et al. 2015(231)	Facility based study	Cross sectional	178	Pregnant women attending ANC service in health facility	Interviewer administered structured questionnaire	Late ANC initiation	Entry into care after 16 weeks of gestation	Non-attendance of education, rural residence, no history of premature birth, late recognition of pregnancy, and unintended pregnancy
14	Fisseha et al. 2015(255)	Facility based study	Cross sectional	410	Pregnant women attending ANC service in health facilities	Interviewer administered structured questionnaire	Timing of First ANC Booking	Entry into care after 16 weeks of gestation	No history of still birth, no pregnancy complications, lack of knowledge of time to initiate ANC, no partner involvement on ANC
15	Gebre meskel et al. 2015 (242)	Facility based study	Cross sectional	409	Pregnant women attending ANC service in health facility	Interviewer administered structured questionnaire	Timing of First ANC Attendance	Entry into care after 16 weeks of gestation	Low income, not receiving advice on when to start ANC, household food insecurity, unintended pregnancy
16	Girum 2016(240)	Facility based study	Cross sectional	362	Pregnant women attending ANC service in health facilities	Face to face exit interview	Timing of First ANC Visit	Entry into care after 16 weeks of gestation	Rural residence, low income, non-attendance of education, not receiving advice on timing of visit and unintended pregnancy
17	Gulema and Berhane 2017(256)	Facility based study	Cross sectional	960	Pregnant women visiting health facilities for the first time	Interviewer administered structured questionnaire	Timing of First ANC Visit	Entry into care after 16 weeks of gestation	Unemployment, low income, perceived ANC initiation time (16 weeks +), unintended pregnancy, having pregnancy complications
18	Hailesilasie and Enquselasi	Facility based study	Cross sectional	419	Pregnant women attending ANC at government health facilities	Face-to-face interview of pregnant women	Late Initiation of ANC Service Utilization	Entry into care after 16 weeks of gestation	Younger age, non-attendance of formal education, low perceived benefit of

	e 2010(244)								ANC, unintended pregnancy, perceived ANC initiation time (4-6months)
19	Hussen et al. 2016(245)	Facility based study	Cross sectional	255	Pregnant women attending ANC at government health facilities	Interviewer administered structured questionnaire	Timely Initiation of First ANC Visit	Entry into care after 16 weeks of gestation	Non-attendance of formal education, lack of knowledge of ANC, late recognition of pregnancy, high parity
20	Lerebo et al. 2015(233)	Facility based study	Cross sectional	415	Pregnant women attending ANC at government health facilities	Face to face interview of pregnant women	Late Booking for ANC	Entry into care after 16 weeks of gestation	High parity, unintended pregnancy, perceived right time to book ANC (16 weeks +), no history of abortion
21	Mohammed and Berhane 2014(257)	Facility based study	Cross sectional	383	Pregnant women attending ANC at selected public health centres	Face to face interview of pregnant women	Timing of first ANC initiation	Entry into care after 16 weeks of gestation	Younger age, non-attendance of formal education, incorrect perception of timing of ANC, being busy
22	Tekelab and Berhanu 2014(234)	Facility based study	Cross sectional	401	Pregnant women attending ANC service at governmental health centres	Interviewer administered structured questionnaire	Late initiation of ANC	Entry into care after 16 weeks of gestation	Age (≥25 year), non-attendance of formal education, low monthly income, high parity, previous non-use of ANC, unintended pregnancy

One study was excluded due to poor methodological quality and the rest 21 studies were included in the meta-analysis

With regard to the demographic characteristics, the participants in the included studies were pregnant women or women who have at least had one birth in the five or three years prior to the studies. Age of the participants ranged from 15 to 49 years. Majority of the participants in the included studies were urban residents. Moreover, a higher proportion of the participants in the included studies were married and attended formal education (primary school and above).

3.4.2 Magnitude of delayed initiation of ANC

The pooled estimate of the magnitude of delayed initiation of ANC in Ethiopia was 64% (95% CI: 57%, 70%) (Figure 3.2*)*. The result of the analysis for the magnitude of delayed initiation of ANC based on the studies that reported the outcome variable with (≥ 12 weeks) was 66% (95% CI: 56%, 76%), whereas based on the studies that defined the outcome variable with (≥ 16 weeks) it was 62% (95% CI: 52%, 71%).

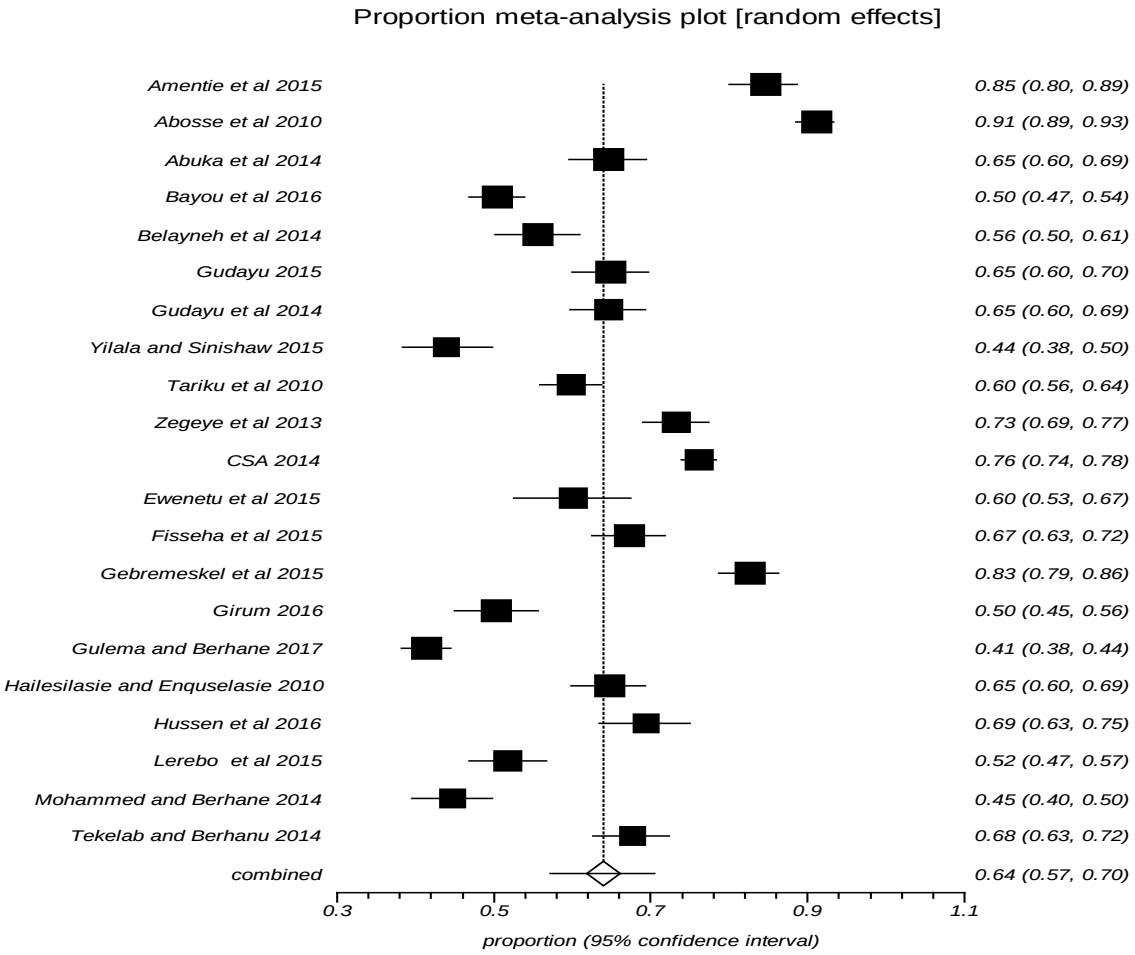

Figure 3.2. Pooled estimation of delayed initiation of ANC in Ethiopia, 2002-2017. *NB (◊: Overall combined pooled proportion, and ■: Original studies proportion)*

3.4.3 Factors associated with delayed initiation of ANC

The current review revealed various factors associated with delayed initiation of ANC in Ethiopia. Significantly associated Delay One factors include maternal age, maternal education, husband's education, pregnancy intention, women autonomy, knowledge on ANC, partner involvement, pregnancy complication, and parity. Significantly associated Delay Two factors were maternal occupation, monthly income, and place of residence. Means of checking pregnancy was the only Delay Three factor that showed statistically significant association with delayed ANC. The review also demonstrated that Delay One factors such marital status and history of abortion and Delay Three factor (previous use of ANC) were not significant predictors of delayed attendance of ANC services (Table 3.2).

Table 3.2. Overview of factors associated with delayed initiation of ANC according to the Three Delays model in Ethiopia, 2002-2017

Category of the factors	**Significantly associated with delayed ANC (at COR at 95% CI)**	
	Yes	**No**
Delay One	Maternal age	History of abortion
	Maternal education	Marital status
	Husband's education	
	Pregnancy intention	
	Women autonomy	
	Partner involvement	
	Knowledge on ANC	
	Pregnancy complication	
	Parity	
Delay Two	Place of residence	
	Maternal occupation	
	Monthly income	
Delay Three	Means of checking pregnancy	Previous ANC utilization

3.4.3.1 Maternal age

Maternal age was significantly associated with delayed initiation of ANC. Women aged between 15 and 30 were less likely to have delayed their first ANC booking as compared to women aged 31 to 49 years of age (OR, 0.70; 95% CI: 0.53, 0.93). However, the subgroup (delayed initiation ≥16 weeks) showed no association between maternal age and delayed booking of ANC (OR, 0.70; 95% CI: 0.42, 1.19). But it did not affect the overall association. The random effects model was employed for the analysis as the I^2 value was >50% (Figure 3.3).

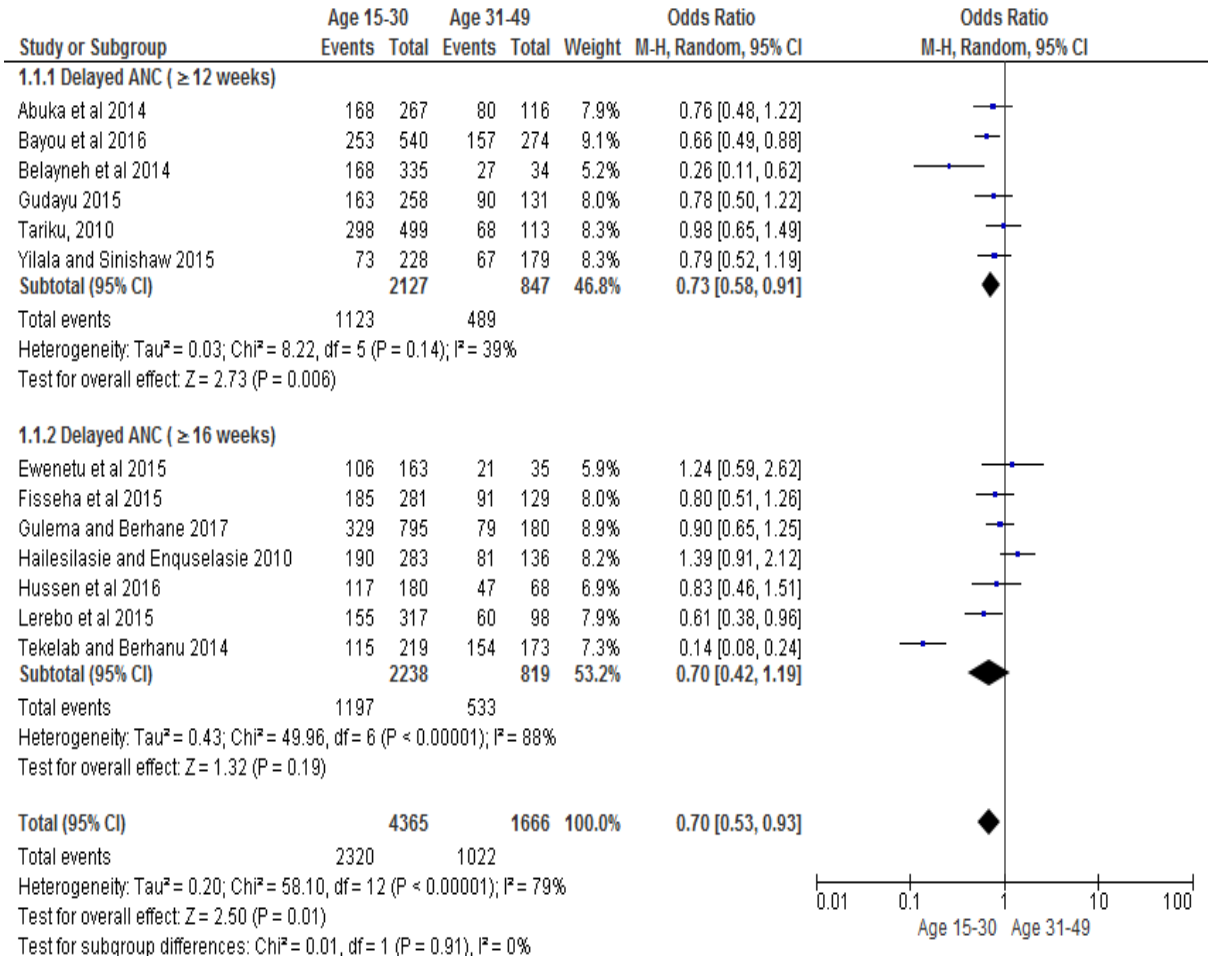

Figure 3.3. Subgroup and overall association between maternal age (reference category: age 31-49) and delayed initiation of ANC in Ethiopia, 2002-2017

3.4.3.2 Maternal education

The meta-analysis showed that maternal education was significantly associated with delayed ANC initiation. The overall Odds Ratio of 0.49 at 95% CI: 0.38, 0.63 indicated that women who have attended primary or above levels of education were less likely to delay their first ANC visit as compared to women without formal education. Despite the heterogeneity of the studies, the finding showed statistically significant association. The subgroup analysis for studies with (≥12 weeks) (OR, 0.57; 95% CI: 0.45, 0.72) and studies (≥16 weeks) (OR, 0.43; 95% CI: 0.28, 0.67) both showed significant association between the maternal educational status and delayed initiation of ANC. We used random effect model for the analysis since the I^2 value was 75% (Figure 3.4).

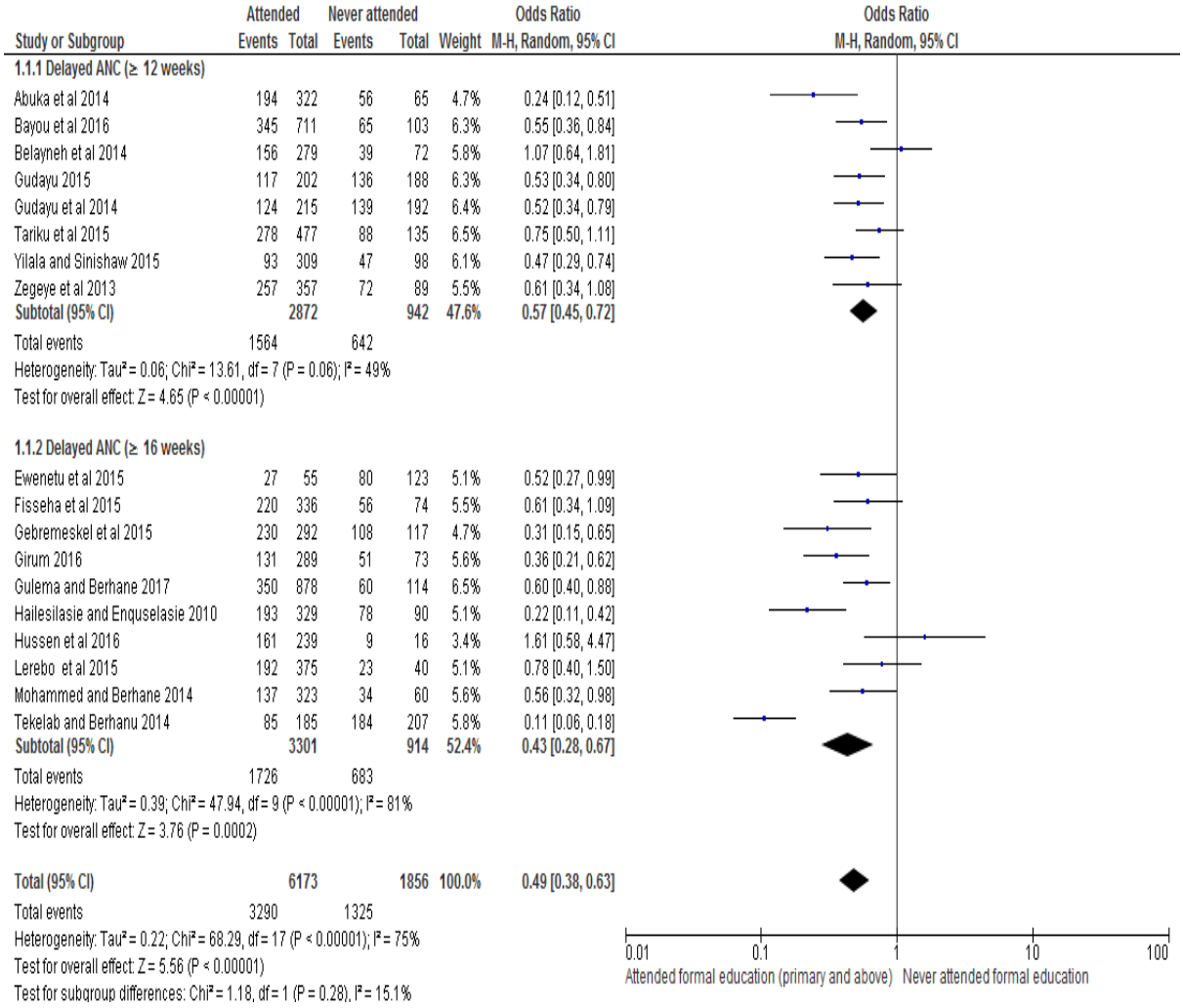

Figure 3.4. Subgroup and overall association between maternal education (reference category: never attended formal education) and delayed initiation of ANC in Ethiopia, 2002-2017

3.4.3.3 Place of residence

According to the factor analysis of the included studies, place of residence was significantly associated with delayed initiation of ANC. Women who live in urban area were less likely to have delayed initiation of ANC (OR, 0.29, 95% CI: 0.16, 0.50). No difference was found in terms of the direction of association between place of residence and delayed initiation of ANC in the subgroups analysis. Random effect model was used for the analysis since the heterogeneity test showed an overall I^2 value of 89% (Figure 3.5).

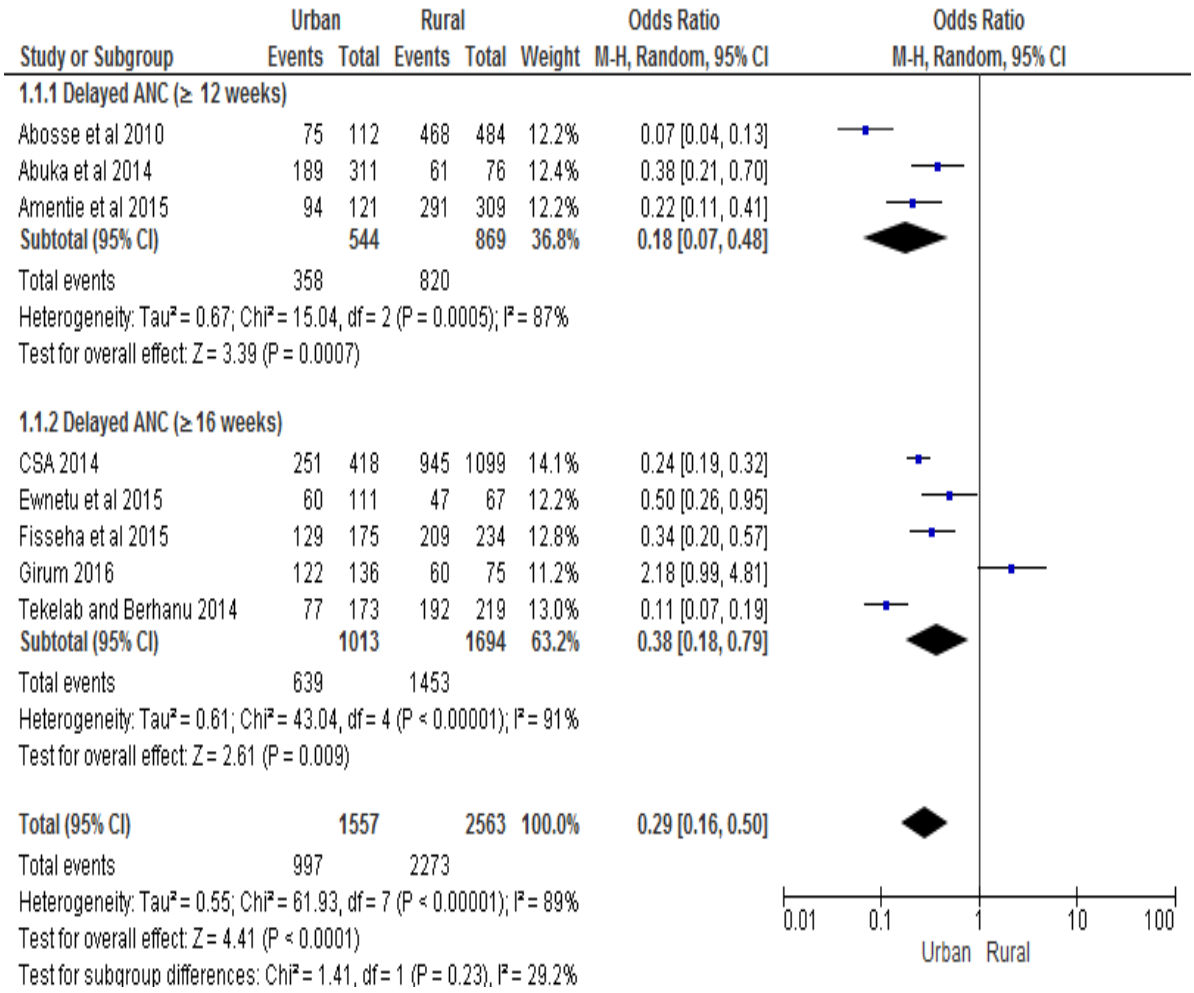

Figure 3.5. Subgroup and overall association between place of residence (reference category: rural) and delayed initiation of ANC in Ethiopia, 2002-2017

3.4.3.4 Pregnancy intention

The review finding showed that women with intended pregnancy were less likely to delay their ANC initiation (OR, 0.49; 95% CI: 0.40, 0.60). There was no difference between the sub-groups in the direction of association. As the heterogeneity test indicated an I^2 value of 59%, random effect was considered for the analysis (Figure 3.6).

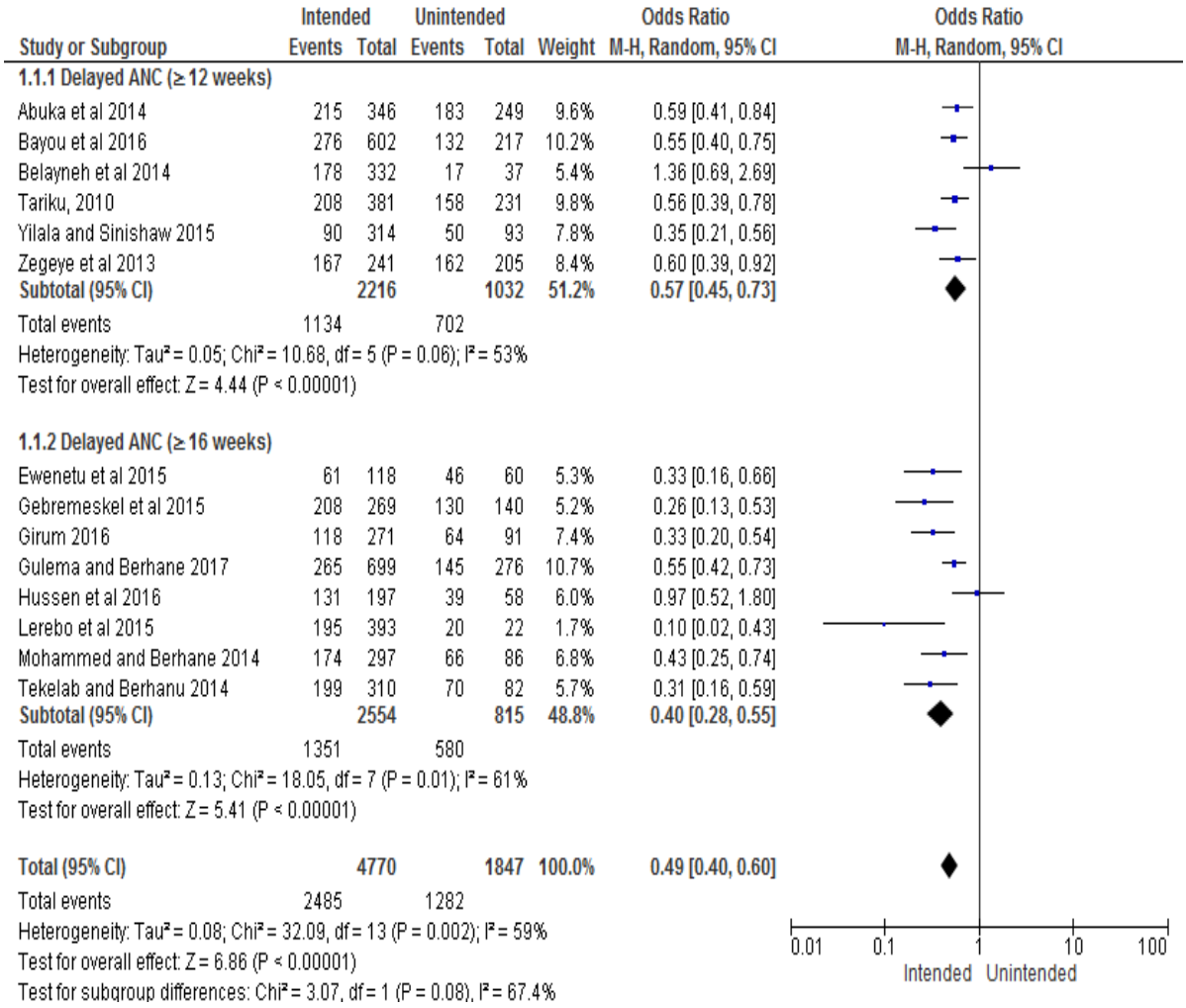

Figure 3.6. Subgroup and overall association between pregnancy intention (reference category: unintended) and delayed initiation of ANC in Ethiopia, 2002-2017

Below are the descriptions of other factors that are associated with delayed initiation of ANC with the meta-analysis test statistics (Table 3.3).

Table 3.3. Summary of the test statistics of association between the remaining Delay One, two and three factors with delayed initiation of ANC in Ethiopia, 2002-2017

Predictor variable	Subgroup	OR (95%CI)	I^2	Combined OR (95% CI)	Overall I^2
Monthly income	I	1.77(1.16, 2.72)	65%		
[≤1000 Ethiopian Birr (50USD)**]**	II	2.26(0.96, 5.29)	94%	2.06(1.23, 3.45)	91%
Marital status	I	0.92(0.55, 1.54)	77%		
[In marriage**]**	II	0.68(0.38, 1.22)	57%	0.81(0.56, 1.16)	68%
Maternal occupation	I	0.76(0.53, 1.09)	83%		
[Employed**]**	II	0.74(0.57, 0.97)	66%	0.75(0.61, 0.93)	74%
Husband education [Attended primary/above]	II	0.44(0.23, 0.85)	80%		
Women's autonomy [Autonomous]	I	0.38(0.15, 0.94)	89%		
Previous use of ANC	I	0.65(0.42, 1.02)	45%		
[Previous use]	II	0.53(0.17, 1.67)	92%	0.62(0.34, 1.11)	85%
Parity	I	0.51(0.42, 0.61)	0%		
[Nulliparity**]**	II	0.42(0.27, 0.66)	81%	0.46(0.36, 0.58)	67%
Partner involvement	I	0.44(0.21, 0.91)	85%		
[Involved]	II	0.14(0.08, 0.22)	85%	0.24(0.07, 0.75)	85%
Knowledge of ANC	I	0.32(0.22, 0.46)	4%		
[Knowledgeable]	II	0.46(0.35, 0.62)	54%	0.40(0.32, 0.51)	29%
History of abortion	I	1.19(0.85, 1.66)	0%		
[Have history of abortion**]**	II	1.14(0.67, 1.95)	77%	1.16(0.79, 1.69)	77%
Pregnancy complication [Presence of complication]	II	0.23(0.06, 0.95)	97%		
Means of identifying pregnancy [Urine]	I	0.50(0.36, 0.69)	67%		

Subgroup: **I**=*Studies defining delayed initiation of ANC (after 12 weeks of gestation),* ***Subgroup****: **II**=Studies defining delayed initiation of ANC (after 16 weeks of gestation),* **I^2** is the percentage of total variance due to between study heterogeneity

3.4.3.5 Family monthly income

Monthly average family income was significantly associated with delayed ANC initiation. It was demonstrated that there were increased odds of delayed initiation of ANC among women with an average family income of ≤1000 Ethiopian Birr (50USD) compared to those women whose average family income was >1000 Ethiopian Birr (50USD) (OR, 2.06; 95% CI: 1.23, 3.45). The association between family monthly income and delayed initiation of antennal care was not consistent across the two subgroups, where the subgroup which defined the outcome variable based on (≥16 weeks) showed insignificant association between monthly income and delayed initiation of ANC (OR, 2.26; 95% CI: 0.96, 5.29), whereas the subgroup (delayed ANC ≥12 weeks) (OR, 1.77; 95% CI: 1.16, 2.72) showed significant association. Due to the heterogeneity of the studies (I2=91%), we used random effect model for the analysis.

3.4.3.6 Marital status

Our systematic review demonstrated that there was no significant association between marital status and delayed initiation of ANC (OR, 0.81; 95% CI: 0.56, 1.16). The same was true in the subgroup analysis which showed no association between marital status and delayed initiation of ANC. We assumed a random effects model for the analysis since the I2 statistics showed the presence of heterogeneity (68%).

3.4.3.7 Maternal occupation

The overall Odds Ratio showed that there was significant association between maternal occupation and delayed initiation of ANC (OR, 0.75; 95% CI: 0.61, 0.93). Employed women were less likely to delay their ANC as compared to their counterparts. However, the subgroup (delayed ANC initiation ≥12 weeks) (OR, 0.76; 95% CI: 0.53, 1.09) showed no association between maternal occupation and delayed booking of ANC. But the overall association was not altered. The heterogeneity test showed an I2 value of 74%, and therefore random effect model was considered for the analysis.

3.4.3.8 Husband's education

Association between husband's education and delayed initiation of ANC was carried out in one group of studies that defined the outcome variable with (≥ 16 weeks), as this variable was not reported in the other group of studies. The analysis showed that women having a husband who attended formal education were less likely to delay their first antenatal visit as compared to those women whose husband had never attended formal education (OR, 0.44; 95% CI: 0.23, 0.85). Random effect model was implemented for the analysis since the I2 value was greater than 50%.

3.4.3.9 Women's autonomy

We conducted analysis of a single group of studies that defined the outcome variable with

(≥12 weeks) due to the unavailability of corresponding data about women's autonomy in the other group of studies. Accordingly, the analysis result revealed that women's autonomy has a significant association with delayed initiation of ANC (OR, 0.38; 95% CI: 0.15, 0.94). Autonomous women were less likely to delay the initiation of their first ANC than non-autonomous women. The random effects model was used for the analysis as the I2 test result is 89%.

3.4.3.10 Previous use of ANC

The finding revealed that there was no significant association between previous utilization of ANC and delayed initiation of ANC (OR, 0.62; 95% CI: 0.34, 1.11). This was the case in both subgroups of the studies, and the overall analysis result. We assumed a random effect model for the analysis as the I^2 value (85%) showed substantial heterogeneity between the studies.

3.4.3.11 Parity

Parity was another predicting factor that affected delayed initiation of ANC. In this regard, women with no parity (nulliparous) were less likely to have delayed their ANC initiation as compared to women who were primipara and above. This was demonstrated in the overall Odds Ratio, 0.46 at 95% CI: 0.36, 0.58. There was no difference in the association between parity and delayed initiation of ANC in the subgroup analysis. Since the I2 value was 67%, indicating considerable heterogeneity of the included studies, we assumed a random effect model for the analysis.

3.4.3.12 Partner involvement

We conducted the analysis using studies from both subgroups and it was found that partner involvement has a significant association with delayed initiation of ANC. Women who had a partner who was involved in ANC were less likely to delay ANC initiation compared with women with no partner involvement in ANC (OR, 0.24; 95% CI: 0.07, 0.75). We

considered a random effect model for the analysis because the I2 value was 85%.

3.4.3.13 Knowledge of ANC

The overall analysis of both groups of studies showed that knowledge of ANC has association with delayed initiation of ANC. Knowledgeable women were less likely to delay their ANC booking as compared to non-knowledgeable women (OR, 0.40; 95% CI: 0.32, 0.51). A fixed effects model was assumed for the analysis as the Chi-square test (7.08) with the p-value (0.21) showing statistically insignificant heterogeneity among the included studies for this factor analysis.

3.4.3.14 History of abortion

We found no significant association between history of abortion and delayed initiation of ANC (OR, 1.16; 95% CI: 0.79, 1.69), and this was true in the analysis result of both subgroups of studies. We assumed a random effect model since the I^2 statistics (77%) showed substantial heterogeneity.

3.4.3.15 Pregnancy complications

There was significant association between the presence of complications during pregnancy and timely initiation of ANC on a single group analysis (delayed initiation of ANC ≥ 16 weeks). Women who experienced complications during pregnancy were less likely to delay their first ANC attendance compared to women who did not experience complications during pregnancy (OR, 0.23; 95% CI: 0.06, 0.95). Random effect model was used for the analysis since the I^2 value was greater than 50%.

3.4.3.16 Means of identifying pregnancy

No sub-group analysis was performed due to lack of relevant statistics with regards to means of identifying pregnancy in one group (delayed initiation of ANC ≥ 16 weeks).

Single group (delayed initiation of ANC ≥ 12 weeks) analysis, however, showed a significant association between means of identifying pregnancy with delayed initiation of ANC. Women who identified their pregnancy with a urine test were less likely to delay their first ANC visit as compared to women who identified their pregnancy using other means (OR, 0.50; 95% CI: 0.36, 0.69). We considered a random effects model for the analysis since the I^2 value was greater than 50%.

3.5 Discussion

Maternal age, maternal education, husband's education, maternal occupation, place of residence, parity, knowledge of ANC, women's autonomy, partner involvement, pregnancy intention, pregnancy complications, and means of identifying pregnancy were significantly associated with the timing of ANC initiation in Ethiopia. We found out that nearly two-thirds of the women in Ethiopia initiated their first ANC late after the 12th week of pregnancy. Marital status, history of abortion, and previous use of ANC showed no significant association with delayed initiation of ANC.

Timely initiation and continuous attendance of ANC is believed to improve maternal health outcomes (122, 123). This is the case particularly in developing countries where the health status of women is very poor. It is imperative to understand the overall level of delayed initiation of ANC and the contributing factors at the country level to inform current efforts to improve maternal outcomes through adequate utilization of ANC in Ethiopia. The current systematic review supplied a summary of available evidence on the level of delayed initiation of ANC and associated factors in Ethiopia. The importance of systematic reviews to provide relevant information to transform the health care delivery system and policy modification or ratification is well documented (258). This systematic review summarizes up-to-date empirical evidence and informs key areas of action regarding delayed initiation of ANC in Ethiopia. This is an important step toward ensuring maternal health program planners and policymakers in the country make informed decisions regarding where corrective measures should be instituted, and how they can be maximized.

Even though the WHO (103, 106) has recommended initiation of ANC attendance not

later than the first trimester of pregnancy, the reviewed evidence showed that the magnitude of delayed initiation of ANC is very high, at 64% in Ethiopia. This figure was almost in line with a comparative report of Demographic and Health Survey data of twenty one sub-Saharan African countries (91) where, on average, more than two-thirds of the reproductive-aged women initiated their first ANC after the first trimester of pregnancy. This might be due to several socio-cultural, economic, and contextual factors including women's poor decision-making power at a household level due to deeply rooted gender inequality, poor educational status, and poverty, which in turn could limit the women's ability to seek care earlier. The ability to seek early care and assistance during pregnancy among Ethiopian women, especially in rural areas, is linked with many cultural practices (64, 206), which are barriers to accessing services throughout a woman's pregnancy. Delayed initiation of ANC was a significant risk factor for maternal death, particularly among disadvantaged women (229). Hence, countries need to prioritize efforts to improve the initiation of ANC.

According to this review, maternal age and education, husband's education, parity, knowledge of ANC, and the women's lack of autonomy were influencing factors for delayed first ANC attendance in Ethiopia. The result of the current review was in agreement with the systematic review of studies (190, 191, 259) conducted in other settings where maternal age, maternal education, husband's education, and parity were the influencing factors for delayed initiation of ANC. The possible reason for older women aged 30 to 49 delaying their first ANC might be that they most likely are uneducated, have poor knowledge of ANC, have experienced pregnancies without complications previously, are less fearful than younger women, and are more likely to be multiparous. Education of the mother and husband could play a great role in improving awareness of health matters in general, and the importance of ANC in particular. Having a better awareness may enable women to seek ANC and utilize the service early in pregnancy. This was particularly reflected in the systematic review of studies among non-western women in industrialized countries (246) where women's low level of educational status was associated with late entry into ANC.

Furthermore, a lack of knowledge about ANC is positively associated with delayed initiation of ANC. Women who had been provided with information regarding ANC, pregnancy risks, and danger signs were more likely to initiate ANC early compared to

women who did not have knowledge of these issues. This could motivate the women to initiate ANC early to minimize the risks associated with pregnancy. It was anticipated that well informed women were more likely to make judicious choices about the proper utilization of ANC. It was also found that women's autonomy was a significant predictor of timely initiation of ANC, whereas non-autonomous women were more likely to postpone ANC. The postponement could be due to the fact that they were under the influence of their partner or family (especially in male-headed households), restricted to complying with family norms, had lack of family or social support, or a partner who was not available or who refused to accompany them. This was demonstrated in a systematic review of studies in the developing countries (191), where social support from family members, extent of ties within social networks, and obtaining health information from these sources highly influence timely utilization of ANC.

Additionally, the meta-analysis revealed that place of residence, maternal occupation, monthly income, and partner involvement were significantly associated with delayed ANC initiation. Rural women were more likely to delay their first ANC attendance than urban women. This may be explained by the fact that urban women would most likely have easy access to health care facilities, have a good awareness of health matters, and have greater exposure to media delivered information. Moreover, unemployed women were more likely to delay initiation of ANC as compared to employed women. A similar finding was reported in other systematic reviews (190, 246) where not being in employment is associated with women's delayed entry into the care. It was also evidenced that women with high economic status were more likely to receive ANC earlier than those with lower economic status (190, 191). These financial constraints are in turn related to other barriers to seeking help, including transportation costs, the cost of obtaining care, or laboratory tests (211, 212).

Moreover, our findings suggest that women whose partners were involved in ANC were less likely to delay their first ANC attendance than women whose partner was not involved in ANC. Partner involvement in terms of initiating and/or supporting the idea to utilize ANC early, or by accompanying the pregnant mother to the health facility may have an important impact on the early attendance of ANC. In many cultures, the involvement of men in reproductive health has not been considered an important issue. Male partners did not traditionally accompany their wives to attend ANC and other maternal health services

(190). The husband's lack of involvement in ANC may immensely affect the women's capability to initiate ANC early. It was found in a systematic review (260) that the involvement of men in ANC has a positive influence on the overall uptake of the service and its early attendance.

Furthermore, the meta-analysis identified factors such as pregnancy intention, presence of pregnancy complications and means of identifying pregnancy as important factors that affect delayed initiation of ANC. This finding is consistent with a systematic review of smalls scale studies conducted in both developed and developing countries (261) on the relationship between pregnancy intention and timely initiation, as well as obtaining adequate ANC. It was revealed that unintended pregnancy has a strong association with delayed initiation of first ANC services. Another systematic review (191) confirmed that women whose pregnancy was unintended tended to initiate ANC later than the first trimester of pregnancy. With regards to complications during pregnancy, the findings of this study are similar to a systematic review of literature (190) conducted in developing countries, where pregnant women who did not experience obstetric complications were more likely to delay their first ANC compared to their counterparts.

In the current systematic review and meta-analysis, we observed some discrepancies within the included studies in defining the outcome variable "delayed initiation of ANC". Half of the included studies defined delayed initiation of ANC based on the cut-off point of 12 weeks of gestation, whereas the rest of the studies defined it based on 16 weeks. The WHO (103, 106) defined late ANC initiation as entry into care after 12 weeks of pregnancy. Conversely, in this review, we noticed a contrasting type of definition across several studies (114, 230-241, 244, 245, 262) as well as ANC practice in health facilities (105), implying that there was poor compliance of the WHO recommendation on the timing of first ANC initiation in Ethiopia. Countries might prefer to adapt or contextualize the original clinical practice guidelines with some changes, depending on their setting, to effectively implement the recommendations. Even if recommendations from the parent clinical practice guidelines can be adapted, how they are implemented needs to address local issues. Thus countries may need to contextualize guidance by addressing those implementation issues so that care becomes more relevant to the local environments (263). However, there should not be inconsistencies between the implemented specific health recommendation within the country's health care delivery system, and the health research

arena. Hence, we recommend concerned parties in the health sector in Ethiopia, particularly the health research scholars, adhere to the WHO recommended guideline on the timing of ANC initiation. Moreover, any further adapted or contextualized guideline on the timing of ANC initiation needs to be followed or implemented consistently in a standardized way.

The current systematic review and meta-analysis was not without limitations. The first limitation was the exclusion of qualitative studies from the review, which might have revealed other important factors affecting women's behavior to delay ANC attendance, or could otherwise corroborate the quantitative findings. Secondly, since our meta-analysis used Crude Odds Ratios, it was difficult to fully ascertain the effect of the exposure factors on the outcome of interest. Thirdly, as all the included studies were cross-sectional by design, it was difficult to establish a temporal relationship between the outcome and exposure variables. Lastly, conducting meta-analysis despite the inherent heterogeneity between the included studies may have affected the quantitative findings.

Our systematic review and meta-analysis also had some strengths. We considered the selection and inclusion of both published and unpublished literature, which has the potential to minimize publication bias. Moreover, our search strategy was extensive using several major medical databases and other search engines. Lastly, we conducted a sub-group analysis of studies that employed different definitions of delayed initiation of ANC to appreciate the independent subgroup findings.

3.6 Conclusion

The current review revealed that nearly two-thirds of women were delaying their first ANC visit in Ethiopia. The review pointed out various factors attributed to a high level of delayed initiation of ANC in Ethiopia. Among these: maternal age; place of residence; maternal education; husband's education; maternal occupation; family monthly income; pregnancy intention; parity; knowledge of ANC; women's autonomy; partner involvement; health complications during pregnancy; and, means of identifying pregnancy, showed significant association with the timing of ANC initiation. Therefore, intervention efforts to improve ANC utilization in Ethiopia require targeting these factors.

Moreover, strategies should be designed to intensify advocacy of female education; women's empowerment activities need to be continued through economic reforms; strengthen family planning programs to reduce unintended pregnancies; and promote partner involvement in ANC through male targeted means of communication. Further qualitative studies are recommended to gain further insight into the societal and health system barriers that contribute to delayed initiation of ANC in Ethiopia.

Chapter 4

Methods

In Chapter 2, the available literature on maternal health service utilization and associated factors was discussed, and gaps in current knowledge were identified. In Chapter 3, the results of the systematic review and meta-analyses of existing literature on delayed initiation of antenatal care and associated factors were presented. This section provides an overview of the methods that were implemented to address the research aims 2-6 (Page 50). A summary of the methodological procedures that were implemented in this thesis is provided (Table 4.1). A brief description of the research settings for the studies described in Chapters 5 through 9 is also provided. This is followed by a discussion of the specific methodical procedures applied in the secondary data analysis (Chapter 5). Subsequently, the methods used in implementing the quantitative survey are presented (Chapter 6 to 8). The section concludes by describing the methodological procedures applied in the qualitative study (Chapter 9).

4.1 Overall methods summary

The overall methodological procedures of the research papers embedded in this thesis are summarized in the table below. The papers in Chapters 3, 5, 6, 8, 9 were published in peer reviewed journals, and the paper in Chapter 7 was submitted to a peer reviewed journal. As the details of the methods of Aim 1 were addressed in Chapter 3 (Section 3.3), the subsequent sections provide the details of the methods that were implemented to address the research aims 2-6 of this thesis.

Table 4.1. Tabular summary of the overall methodological procedure of this thesis (Aim 1-6)

Aims		Study design	Study subjects	Data source	Data analysis	Chapter
Aim 1	To determine the level of, and factors associated with, delayed initiation of antenatal care in Ethiopia	Review of observational studies	Reproductive-aged women who were pregnant or gave at least one birth	Databases such as PubMed (Medline), EMBASE, CINAHEL, and grey literature	Systematic review and meta-analysis	3
Aim 2	To investigate the magnitude and causes of maternal mortality, and resulting trends among reproductive-aged women in Kersa HDSS	Population-based surveillance with secondary data analysis	Reproductive-aged women who died due to maternal causes from 2008 to 2014	Extracting secondary surveillance data from the Kersa HDSS	Descriptive statistics	5
Aim 3	To examine antenatal care utilization through the application of Andersen-Newman behavioral model in Kersa	Analytical cross-sectional study	Reproductive-aged women who had given birth in the preceding 3 years prior to the survey date	Community-based house-to-house survey	Descriptive and inferential analysis	6
Aim 4	To assess the predisposing, enabling, and need factors associated with skilled delivery care utilization in Kersa	Analytical cross-sectional study	Reproductive-aged women who had given birth in the preceding 3 years prior to the survey date	Community-based house-to-house survey	Descriptive and inferential analysis	7
Aim 5	To explore the magnitude and correlates of postnatal care utilization in Kersa	Analytical cross-sectional study	Reproductive-aged women who had given birth in the preceding 3 years prior to the survey date	Community-based house-to-house survey	Descriptive and inferential analysis	8
Aim 6	To explore and identify factors that contribute to delayed use of maternal health services in Kersa	Exploratory interpretive qualitative study	Reproductive-aged women, mothers-in-law, husbands, traditional birth attendants, and Health Extension Workers	A qualitative study involving focus group discussions	Thematic analysis	9

4.2 Research setting for aim 2 – 6

These studies were conducted in Kersa district, located within the Eastern Hararghe zone of Oromia regional state, in eastern Ethiopia (Figure 4.1). Geographically, Kersa is bordered by different districts in the Eastern Hararghe zone. To the south, the district is bordered by Bedeno district, to the west by Meta district, to the north by Dire Dawa administrative council, to the northeast by Haramaya district and to the southeast by Kurfa Chele district. The district's capital is Kersa town, which is located nearly 486 kms from the capital city (Addis Ababa). According to the population projection for Ethiopia published by the Central Statistical Agency in 2014, the district has an estimated total population of 205,628 with a male to female ratio of 1.02. The population is predominantly rural (92%).

Kersa district has 38 *kebeles*, of which three are urban and 35 are rural (228, 264). The district has 24 *kebeles* monitored by the Health and Demographic Surveillance System (HDSS) and 14 non-HDSS *kebeles*. The 24 HDSS *kebeles* are comprised of three located in urban areas, with the rest located in rural areas. HDSS is a platform to oversee the health and demographic characteristics of a community residing in a distinct geographic area. It continuously monitors new health threats; tracks the change in population numbers through fertility and migration rates updated at regular intervals; and also measures the effect of interventions on communities (265, 266). The information generated from the HDSS is important to inform planning by policymakers and health managers, especially in countries where there is a lack of routine demographic information. The HDSS is also used as a platform for conducting primary studies that aim to investigate public health problems within the community (265). The Kersa HDSS baseline census was conducted in 2007 and has been updated every 6 months, with the ongoing registration of demographic and health events. The Kersa HDSS belongs to the International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH), a worldwide network of HDSS in Africa, South America and Asia (265). In the Kersa HDSS site, as of 2013, there were 13,544 households, 60,694 total midyear population, and 13,534 reproductive-aged women. The crude death rate per 1000 is 7.8, the crude birth rate per 1000 is 37.2 and the total fertility rate is 5.3 (265). As of the end of 2014, there were only 12 HDSS *kebeles* in the district, having an active population of 60,811 living in 12,198 households. According

to the information from the head of the Kersa HDSS coordinating office, in 2015 the number of households under surveillance was scaled up to include an additional 12 *kebeles* with a population of 130,118 living in 26,095 households.

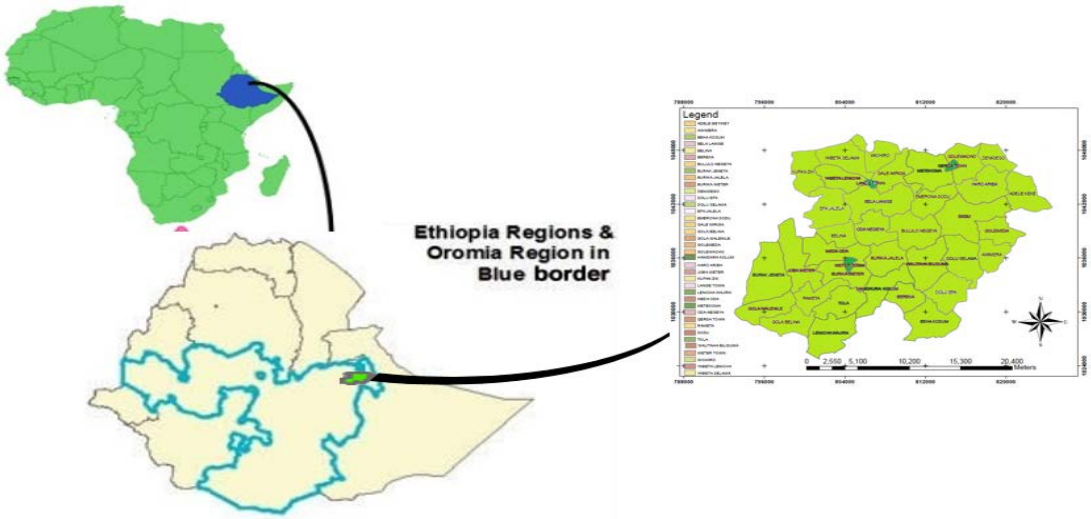

Figure 4.1. The location of Kersa district in Oromia region, in eastern Ethiopia (*Source*: (265, 267))

All *kebeles* have access to land or mobile telephone connections. In most rural areas, the main sources of water are springs and wells, though there is tap water in urban areas and their adjacent *kebeles*. Most of the residents are farmers by occupation. In the district, the main cash crop is khat (265). With regards to road infrastructure, all *kebeles* have access to non-asphalt roads, though the terrain is mountainous in the majority of the rural *kebeles*.

Figure 4.2. Partial view of the topography of a rural *kebele* in the study district and a cluster of households (NB: *this photo was taken during the fieldwork*)

The district has seven health centres, thirty-four health posts, and eight private pharmacies at different locations. In each *kebele,* there are two Health Extension Workers providing health promotion activities including some maternal health services. According to information from the district health office, the health coverage in the district is 80% (268).

Figure 4.3. Front view of a health centre in one urban *kebele,* Kersa district, eastern Ethiopia (NB: *this photo was taken during the fieldwork*)

The health centres routinely provide the recommended packages of ANC, skilled delivery care and PNC (See Chapter 2). Women initially attend their first ANC at a health centre and subsequently attend the remainder of visits in the health post.

Figure 4.4. Antenatal care unit within a health centre, Kersa district, eastern Ethiopia (NB: *this photo was taken during the fieldwork*)

The government subsidizes the maternal health services, though most public health centres charge a fee for the cost of some medicine for some aspects of maternal health services (210).

Figure 4.5. Delivery unit in a health centre, Kersa district, eastern Ethiopia (NB: *this photo was taken during the fieldwork*)

4.3 Analysis of surveillance data (Aim 2)

To investigate the magnitude, trends, and causes of maternal mortality among reproductive-aged women in Kersa HDSS (Chapter 5).

4.3.1 Study design

The study used a longitudinal population-based surveillance design. A descriptive secondary data analysis was carried out through extracting surveillance data on maternal mortality from the Verbal Autopsy data set of the Kersa HDSS for seven consecutive years (2008-2014). HDSS is a dynamic platform which longitudinally collects demographic and health characteristics of a census population in a well-defined geographic area (265, 266). The HDSS begins with a baseline census of a defined population followed by regular cycles of surveillance to monitor the change in the initial population by gathering information on births, deaths, and migrations. Data on causes of death are recorded using

the Verbal Autopsy tool which is an element of the HDSS data set.

4.3.2 Source and study population

The source population was all women of reproductive age at the Kersa HDSS site from 2008-2014. The study population were all reproductive-aged women whose death was recorded by the Kersa HDSS during 2008-2014. Data of deceased women who lived in the study area for less than six months were excluded from the analysis as they were not confirmed as permanent residents. The data of the study population was extracted as illustrated in the flow diagram below (Figure 4.6).

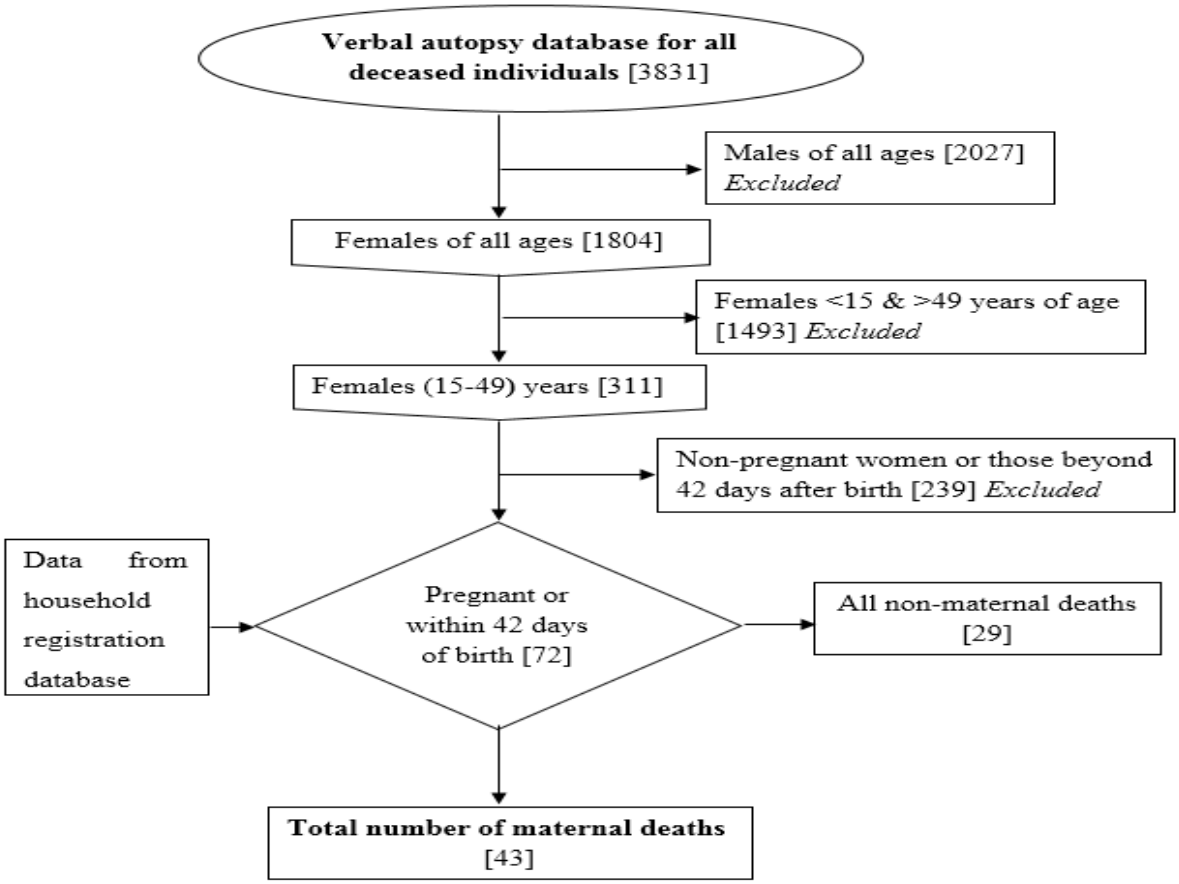

Figure 4.6. Flowchart depicting the data extraction procedure used to identify maternal deaths from the Kersa HDSS database 2008-14.

4.3.3 Sampling

The sample comprised the data of all deceased reproductive-aged women who lived in the households under surveillance at the Kersa HDSS from 2008-2014. Accordingly, the total number of reproductive-aged women who died during the reference period was 311; of which 72 women died during pregnancy or within 42 days of birth. All pregnancy-related deaths (72) were classified into maternal deaths (43) and non-maternal deaths (29) based on the final assigned cause of death. The data profile of all reproductive-aged women who died during the surveillance period and who fulfilled the criteria were included in the study by extracting and retrieving their data from the Kersa HDSS database.

4.3.4 Measurement variables

The measurement variables and indicators that reflect the research questions of Study-1 are summarized below (Table 4.2). The definitions and methods of calculation of the indicators are also described. The main study variables were obtained from the Verbal Autopsy data set of the Kersa HDSS. The background variables (religion, ethnicity, occupational status, and educational status) were extracted from the Household Registration System database of the Kersa HDSS.

Table 4.2. Major variables and indicators of the study, and their definitions

Variables	Definitions
Maternal Mortality Ratio (MMR):	The measurement of this variable was based on the WHO definition (8). This variable was calculated by dividing the number of maternal deaths by the total number of live births from 2008 to 2014 and changed into 100,000 live births. MMR is the most commonly used international measure of maternal mortality and serves as an indicator of the risk of death once a woman has become pregnant (23).
Pregnancy-related death	The number of deaths of women while they were pregnant or within 42 days after the termination of pregnancy irrespective of the cause, divided by the total number of live births in the same period.
Maternal Mortality rate (MMrate)	Number of maternal deaths divided by the total number of reproductive-aged women in the study area during the period (2008-2014).

Proportion of maternal deaths among female deaths	The number of maternal deaths divided by the total number of deaths among reproductive-aged women in the period 2008-2014.
Lifetime Risk of maternal death	This was approximated by [Lifetime Risk=1-(1-Mmrate)^{35}] or "Life Time Risk=MMR multiplied by 35". The Lifetime Risk of maternal death is an important measure of the cumulative loss of life due to maternal deaths over the woman's life course (269).
Maternal morbidities (cause of death)	Conditions that either pre-exist or arise due to pregnancy complications that lead the woman to die, thereby adversely affecting the outcome of a pregnancy that was expected to be normal. Consequently, this variable quantifies the percentage share of each cause of maternal death during the reference period (2008-2014).
Socio-demographic variables	Maternal age at death, place of residence, marital status, religion, ethnicity, occupational status, and educational status were included.
Obstetric and health service-related variables	Including gestational age at death, mode of delivery, place of delivery, timing of maternal death, type of delivery attendant during delivery, ANC utilization, accessing treatment before death and the treatment type were considered.

4.3.5 Source of data

The primary source of the data was the Verbal Autopsy data set of the Kersa HDSS. Verbal Autopsy is a method of interviewing close relatives or caregivers of the deceased person about the circumstances, signs, and symptoms that occurred before death; answers to which the respondent provides in their own words (270). The Verbal Autopsy questionnaire considered for this study was adapted from the 2007 standard WHO Verbal Autopsy questionnaire for adults 15 years and older (271). The questionnaire was used for collecting information such as age, sex, place of death, and signs and symptoms observed during the late-life period of the deceased person. In addition, a short narrative history of the course of the disease that led to death; health services used in the period before death; and risk factors such as substance use were included in the interview. For deceased women, questions related to pregnancy and childbirth, plus illnesses of the post-partum

period were included (265).

After the appropriate mourning period of 45 days, data collectors conduct an interview with a person who had close contact with the deceased during the illness. The completed Verbal Autopsy questionnaires are then passed onto at least two physicians to assign the underlying causes of death using International Classification of Diseases (ICD)-10 codes and title, and then the ICD-10 codes. After checking the agreement between the physician-assigned causes of death, discordant cases were sent to a third physician once again for independent review and diagnosis. If any of two of these three physicians assigned an underlying cause of death to the same Verbal Autopsy code, this is considered as the final cause of death; otherwise, the causes are labeled as undetermined (272).

All standard Verbal Autopsy questionnaires, household members and death registration forms are first translated into the local language (Oromiffa) and used for data collection. In addition to the information from the Verbal Autopsy database, some basic data such as religion and ethnicity of the deceased women were obtained from the main household registration system database of the Kersa HDSS. For inclusion in the current study, data related to all women who were permanent residents; who died during pregnancy, birth or within 42 days after delivery were extracted.

4.3.5.1 Data quality control

Data related to maternal mortality were accessed from the standardized longitudinal demographic surveillance of Kersa HDSS. Quality assurance processes were embedded into all aspects of the surveillance process starting from data collection to entry into the computer. The surveillance also makes use of a standardized study tool. In the Kersa HDSS, if inconsistent or missing data were detected at any step during the data collection process, the questionnaire was returned to the enumerators for checks and corrections, including re-interviewing of participants as required. In addition, the supervisors select 5% of completed questionnaires and visit the houses where the data were collected to check whether the information was accurate or not. The field coordinator checks 1% of the questionnaires in a similar manner. Once the data had passed these steps, it was entered into the database, and the hard copies archived. Similar measures of quality assurance

procedures have also been applied to the data collection process that makes use of the Verbal Autopsy questionnaires for a deceased person. Furthermore, during the extraction of the data, some quality checks were executed. We cross-checked the electronic version of the data with the archived hardcopy through tracing the information back on a sample profile of deceased women. Data cleaning and adjustment were also conducted to avoid errors in the labeling or order of the variables of interest. To minimize the inconsistent values of the variables in different data sources, we mainly measured the variables from the Verbal Autopsy data and dropped the erroneous variables from the final data set.

4.3.5.2 Data management and analysis

Descriptive statistics consisting of frequency and proportion to summarize main variables including maternal death in each year from 2008-2014 and causes of death were performed. The analysis was conducted using STATA software. The overall level of MMR was calculated by dividing the total number of maternal deaths (from the Verbal Autopsy data) from 2008 to 2014 with the total number of live births in the same period and this was then converted into 100,000 live births. The level of MMR for each year from 2008 to 2014 was calculated in the same manner and the trends in different years were plotted. Temporal trends of MMR across different years were conducted to show the seasonal variation. Moreover, population characteristics such as age and cause of death were used to plot the pattern of MMR across different years. We used Pearson's Chi-squared test to determine the significance of the trend over time. Results of these analyses are presented in Chapter 5.

4.3.6 Ethical considerations

Ethical approval was obtained during the establishment of Kersa HDSS from the Institutional Health Research Ethics Review Committee of Haramaya University (FOHS/00/9634/2008), and the Ethiopian Public Health Association (IRB-00005684) (265). Ethical approval was also secured from the Human Research Ethics Committee of the University of Newcastle for this surveillance data analysis (H-2016-0403) (*See Appendix 3*). To gain access to the data and extract the variables of interest from the Kersa HDSS database

the investigators first submitted a formal data request letter briefly outlining the research proposal to the HDSS organizing team. After the team reviewed and approved the data request, the investigators were granted open access to the data to extract and analyse the variables of interest. Through this process, the team reviewed and approved the request for open access to extract and analyse the data used for Study-1 in this thesis. During the surveillance process, informed verbal consent was obtained from the head of the family, or eligible adult among the family members, before conducting an interview to capture the information on the occurrence of vital events such as death.

4.4 Community survey (Aim 3-6)

The purpose of the community survey is to explore the level of, and factors associated with, antenatal, skilled delivery and postnatal care utilization among reproductive-aged women in Kersa district, eastern Ethiopia (Chapter 6 to 9). The community survey involved fieldwork in Kersa district. The fieldwork comprised two studies; (i) a quantitative study, and (ii) a qualitative study, both of which are presented in the subsequent sub-sections.

4.4.1 Quantitative study (Aims 3-5)

4.4.1.1 Study design and period

The study employed a quantitative research approach with both descriptive and analytical components. The study involved a cross-sectional design using primary data collected from a house-to-house survey in the study community. The study was conducted from June to August 2017.

4.4.1.2 Source and study population

The source population were all reproductive-aged women in Kersa district. Reproductive-

aged women are those women aged on average 15-49 years and able to give birth. In Ethiopia, the estimated total number of reproductive-aged women in 2012 was projected to reach 20.7 million by the Inter-Censual Population Survey conducted by the Central Statistical Agency (CSA), with the highest number of women (7 million) found in Oromia region (68). In the former 12 Kersa HDSS *kebeles*, there were 13,534 reproductive-aged women in 2013 (265), which when extrapolated for the 38 *kebeles* to give a total of around 42,857 reproductive-aged women for the whole Kersa district.

The study population were all reproductive-aged women who gave birth in Kersa district in the three years prior to the survey date, regardless of the birth outcome.

4.4.1.2.1 Inclusion criteria

1. Reproductive-aged women
2. Lived in the district for more than 6 months
3. Had had at least one birth in the three years prior to the survey date
4. Had delivered their baby after 28 weeks of gestation

4.4.1.2.2 Exclusion criteria

1. Critically ill during the data collection period
2. Physically disabled (hearing or speaking problems) or mentally disabled (based on the family report, and on observation)

4.4.1.3 Sample size determination

To calculate a reasonable and sufficient sample size to study maternal health service utilization, the relevant research was reviewed, and the most pertinent literature was selected. Accordingly, there were two scenarios for the sample size calculation.

4.4.1.3.1 Sample size determination for the proportion of maternal health service use

As shown in Table 4.3, the sample size to measure the *proportion* of maternal health

service (ANC, skilled delivery care, and PNC) users was determined by considering the following assumptions by using single population formula ($n=(Z\alpha/2)^2P(1-P)/d^2$); where the level of significance of the population ($Z\alpha/2$) at 95% CI is equal to 1.96, 4% level of precision (d = 0.04), non-response rate of 10%, design effect (DEFF) of two, the *proportion* of ANC attendants (51%) (*P1*), *proportion* of skilled delivery care attendants (20%) (*P2*), and *proportion* of PNC attendants (10.3%) (*P3*) from the Ethiopian National Demographic and Health Survey breakdown for Oromia region where the study district is located (44). The Ethiopian National Demographic and Health Survey for Oromia region was chosen for the sample size calculation because the study measured the variables of interest from women living in all districts in the region, and the current study district belongs to this region. Moreover, the study was carried out on a nationally representative sample of reproductive-aged women sound enough to draw robust and statistically significant findings compared to smaller pocket studies in the country. The following table summarized the sample size determination using the aforementioned parameters. The sample size was calculated using Open Epi version 3.01 (273).

Table 4.3. Sample size determination using different parameters for the proportion of maternal health service use

Using single population formula					
Main variables	Level of precision (d)	Z score at 95% CI	Sample size	Initial sample size including 10% non-response rate	Final sample size after adjusting for DEFF ($N=n_0*2$)
ANC attendance (*P1=0.51*)	0.04	1.96	600	660	**1320**
Skilled delivery care attendance (*P2=0.20*)	0.04	1.96	384	422	**844**
PNC attendance (*P3=0.10*)	0.04	1.96	222	244	**488**

4.4.1.3.2 Sample size determination for predictors of maternal health service use

The table below summarizes the sample size calculation for *factors associated* with each

maternal health service (ANC, skilled delivery care, PNC) utilization by taking 95% confidence interval and 80% power. Based on previous research it was apparent that place of residence (49, 56, 79, 96, 173, 181, 213); educational status (49, 111, 115, 140, 179, 184); and living or not living in HDSS site (111) are among the basic factors that are consistently associated with the uptake of the three components of maternal health services. The corresponding sample sizes based on the above assumptions were calculated using double population formula. Where n_1=number of exposed, n_2=number of unexposed, $Z_{\alpha/2}$=standard normal variable for two-tailed test based on alpha level (relates to the confidence interval level), $Z_{1-\beta}$ =standard normal variable for one-tailed test based on beta level (relates to the power level), r = ratio of unexposed to exposed, p_1 = proportion of maternal health service users among exposed and $q_1 = 1-p_1$, p_2 = proportion of maternal health service users among unexposed and $q_2 = 1-p_2$, $\bar{\bar{p}} = p1+rp_2/r+1$, $\bar{\bar{q}} = 1-\bar{\bar{p}}$,

$$n1 = \frac{[Z_{\alpha/2}\sqrt{(r+1)\overline{pq}} + Z_{1-\beta}\sqrt{rp1q1 + p2q2}]^2}{r(p1-p2)^2}$$

$$n2 = rn1$$

The sample size computation was made via Open Epi version 3.01. Numerous reviewed literature was considered to obtain the percentage of users among the exposed and non-exposed participants in the sample size calculation and were cited in the table below.

Table 4.4. Sample size determination for assessment of exposure variables of maternal health service utilization

Main predictors of antenatal care utilization					
Predictor variable	**Uptake in unexposed**	**Uptake in exposed**	**Unexposed to exposed ratio**	**Sample size including 10% non-response rate (=n_0)**	**Final sample size with DEFF (N=n_0*2)**
Place of residence (Urban is the "Exposed")(44)	58%	90%	1:1	64	**128**
Education (Educated are the "Exposed" (56)	25.1%	51.4%	1:1	117	**234**
Living in HDSS site or not (HDSS is the "Exposed") (111)	75%	85%	1:1	550	**1100**
Main predictors of skilled delivery care utilization					

Place of residence (Urban is the "Exposed") (96)	10%	59%	1:1	31	**62**
Education (Educated are the "Exposed") (56)	4.7%	26.1%	1:1	97	**194**
Living in HDSS site or not (HDSS is the "Exposed") (111)	18%	30%	1:1	438	**876**
Main predictors of postnatal care utilization					
Place of residence (Urban is the "Exposed") (44)	13%	45%	1:1	68	**136**
Education (Educated are the "Exposed") (56)	4.9%	18.1%	1:1	200	**400**
Living in HDSS site or not (HDSS is the "Exposed") (112, 174)	49.7%	88%	1:1	48	**96**

Therefore, it was clear from the two above sample size calculation scenarios that the largest sample size was **1320.** This sample size was considered as the final figure for the current study to ensure that the sample had adequate power to make scientific inferences pertaining to all the aims.

4.4.1.3.3 Why use a design effect?

The justification for using a design effect to double the sample size was that we had stages to classify the study district into two (urban and rural). Subsequently, this was further stratified into HDSS and non-HDSS *kebeles*; it is speculated that women who live in these setting have different maternal health service use patterns (111). In addition, the intra-cluster correlation effect was also assumed, because individual women within the *kebele* are likely to be similar with respect to their use of maternal health services, as they share the same living environment, and are exposed to the same kind of services or skilled health care providers, as well as health information. To make an adjustment for the stages and intra-cluster correlation a design effect of two was used to increase the sample size to maintain the desired level of precision.

4.4.1.4 Sampling procedure

The community survey was conducted in different randomly selected *kebeles* in the district. A multi-stage sampling procedure was followed to select the study participants. A depiction of the sampling procedure to select representative subjects from the district is presented in Figure 4.7. Firstly, the whole study district was stratified into rural and urban *kebeles*. The rural *kebeles* were classified into HDSS and non-HDSS *kebeles*, but there were no non-HDSS *kebeles* in the urban strata. To get the optimum sample representation, 25% of all the *kebeles* in the district were included in the study. To affect this, from the total 38 kebeles (35 rural & 3 urban) in the study district, a total of 10 *kebeles* (2 urban and 8 rural) were selected.

In the rural strata, there were 21 HDSS and 14 non-HDSS *kebeles*, while all three *kebeles* in the urban strata were from HDSS sites. Using simple random sampling techniques five *kebeles* were selected from the 21 rural HDSS *kebeles* and three kebeles were selected from the 14 rural non-HDSS *kebeles.* Using a similar sampling technique two *kebeles* were drawn from the three urban HDSS *kebeles*. This is to ensure the urban-rural mix in the final sample. On the other hand, the proportional allocation of the sample kebeles enabled the generalization of the study findings from the sample to the general reference population in the whole district.

To select the individual study subjects, the following technique was implemented. For both HDSS and non-HDSS site *kebeles*, households having at least one reproductive-aged women who had had at least one birth in the three years prior to the survey date and who had resided for more than six months in the *kebele* were identified. The households were listed from the Health Extension Workers health management information system registration log sheet and family folder, and the number of eligible women in each *kebele* was determined. We used the same kind of listing for both the HDSS and non-HDSS *kebeles* to reduce bias related to use of different listings. If more than one eligible woman was found in the same household, one of them was selected at random to avoid intra-household correlations. Since the number of households which had at least one reproductive-aged women was different from one *kebele* to the other, the total sample size (1320) of the study was proportionally allocated to each randomly selected *kebele*. Finally,

the study subjects were selected through systematic random sampling techniques from the list of households having eligible women in the respective *kebele*.

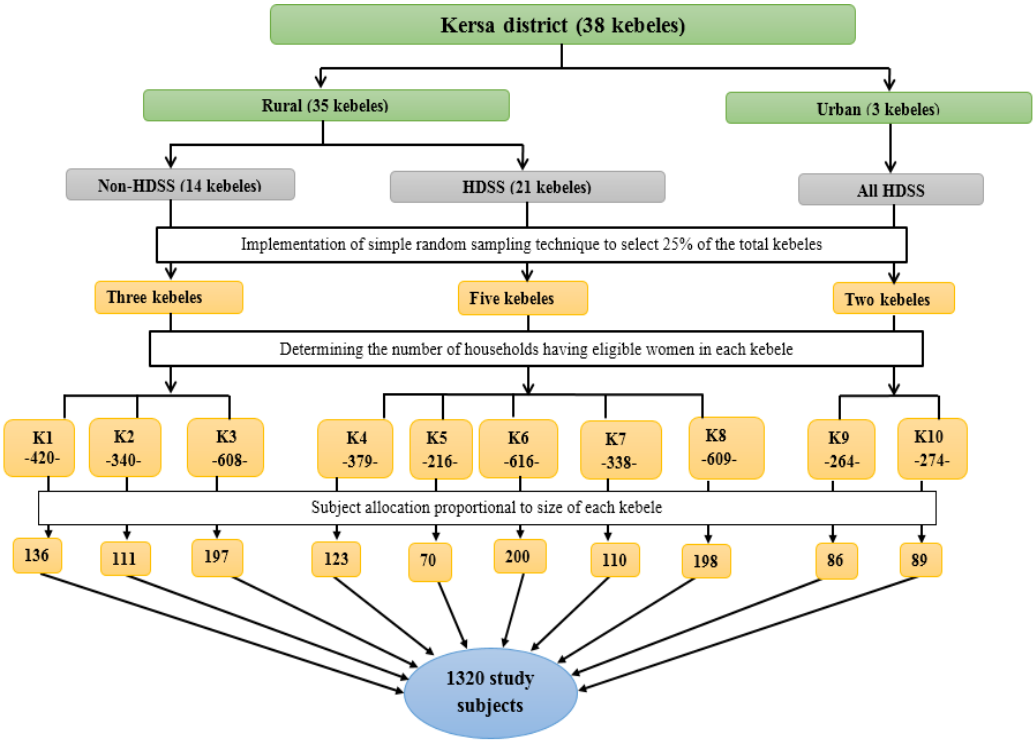

Figure 4.7. Schematic presentation of the sampling procedure to select study subjects (*NB: $K_{1\text{-}10}$ = codes of the randomly selected ten kebeles*)

4.4.1.5 Source of data and data collection procedures

This section has two components: the data source and questionnaire, and the data collection procedure. The details of this section are described below.

4.4.1.5.1 Data source and questionnaire

The data source for the present study was a community survey with house-to-house interviews of reproductive-aged women. In line with the conceptual framework of the thesis, the quantitative study tool was adapted from pertinent literature (53, 81, 108, 132, 198, 235, 274-277) including the Ethiopian Demographic and Health Survey MEASURE evaluation survey tool, JPIEGO Safe Motherhood questionnaire, and different studies that

have had a similar sample of study subjects to the current research. The tool was first prepared in an English version and translated into the local language (Oromiffa) to collect the data. To check the questionnaire for consistency, the tool was first translated from English to Oromiffa by one translator and vice-versa by another translator. The questionnaire contained several sub-sections: socio-demographic characteristics of the respondents, general information about pregnancy and ANC, perception of and utilization of ANC, perception of the quality of antenatal care service, questions on delivery choices, PNC utilization, social networking, and social support. In the social networking sub-section, questions included were whether the women were members of the Women's Development Army network and regular participants in the Women's Development Army meetings; whether they were living in a model family; best friend's use of maternal care; and social support received during pregnancy or labour. All questions were asked about the last three years preceding the survey date. The questionnaire can be found in *Appendix 1*.

4.4.1.5.2 Data collection procedure

The data collectors administered the survey by going from house to house in their assigned *kebeles* during the daytime. The data collectors visited randomly selected households and collected data using face-to-face interview techniques at the participant's residence. Data were collected by resident HDSS enumerators who had extensive experience in conducting interviews in both urban and rural *kebeles*. Eight data collectors and one supervisor were deployed in the data collection process. The interviewers used an inbuilt offline mode of a digital survey tool called Survey Gizmo *(*https://www.surveygizmo.com/*)* on iPads to collect the data. The survey questions were administered in the local language (Oromiffa) and responses were recorded on the iPad. The English and Oromiffa language questionnaires were integrated together in the Survey Gizmo to create an easy flow for the interview. For women who had given birth more than once during the three-year period before the survey, the most recent birth was considered in the survey assessment. In the event of nonappearance or a closed house, the data collectors made three rounds of visits and subsequently replaced eligible women in the next available household for the interview. The student researcher and one HDSS supervisor closely monitored the overall data collection process.

4.4.1.6 Measurement variables

4.4.1.6.1 Outcome variables

- Antenatal care utilization
  - ✓ **ANC attendance (at least one visit):** Women who had attended at least one ANC check-up during their most recent pregnancy as reported by the participant. The variable was categorized as "*those who had never made an ANC visit*" which was coded as (0) and "*those who had made at least one ANC visit*" which was coded as (1).
  - ✓ **ANC attendance (four visits):** Women who had made the WHO's recommended minimum of four ANC visits (104) during their most recent pregnancy as reported by the participant. The variable was dichotomized into two: "*those who had made four or more ANC visits*" which was coded as (1) and "*those who had made less than four ANC visits*" which was coded as (0).
- **Skilled delivery care utilization**: Women who had received delivery care from a skilled health worker at the time of labour and parturition of their most recent birth irrespective of the setting where the birth occurred.
- **Postnatal care utilization**: Women who had received a health check during the postnatal period (birth to six weeks after the delivery of the baby) for the mother-newborn pair or mother only from a skilled health worker for the most recent delivery regardless of the outcome and place of birth. Those post-partum women who had received PNC service at least once within the first six weeks after delivery (coded as 1) and those who had never received the service (coded as 0).

4.4.1.6.2 Predictor variables

The predictor variables of the study were framed based on the Andersen-Newman behavioral model of health care utilization (74, 75) and categorized into three sets of factors: predisposing, enabling and need factors (Table 4.5).

Table 4.5. Predictor variables categorized according to the Anderson-Newman model of health care utilization

Category	Factors
Predisposing Factors	Socio-demographic factors, such as maternal education, and age
	Reproductive and obstetric factors
	Knowledge and attitudes towards the care
	Means of communication, such as the presence of television, radio and internet in the household
	Availability of telephone
	Receiving education on maternal health
	Social networks related factors, such as the presence of Women's Development Army network and best friend's use of maternal care (Best friends: friends who regularly shared the woman's feelings and emotions, and felt their opinions and various behavioral practices important in the woman's lives)]
Enabling Factors	Economic factors and place of residence
	Health service-related factors, and living in (HDSS/Non-HDSS) site
	Decision maker on household expenses
	Social support
Need Factors	Awareness of danger signs or complications
	Experience of complications
	Pregnancy intention
	Ever Health Extension Workers home visit
	History of abortion, stillbirth and infant death
	Attendance of care during the index pregnancy
	Perceived benefit of the care

4.4.1.7 Data quality assurance

To maintain a high level of data quality for the community survey, the following measures were taken before and during the field operation of data gathering, data compilation and analysis. Before the beginning of the actual data collection, the quantitative study tool passed through pre-testing. The pre-testing was conducted in 5% of the sample (on 66 women) from a neighbouring district (Haramaya district). Based on the pre-testing findings, we evaluated the overall order of contents of the questionnaire; study variables; cultural appropriateness; and the clarity of the questions to the interviewee; and determined the average time taken to finish a single interview. All required revisions and

customizations were made on the study tool after examination of the pre-test data and feedback from data collectors. Data collectors were recruited and assigned based on their previous experience of undertaking face to face interviews and data collection in a similar area. For instance, experienced HDSS interviewers and a supervisor were recruited and deployed for the house-to-house survey.

Before conducting the data collection, a two-day intensive training session was provided to research assistants. During training, topics such as the purpose of the study, sampling methodology, data collection procedures, interview techniques using iPads, uploading responses, and handling ethical issues were covered. The training also involved working on simulated exercises and demonstrations by assistants carrying out an interview using the tool. The training was facilitated by the student researcher at Harar health and medical campus of Haramaya University. The training ensured that the data collectors were familiar with the intended research, its methodology and the data collection process - including the use of iPads - without any confusion. To ensure proper sampling of the participants, the student researcher himself had randomly selected the *kebeles*, allocated samples, and carried out the random selection of individual women for the interview. During data collection, the student researcher and the supervisor checked the response of the participants for completeness and correctness on the digital survey tool (Survey Gizmo). The supervisor repeated 10% of randomly selected interviews made by the data collectors daily to check for the validity of the completed responses. The supervisor regularly provided feedback to the interviewers. In the case of any incorrect or inconsistent responses, the interviewer went back to the interviewed woman's household and corrected the mistakes. Use of iPads for the data collection reduced the possibility of incompleteness and inconsistencies. The student researcher closely followed the running of the data collection process to solve any potentially arising problems.

4.4.1.8 Data management and analysis

Data were exported from Survey Gizmo into Statistical Package for Social Sciences (SPSS) (Version 23; IBM Corp, 2015) for cleaning and analysis. The labeling of each variable was checked and appropriately named before commencing the analysis. Data cleaning was made by calculating simple frequencies. As part of the data management and

preparation for analysis, some variables were transformed to generate new variables that could be meaningfully used in the analysis. The transformations were carried out either through recoding or producing new variables from the existing ones through computation techniques. The recoding was done through collapsing the categories of some nominal variables, changing continuous variables to categorical, and changing "string" variables to "numeric" to enable running inferential tests during regression. System missing values that existed in the data set due to skipping questions were managed accordingly in the variable recoding process. For multivariate analysis, variables with system missing values due to skipping questions were recoded into a new variable where the missing values were categorized into an existing category of the variable (usually to the "*No*" category). Categories of some variables with negligible frequency, such as, "*don't know*" or categories not relevant for an inferential test due to small cell value were recoded into an existing category of the variable for the regression analysis while remaining unchanged in the descriptive analysis.

Using the Principal Component Analysis statistical procedure in SPSS, a wealth index was constructed using household properties as an economic indicator and five categories of quintiles were composed. The Principal Component Analysis is a statistical procedure applied to aggregate the number of variables into a smaller number of dimensions to create indices or components which are a linear combination of weighted variables that reflect the largest possible total variance (278). The wealth index was computed using household asset ownership, household characteristics, and access to utilities where the presence or absence of the assets or characteristics in the household is coded into the dichotomized format of (1) and (0). This method of appraising household assets served as a proxy measure for socioeconomic status or wealth of the household, as an alternative to the traditional estimation of household wealth status through income or expenditure data. Some of the household assets and utilities included in the Principal Component Analysis are the presence of electricity, a wall clock, a radio, a television, mobile phones, a refrigerator, oxen, cows, sheep, toilet, and piped water. The wealth index was divided into five equal categories ranked from lowest to highest, and the wealth index scores were then used to group the households into these quintiles.

4.4.1.8.1 Descriptive analysis

As the first phase of data analysis, the data were descriptively summarized. Descriptive statistics such as frequency and percentage distribution, measures of central tendencies (such as *mean*), and measures of variability (such as *standard deviation*) were used to summarize the variables of the study for the sampled population. In this manner, the demographic and reproductive characteristics of the study participants were descriptively summarized in tables. The findings are also presented in graphic forms such as pie charts, and bar graphs. Cross-tabulation of variables was also carried out to discern any relationship between two variables in terms of percentage-wise distribution within a contingency table.

4.4.1.8.2 Logistic regression analysis

In the second phase of the data analysis, measures of associations were conducted. Inferential statistics or measure of associations were carried out to determine factors that were associated with the outcome variables. Binary logistic regression analysis was applied to identify factors associated with ANC, skilled delivery and PNC utilization. The selection process of the initial set of independent variables was based on the theoretical model of the study supported with a review of previous studies and running of some preliminary analysis. After running a cross-tabulation of the variables, bivariate followed by a multivariate logistic regression analysis were conducted to assess and interpret the correlations as well as to control for potential confounders. The regression analysis was carried out using the "*enter*" method. Prior to performing the regression analysis, some of the main scientific assumptions of logistic regression, such as the absence of multicollinearity between the explanatory variables, having adequate events per individual variable, and linearity for continuous variables were confirmed. The absence of multicollinearity among the covariates was considered when the value of the Variance Inflation factor was less than five. The model fitness of the multivariate logistic regression analyses was assessed using the Hosmer-Lemeshow goodness of fit statistical test ($P>0.05$).

Bivariate logistic regression analysis was carried out to determine the crude association

between each predictor variable with the outcome variable using Crude Odds Ratio (COR) at a 95% confidence interval. The regression model was built in three steps. The first step involved including only predisposing factors that showed significance in the bivariate analysis. The second step involved the inclusion of predisposing and enabling factors in the model. Finally, the third step involved regressing the predisposing, enabling and need factors that showed an association with the outcome variables with a p-value of less than 0.05. In the final multivariate logistic regression analysis, statistically significant associations between the predictors and outcome variables were confirmed if the Adjusted Odds Ratio (AOR) at a 95% confidence interval revealed a p-value of less than 0.05. The value of the AOR and confidence intervals were considered to interpret the direction and strength of the association between different variables. The results of these analyses are presented in Chapter 6 to Chapter 8.

The term “association” has been frequently mentioned in the context of this thesis. However, cautious interpretation is required to differentiate between “association” and “causation”. Association takes the meaning that some explanatory variables showed a positive correlation with the outcome variable based on statistical estimates (such as Odds Ratio) and does not necessarily indicate a causal association. Statistical association may go further to a level of causal association where the variable has a direct influence on the outcome of interest and the correlation is expressed as cause and effect. However, most of the associations presented in this thesis are statistical associations, as it is not possible to establish a causal sequence between the variables in cross-sectional studies in general.

4.4.1.9 Ethical considerations

Ethical approval was secured from the Human Research Ethics Committee of the University of Newcastle, Australia, with a protocol approval reference number (H-2016-0403). In addition, ethical approval was obtained from the Institutional Health Research Ethics Review Committee of Haramaya University (reference number IHRERC/129/2017). The ethical clearance letters from both ethics committees are attached in *Appendix 3* and *Appendix 4* respectively. Letters of permission were also written to all stakeholders and officials in the hierarchy of the study district, *kebeles* and villages (*Appendix 5*). The purpose and procedure of the study were explained using the

participant's information statements, and informed verbal consent was obtained from each of the research participants. The interviewer read the information statements to each participant before starting the interview, or the participant read the information statement, depending on the literacy of the participants. Participants were made aware that their participation was entirely their own choice and that they had the right to withdraw from the project at any time. The confidentiality of the respondents was kept throughout the study by avoiding associating participants' personal identification details with responses within the study tool. The study did not encompass financial and non-financial incentives or undue influence to induce research subjects to participate in the study. During house-to-house interviews, the participant's privacy was maintained by carrying out the interview in a separate place where auditory and visual privacy was assured. For participants who became emotionally distressed by the study questions, the interviews were paused, and the participants received reassurance and advice from the supervisor to ameliorate the situation. Pregnant or postpartum women who requested access to health services were referred to nearby health facilities. Data were kept stored in a password-protected computer in possession of the student researcher. Data were also backed up in the Research Centre for Generational Health and Ageing secure electronic server and will be retained for a minimum of five years as per the University of Newcastle requirements following which time, they will be destroyed in line with the university's policy provision. No one outside of the student researcher and supervisors has access to the data. The reports generated from the data contain no personal identifying information, and the analyses were carried out based on a pooled data level.

4.4.2 Qualitative study (Aim 6)

4.4.2.1 Study design

An interpretive qualitative study was conducted using focus group discussions. The qualitative study was implemented to understand the delaying factors for maternal health service utilization based on the experiences and perspectives of key members of the community. The qualitative study was designed to provide an in-depth understanding of the situation of maternal health service utilization from the perspective of key participants

in the community. Using the qualitative study, we aimed to capture the knowledge, practices, feelings, thoughts, and attitudes of participants on maternal health service use. Qualitative studies are commonly applied to give descriptions of the perceptions, beliefs, and opinions of the targeted participants about a health issue, which enables the researcher to explore why people behave in a certain manner towards a particular health issue (279). Qualitative studies are also capable of assessing other salient factors, such as the cultural factors and belief systems, that could be community determinants of non-attendance of maternal health services. The focus group discussion method was therefore employed for the qualitative study.

4.4.2.2 Justification of the study

As the quantitative studies were unable to adequately explore the societal and cultural practices that influence maternal health service utilization due to the methodological limitation of such studies, further qualitative research was required to understand these issues. In the current study, an interpretative research approach was used to investigate the household and societal-level factors that contribute to delayed maternal health service utilization. The interpretive research approach is commonly used in qualitative studies and involves exploring participants' experiences, meanings, and interpretations in relation to a health problem in order to understand that problem from multiple individual viewpoints (280).

The qualitative study investigated the factors that delay women from seeking and using maternal health services, including personal perceptions; sociocultural beliefs; and customary or normative behaviors. The study involved focus group discussions to examine and interpret the research question in context, including through an examination of the experiences, beliefs, and shared perspectives of participants. Qualitative data are subjective in nature and thus not amenable to counting or quantitative measurement (281). However, they do provide deeper insights into how, and to what extent, factors negatively influence women's use of maternal health services by encouraging interaction and free discussion among individuals with lived experiences of health service utilization (282).

By employing qualitative modes of enquiry, we illuminate the deeply rooted societal and

cultural barriers that contribute to delayed maternal health service use. Qualitative methods were selected to gather information about the reasons that women in the study community behave as they do in seeking and using maternal health services because they allow for interactions and open discussions with individuals who have lived experiences in their social contexts. The personal assertions of targeted community members' subjective thoughts, feelings, attitudes and reasons as regarding women's use or non-use of healthcare services provided rich information. This information helped to elucidate the contextual societal and cultural factors that delay women from seeking care, and from reaching and receiving maternal health services.

4.4.2.3 Study population

Reproductive-aged women, traditional birth attendants, mothers-in-law, husbands, and Health Extension Workers were included as target groups for the study. Targeted participants who assumed a leadership role in their respective community, who had lived for less than six months in the community and those who were not familiar with the local socio-cultural condition were not included in the qualitative study.

4.4.2.4 Sampling

Participants for the focus group discussion were identified through purposive sampling. Different categories of participants from different villages of the *kebeles* in the district were recruited and included in the group discussions. Participants who were thought to play a major role, were knowledgeable or who had lived experiences in relation to maternal health services from both urban and rural *kebeles* were identified and invited to take part in the group discussion. The target participants for the focus group discussion consisted of the following discussants: reproductive-aged women, mothers-in-law, traditional birth attendants, husbands, and Health Extension Workers. With the assistance of village-level facilitators and the Women's Development Army leaders, the study participants were recruited from different *kebeles* of the study district. The participants were recruited based on the participant's willingness to take part in the discussion from different villages in the same *kebele*. The facilitators recruited voluntary participants from

different villages in each included *kebeles* to form a group. Accordingly, 20 reproductive-aged women, 19 mothers-in-law, 12 traditional birth attendants, 24 husbands, and 13 Health Extension Workers were included in the focus group discussion.

4.4.2.5 Data collection procedure

The initial focus group discussion guide was developed after reviewing relevant previous studies (110, 132, 173, 217, 283, 284) and was adapted to the research objective. As the study progressed, the focus group discussion questions were further framed after gaining some reflections from the first few discussions. The tool was first prepared in an English version and translated into the local language (Oromiffa) to collect the data. The tool was translated to the local language and re-translated into English to check for consistency. The focus group discussion guide is included in *Appendix 2*. The focus group discussion guide consisted of a range of open-ended questions covering several issues related to perceptions, feelings, thoughts, experiences, and barriers related to ANC, skilled delivery and PNC utilization. The focus group discussion guide addressed topics related to the following: perception on the importance of attending maternal health services; main reasons for women's non-attendance of maternal health services; community values around maternal health services seeking; possible areas of improvement in referral and transportation during an obstetric emergency; the importance of participating in Women's Development Army networks for promotion and utilization of maternal health services; and social support. The focus group sessions averaged about 60 minutes (range = 40-80 minutes) and consisted of between six to ten participants per group. Overall, thirteen focus group discussions were conducted involving a total of eighty-eight participants. Information saturation was used to determine the number of focus group discussions per each group of a target group (281). The saturation point was reached if no new ideas or information or insights on the delaying factors for maternal health service utilization were obtained. The group discussions were conducted in elementary schools, health posts, and health centres located in the villages. The group discussions were moderated in the local language and audio-recorded. Using the Focus Group Discussion guide, two moderators (male and female) who were staff members of Haramaya University, with experience in handling focus group discussions and fluent in the local language, conducted the group discussions. Handwritten notes were also taken during each group discussion. The student

researcher closely monitored the focus group discussion process to ensure that the correct procedures were followed in carrying out the discussions.

4.4.2.6 Data quality assurance

4.4.2.6.1 General data quality measures

To ensure the quality of the focus group discussion data the following measures were undertaken.

The student researcher provided an orientation session to the moderators to highlight the content, purpose, and procedure of the focus group discussion including a briefing on the discussion guide. Under strict coaching and with follow-up by the student researcher, one male with a Master in Public Health and one female PhD student, both of whom were university academic members having prior experience in handling qualitative data, carried out the focus group discussions. In order to avoid professional influence on the participants, the moderators built rapport by initiating the discussions through the introduction of their affiliations and role. During the focus group discussions, the moderators applied probing methods and question rephrasing approaches to clarify the questions for the participants to gain optimum information about the issues raised for the discussion. The audio recordings were carefully transcribed into the local language and then meticulously translated into English by the moderators. Samples of English transcripts were randomly double-checked with the local language transcripts and audio-recordings to ensure language consistency.

4.4.2.6.2 Rigour of the qualitative study

The rigour of the study was determined based on evaluative criteria used by previous studies (285-287). The criteria, such as credibility, dependability and confirmability, and transferability were addressed to assess the rigour of the study.

4.4.2.6.3 Credibility

To enhance the credibility of the results, data were sourced from five different target groups to learn their perspectives. The moderators and the student researcher spent adequate amount of time in the field to fully understand the problem under question. In each target group of participants, the number of focus group discussions were determined by information saturation. The saturation point was achieved if no new ideas, concepts or insights emerging on the delaying factors for maternal health service utilization was obtained. Triangulation of the information was carried out to ensure the completeness of the evidence and to increase the potential for an in-depth understanding of the problem. The coding process was reviewed by an expert in qualitative research, and modifications were made.

4.4.2.6.4 Dependability and confirmability

Experienced moderators who were native speakers of the local language, who originated from the same socio-cultural background as the participants, and who were familiar with the local norms and traditions, conducted the focus group discussions. We are cognizant that due to the high social status of the moderators (being academic professionals, highly educated, and coming from the urban area), there might exist power dynamics that could influence the relationship between the moderators and the participants. This relationship dynamics might have made some participants reluctant to voice their opinions on certain issues raised by the moderators. However, we attempted to minimize this power differential by recruiting participants via local facilitators, building rapport, making the discussion using plain and simple language, ensuring moderators' neutral position, creating a more interactive discussions by proactively encouraging participants to share their thoughts, and conducting the discussions at the participants' convenient time and locations. The moderator-participant interaction was based on mutual trust and respect. The discussion took both an insider and outsider orientation, where participants shared experiences or thoughts among themselves and sometimes addressed the moderators. Participants expressed their opinions without pressure and freely shared their lived experiences about the problems as the discussions were well facilitated, and the moderators encouraged the group discussion in a neutral manner while tracking the

discussion within the intended topic. Consequently, even though most participants rate the services as important, they were able to express their opinion on important barriers that delay women's utilization of maternal health services.

The participants also appeared to present their criticisms of the general health care provision in government health facilities and lack of good governance of the local administration to the moderators, though this was not enquired about. As part of enhancing the rigour of the study, the NVIVO software allowed auditing of the findings and help minimize the possibility to focus on irrelevant findings. Using the software, we ran queries and used referring back techniques to contextualize the transcript to discern whether the findings reflected in the themes were sufficiently supported by the raw data from different participant groups.

4.4.2.6.5 Transferability

With regards to the transferability of the findings, the study was conducted in a largely rural context where there is a low literacy level, underdeveloped socio-economic conditions, poor accessibility to transport and road condition, and deeply rooted socio-cultural practices. The findings might be applicable to settings with similar socio-economic and cultural conditions in or beyond Ethiopia. However, for readers to make their own judgment about the transferability of the finding to a specific context, we provided detailed and appropriate descriptions of the context of the study in the "research setting" section and examples of raw data in the form of direct quotations.

4.4.2.7 Data management and analysis

After completion of the focus group discussions from each target group in the field operation, all the recorded voices of the participants were directly transcribed in the local language by the moderators who conducted the focus group discussions. The recorded and transcribed data were complemented with handwritten notes taken during the focus group discussions. The two moderators who conducted the focus group discussion translated the transcribed data into English. The student researcher thoroughly reviewed the English

transcribed texts to gain a clear idea of the overall perspective of the qualitative data. Subsequently, the transcribed data were imported into NVIVO software version 11 for data analysis (288).

The qualitative data were coded and categorized using a thematic analysis approach (289, 290). Thematic analysis is a flexible method to allow for comparison within the transcribed texts and involves the categorization of commonly recurring concepts into themes. The coding was performed by identifying the concepts described in the transcriptions that were related to the research questions and aggregating similar codes into the same theme. The coding involved an iterative process and was carried out by capturing and coding concepts from the transcript. Upon concluding the coding process, the codes were further categorized into themes. These emergent themes were reviewed and compared, and where necessary, re-classified with similar concepts. During the write up of the study findings, typical response quotations representing the verbal expression of the respondents were inserted into the descriptions to supplement the issues being elaborated in the themes. The analysis process was guided and structured by the Three Delays model (84). Then, the main factors were drawn from the thematic analysis and mapped into the relevant category of the three overarching domains of the model: Delay One, Two and Three.

4.4.2.8 Ethical considerations

The protocol was approved by the Human Research Ethics Committee of the University of Newcastle (H-2016-0403) and Institutional Health Research Ethics Committee of Haramaya University (IHRERC/129/2017), and these approvals can be found in (*Appendix 3* and *Appendix 4*). Before conducting the study, an official letter was written to local authorities in the district (*Appendix 5*). During participant recruitment, each participant was given an information statement to read, or the moderator read it to them, depending on the literacy level. Thus, each participant was asked to give informed verbal consent before participating in the discussion, including consenting to the use of an audio recording tool. In addition, each participant was anonymously coded to identify them to maintain the confidentiality of the information. At the end of the group discussions, the moderators

gave explanations on health issues raised by the participants. The audio-recordings of the qualitative study are being kept in a safe place to avoid information leakage to anyone outside of the research team until they are securely destroyed in approximately five years' time. The reports arising from the qualitative data did not contain any identifiable information and the findings are supported with de-identified verbatim quotes. The culture and norms of the community were respected throughout the data collection process.

Chapter 5

Magnitude, trends and causes of maternal mortality among reproductive-aged women in Kersa Health and Demographic Surveillance System, eastern Ethiopia

5.1 Foreword

In Ethiopia, national estimates of maternal mortality have been calculated for several years. Despite the importance of collating similar data on a smaller scale, local estimates of maternal mortality are rarely conducted. Local level measurement of maternal mortality is important to design context-specific interventions. Studies such as those included in this thesis can make important contributions to bridging this knowledge gap around local level maternal mortality; and contribute to the national picture of the problem. The purpose of this study is to estimate the magnitude of local levels of maternal mortality; and assess causes at a community level; to achieve the research Aim 2: To investigate the magnitude and causes of maternal mortality and resulting trends among reproductive-aged women in Kersa HDSS.

This chapter has been published with *BMC Women's Health:*
Tesfaye G, Loxton D, Chojenta C, Assefa N, and Smith R. Magnitude, trends and causes of maternal mortality among reproductive-aged women in Kersa Health and Demographic Surveillance System, eastern Ethiopia. *BMC Women's Health, 2018; 18(198).*

Abstract

Background: Despite efforts at curbing both, developing countries are still burdened with high rates of maternal morbidity and mortality. Ethiopia is no exception and has one of the world's highest rates of maternal deaths. Reducing the huge burden of maternal mortality remains the single most serious challenge in Ethiopia. There is a paucity of information with regard to the local level magnitude and causes of maternal mortality. We assessed the magnitude, trends and causes of maternal mortality using surveillance data from the Kersa Health and Demographic Surveillance System, in eastern Ethiopia.

Method: The analysis used surveillance data extracted from the Kersa Health Demographic Surveillance System database for the duration of 2008 to 2014. Data on maternal deaths and live births during the seven-year period were used to determine the maternal mortality ratio in the study. The data were mainly extracted from a Verbal Autopsy database. The sample was comprised of all reproductive-aged women who died during pregnancy or childbirth or within 42 days after delivery. The Chi-squared test for linear trend was used to examine the significance of the change in rates over time.

Results: Out of the total 311 deaths of reproductive-aged women during the study period, 72 (23.2%) died during pregnancy or within 42 days of delivery. The overall estimated maternal mortality ratio was 324 per 100,000 live births (95% CI: 256, 384). The observed maternal mortality ratio has shown a declining trend over the seven-years period though there is no statistical significance for the reduction (χ^2=0.56, P=0.57). The estimated pregnancy-related mortality ratio was 543 per 100,000 live births (95% CI: 437, 663). Out of those who died due to pregnancy and related causes, only 26% attended at least one ANC service. The most common cause of maternal death was post-partum hemorrhage (46.5%) followed by hypertensive disorders of pregnancy (16.3%).

Conclusion: The magnitude of maternal mortality in Kersa is considerably high but has shown a decreasing trend. Community-based initiatives that aim to improve maternal health should be strengthened further to reduce the prevailing maternal mortality. Targeted information education and communication should be provided.

Keywords: Maternal mortality, reproductive-aged women, Kersa HDSS, eastern Ethiopia

5.2 Background

Improving women's health and reducing maternal mortality has long been a global public health priority for the United Nations international development agenda (15, 125). Globally, the Maternal Mortality Ratio (MMR) declined from 385 in 1990 to 216 in 2015. During that same period, however, the MMR reduction in sub-Saharan Africa remained stalled and most countries in the region registered sluggish progress in reducing maternal mortality (4, 5, 18). According to the World Health Organization (WHO) estimates, the magnitude of MMR in Ethiopia remains high, but the level has shown a steady decline from 1,250 in 1990 to 353 in 2015 (5). In the Sustainable Development Goal (SDG) period, the goal is to reduce the global MMR to less than 70 per 100,000 live births by 2030, with no country having MMR over 140 per 100,000 live births (3).

In Ethiopia, the Federal Ministry of Health has applied multi-pronged approaches to reducing maternal morbidity and mortality. These approaches have included improving access to and strengthening facility-based maternal health services (53). Ethiopia's Health Sector Development Plan target was to reduce MMR to 267 per 100,000 live births by the year 2015, but the country was unable to meet this target (17). It was well recognized that the huge burden of maternal mortality in Ethiopia remains the single most serious challenge to the health sector (291). Efforts to end preventable maternal mortality remains at the top of the country's health sector agenda in line with the SDGs. The issue was targeted in the 2015 health sector transformation plan (48).

The highest number of maternal deaths has been reported in countries happen where women are least likely to deliver their babies with the assistance of skilled practitioners, such as a nurse/midwife, doctor, and other health workers (2). In many countries, it is women living in rural areas; at the lowest wealth quintile; and with less education, who are most susceptible to maternal mortality (2, 4). High maternal mortality levels are also a manifestation of deep-seated gender inequalities that hinder women's ability to make decisions about household resources, which in turn could limit their ability to obtain social support and to access maternal health services (43).

Despite efforts at curbing maternal morbidity and mortality, developing countries are

burdened with high maternal morbidity and mortality and are still facing the challenge of addressing the problem with very limited personnel and material resources (36). More than 50% of all maternal deaths were from just six countries: Ethiopia, India, Nigeria, Pakistan, Afghanistan, and the Democratic Republic of Congo (36, 37). The modeled estimate by WHO and the World Bank for Ethiopia showed a MMR of 353 per 100,000 live births in 2015 (5).

In Ethiopia, most studies on maternal mortality have been conducted in a facility setting (24, 27, 292). Given that only a small number of mothers deliver at health institutions in Ethiopia, maternal mortality measurement from facility-based data may not reflect the true picture (53, 96). In addition, there is a paucity of information with regards to local levels of magnitude and causes of maternal mortality in the community setting in Ethiopia. The differing study results regarding the magnitude of maternal mortality across Ethiopia suggest more rigorous and locally generated evidence is necessary (5, 44, 53). This study, therefore, aimed to investigate the magnitude of, trends in, and causes of maternal mortality among reproductive-aged women using surveillance data in a community setting in eastern Ethiopia.

5.3 Methods

5.3.1 Study setting

The study was conducted in the Kersa Health and Demographic Surveillance System (HDSS) site, Kersa district, eastern Ethiopia. The HDSS is a member of INDEPTH network (265). According to the country's 2014 population projection, the district has an estimated total population of 205,628. The district has 38 *kebeles* (the smallest administrative units in Ethiopia with an average population of 5000), of which three are urban, and 35 are rural *kebeles* (228, 264). The Kersa HDSS baseline census was conducted in 2007 and since then it has been updated every six months, with the registration of demographic and health events. In Kersa HDSS catchment population, there are six health centres, 20 health posts, and five clinics. From 2008 to 2014, there were 12 *kebeles* under the Kersa HDSS and the current study considered the data that was drawn

from this surveillance population.

5.3.2 Study design

The study used longitudinal population-based surveillance design and we carried out secondary data analysis through extracting data for the seven consecutive years (2008-2014).

5.3.3 Population

All women of reproductive age at the Kersa HDSS site during the period 2008-2014 were the source population. The study population were all reproductive-aged women who died during 2008-2014 and were recorded by the Kersa HDSS. Data on the deceased women who used to live in the study area for less than six months were excluded from the analysis as they were not confirmed to be permanent residents.

5.3.4 Source of data and data collection methods

The primary source of the data was the Verbal Autopsy database of the Kersa HDSS. Verbal Autopsy is a method of interviewing close relatives or caregivers of the dead person about the circumstances, signs, and symptoms that occurred before the death event, with the respondent relaying answers in his/her own words (271). Once the interview is completed, the Verbal Autopsy questionnaires are passed on to at least two physicians (General practitioners) to assign the cause of death using the ICD-10 codes. After checking the agreement of physician-assigned cause of death based on Verbal Autopsy coding, discordant cases are sent to a third physician for independent review and diagnosis. If any two of these three physicians assign the same cause of death, then that is considered as the final cause of death; otherwise, the causes are labeled as undetermined. In addition to the information on the Verbal Autopsy database, some basic data such as religion and ethnicity of the deceased women were obtained from the main household registration system database of the Kersa HDSS.

The data extraction procedure from the Verbal Autopsy database was elucidated as follows. From all the deceased individuals who have Verbal Autopsy data in the database. Firstly, males of all ages were excluded. Then, the data of all deceased women aged less than 15 years and greater than 49 years were excluded. From all the women's deaths in the reproductive age, the data of those women who were not pregnant or beyond 42 days after birth during the time of death were then excluded. Finally, the remaining data, that of all deceased women during pregnancy, birth or within 42 days of delivery were considered for the analysis.

5.3.5 Data quality control

Quality assurance measures were embedded into all aspects of the surveillance process. In the Kersa HDSS, if inconsistent or missing data were detected at any step during the data collection process, the questionnaire was returned to the data collectors for checks and corrections. In addition, the supervisor selected 5% of questionnaires and visited the houses where the data were collected to check whether the information was accurate. The field coordinator checked 1% of the questionnaires in a similar manner. Similar measures of quality assurance procedures have also been applied to the data collection process that makes use of the Verbal Autopsy questionnaires for a deceased person. The surveillance also made use of a standardized study tool. During the data extraction, cross-checking of the electronic version of the data with the archived hardcopy was carried out through tracing the information back on a sample of deceased women. Data cleaning and adjustments were conducted to avoid errors in the labeling or order of the variables of interest.

5.3.6 Data analysis

Descriptive statistics consisting of frequency and proportion were performed to summarize the main variables. The analysis was conducted in STATA software. Some of the major statistical parameters computed were the following: MMR; pregnancy-related death ratio; maternal mortality rate; lifetime risk of maternal deaths; and proportion of maternal deaths

among female deaths. The overall level of MMR was calculated by dividing the total number of maternal deaths (from the Verbal Autopsy data) from 2008 to 2014; with the total number of live births in the same period, which was then converted to 100,000 live births. The level of MMR for each year starting from 2008 and up to 2014 was calculated in the same manner and the trend at different years was plotted. The temporal trend of maternal mortality was also conducted to demonstrate the seasonal variation. We used the Chi-squared test to determine the significance of the trend over time. "*Pregnancy-related death*" was the number of deaths of women while they were pregnant, or within 42 days after termination of pregnancy, irrespective of the cause; divided by a total number of live births in the same period. "*Proportion of maternal deaths among female deaths*" was the number of maternal deaths divided by the total number of deaths among reproductive-aged women in the same period. The "*Life Time Risk of maternal death*" was approximated by [Life Time Risk=1-(1-Maternal mortality rate) [35]]. To obtain the Life Time Risk of maternal death, we first calculated maternal mortality rate (Mmrate) by dividing the number of maternal deaths by the total number of reproductive-aged women in the study area during the same period. The Life Time Risk of maternal death is an important measure of the cumulative loss of life due to maternal deaths over a woman's life course (269).

5.4 Results

5.4.1 General findings

Out of the total number of reproductive-aged women (34,101) during the study period, there were a total of 311 deaths. Of these, 72 (23.2%) (95% CI: 18.6%, 28.2%) occurred during pregnancy or within 42 days after delivery. Of all the women who died during pregnancy or within 42 days after delivery, 43 (59.7%) with 95% CI (47.5%, 71.1%) died due to pregnancy or related causes based on the ICD codes. In the same period, the total number of live births was 13,269. Hence, based on this, the MMR was 324 per 100,000 live births (95% CI: 256, 384). The Pregnancy-Related Mortality Ratio was 543 per 100,000 live births (95% CI: 437, 663), the proportion of maternal deaths among female deaths was 13.8% (95% CI: 10.2%, 18.2%), and the lifetime risk of maternal death was calculated by (Life Time Risk=1-(1-Mmrate)^{35})=1-(1-0.00126)^{35}, Life Time Risk=1-

0.95683166, Life Time Risk of maternal death=0.0432 ~ 4.3% (approximately one in 23).

5.4.2 Basic socio-demographic characteristics

The mean age of the women who died due to maternal causes was 27.6 (SD=7.5) years. The majority of the mothers who died due to maternal causes were illiterate (83.7%), married (90.7%), a house-wife (72.1%), of Muslim religion (93.1%) and Oromo by ethnicity (93.1%) (Table 5.1).

Table 5.1. Distribution of women who died due to pregnancy-related causes by socio-demographic characteristics, Kersa HDSS, 2008-2014

Variables	**All pregnancy-related deaths (n=72)**	
	Maternal deaths, no (%)	**Non-maternal deaths,** no (%)
Age		
15-19	5 (11.6)	5 (17.2)
20-29	21 (48.8)	8 (27.6)
30-39	13 (30.2)	15 (51.7)
40-49	4 (9.3)	1(3.4)
Marital status		
Never married	1 (2.4)	0
Married	39 (90.7)	28 (96.6)
Widowed	3 (6.9)	1 (3.4)
Occupational status		
Farmer	5 (11.6)	4 (13.8)
House maid	4 (9.3)	2 (6.9)
House wife	31 (72.1)	20 (69)
Merchant	1 (2.3)	1 (3.4)
Student	2 (4.7)	0
Daily labourer	0	2 (6.9)
Educational status		
Illiterate	36 (83.7)	25 (86.2)
Grade 1-4	2 (4.7)	3 (10.3)
Grade 5-8	2 (4.7)	1 (3.4)
Grade 9-10	2 (4.7)	0 (0.0)
Grade 12+	1 (2.3)	0 (0.0)
Ethnicity		
Oromo	40 (93.1)	29 (100)
Amhara	3 (6.9)	0 (0.0)

Religion		
Muslim	40 (93.1)	29 (100)
Orthodox Christian	3 (6.9)	0 (0.0)
Residence		
Urban	5 (11.6)	4 (13.8)
Rural	38 (88.4)	25 (86.2)

5.4.3 Magnitude and trends of maternal mortality

The overall MMR was 324 per 100,000 live births with 95% CI (256, 384) in the study area during the reference period. The number of maternal deaths per each year and the corresponding MMRs with confidence intervals are presented in Table 5.2. Across the study years the trend of the MMR varied, the lowest being in 2013 with 172 per 100,000 live births and the highest peak observed in 2011 with 636 per 100,000 live births.

Table 5.2: Annual maternal mortality ratios over the seven-years period (2008 to 2014), Kersa HDSS

Year	Number of maternal deaths	Number of live births	MMR with 95% CI
2008	6	1615	372 (186, 557)
2009	5	1757	285 (114, 445)
2010	8	2019	396 (198, 502)
2011	10	1572	636 (382, 827)
2012	5	1808	221 (111, 442)
2013	4	2319	172 (60, 245)
2014	5	2179	229 (92, 335)

There was a slowly declining trend in MMR during the reference period in the study area with a gradient of 29.643 on a linear scale (Figure 5.1), though there is no statistical significance for the reduction (χ^2=0.56 and P=0.57).

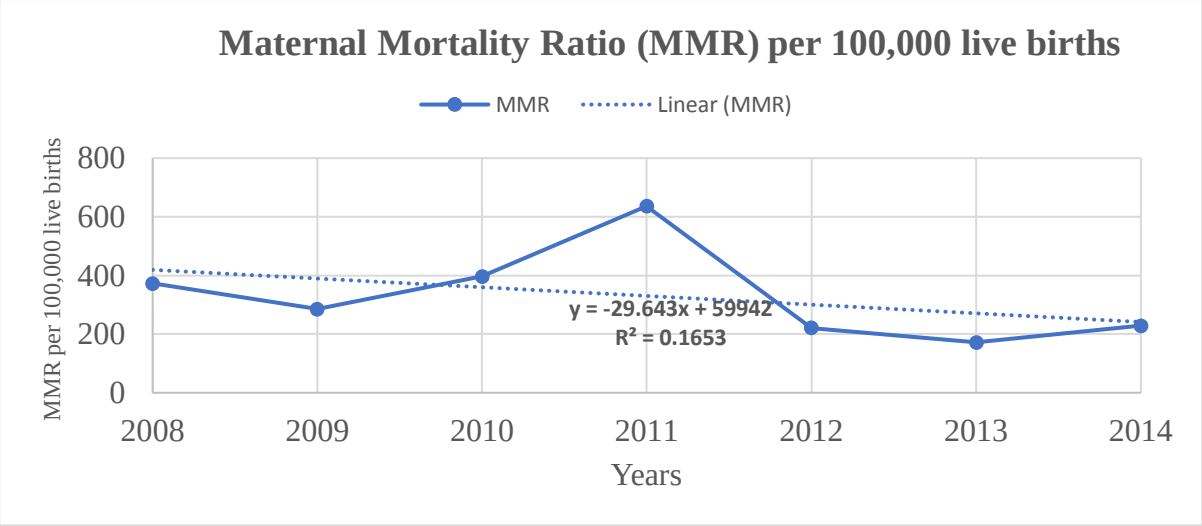

Figure 5.1. Trends of maternal mortality ratio in Kersa HDSS, 2008-2014

Furthermore, as shown in Figure 5.2, except in 2010, 2012 and 2013, the highest rates of maternal mortality persistently occurred in the age group 20-29 years.

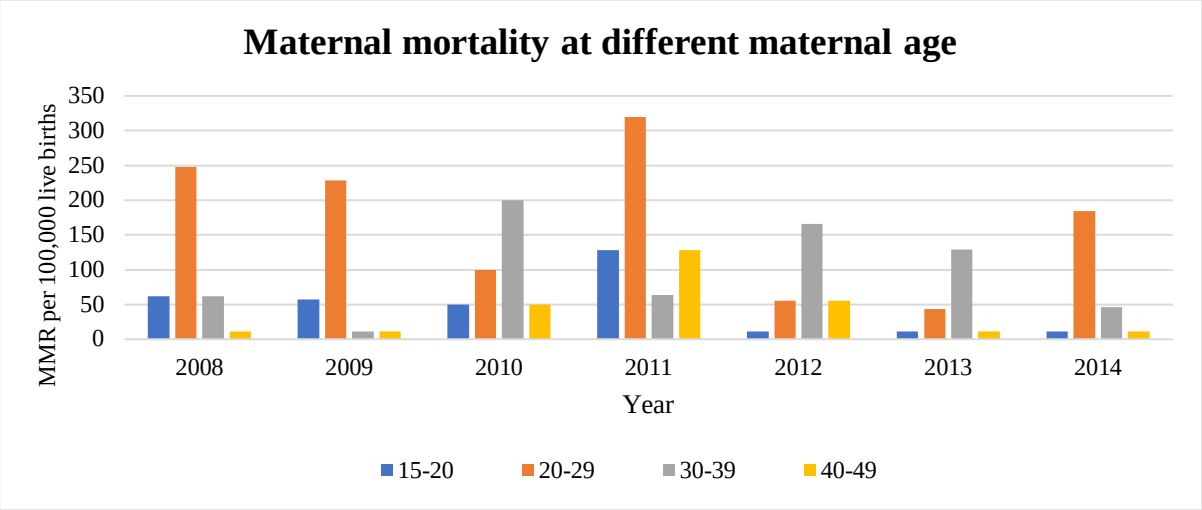

Figure 5.2. Age-wise distribution of maternal mortality in Kersa HDSS, 2008-2014

Moreover, the study revealed an observed temporal (seasonal) variations in MMR in the study area. Throughout the study period, the highest rate of death was observed during the winter season. At the beginning of the surveillance year, the MMR overlapped at 124 per 100,000 live births for the three seasons (winter, autumn, and summer). In subsequent years, however, the rate persistently became higher in the winter season until the end of the surveillance period with the highest rate observed in 2011 (Figure 5.3).

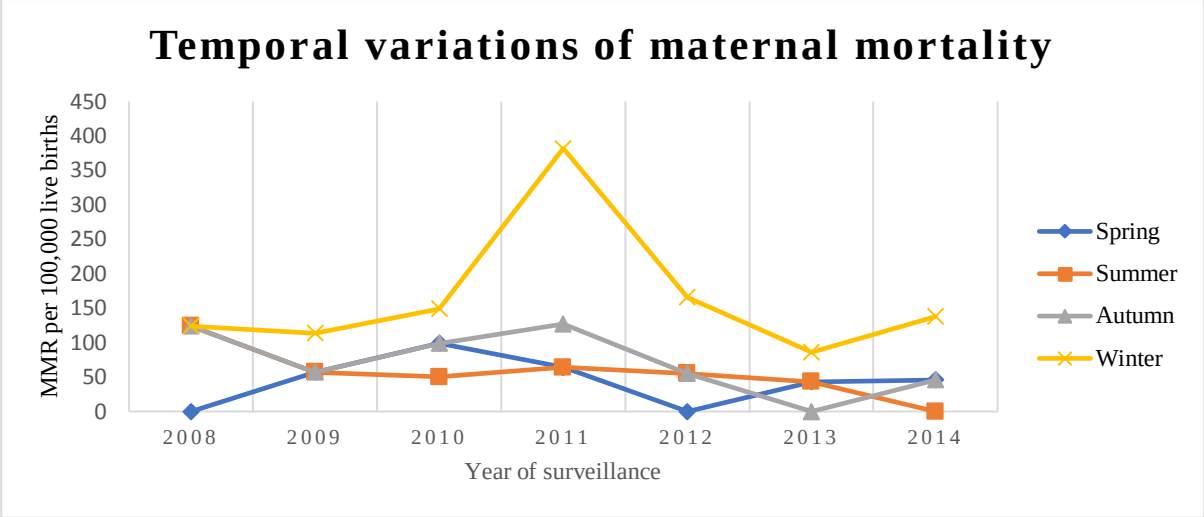

Figure 5.3. Temporal variation of maternal mortality in Kersa HDSS, 2008-2014

5.4.4 Causes of maternal death

The maternal morbidities that lead to maternal deaths were identified using the ICD codes. This was generated from the Verbal Autopsy database using the corresponding Verbal Autopsy code. Accordingly, the main cause of death among the 43 (59.7%) mothers who died due to pregnancy or its related causes was postpartum hemorrhage (46.5%), followed by hypertensive disorders of pregnancy (16.3%) (Figure 5.4).

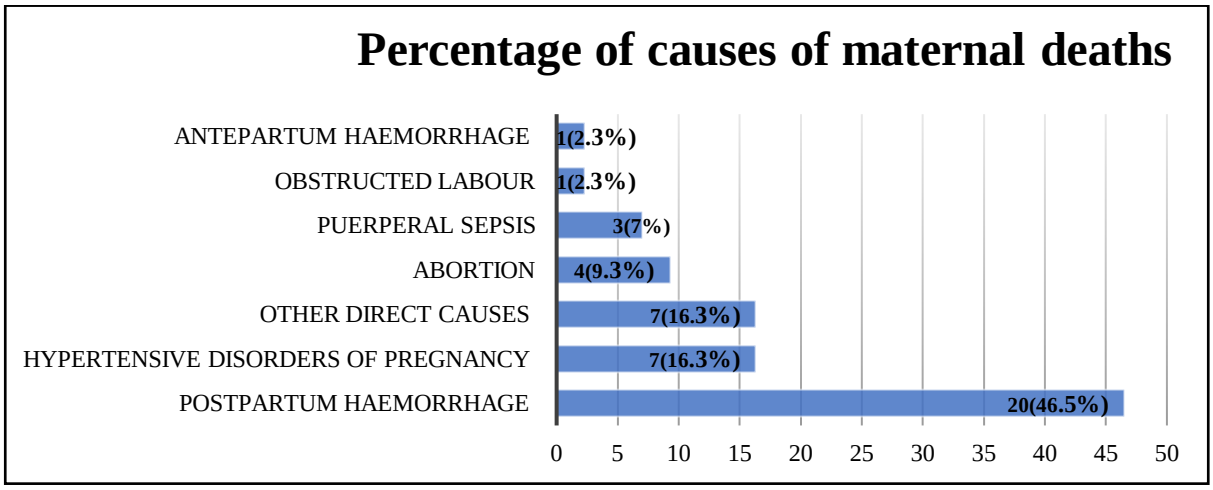

Figure 5.4. Proportion of maternal deaths by cause, Kersa HDSS, 2008-2014

It is worth noting that, among the pregnancy-related deaths, a significant percentage (14%) of the mothers died due to partner violence and transport accidents. Though not statistically significant (P=0.40), there was an observed variation in the cause of maternal

death across different years (Figure 5.5). For instance, though postpartum hemorrhage persisted in being the leading cause of maternal death from 2008-2013, in 2014 however, the leading cause of maternal death was hypertensive disorders of pregnancy.

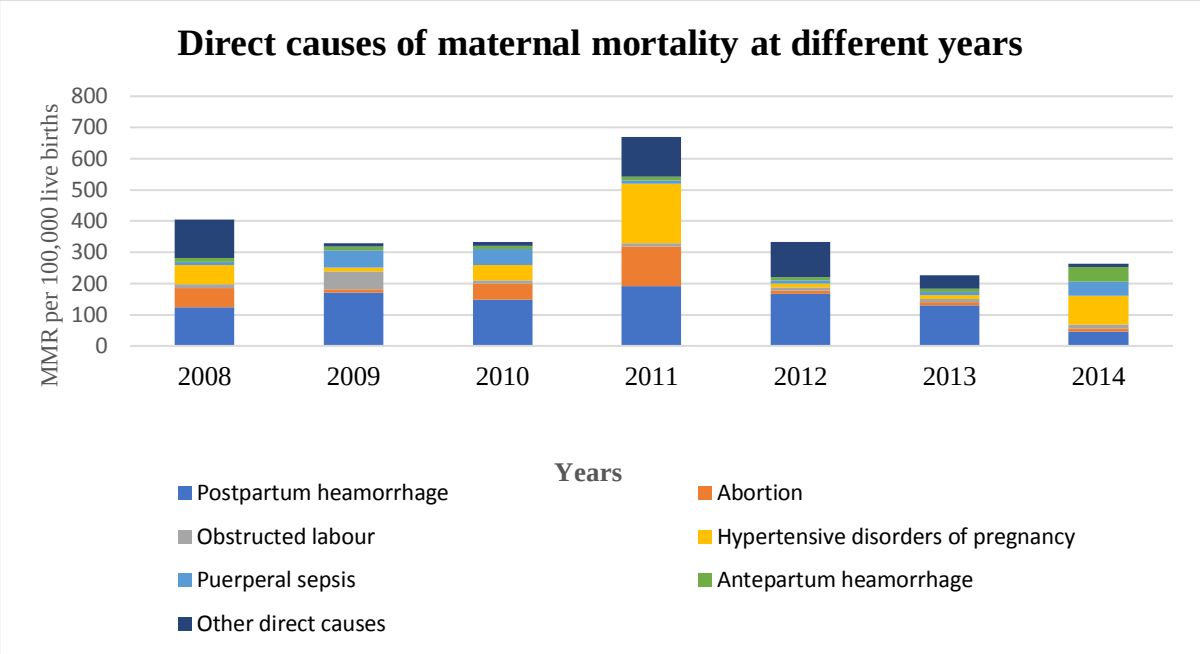

Figure 5.5. Causes of maternal mortality across various years (2008-2014), Kersa HDSS

5.4.5 Place of death

Regarding the place of maternal death, most (56%) of the deaths occurred at home, followed by the hospital (33%), other places (9%), and health centre (2%). The majority (63%) of maternal deaths occurred after giving birth, and among which 18 (67%) give birth at home and 9 (21%) delivered at health facility. Among those who gave birth at home, 27% died in a hospital and other lower-level health facilities.

5.4.6 Previously known morbidities

Based on the information from the respondents, there were some previously known morbidities among the deceased mothers such as high blood pressure (9.3%), diabetes (2.3%), malnutrition (2.3%), tuberculosis (2.3%) and other diseases such as anemia (4.7%). With regards to injuries or accidents, only 3% of the deceased mothers were

known to have a history of injuries or accidents, such as suicide and insect bites, surrounding their deaths.

5.4.7 Obstetric measurements and health service use

Nearly a quarter (26%) of the deceased mothers attended at least one ANC consultation for their pregnancy. With regards to the timing of maternal death during the course of pregnancy, among the deceased mothers, 27 (62.8%) died after giving birth, the majority of those (55.6%) within the first day. Among those who died after giving birth, the majority (66.7%) gave birth at home. The majority of the deliveries were assisted by untrained traditional birth attendants (48.1%) (Table 5.3).

Table 5.3. Obstetric measurements of women who died due to maternal causes, Kersa HDSS, 2008-2014.

Obstetric related variables (N=43)	**Frequency**	**Percent**
Died during pregnancy (before delivery)	12	27.9
Gestational age at death (n=12)		
First trimester	3	25
Second trimester	2	16.7
Third trimester (including in labour)	7	58.3
Died after giving birth	27	62.8
Died after undergoing abortion	4	9.3
Type of delivery (n=27)		
Normal	21	67.7
Forceps/vacuum	4	19.9
Caesarean section	2	6.6
Died postnatally (n=27)		
Within the first day	15	55.6
Between 1-7 days	8	29.6
Between 7days -6 weeks	4	14.8
Place of delivery (n=27)		
Home	18	66.7
Hospital	8	29.6
Health centre	1	3.7
Delivery attendants during delivery (n=27)		
Traditional birth attendants		
Untrained	13	48.1

Trained	3	11.1
Doctors	7	25.9
Nurses	2	11.1
Relatives	2	3.7

More than half (60.6%) of the deceased mothers received some treatment for the condition that led to their death. The main treatment modality the mothers received before their death was oral and injection antibiotics (46.2%). Other treatments included intravenous fluid and Oral Rehydration Salt (34.6%), nasal treatment (15.4%) such as food or fluid that passed through the nose, and one woman received blood transfusions (3.8%). With regards to the place of treatment, among the mothers who received some treatment, a substantial proportion (80.8%) received treatment at home assisted by traditional healers. However, a larger proportion (84.6%) of the mothers at the same time received treatment at government clinics during the course of the health condition that led to their death. Only 2.3% of the interviewees declared that the deceased mothers had a history of smoking cigarettes.

5.5 Discussion

Using surveillance data, this study was intended to assess maternal mortality and identify the causes of death among reproductive-aged women over a seven-year period in Kersa HDSS, eastern Ethiopia. The study showed a cumulative average MMR of 324 per 100,000 live births with a decreasing trend over the study period. The main causes of maternal death were postpartum hemorrhage (46.5%) and hypertensive disorders of pregnancy (16.3%). Most of the mothers (56%) died at home, and the majority (62.8%) of the mothers died after giving birth.

For every 1,000 live births in the study area during the seven-year period, about three women died during pregnancy, childbirth or within 42 days of childbirth. This finding is almost similar to the national average (353 per 100,000 live births) but below the sub-Saharan average (546 per 100,000 live births) (5). Even though the MMR is below the sub-Saharan Africa average, it is higher than the world average, as is the case with other sub-Saharan African countries such as Sudan, Ghana, and Rwanda (Figure 5.6) (5). The

overall cumulative average of maternal mortality in the present study is considerably high and is deemed to require government action. However, the observed MMR across the seven-year period appears to decline. The result of the present study is almost in agreement with the finding that was reported from a review of studies conducted in Ethiopia, where the level of maternal mortality was found to decline slightly (292). The decreasing level of maternal mortality in this study might be related to the current government efforts to improve maternal health by implementing community-based programs that involve community mobilization. Moreover, it might also be explained by the fact that the population under surveillance (through the HDSS) most likely have better awareness and use of maternal health care, which could potentially lead to a lowered MMR. Furthermore, it was found that residing in a HDSS site has a positive influence on maternal health (111).

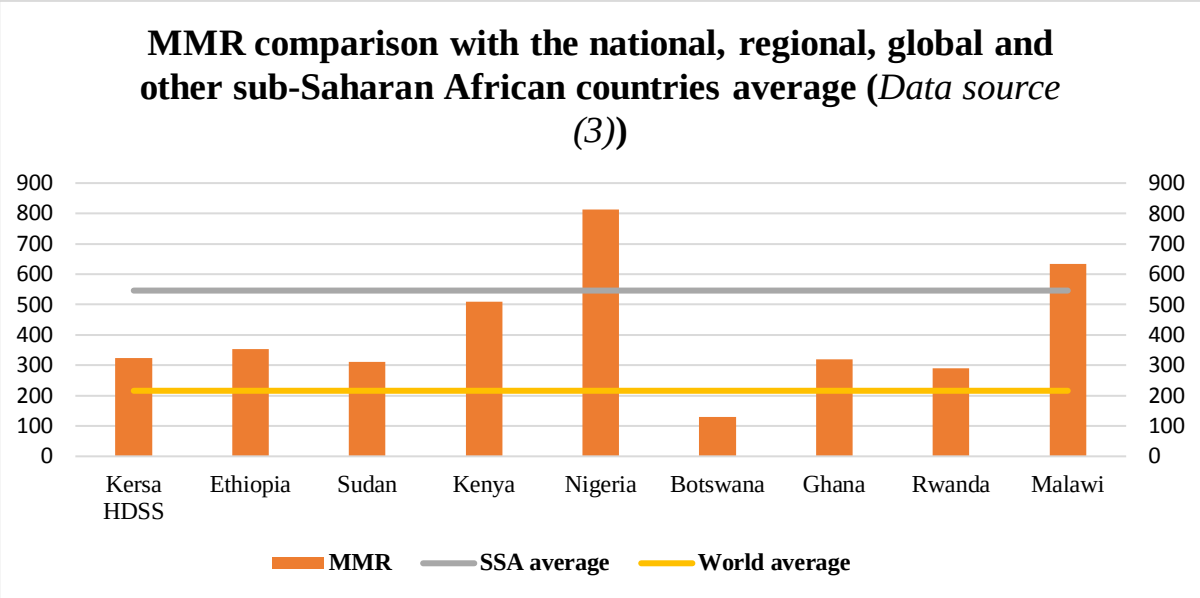

Figure 5.6. Comparison of the maternal mortality ratio with the national, regional, global and other sub-Saharan African countries average

Nonetheless, the trend of maternal mortality has varied slightly over the years. For instance, there was an increase in MMR in 2011 but a decrease in 2013. The reasons for this are not clear but may have something to do with the relatively higher number of pregnancies and an increased number of poor pregnancy outcomes in 2011 compared to 2013. There were more pregnancies in that year, which might be associated with a high agricultural production in the preceding year that enhanced an increased number of families formed among young couples in the district. Moreover, there was a high number

of pregnancy failures and still-births in the same year (265). In connection with this, in the same year compared to other years, the absolute number of maternal deaths may have increased. In addition, the study findings revealed that there had been a temporally heterogeneous pattern in rates of maternal death, where MMR was highest during the winter season throughout the study period. The finding highlights that since the winter season has heavy rainfalls, the road may get muddy, the rivers might become full, and rural bridges could be damaged. Hence the parturient family might not be able to transport the women to a health facility for delivery care, and thus most women remain at home to deliver their baby, which might have contributed to the higher rates of maternal death. Moreover, during the rainy season, there is an increased rate of malaria transmission, and pregnant women could, in turn, develop adverse maternal disorders (anemia and eclampsia), which subsequently contribute to high rates of maternal deaths. It has been shown that malaria-associated anemia and eclampsia tend to increase during the rainy season among pregnant women in sub-Saharan Africa (293).

Generally, we found the leading cause of maternal death during the study period to be post-partum hemorrhage. This finding is in accordance with other research results from developing countries and sub-Saharan Africa, where hemorrhage is the leading direct cause of maternal death (22, 23). A similar finding was also reported from a community-based study in northern Ethiopia (227). The finding of the current study, however, is in contrast with a systematic review of studies in Ethiopia which showed the major cause of maternal death to be obstructed labour (36%) followed by hemorrhage (22%) (27). This difference may be partly explained by the fact that the review only included facility-based studies where most pregnant women came to a health facility very late, with advanced complications such as obstructed labour which leads to prolonged labour (27, 84). Another possible explanation for this may be that, as the Verbal Autopsy data used in the present study is prone to misclassification of maternal deaths, the examiners might have misdiagnosed obstructed labour that leads to hemorrhage. The mothers, however, might have died due to initially developing obstructed labour which is typically not the cause of death but rather due to the hemorrhage that resulted from prolonged labour.

In the current study, there were 543 pregnancy-related deaths per 100,000 live births during the seven-year period. Though the majority of the pregnancy-related deaths were due to causes related to pregnancy or childbirth, non-obstetric causes such as partner

violence and transport accidents were also contributors. This highlights that partner violence, including murder and other injuries or accidents to women, contributes to the rates of death among pregnant and postpartum women to a considerable extent in Ethiopia. This underscores the need to design programs that could address issues of gender-based violence at the community level to synergize with current efforts to improve maternal health. The results of the study are similar to a study conducted in Mozambique, in which it was reported that a combination of partner violence and injury were the fourth leading cause of maternal death (32). The finding further highlights that the social status of women in the community might be a root factor for the high rate of maternal mortality in Ethiopia The findings of this study demonstrated that the lifetime risk of maternal death is nearly 1 in 23. This result is lower than a study finding from a community-based survey in southern Ethiopia which was conducted using the sisterhood method, where women have a one-in-ten lifetime risk of deaths (294). However, this finding is higher as compared to the sub-Saharan African (1 in 39) and national level (1 in 52) (9, 10). The reason for the observed high Life Time Risk of maternal death in the present study might be related to the less precise estimation of the indicator using Mmrate.

In this study, the majority (62.8%) of the mothers died after giving birth and more than half (55.6%) died within the first day. These findings indicate that the first few hours and days after giving birth are a critical period during which mothers should receive immediate attention from health care providers at a health facility to avert catastrophic maternal deaths. The aggregation of maternal death around delivery or immediately after delivery also means that mothers should have access to health facilities to receive skilled care during this period.

In the present study, more than half (60.5%) of the deceased mothers had sought health care services for the health condition that led to their death. However, a substantial proportion (80.8%) of them sought the service from traditional healers at home. This has implications for maternal health behavioral change programs. Traditional healers, including traditional birth attendants, still play a paramount role in rendering services at the community level, but it has been shown that they are not effective in improving maternal health even when trained (34, 295). Yet the reliance of local women on traditional birth attendants emphasizes the need to understand, at the grassroots level, why uptake of skilled delivery care is low in comparison with traditional birth attendants'

utilization. Perhaps strategies should be designed to provide focused training to traditional birth attendants so as to make them capable of recognizing the critical time to seek health care for women in their village (156). Therefore, there is a need to consider revisiting the strategies for training traditional birth attendants to make them contribute towards the improvement of maternal health.

5.5.1 Implications of the study

The measurement of maternal mortality using data from the direct surveillance system is the current gold standard method of determining the MMR. Using direct surveillance methods in the current study, it was possible to estimate the MMR. Hence, the study demonstrates the utility of estimating maternal mortality based on HDSS data to inform policy and enable locally appropriate program development. Despite efforts to maintain the data quality at every step of the surveillance process at Kersa HDSS, there was still some misclassification of deaths, which could be partly attributed to misreporting. For the data to be strong enough to support evidence-based decision making, it is crucial that data collection systems in HDSS sites institute ways to improve reporting from the community.

5.5.2 Limitations of the study

As the study used secondary data, there were incomplete or mislabelled variables, restricted variable data, inconsistent values, and missing records. In addition, the Verbal Autopsy codes used to assign the cause of death were mainly limited to the direct causes, rather than the indirect causes. This could be related to the fact that the cause of death was determined by physicians using the Verbal Autopsy questionnaire, which depends on the subjective response of the interviewee. This might most likely suffer from respondents' information bias, which may lead to misclassification of the underlying cause of death. Due to the sensitive nature of the issue, abortion-related maternal deaths were likely to be underreported. Using the current data, we are unable to make inferences that compare the women who died with the women who survived childbirth. Moreover, the use of a small sample for the analysis made it difficult to draw inferences to the general population. However, our intent was to describe maternal mortality at the local level in the Kersa

HDSS.

5.6 Conclusion

The magnitude of maternal mortality is considerably high, though it has shown a declining trend. The major causes of maternal mortality were postpartum hemorrhage and hypertensive disorders of pregnancy. Community-based initiatives should be strengthened to further reduce the prevailing maternal mortality. Targeted information education and communication should be provided to illiterate housewife women in their twenties. The health messages targeting these group of mothers should be tailored to their needs and match their level of literacy in order to bring better health outcomes. Future interventions on maternal health in this setting should also be tailored in such a way that women are educated through existing mother peer groups or Women's Development Army networks at the village level. Moreover, strategic actions are required to promote skilled delivery care attendance and attention should be given to availing community-based trained delivery assistants in rural communities.

Chapter 6

Application of the Andersen-Newman model of health care utilization to understand antenatal care use in Kersa district, eastern Ethiopia

6.1 Foreword

The findings of secondary surveillance data analysis in the previous chapter indicated that just one-quarter of deceased women attended antenatal care for the pregnancy that led to their death, clearly showing low use of the service. Drawing upon these findings, this chapter attempts to explore the antenatal care utilization among reproductive-aged women at the district level in order to answer Aim 3: To examine antenatal care utilization through the application of Andersen-Newman behavioral model in Kersa

This chapter has been published with *PLoS ONE*.
Tesfaye G, Chojenta C, Smith R, and Loxton D. Application of the Andersen-Newman Model of Health Care Utilization to understand antenatal care use in Kersa District, eastern Ethiopia. *PLoS ONE, 2018; 13(12).*

Abstract

Background: In Ethiopia, the uptake of antenatal care services has been low. Moreover, there is less frequent and late attendance of antenatal care among women who do attend. Using the Anderson-Newman model of health care utilization, this study identified factors that either facilitate or impede antenatal care utilization in Kersa district, eastern Ethiopia.

Method: A community-based cross-sectional study was conducted. A total of 1294 eligible women participated in the study. Data were collected using face to face interviews with a pre-tested structured questionnaire administered with a digital survey tool. Data were collected in a house to house survey of eligible women in the community. Bivariate and multivariate logistic regression analyses were used to examine the predisposing, enabling and need factors associated with antenatal care utilization.

Result: Out of the 1294 respondents, 53.6% (95% CI: 50.8%, 56.3%) attended antenatal care at least once during their last pregnancy. Only 15.3% attended four or more antenatal care visits and just 32.6% attended prior to the 12th week of gestation. Educational status, previous use of antenatal care and best friend's use of maternal care were significant predisposing factors associated with at least one antenatal care visit. Type of *kebele*, wealth index and husband's attitude towards antenatal care were significant enabling factors associated with at least one antenatal care consultation. Health Extension Workers providing home visits, perceived importance of antenatal care and awareness of pregnancy complications were significant need factors associated with at least one antenatal care consultation. Husband's attitude towards antenatal care, head of the household, awareness of pregnancy complications, and history of abortion were predictors of attending four or more antenatal care visits.

Conclusion: More than half of the women attended at least one antenatal care visit. A sizable proportion of women had infrequent and delayed antenatal care. Intervention efforts to improve antenatal care utilization should involve the following: improving women's educational levels, utilizing peer education programs to mobilize and support women, designing programs to change husbands' attitudes, amelioration of the quality of antenatal care, increasing the Health Extension Worker's home visits program, and increasing the awareness of pregnancy complications.

Keywords: Antenatal care utilization, Andersen-Newman model, eastern Ethiopia

6.2 Background

Maternal mortality remains a global public health priority, even in the era of Sustainable Development Goals (SDG) (106). In many developing countries, including Ethiopia, obstetric complications that occur during pregnancy and parturition are the leading causes of maternal mortality among reproductive-aged women (5, 33). Inadequate maternal care in resource-poor settings and insufficient utilization of available services, such as antenatal care (ANC), further aggravate the burden of maternal mortality (37). Evidence has shown that providing timely and appropriate ANC leads to a reduction in maternal deaths (50, 106). Antenatal care contributes to a reduction in maternal mortality, not only through facilitating prompt diagnosis and management of life-threatening obstetric complications but also through screening mothers who could potentially develop complications during childbirth (106, 296). The ANC interventions offered during pregnancy include early detection and treatment of obstetric complications such as pre-eclampsia, antepartum hemorrhage, anemia and nutritional problems. In developing countries, ANC also includes the provision of Tetanus Toxoid vaccination, early identification and treatment of Sexually Transmitted Infections, provision of insecticide-treated bed nets, and prophylaxis medication for malaria (101).

The World Health Organization (WHO) recommends that all pregnant women access a minimum of four focused ANC check-ups with a skilled health worker (103, 104). It was recommended that pregnant women should initiate the first ANC attendance during the first trimester (104, 106). There has been good progress in ANC utilization in developing countries where the majority (80%) of women receive at least one ANC check-up (91). However, only a small proportion (40%) of pregnant women in these countries have attended the minimum four ANC visits (4). Furthermore, in sub-Saharan Africa, nearly three quarters (72%) of women initiate their first ANC check-up after the first trimester of pregnancy (91). At the time this study was conducted, the WHO focused ANC model with a minimum of four visits and initiation of the first visit within the first trimester (104) was in place in Ethiopia and this research looked at the ANC practices of these recommendations.

In previous small-scale studies in Ethiopia (49, 108, 110-112, 114, 115), researchers

demonstrated a fairly good level (70-88%) of utilization of at least one ANC consultation. Additionally, in the 2016 national Demographic and Health Survey report (44), almost two thirds (62%) of women received at least one ANC check-up for their most recent pregnancy. However, in many of these studies (49, 108, 110, 111) it was reported that the proportion of women who attended four or more ANC visits was below 40%. Furthermore, a similar finding reported in the national survey (44) found only 32% of pregnant women received four or more ANC check-ups. In rural areas of Ethiopia, the proportion of pregnant women who attended four or more ANC check-ups was only 27% compared to 63% in urban areas. Although evidence has shown that early initiation is associated with better maternal health outcomes (121, 122), nearly two thirds (64%) of women in Ethiopia delay their first ANC enrolment to the second or third trimester of pregnancy (297).

There is empirical evidence (79, 114, 132, 172, 298) that socio-demographic, reproductive and obstetric factors, as well as previous experience of service use, were associated with poor utilization of ANC. Yet, there is a need to examine these factors in a systematic way within one study, to permit the identification of the most important barriers and facilitators to ANC uptake. The Andersen and Newman behavioral model for health service utilization provides a framework that permits systematic identification of factors that influence individual decisions to use (or not use) available health care services (74, 75). According to the Andersen and Newman, *predisposing factors* are those socio-cultural characteristics of the individual that exist prior to their health condition, *enabling factors* reflect the means or logistics required to obtain the services, and *need factors* are the most immediate cause of health service use and reflect the perceived health status of the individual.
In order to uncover the contextual factors that affect the uptake of ANC, it is crucial to carry out studies based on a health model which addresses most aspects of personal decision-making regarding health care utilization. Therefore, using the Andersen and Newman model of health care utilization, the present study aims to identify the key factors that affect ANC utilization among reproductive-aged women in Kersa district, eastern Ethiopia.

6.3 Method

6.3.1 Study setting

A community-based cross-sectional study was conducted in Kersa district, Eastern Hararghe zone of Oromia regional state, in eastern Ethiopia from June to August 2017. The district capital is Kersa town, which is located 486 kms from the capital city, Addis Ababa. According to the population projection for Ethiopia published by the Central Statistical Agency in 2014, the district has an estimated total population of 205,628. The population is predominantly rural (92%). The district has 38 *kebeles* of which three are urban and 35 are rural (228, 264). The *kebele* is the lowest administrative unit in Ethiopia consisting of around 1000 households or an approximate population of 3000 to 5000 (17). The district has 24 Health and Demographic Surveillance System (HDSS) *kebeles* and 14 non-HDSS *kebeles*. HDSS is a platform to regularly follow the health and demographic characteristics of a community residing in a distinct geographic area. It monitors new health threats, tracks the change in population number through fertility and migration rates, and measures the effect of interventions on communities (265, 266). All *kebeles* have access to non-asphalt roads, though the terrain is mountainous in the majority of the rural *kebeles*. The Kersa district contains seven health centres, thirty-four health posts and eight private pharmacies at different locations within the district. In each *kebele*, there are two Health Extension Workers providing health promotion activities. According to the information from the district health office, the health coverage (physical accessibility of health facilities) of the district is more than 80% (268).

6.3.2 Population

The study population was all reproductive-aged women in the Kersa district who gave birth in the three years prior to the survey, regardless of the birth outcome. Women who had lived in the district for more than six months and delivered their most recent baby after 28 weeks of gestation were included. Women who did not volunteer to participate in the study, were critically ill and physically or mentally disabled during the data collection period, were excluded from the study.

6.3.3 Sample size and sampling procedure

The sample size (n=1320) was primarily determined for a broad study on the level of maternal health service uptake and associated factors in Kersa district, eastern Ethiopia. A total of ten *kebeles* (seven from areas where HDSS is conducted and three from non-HDSS areas) were included in the survey. Households with eligible women were identified using the Health Extension Workers health management information system registration log sheet and the number of eligible women in each included *kebele* was determined. The total sample size of the study was proportionally allocated to each *kebele.* Respondents were selected through systematic random sampling techniques and invited to take part in the survey. When two or more eligible women were found within the selected household, one was selected by the lottery method and invited to do the interview.

6.3.4 Measurement variables

6.3.4.1 Outcome variables

***At least one ANC attendance*:** Women who have attended at least one ANC check-up during their most recent pregnancy as reported by the participant.

***Four or more ANC attendance*:** Women who attended four or more ANC visits during their last pregnancy as reported by the participant.

6.3.4.2 Predictor variables

The predictor variables were conceptualized based on the Andersen and Newman behavioral model of health care utilization and grouped into three set of factors: predisposing, enabling and need factors as shown in Table 6.1.

Table 6.1. Predictor variables for PNC utilization and their operational definitions

Variable category	Operational definition
Predisposing factors	
Maternal education	Formal schooling status starting from attending elementary school

Mass media availability	Presence of communication tools such as television, radio or internet in the household
Telephone ownership	Ownership of mobile telephone at the household level
Education on maternal health	Receiving education on maternal health (such as the use of maternity service, and nutrition) from any source
Age at marriage	Completed in years at the time when the respondent first married
Age at first pregnancy	Completed in years at the time when the respondent first got pregnant
Birth order	Birthing order of the index child in the woman's life
Previous use of ANC	Practice of ANC for any of the previous pregnancies in the woman's life
Living in a model family	A woman who lives in a family which adopted and implemented the full Health Extension service packages in Ethiopia
Best friend's use of maternal care	A friend who regularly shared the woman's feelings, emotions, and opinions and various behavioral practices important in the woman's life and uses services such as ANC, skilled delivery care and PNC
Enabling factors	
Place of residence	*Urban* versus *rural* based on the *kebele* where the woman lives
Type of *kebele*	Based on the living site of the woman (*kebeles* under surveillance versus *kebeles* not under surveillance)
Wealth index	Produced from the existing variables (household assets ownership, household characteristics and access to utilities) from the data set through factor analysis using Principal Component Analysis
Head of the household	A person who is responsible for heading the household
Decision making on household expenses	A person who decides on household matters including whether to visit health facilities during illness or emergency conditions
Husband's attitude	Respondent's judgment about the feeling of her husband towards ANC while she was pregnant
Social support	Type of help the woman received from her best friends during pregnancy, labour and post-delivery (prompted question)
Need factors	
Awareness of pregnancy complication	Respondents were asked whether they had knowledge of any dangerous pregnancy-related symptoms (such as bleeding)
Perceived importance of ANC	Women's perception of how useful ANC attendance is for a healthy pregnant woman
Pregnancy intention	Women's thinking on whether their last pregnancy was planned or not
Health Extension Workers home visit	Receiving visit and health education by a Health Extension Worker at woman's home
History of abortion	Lifetime number of abortions coded as Yes or No

6.3.5 Source of data and data collection methods

To obtain the data, we used house-to-house interviews with eligible reproductive-aged women using a structured questionnaire. The study tool for the survey was adapted from pertinent literature. The study tool was first prepared in English and subsequently translated into the local language (Oromiffa) to collect the data. The tool was re-translated back to English to check for consistency. A template of the study tool was prepared using an online survey tool (Survey Gizmo) and downloaded onto iPads for offline data collection. The data was collected by resident HDSS data collectors who have extensive experience in conducting interviews in both urban and rural *kebeles* using the iPads. The principal author (GT) and a supervisor closely monitored the overall data collection

process.

6.3.6 Data quality control

The study tool was pre-tested on 65 women living in a neighbouring district. All required revisions were made to the study tool based on the pre-test. Experienced HDSS data collectors and a supervisor were recruited and deployed for the data collection. A two-day intensive training course was provided to the data collectors and the supervisor about the aim of the study and sampling procedures; data collectors also performed simulated exercises on how to interview respondents. To ensure the correct inclusion of the participants, the student researcher made the random selection of the *kebeles*, was responsible for the proportional allocation of the samples, and carried out the random selection of the interviewees. We used iPads for data collection to avoid missing or incomplete responses. The supervisor cross-checked the completed responses on the iPads by repeating the interviews with 10% of the respondents to check for correct completion of valid responses. The responses were uploaded into the online survey tool every day, and the lead author double-checked for any inconsistencies and gave feedback to the interviewers also on a daily basis.

6.3.7 Data management and analysis

The data were directly exported from the digital survey tool into SPSS software version 23 for analysis. Before commencing data analysis, appropriate transformations were made on the variables and missing values were also managed as necessary. Descriptive statistics and appropriate measures of central tendencies were used to summarize the key variables. Variables with missing data due to the skipping nature of the question (*husband education* and *living in a model family*) were managed by re-coding the system missing value into an existing relevant category of the variable. Categories of some variables with negligible frequency, such as, "*don't know*" or categories not relevant for an inferential test due to small cell values were recoded into another related category. Before fitting the full multivariate model, all the variables were considered for the multicollinearity diagnostics and all showed no multi-collinearity with a variance inflation factor of less than five.

Bivariate logistic regression analysis was conducted to examine the association between the predictor and outcome variables using the Crude Odds Ratio (COR) at a 95% Confidence Interval (CI). Factors that were significant with a p-value of less than 0.05 were retained for further consideration in three blocks of the multivariate logistic regression model. The three-block models were built in such a way that, *model 1* contained only the *predisposing factors*, *model 2* included *predisposing* and *enabling factor*s, and *model 3* (the final full model) considered all three factors simultaneously (*Appendix 8*). In the final multivariate model, factors with a p-value of less than 0.05 were declared statistically significant. Two separate multivariate models were fitted for primiparous and multiparous women for the "at least one ANC" outcome variable. The factors that showed statistically significant association in the multivariate logistic regression analysis were mapped into the three domains: predisposing, enabling and need factors to streamline the analysis using the Andersen and Newman model of health care utilization.

6.3.8 Ethics approval

The study was conducted after securing ethical approval from the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University, Ethiopia with approval number (IHRERC/129/2017) and the Human Research Ethics Committee of the University of Newcastle, Australia with approval number (H-2016-0403). Informed verbal consent was obtained from each respondent before commencing interviews. The informed verbal consent procedure had been approved by both Ethics Committees. Participants read or listened to the Information Statement provided by the interviewer and were asked if they understood its contents. Then, if they decided to participate, they informed the interviewer that they were happy to take part in the research, and this was taken as a participant's informed verbal consent. For respondents aged 15-18 years, we obtained informed consent from themselves as they were married, had had at least one birth, assumed social responsibility and were therefore considered to be mature minors. The Ethics Committees approved this minor consent procedure for women between 15 and 18 years. The confidentiality of the respondents was ensured by avoiding personal identification details in the study tool.

6.4 Results

6.4.1 Socio-demographic characteristics

A total of 1294 women participated in the study. More than half (652, 50.4%) of the respondents fell within the age range of 25-34 years with a mean age of 27.4(±6) years. Most women were married (1277, 98.7%), with a large majority (1205, 94.2%) being in a monogamous marital union and the highest proportion belonging to the Oromo ethnic group (1274, 98.5%). Most respondents were Muslim (1253, 96.8%) housewives (1240, 95.8%) who had never attended formal education (941, 72.7%) married to a husband who had never attended formal education (645, 50.4%) and was now engaged in farming (1156, 90.4%) (Table 6.2).

Table 6.2: Basic socio-demographic characteristics of the respondents, Kersa district, eastern Ethiopia.

Variables	Frequency	Percentage
Maternal age (n=1294)		
15-24	411	31.8
25-34	652	50.4
35-49	231	17.9
Marital status (n=1294)		
Married	1277	98.7
Others *(Single, divorced, widowed and separated)*	17	1.3
Type of marital union (n=1279**)**		
Monogamous	1205	94.2
Polygamous	74	5.8
Ethnicity (n=1294)		
Oromo	1274	98.5
Others (*Amhara, Arab*)	20	1.5
Religion (n=1294)		
Muslim	1253	96.8
Others *(Orthodox Christian and protestant)*	41	3.2
Occupational status (n=1294)		
Housewife	1240	95.8
Government employee	24	1.9
Merchant	19	1.5
Farmer	11	0.9
Educational status (n=1294)		
Never attended	941	72.7
Elementary (1-8)	267	20.6
Secondary (9-12)	61	4.7
Tertiary (12+)	25	1.9
Wealth index (n=1294)		
Highest	258	19.9
Fourth	261	20.2
Middle	260	20.1

Second	258	19.9
Lowest	257	19.9
Husband's education (n=1279)		
Never attended	645	50.4
Elementary	438	34.2
Secondary	133	10.4
Tertiary	63	4.9
Husband's occupation (n=1279)		
Farmer	1156	90.4
Daily labourer	29	2.3
Government employee	65	5.1
Merchant	29	2.3
Educated family member (n=1294)		
Yes	574	44.4
No	720	55.6

6.4.2 Reproductive characteristics of respondents and knowledge about ANC

The majority of respondents (1114, 86.1%) were first married when they were under 18 years of age and 1155 (89.3%) became pregnant for the first time at or before 20 years of age. More than half (51.9%) of the women's most recent births were a third child or less in birth order. Nearly two thirds (63.8%) of the women had been pregnant three or more times in their lifetime. Moreover, 820 (63.4%) of the women had experienced three or more deliveries in their lifetime. A total of 94 (7.3%), 95 (7.4%) and 264 (20.4%) had a history of abortion, still-birth and infant death respectively. Additionally, 917 (70.9%) women reported that their last pregnancy was intended, while for 377 (29.1%) of the women it was unintended.

With regards to women's knowledge of ANC, more than three-quarters (1000, 77.3%) had heard about ANC and 644 (49.8%) believed that ANC is beneficial for both the mother and the child. More than three quarters (76%) of the women had heard about ANC from a health facility, followed by a Health Extension Worker (12%) (Figure 6.1).

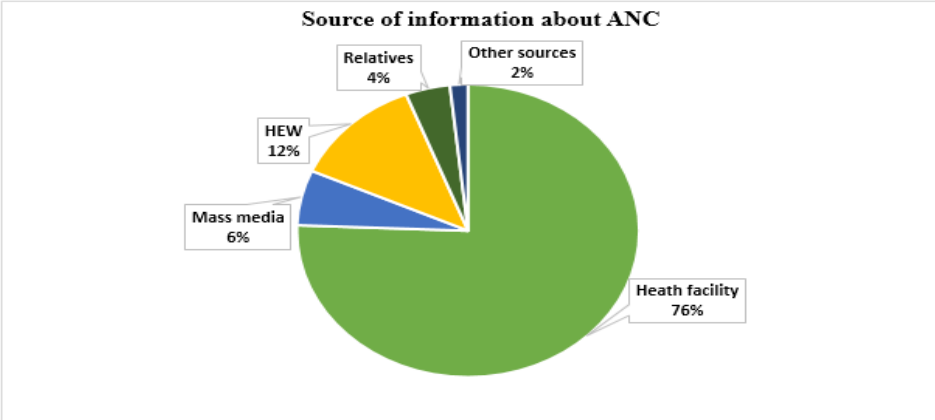

Figure 6.1. Sources of information about ANC among reproductive women in Kersa district, eastern Ethiopia, 2017

A total of 1242 (96%) respondents felt that pregnant women should get ANC from a health care provider. Only 384 (29.7%) respondents knew that a pregnant woman should first start to attend ANC within three months of pregnancy. About 712 (55.7%) of the women's partners had a positive attitude towards ANC, and 521 (40.7%) never discussed ANC with their partner. Less than half (556, 43%) had knowledge about pregnancy-related complications.

6.4.3 Health promotion activities and decision making in the household

More than half (672, 51.9%) of the women had received education on maternal health. The majority (524, 84.2%) received maternal health education from Health Extension Workers, followed by mass media (47, 7.6%), health care providers (32, 5.1%), family members (14, 2.3%), community health agents (32, 0.5%) and Women's Development Army leaders (2, 0.3%). More than half (727, 56.2%) of the respondents' homes had been visited at least once by a Health Extension Worker. More than 90% of the women lived in a partner-headed household, followed by a household headed by parents (21, 1.6%) or the respondents themselves (20, 1.5%). More than two thirds (900, 69.6%) of the women stated that decision making at the household level was undertaken jointly with the partner, followed by the respondents (205, 15.8%), the partner (172, 13.3%) and parents (7, 1.3%).

6.4.3.1 Antenatal care utilization

About 43.8% of the women attended ANC for their previous pregnancy. Six hundred and ninety three (53.6%, 95% CI: 50.8%, 56.3%) of the women reported to have attended ANC at least once during their most recent pregnancy while only 106 (15.3%) made four or more visits. Of those who had attended at least one ANC, 226 (32.6%, 95% CI: 29.6%, 36.6%) initiated their first visit early (≤3 months of pregnancy). About one fifth (19.9%) of women were accompanied by their partner during the course of attending ANC (Table 6.3).

Table 6.3: Antenatal care utilization among reproductive-aged women in Kersa district, eastern Ethiopia, 2017

Variable	Number	Percentage
Ever use of ANC for previous pregnancies (n=1059)		
Yes	464	43.8
No	595	56.2
ANC utilization for most recent pregnancy (n=1294)		
Yes	693	53.6
No	601	46.4
Partner accompanying during ANC (n=693)		
Yes	138	19.9
No	555	80.1
ANC provider/s (n=693)*		
Doctor/health officer	54	7.8
Nurse/midwife	470	67.8
Health Extension Worker	235	33.9
Other	14	2.1
Timing of first ANC initiation (n=693)		
≤3 months (Early ANC)	226	32.6
>3 months (Late ANC)	457	67.9
Don't know	10	1.4
Frequency of ANC (n=693)		
Once	79	11.4
Twice	163	23.5
Three times	345	49.8
Four and more	106	15.3
Place of ANC attendance (n=693**)***		
Government hospital	15	2.2
Government health centre	492	71
Government health post	204	29.4
Private hospital/clinics	44	6.3
Home	59	8.5
Other	3	0.4

*Does not sum up to the **total** due to the possibility of multiple responses

Women had listed their personal reasons for not attending ANC, the most common being that they felt in good health (60.2%), followed by having no or little knowledge (54.4%),

and being too busy to attend ANC (10%) (Figure 6.2).

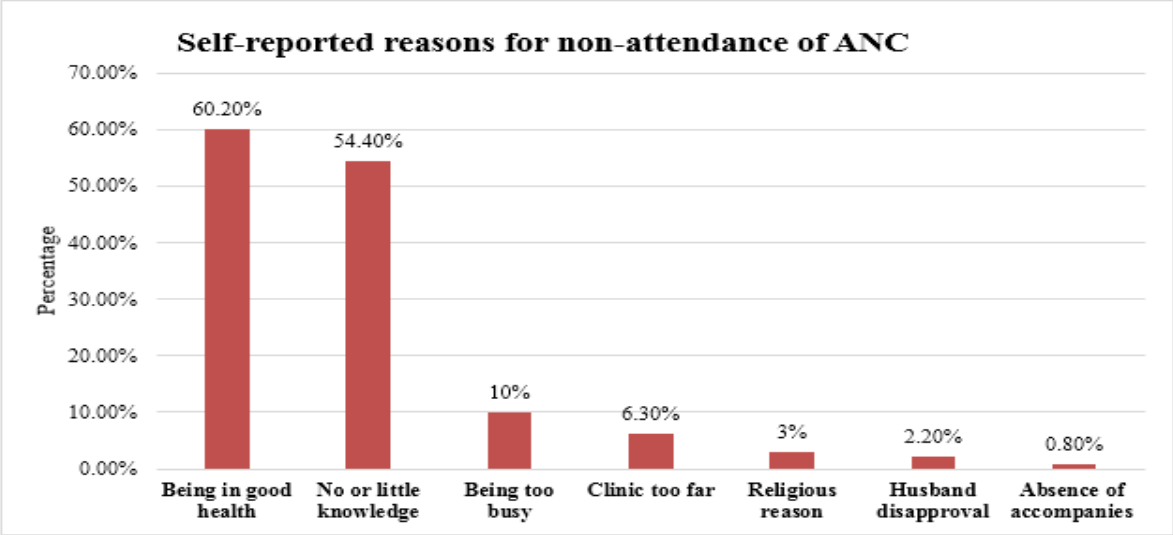

Figure 6.2. Commonly mentioned self-reported reasons for non-attendance of ANC among reproductive-aged women in Kersa district, eastern Ethiopia, 2017

6.4.3.2 Differentials in the timing of the first ANC attendance

A higher proportion of women (42.5%) in urban areas initiated their first ANC visit during the first three months of pregnancy compared with rural women (30.5%). Likewise, significantly more women (37.1%) who previously used ANC presented for the first ANC during the first three months of a subsequent pregnancy than women who had not used ANC previously (22.2%) (Figure 6.3).

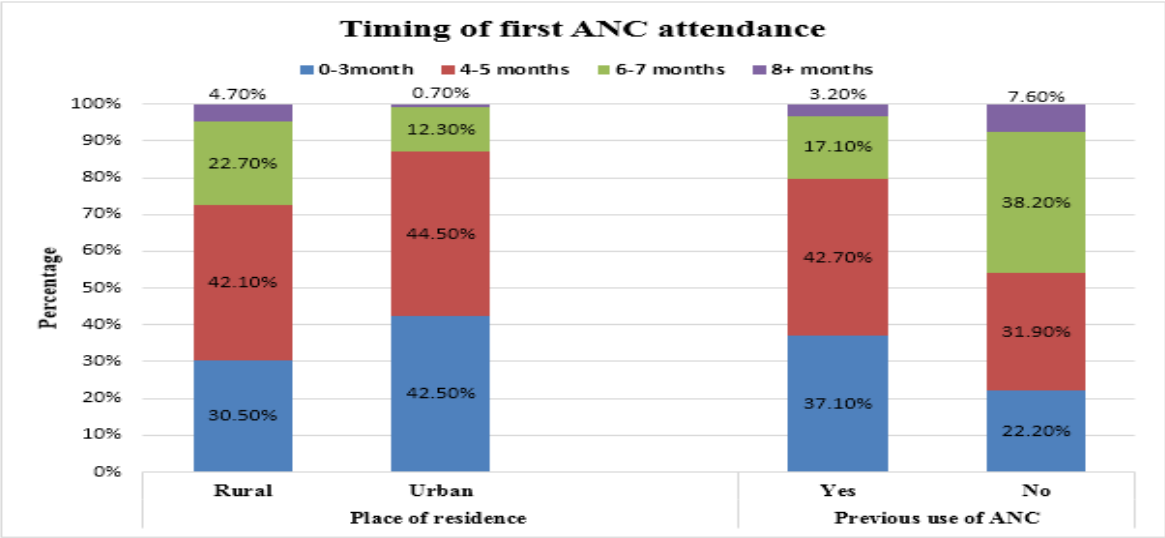

Figure 6.3. Timing of first ANC by place of residence and previous use of ANC among reproductive-aged women in Kersa district, eastern Ethiopia, 2017

6.4.3.3 Service experience of ANC attendees

Among women who had attended ANC at least once, a large proportion (621, 89.6%) had received Tetanus Toxoid injections during their ANC and the majority (87.6%) had received the injection two or more times. A large number (651 or 93.9%) of the women received information about delivery at a health facility from the provider. Blood pressure was measured always in 361 (52.1%) cases, in some visits in 173 (25%) cases, never measured in 144 (20.8%) cases, and 15 women reported that they didn't know (2.2%). Weight was reported as measured always by 337 (48.6%) respondents, on some visits by 182 (26.3%), never measured in 62 (23.4%), and 12 didn't know (1.7%). A laboratory examination was never carried out as reported by 330 (47.6%) women, whereas a physical examination was not done for 278 (40.1%) women. Health workers were reported as being respectful by 657 (94.8%) women during the ANC visit but 509 (73.4%) claimed that there was a lack of privacy while receiving ANC. About 440 (63.5%) women were able to ask questions of the provider and 582 (84%) women were reminded by the provider to return for another ANC visit. Seventy-one (10.2%) of the ANC attendees were requested to pay for the service, and only 35 (5.1%) of the women felt the waiting time was a problem, as most (644, 92.9%) of the women received ANC within 2 hr or less. A total of 578 (83.4%) women received ANC from a health facility which was located within 5 km of their home.

6.4.4 Factors associated with ANC utilization

The results of the multivariate logistic regression analysis are presented in Table 6.4. We fitted two separate models for the "ANC at least one" outcome for multiparous (*m1*) and primiparous women (*m2*). After adjusting for potential confounders in the multivariate logistic regression model of all factors of interest considered in the three domains of Andersen and Newman behavioural model of health care utilization, educational status, previous use of ANC and best friend's use of maternal care were the predisposing factors that significantly predict an attendance of at least one ANC visit. Primiparous women who had attended formal education were three times more likely to attend at least one ANC visit (AOR, 3.02; 95% CI: 1.26, 7.25) than those who never attended education.

Multiparous women who had no previous experience of ANC attendance (AOR, 0.05; 95% CI: 0.03, 0.07) were less likely to attend ANC at least once compared to women who previously attended ANC. Women whose best friends did not utilize maternal care were less likely to attend at least one ANC ((AOR, 0.53; 95% CI: 0.36, 0.78) in *m1* and (AOR, 0.27; 95% CI: 0.12, 0.63) in *m2)* for their most recent pregnancy compared with women whose best friends utilized maternal care.

Enabling factors such as type of *kebele***,** wealth index, and husband's attitude towards ANC showed statistically significant associations with attendance of at least one ANC visit for the most recent pregnancy. Wealth index and husband's attitude showed a statistically significant association in both models of at least one ANC. Multiparous women who lived in HDSS site had an increased chance of using at least one ANC consultation than those who lived in non-HDSS sites (AOR, 1.60; 95% CI: 1.07, 2.40). Women who belonged to the higher wealth quintiles (*especially in the fourth quintile*) were more likely to attend at least one ANC visit ((AOR, 2.14; 95% CI: 1.22, 3.76) in *m1* and (AOR, 5.90; 95% CI: 1.74, 20.03) in *m2*)) than women in the lower wealth quintiles. Women whose husbands had a negative or neutral attitude towards ANC (AOR, 0.37; 95% CI: 0.25, 0.54) in *m1* and (AOR, 0.27; 95% CI: 0.11, 0.62) in *m2*) were less likely to attend ANC at least once than women whose husbands had a positive attitude. The study also demonstrated that the odds of using four or more ANC check-ups is lower for women whose household was headed by their partner or parents (AOR, 0.16; 95% CI: 0.05, 0.58) compared to women whose household was headed by themselves. Moreover, women whose husbands have a negative or neutral attitude towards ANC have less odds of attending four or more ANC visits (AOR, 0.41; 95% CI: 0.23, 0.75) than women whose husbands have a positive attitude.

Lastly, Health Extension Workers' home visits, perceived importance of ANC and awareness of pregnancy complications were the need factors that showed a significant association with attending at least one ANC visit. However, only the factor "*awareness of pregnancy complication*" showed a significant association in both models. Multiparous women who had never received a Health Extension Workers home visit (AOR, 0.57; 95% CI: 0.38, 0.84) were less likely to attend at least one ANC visit than their counterparts. Women who had no knowledge of pregnancy complications were less likely to attend at least one ANC compared to women who were aware of pregnancy complications (AOR,

0.52: 95% CI: 0.35, 0.79) in *m1* and (AOR, 0.15; 95% CI: 0.06, 0.40) in *m2*). Multiparous women who perceived that attending ANC is important were more likely to attend at least one ANC visit compared to those who perceived it is not important (AOR, 1.89; 95% CI: 1.17, 3.06). Women who had no awareness of pregnancy complications have less odds of attending four or more ANC visits compared to women who have awareness (AOR, 0.51; 95% CI: 0.30, 0.85). Women who had an abortion history were more likely to attend four or more ANC visits than their counterparts (AOR, 2.06; 95% CI: 1.05, 4.04).

Table 6.4: Factors associated with ANC utilization among reproductive-aged women in Kersa district, eastern Ethiopia, 2017

Predisposing factors	***Categories***	**ANC at least one** AOR (95% CI) (*n=1059*) *m1*	**ANC at least one** AOR (95% CI) (*n=235*) *m2*	**ANC 4+** AOR (95% CI) (*n=693*)
Educational status	Never attended	1	1	1
	Attended	1.50(0.92, 2.46)	**3.02(1.26, 7.25)***	1.18(0.69, 2.02)
Husband's education	Never attended	1	1	1
	Attended	1.21(0.83, 1.74)	1.91(0.81, 4.48)	1.06(0.62, 1.79)
Education on maternal health	Yes	0.96(0.66, 1.40)	1.71(0.74, 3.97)	
	No	1	1	
Mass media availability	Yes	1.01(0.66, 1.52)	1.10(0.45, 2.62)	
	No	1	1	
Telephone (mobile) ownership	Yes	0.73(0.45, 1.17)	1.03(0.39, 2.77)	
	No	1	1	
Age at first marriage	*Continuous*			1.09(0.92, 1.28)
Age at first pregnancy	*Continuous*			1.03(0.88, 1.21)
Birth order	≤3rd	1		
	>3rd	0.85(0.59, 1.25)		
Previous use of ANC	Yes	1		
	No	**0.05(0.03, 0.07)***		
Living in a model family	Yes	1		1
	No	1.15(0.31, 4.24)		0.58(0.25, 1.35)
Best friend's use of maternal care	Yes	1	1	
	No/don't know	**0.53(0.36, 0.78)****	**0.27(0.12, 0.63)****	
Parity	Yes			1
	No			0.73(0.43, 1.25)
Enabling factors				
Residence	Rural	1	1	1
	Urban	0.50(0.22, 1.14)	0.94(0.21, 4.15)	1.07(0.58, 1.96)
Type of *kebele*	HDSS	**1.60(1.07, 2.40)***	1.61(0.66, 3.92)	
	Non-HDSS	1	1	
Wealth index	Highest	1.52(0.85, 2.70)	**6.87(1.81, 26.01)***	
	Fourth	**2.14(1.22, 3.76)****	**5.90(1.74, 20.03)****	
	Middle	1.21(0.69, 2.12)	**5.46(1.57, 18.95)***	
	Second	1.68(0.98, 2.89)	**3.97(1.12, 13.44)***	
	Lowest	1	1	
	Respondent	1	1	

Decision making on household expenses	Jointly	1.50(0.91, 2.48)	1.99(0.64, 6.20)	
	Partner/parents	1.34(0.66, 2.71)	2.07(0.50, 8.03)	
Head of the household	Respondent			1
	Partner/parents			**0.16(0.05, 0.58)**
Husband's attitude towards ANC	Positive	1	1	1
	Negative/neutral	**0.37(0.25, 0.54)****	**0.27(0.11, 0.62)****	**0.41(0.23, 0.75)**
Social support from friends	Yes	1	1	
	No	0.69(0.37, 1.29)	0.67 (0.24, 1.83)	
Need factors				
Health Extension Workers home visit	Yes	**1**		
	No	**0.57(0.38, 0.84)***		
Pregnancy intention	Intended	1		
	Unintended	0.73(0.49, 1.09)		
History of abortion	Has no history			1
	Has history			**2.06(1.05, 4.04)**
Awareness of pregnancy complications	Yes	1	1	1
	No	**0.52(0.35, 0.79)****	**0.15(0.06, 0.40)****	**0.51(0.30, 0.85)**
Perceived importance of ANC attendance	Not important	1	1	
	Important	**1.89(1.17, 3.06)***	2.12(0.74, 6.08)	

Key*: AOR*: Adjusted Odds Ratio (adjusting for all the ***predisposing***, ***enabling*** and ***need*** factors in final full model), ***CI*:** Confidence Interval (95%), ***Bold*:*** statistically significant variables, ****** statistically significant variables in the two models (*m1 and m2*) of "*at least one ANC*" outcome

6.5 Discussion

In this study, we set out to examine the factors associated with ANC utilization in Kersa district, eastern Ethiopia. We found that women's education, previous use of ANC and best friend's use of maternal care were significant predisposing factors associated with at least one ANC attendance. Furthermore, type of *kebele*, wealth index and husband's attitude towards ANC were significant enabling factors influencing at least one ANC use. Health Extension Workers' household visits, perceived importance of ANC attendance, and awareness of pregnancy complications were significant need factors that predicted at least one ANC attendance. Being head of the household, having a history of abortion, having awareness about pregnancy complications and husband's attitude towards ANC were factors that predicted attendance of four or more ANC visits.

In the study, it was demonstrated that 53.6% of the women received at least one ANC check-up for the index pregnancy. This finding is consistent with a study conducted in Tigray, Northern Ethiopia (132), where 54% of the women received ANC at least once for their most recent pregnancy. The finding is also comparable with the Oromia region average (51%) where the current study district is located. However, the level of ANC uptake observed in this study is lower than that of the national average (62%) (44) and the findings from many other studies in different regions of Ethiopia (49, 108, 110, 111). The exhibited disparities in the magnitude of ANC utilization might be attributed to the inter-regional difference in geographical area, socio-economic and cultural settings in Ethiopia. For instance, in some regions of Ethiopia, there is an underdeveloped health care system whereas in others the people live in nomadic areas where health service is rarely available. Moreover, each region in Ethiopia has its own peculiar socio-economic features and cultural practices that can either positively or negatively influence health care utilization patterns. The current study was conducted in a largely rural area of the country where there are high socio-cultural barriers and poor community perceptions towards utilization of ANC (64) that may affect ANC uptake.

Furthermore, in this study, the proportion of women who attended four or more ANC visits was only 15.3%. This result is lower than in a study conducted in Kombolcha district, eastern Ethiopia (38.3%) (108) but higher than in a study conducted in Tigray,

Northern Ethiopia (6.4%) (115). The differences may be related to the fact that the studies were conducted at different points in time and the level of safe motherhood primary health care activities might be different in various parts of the country. It is recommended that further studies be conducted at some period after the new WHO guideline (having a minimum of eight ANC visits) (106) is implemented in Ethiopia. Antenatal care is more effective in averting unfavorable pregnancy complications if given early in the pregnancy (122). However, the current study showed that only one third (32.6%) of the women surveyed initiated ANC before the 12th week of gestation. The result is in line with a systematic review finding (297), where only 36% of pregnant women in Ethiopia began ANC during the early stages of pregnancy.

The result of the multivariate analysis indicated that women's utilization of ANC is affected by predisposing, enabling and need factors. Predisposing factors including women's education, previous use of ANC and women's best friend's use of maternal care were predictors of ANC utilization. Women might be informed about the benefits of ANC utilization in various ways, such as: exposure to mass media; information exchange with friends; community-based health education; and previous exposure to health services. The current study provided evidence that shows multiparous women who had obtained ANC services for their previous pregnancy were more likely to attend at least one ANC consultation for subsequent pregnancies. It has been previously documented (50, 299) that obtaining maternal care in the previous pregnancy positively influenced the utilization of the service for the subsequent pregnancy. This might be related to the fact that women could be better informed about the benefit of ANC through the previous service attendance.

Women's education showed an association with ANC utilization, particularly among primiparous women. Demographically, primiparous women (*those who only had one delivery*) are often younger and more educated than multiparous women, which might make this variable more significantly predict ANC utilization for this group of women than multiparous women. Evidence suggests that younger women (49, 115) and those with fewer deliveries (49) have increased odds of ANC utilization. Education is a very important factor that influences behavior and the changing attitudes of individuals (185). Women's education helps not only to increase their empowerment but also transform their social value, which enables women to have improved access to maternal care and

enhances their ability to utilize it. The positive influence of education on ANC utilization is well documented in several prior studies in Ethiopia (49, 111, 115, 172).
Best friend's use of maternal care is another predisposing factor associated with ANC utilization in this study. Women whose best friends use maternal care were more likely to attend at least one ANC visit compared to women whose best friends did not use maternal care. It has been illustrated in the systematic review (246) of ANC utilization among non-western women that acquiring and following advice from friends or peers has facilitated better ANC utilization for pregnant women. A study in India (300), also reported that a woman's social network had a positive correlation with ANC utilization. Social networks significantly influence the decision-making and health-seeking behaviour of pregnant women towards ANC, which ultimately facilitates or hinders their access to and utilization of the service (74). The social ties that individuals develop, whether their families, friends or peer groups are essential to spanning interactions with better informed opinion leaders inside the community who could, in turn, sway the people's behavior or actions towards the use of preventive health care services (300-303). Results that demonstrated the positive influence of best friends highlights a largely untapped resource for public health messaging in Ethiopia. Maternal health promotion activities should involve spreading messages regarding the benefit of attending ANC for the health of the mother and the child by targeting the social networks of women through peer education programs.

Enabling factors such as type of *kebele*, wealth index, and husband's attitude were independently associated with ANC utilization. Women in the fourth wealth index category were more likely to use ANC compared to women in other lower wealth categories. This was consistent with a study conducted in Southern Ethiopia (111), where women who belonged to the higher wealth quintiles had higher odds of ANC attendance that women in lower quintiles. This could be due to the fact that women with higher economic status could easily afford to cover health care and transportation costs. Also, women with high economic status tend to be more educated and this could, in turn, increase their service use. Therefore, economic reform activities in Ethiopia that involve women and poorer families could subsequently increase women's ANC uptake.

Multiparous women who live in the HDSS site were more likely to use ANC services than those who live out of the HDSS site. This was in line with a study conducted in southern Ethiopia (111) in which living in a HDSS site is to some extent protective of maternal

death resulting from non-use of services. It is expected that demographic and health surveillance sites are exposed to continuous surveys and health information as there could be regular visits by field enumerators and researchers. Evidence (304) suggests that populations under HDSS have better health indicators compared to populations not under surveillance because of repeated data collection and measurements which could function as a passive intervention resulting in behavior change.

A husband's attitude towards ANC also influenced women's utilization of ANC in this study. The risk of non-attendance of at least one ANC was high for women whose husband's attitude was negative or neutral. The effect of a husband's attitude on women's utilization of ANC has been well documented in other studies conducted in different parts of Ethiopia (114, 305). A husband's attitude towards ANC influences their tendency to approve the care for their wives. As most women in developing countries need a husband's approval to seek health services, including ANC, a husband should have a supportive attitude towards health services, thereby allowing his wife to attend the services. In addition, this study demonstrated that women living in parents or partner-headed households had less odds of attending four or more ANC consultations. Hence, intervention efforts should be in place to improve husband's attitudes towards ANC and improve women's decision-making capacity to increase the uptake of the service. One such intervention may be designing messages about maternal health and diffusing this through community-based men's social networks to improve their knowledge. Also, as more educated men tend to be more involved in their spouse care (306), improving men's educational status is essential.

Health Extension Workers' home visits, perceived importance of ANC attendance and awareness of complications that occur during pregnancy are significant predictors of at least one ANC consultation. Women who received a Health Extension Workers' home visit were more likely to attend at least one ANC visit compared to women who never received a Health Extension Workers visit. A similar study finding was reported from a study conducted in southern Ethiopia (174). Access to Health Extension Workers home visits should be further strengthened to reach women while they are at their home to effectively provide health messages and promote ANC utilization. Increasing the frequency of contact and improving the continuity of Health Extension Worker home visits through expanding the Health Extension Workers' outreach service operation hours

is crucial, particularly for reaching pregnant women in underserved communities. Moreover, upgrading the capacity of the Health Extension Workers to provide the full package of home-based ANC services apart from the routine health education and promotion activity is required.

Perceived importance of ANC attendance showed a positive association with ANC utilization, where multiparous women who believe that attending the service is important were more likely to attend the care. The finding of the study was in accordance with a study conducted in Lao People Democratic Republic (211) where women who had a positive attitude towards the benefits of ANC service were more likely to use these services than those with a negative attitude about the benefit of the service. Moreover, in a different study in Ethiopia, it was demonstrated that knowledge of the benefits of ANC services was significantly associated with women's utilization of early ANC services (117). The finding highlights the need to establish strategies that aim to improve women's awareness of the importance of ANC attendance using community-based education programs, especially among multiparous women.

The current study also revealed that women who have an awareness of pregnancy complications were more likely to attend ANC than their counterparts. The results of this study were comparable with other studies in Ethiopia (49, 110, 112) where the odds of ANC utilization were higher among women with a better awareness of pregnancy complications than those with poor knowledge of the same. The result highlights the need to design intervention strategies that involve promoting awareness about pregnancy-related complications among women.

6.5.1 Modifiable factors for program or policy consideration

The factors that are amenable to modification in the context of Ethiopia for further government and stakeholders' interventions to increase ANC uptake are illustrated below. Predisposing factors that can be targeted by the government to mitigate poor utilization of ANC include women's education, previous use of ANC and best friend's use of maternal care. Enabling factors such as husband's attitude towards ANC can also be targeted to increase ANC attendance. Lastly, increasing Health Extension Workers' home visits,

increasing women knowledge on the importance of ANC attendance, and promoting awareness of obstetric complications could be potential areas of intervention to further improve ANC utilization in Ethiopia (Figure 6.4).

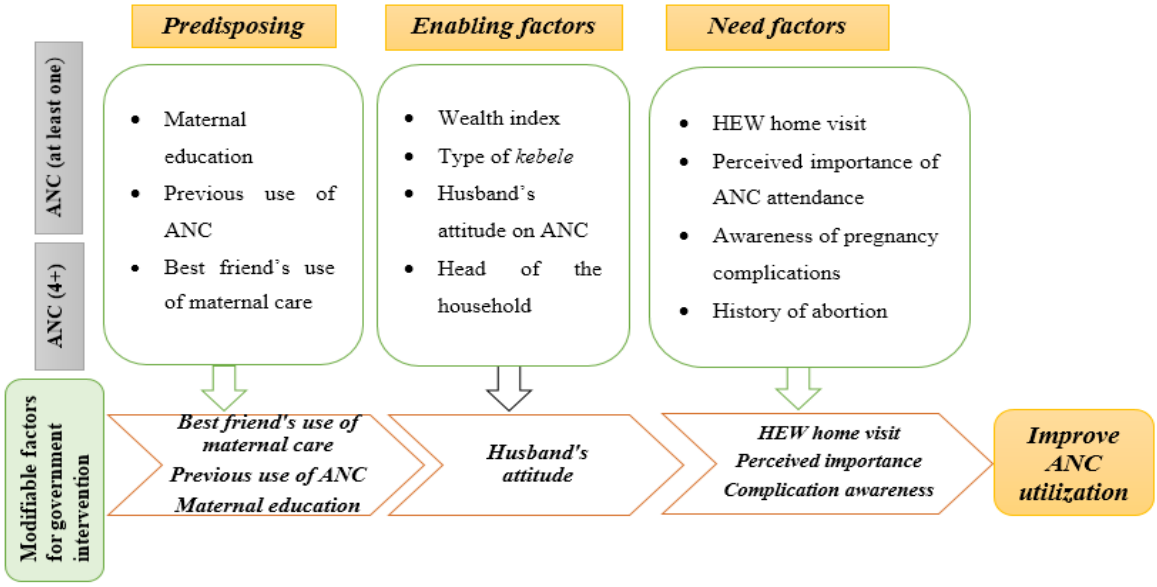

Figure 6.4. Modifiable predisposing, enabling and need factors associated with ANC utilization for government intervention, 2017

6.5.2 Strengths and limitations of the study

We believe that the inclusion of data regarding only the most recent pregnancy that occurred within the three years preceding the survey could minimize the risk of recall bias. We considered many predictor variables from the three domains of the Andersen and Newman behavioral framework of health care utilization into one model to better control for potential confounders. The use of iPads with digital survey tools for the data collection is another strength of the study because missing data are minimized. One limitation of the study was reliance on self-reporting of data. In addition, due to the cross-sectional nature of the study, it is difficult to establish a temporal relationship between the predictors and outcome variables. Though training was provided to the interviewers to inform respondents about the purpose of the study, the study might still be prone to social desirability bias. Despite these limitations, the findings of the study are sufficiently valid to inform program development.

6.6 Conclusion

More than half of the women attended ANC at least once during their last pregnancy. A higher proportion of women attended less than four ANC check-ups and delayed their first ANC visit. Attending formal education, belonging to higher wealth quintiles, previous use of ANC, best friend's use of maternal care, living in HDSS site, husband's positive attitudes towards ANC, receiving Health Extension Worker home visits, perceiving ANC attendance as important, and having an awareness of pregnancy complications were drivers for attendance of at least one ANC. Moreover, partner or parents being head of household, no abortion history, poor awareness of pregnancy complications, and husband's negative or neutral attitude towards ANC were deterrents for attending four or more ANC visits. Maternal health intervention efforts in Ethiopia should involve strategies that focus on the following key areas: improving women's education enrolment; designing women's peer education programs to mobilize and support women; introducing programs to change husband's attitude through community mobilization; prioritising women-centred economic reforms; ameliorating service provision of ANC; strengthening the Health Extension Worker home visits programs to further expand the health promotion and diseases prevention activities; and designing programs to increase awareness about pregnancy complications and importance of practicing ANC during pregnancy, especially for underprivileged women in rural areas.

Chapter 7

Predisposing, enabling and need factors associated with skilled delivery care utilization among reproductive-aged women in Kersa district, eastern Ethiopia

7.1 Foreword

Decreased use of skilled delivery care is associated with increased maternal mortality. The surveillance data analysis in Chapter 5 showed that two-thirds of women who succumbed to maternal death in Kersa had not given birth in health facilities assisted by skilled practitioners. The purpose of this chapter is to understand the context-specific factors associated with poor uptake of skilled delivery care at the community level in eastern Ethiopia, to achieve Aim 4: To assess the predisposing, enabling, and need factors associated with skilled delivery care utilization in Kersa.

This chapter has been submitted to Reproductive Health and is currently under peer review.

Abstract

Background: Skilled delivery care utilization in Ethiopia is still very low compared with the goal set by the global community for countries with the highest maternal mortality. As a result, the country is overburdened with high maternal morbidity and mortality. We aimed to explore the predisposing, enabling and need factors associated with skilled delivery care utilization among reproductive-aged women in Kersa district, eastern Ethiopia.

Methods: A community-based cross-sectional study was conducted with a total of 1294 women. The participants were selected using systematic sampling techniques. An interviewer-administered structured questionnaire aided by an electronic survey tool was used to collect data. Univariate analyses were conducted to describe the study sample. Bivariate and multivariate logistic regression analyses were carried out to elicit the association of predisposing, enabling and need factors associated with skilled delivery care utilization. Separate multivariate models were fitted for primiparous and multiparous women categories. Odds ratios with 95% confidence intervals were used to assess statistical significance.

Results: More than a quarter (30.8%) of the women surveyed used skilled delivery care for their most recent birth. Significant predisposing factors were as follows: presence of educated family member; receiving education on maternal health; previous use of skilled delivery care; and best friend's use of maternal care. Place of residence was the enabling factor that predicted skilled delivery care use. Antenatal care attendance and pregnancy intention were significant need factors associated with skilled delivery care utilization.

Conclusion: The findings of the study highlight the need for a concerted effort to establish community-based peer education programs; improve access to family planning services (to reduce unintended pregnancies); increase antenatal care uptake; and facilitate access to skilled delivery care in rural areas.

Keywords: Skilled delivery care, predisposing factors, enabling factors, need factors, reproductive-aged women, Kersa district, eastern Ethiopia

7.2 Background

Globally, an estimated 303,000 women died due to pregnancy and childbirth complications in 2015, with developing countries accounting for nearly 99% of the global burden (5). Although most maternal deaths that result from pregnancy complications are avoidable; all pregnancies that continued to birth could face obstetric complications that might not be identified during antenatal care (ANC) check-ups. Hence, the presence of a skilled health worker at birth for every delivery remains a crucial factor for the improvement of obstetric outcomes (124) and prevention of maternal deaths that occur during delivery (130). Up to one-third of maternal mortality could be prevented by the appropriate management of birth complications by skilled health workers during birth (40).

A review of studies in Ethiopia (134) identified very low utilization of professionally assisted delivery care at a health facility as one of the main contributing factors to the existing high burden of maternal deaths in the country. Hence, promoting skilled delivery care attendance at health facilities is an essential strategy to prevent maternal mortality (23, 33).

Skilled delivery care attendance is low in most developing countries, with some of the lowest rates of attendance in sub-Saharan African countries (138), where the majority of maternal deaths occur (2). In Ethiopia, according to a recent Demographic and Health Survey report, the proportion of women who utilized skilled birth assistance during delivery was 28% (44). However, the global community has set a goal of reaching 60% utilization of skilled delivery care attendance during birth for countries with the highest maternal mortality, and 90% at a global level (139). Based on the trend of data in the two decades before 2010, the estimated rate of annual improvement in the utilization of skilled delivery care in Ethiopia between the years 2011 to 2015 is 0.4%, which is also far lower than the average rate of improvement in other sub-Saharan African countries (147). Many other studies (119, 131, 210, 213, 307, 308) on skilled delivery care utilization in Ethiopia found less than 40% of pregnant women accessed these services.

A multitude of factors including place of residence, education, wealth status, pregnancy

intention, parity, birth order, previous use of care, physical distance, and cultural barriers are associated with skilled delivery care utilization (64, 110, 115, 172, 187, 188, 206, 309). However, there is limited evidence as to the contextual personal, social and community factors that motivate a majority of pregnant women in Ethiopia to avoid delivering their babies with the assistance of skilled health workers. The existing evidence is restricted to identifying the comprehensive factors influencing skilled delivery care utilization and does not reflect the underlying regional variations in socio-economic, geographic and cultural influences. Consequently, there is a need to understand the regional level contextual factors operating as barriers in the utilization of skilled delivery care, to better inform context-specific interventions. In this study, we attempt to understand the factors associated with skilled delivery care attendance by using the Andersen and Newman behavioral model of health care utilization (74, 75). This model typically classifies the factors that influence the utilization of health care into three categories: predisposing, enabling and need factors. The *predisposing factors* are the demographic and social conditions that influence the person's decision to use the service. The *enabling factors* are economic circumstances that facilitate service utilization. The *need factors* reflect the perceived health service needs and are related to the actual illness condition. The aim of this study was to assess the influence of these three factors on skilled delivery care utilization among reproductive-aged women in Kersa district, eastern Ethiopia.

7.3 Methods

A community-based cross-sectional study was conducted in Kersa district, eastern Ethiopia from June to August 2017. Kersa town, the capital of the district, is located 486 kms from Addis Ababa, the capital city of Ethiopia. The total population of the district was 205,628, as of the 2014 population projection for Ethiopia. In the district, there were 38 *kebeles* (the lowest administrative unit in Ethiopia consisting of 5000 people or 1000 households) or so-called subdistricts. From the 38 *kebeles*, three were urban and thirty-five were rural (228, 264), and 24 *kebeles* were under the HDSS. There were seven health centres, thirty-four health posts and eight private pharmacies in the district. The health centres routinely provide the recommended packages of ANC, skilled delivery care and postnatal care. Based on a recent report from the district health office, the health coverage

of the district was 80% (268).

7.3.1 Population

The population for the study were all reproductive-aged women living in the Kersa district. Only women who had at least one birth within the previous three years, had lived in the district for more than 6 months, and had delivered their most recent baby after 28 weeks of gestation were included. Women who were critically ill, and physically or mentally disabled were excluded from the study.

7.3.2 Sample size and sampling procedure

The total sample size for the study (n=1320) was primarily calculated for a study on maternal health service utilization and associated factors in Kersa district, eastern Ethiopia using different parameters. Twenty-five percent of the total 38 *kebeles* in the district (i.e. 10 *kebeles*) were included in the study to ensure optimum sample representation. Of the included *kebeles*, two were urban, and eight were rural. The study district was first stratified into urban and rural *kebeles*, and these were further classified into HDSS and non-HDSS *kebeles*. A proportional number of study *kebeles* were then selected from each stratum using simple random sampling technique. To select the individual study participants, first, the number of households having at least one eligible woman was determined in each *kebele* using the Health Extension Workers' logbook. Since the number of households with eligible women varied among the included *kebeles*, the total sample size of the study was proportionally allocated to each selected *kebele*. The total calculated sample size was then proportionally allocated to each *kebele* based on the determined number of households with eligible women for each *kebele*. The study participants were drawn from the list of households having eligible women using systematic random sampling techniques. The participants were recruited at the time of the survey based on a pre-identified list of randomly selected households. In the event of two or more eligible women being in the same household, only one woman was randomly selected and interviewed to avoid intra-household correlations.

7.3.3 Measurement variables

7.3.3.1 Outcome variable

Skilled delivery care utilization: women who have received delivery care from a skilled health worker (doctors, midwives/nurse or health officers) at the time of labour and parturition of their last baby irrespective of the setting where the birth occurs.

7.3.3.2 Covariates

(i) *Predisposing factors:* Woman's age, educational status, partner's educational level, presence of another educated family member, age at marriage, birth order, age at first pregnancy, education about maternal health, previous use of skilled delivery care, living in model family, best friend's use of maternal care, mass media and telephone availability at the household level.

(ii) *Enabling factors*: Residence, wealth index, decision making on household expenses, proximity to the nearest health facility, social support, and gender of household head.

(iii) *Need factors*: Health Extension Workers' household visits, experience of still-birth, ever had an abortion, pregnancy intention, ANC attendance for the index pregnancy, history of infant death and experience of delivery complications.

7.3.4 Source of data and data collection methods

A supervisor and eight enumerators were involved in the data collection process. The data were collected using a structured questionnaire administered by face to face interviews at the participant's home. The survey questionnaire was adapted from relevant literature (53, 108, 198, 275, 277) that addresses maternal health service utilization. Variables were measured using closed ended questions and participants were queried about the basic socio-demographic variables, reproductive histories, primary health care services, health promotion and women's autonomy, pregnancy status and maternal health service utilization, social network and social support. Using the translation-back-translation

method, first, the original English version of the questionnaire was translated to the local language (Oromiffa). The Oromiffa version was then translated back into English by a translator who was not involved in the first phase of the translation process. The interviews were conducted using the local language. An off-line mode of a digital data collection software (Survey Gizmo) installed in iPads was used to collect the responses. The Kersa HDSS resident enumerators who were fluent in the local language interviewed the women. A field supervisor and the lead author closely monitored the data collection at the field level.

7.3.5 Data quality control

Pre-testing of the tool was carried out on 5% of the sample of women in the adjacent district. Necessary refinements were made on the tool based on the pre-test findings. We recruited and employed experienced data collectors and a supervisor. Intensive training was provided to the data collectors and the supervisor on the objectives of the study, methodology and sampling procedures and how to use the iPads for collecting responses. Use of iPads during data collection prevented the potential for incomplete responses and missing values. At the field level, 10% of the interviewed women were re-interviewed by the supervisor to check the validity of the responses. During the quality check, if the supervisor found any invalid response on the Survey Gizmo, the interviewer revisited the house and interviewed the woman again. The enumerators uploaded the responses on a daily basis to the online version of Survey Gizmo. The responses were double-checked by the lead author daily for any inconsistencies.

7.3.6 Data management and analysis

Data were analysed using SPSS version 23 software package. We conducted transformation of some of the variables to allow for undertaking meaningful analysis. For the transformation, we used either recoding (through collapsing categories of some nominal variables and categorizing continuous variables) or creating new variables from the existing ones using statistical computation techniques. Univariate analyses were conducted to descriptively summarize the characteristics of the sample population. The

existence of multicollinearity between covariates was determined using a Variance Inflation Factor value less than five. The multivariate model fitness was verified using the Hosmer-Lemeshow test. Bivariate logistic regression analysis was carried out to compare the utilization of skilled delivery care among different groups using p-value. Variables that showed statistical association at a p-value less than 0.05 from each set of variables in the bivariate analysis were entered into the final full multivariate logistic regression model. Two multivariate logistic regression models were fitted (*Model 1* for multiparous women and *Model 2* for primiparous women) to identify factors associated with skilled delivery care utilization. The measure of association using Adjusted Odds Ratios (AOR) with Confidence Intervals (CI) was used to assess the direction as well as the strength of the association between the explanatory and the outcome variables.

7.3.7 Ethical considerations

The study was conducted after securing ethical approval from the Human Research Ethics Committee of the University of Newcastle, Australia and the Institutional Health Research Ethics Review Committee of College of Health and Medical Sciences, Haramaya University, Ethiopia. Informed verbal consent was obtained from each respondent before commencing the interviews. The confidentiality of the respondents was ensured by avoiding personal identification details. During house-to-house interviews, the participants' privacy was maintained by carrying out the interviews in a separate place in their residence where auditory and visual privacy was assured.

7.4 Result

7.4.1 Socio-demographic characteristics

In this study, of the 1,320 women who were approached, a total of 1,294 women gave complete responses to the interviews. Out of these, 50.4% were aged 25-34 years with a mean age of 27.4 (±6) years. The dominant ethnicity and religion were Oromo (98.5%) and Muslim (96.8%) respectively. Married women were nearly 98.7% of the sample and

about one quarter had at least an elementary school education (Table 7.1).

Table 7.1. Distribution of socio-demographic characteristics by place of residence among women in Kersa district, eastern Ethiopia, 2017.

Variables	Rural N (%)	Urban N (%)	Total N (%)
Age (n=1294)			
15-24	353 (31.5)	58 (33.1)	411 (31.8)
25-34	558 (49.9)	94 (53.7)	652 (50.4)
35-49	208 (18.6)	23 (13.1)	231 (17.9)
Marital status (n=1294)			
Married	1105 (98.7)	172 (98.3)	1277 (98.7)
Divorced	4 (0.4)	1 (0.6)	5 (0.4)
Never married	1 (0.1)	2 (1.1)	3 (0.2)
Separated	2 (0.2)	0 (0.0)	2 (0.2)
Widowed	7 (0.6)	0 (0.0)	7 (0.5)
Wealth index (n=1294)			
Highest	208 (18.6)	50 (28.6)	258 (19.9)
Fourth	204 (18.2)	57 (32.6)	261 (20.2)
Middle	228 (20.4)	32 (18.3)	260 (20.1)
Second	243 (21.7)	15 (8.6)	258 (19.9)
Lowest	236 (21.1)	21 (12.0)	257 (19.9)
Ethnicity (n=1294)			
Oromo	1118 (99.9)	156 (89.1)	1274 (98.5)
Amhara and Arab	1 (0.1)	19 (10.9)	20 (1.5)
Religion (n=1294)			
Muslim	1115 (99.6)	138 (78.9)	1253 (96.8)
Protestant and Orthodox	4 (0.4)	37 (21.1)	41 (3.2)
Occupational status (n=1294)			
Housewife	1099 (98.2)	141 (80.6)	1240 (95.8)
Government employee	1 (0.1)	23 (13.1)	24 (1.9)
Merchant	8 (0.7)	11 (6.3)	19 (1.5)
Farmer	11 (1.0)	0 (0.0)	11 (0.9)
Educational status (n=1294)			
Never attended	889 (79.4)	52 (29.7)	941 (72.7)
Elementary	205 (18.3)	62 (35.4)	267 (20.6)
Secondary	23 (2.1)	38 (21.7)	61 (4.7)
Tertiary	2 (0.2)	23 (13.1)	25 (1.9)
Partner's education (n=1279**)**			
Never attended	620 (55.4)	25 (14.3)	645 (49.8)
Elementary	394 (35.2)	44 (25.1)	438 (33.8)
Secondary	88 (7.9)	45 (25.7)	133 (10.3)
Tertiary	5 (0.4)	58 (33.1)	63 (4.9)
Partner's occupation (n=1279)			
Farmer	1090 (98.4)	66 (37.7)	1156 (89.3)
Government employee	6 (0.5)	59 (33.7)	65 (5.0)
Merchant	7 (0.6)	22 (12.6)	29 (2.2)
Daily labourer	4 (0.4)	25 (14.3)	29 (2.2)
Educated family member (n=1294)			
Never attended	672 (60.1)	48 (27.4)	720 (55.6)
Elementary	366 (32.7)	70 (40.0)	436 (33.7)
Secondary	75 (6.7)	35 (20.0)	110 (8.5)
Tertiary	6 (0.5)	22 (12.6)	28 (2.2)

7.4.2 Reproductive characteristics of the women

More than three-fourths (83.3%) of the women had been pregnant more than once, and 1059 (81.8%) of the women had given birth more than once. Small numbers of respondents, 95 (7.3%), 94 (7.3%) and 264 (20.4%) had experienced still-birth, abortion and infant death respectively. More than a quarter of the women (29.1%) admitted that their most recent pregnancy was unintended. About 1114 (86.1%) of the women were first married when they were less than 18 years of age and 1155 (89.3%) of the women became pregnant for the first time at the age of 20 years or less. For 671 (51.9%) of the women, their most recent child was their third or less pregnancy and for 1275 (98.5%) of the women, their most recent child was a full-term delivery. More than half (693 or 53.6%) of the women had attended at least one ANC for their most recent pregnancy (Table 7.2).

Table 7.2. Reproductive characteristics of the women, Kersa district, eastern Ethiopia

Variables (n=1294)	Frequency	Percentage
Age of marriage		
<18 years	1114	86.1
≥18 years	180	13.9
Age at first pregnancy		
≤ 20 years	1155	89.3
> 20 years	139	10.7
Birth order		
≤3rd	671	51.9
>3rd	623	48.1
Birth outcome of the last child		
Live full term	1275	98.5
Live preterm	12	0.9
Stillbirth	7	0.5
Gravidity		
Primigravida	216	16.7
Multigravida	1078	83.3
Parity		
Primipara	235	18.2
Multipara	1059	81.8
History of stillbirth		
No stillbirth	1199	92.6
Had stillbirth	95	7.4

History of abortion		
No history of abortion	1200	92.7
Had a history of abortion	94	7.3
History of infant death		
No history of infant death	1030	79.6
Had a history of infant death	264	20.4
Pregnancy intention for last birth		
Intended	917	70.9
Unintended	377	29.1
ANC use (at least one visit)		
Yes	693	53.6
No	601	46.4

7.4.3 Skilled delivery care utilization

The utilization of skilled delivery care for the pregnancy or pregnancies prior to the most recent was 20.1%. The proportion of women who attended skilled delivery care for the most recent birth was 30.8% regardless of the place of birth, whilst 384 (29.7%) of the births were assisted by a skilled health provider at a health facility. Slightly under half (194 or 48.9%) of the women opted for health facility delivery because it was close to where they lived; whilst almost a quarter (91 or 22.9%) cited high quality services as a motivating factor. Among the women who delivered at the health facility, the final decision to deliver there was made by the respondent themselves (49.1%), followed by their husband (21.7%). About 235 (59.2%) of the women did not make any arrangement or birth plan prior to delivering the most recent child. A high proportion (305 or 76.8%) of the women, were accompanied to a health facility for delivery by their partner, followed by traditional birth attendants (53 or 13.4%) and Women's Development Army leaders (50 or 12.6%) (Table 7.3).

Table 7.3. Skilled delivery care utilization among respondents, Kersa district, eastern Ethiopia.

Variable	Frequency	Percentage
Skilled delivery care for previous pregnancies (n=1059)		
Yes	213	20.1

No	846	79.9
Skilled delivery care for the recent pregnancy (n=1294)		
Yes	398	30.8
No	896	69.2
Place of delivery for the recent pregnancy (n=1294)		
Government hospital	71	5.5
Government health centre	306	23.6
Government health post	17	1.3
Private hospital/clinic	3	0.2
Home	890	68.8
Other (e.g. on the road)	7	0.5
Reason to prefer that facility for delivery (n=397**)		
Close to where I live	194	48.9
Helpfulness of health workers	79	19.9
High-quality services	91	22.9
Little or no expenses	21	5.3
Other reasons	12	3.02
Person attending the care at the health facility (n=397**)**		
Doctor	47	11.8
Health officer	11	2.8
Nurse/midwife	326	82.2
Health Extension Worker	13	3.3
Who made the final decision to deliver at the health facility (n=397)		
Yourself	195	49.1
Your husband	86	21.7
Jointly with your husband	45	11.5
Health Extension Worker	41	10.3
Your parents	14	3.5
Mother-in-law	6	1.5
Women's Development Army leader	5	1.3
Other	5	1.3
Who accompanied to the health facility (n=397)		
Partner	305	76.8
Women's Development Army leader	50	12.6
Health Extension Workers	20	5.0
Traditional birth attendants	53	13.4
No one	32	8.1
Birth preparedness (n=397)		
Yes	156	39.3
No	235	59.2
Don't remember	6	1.5

*****The total number of respondents who delivered at a health facility. The number of women who received skilled care from either a (doctor, nurse/midwife, or health officer) is 398 regardless of the place of delivery. The number of women who were assisted with skilled personnel within a facility is 384. [Birth preparedness: An advance preparation and planning for birth by the woman and her family].***

7.4.4 Referral, prior plan for facility birth and delivery complications

Among the women who presented for delivery at the health facility, 46 (11.6%) were referred to a higher-level health facility for delivery. More than three-quarters (317 or 79.8%) of the women had a prior plan for facility delivery for their most recent birth. Only 94 (7.3%) of the women experienced obstetric complications during the delivery of their most recent baby, with prolonged labour (36.2%) and severe bleeding (29.8%) being the

most common cause of complications. Out of those women who delivered their most recent baby at a health facility, 90 (22.7%) did not recommend facility delivery to their friends. A significant proportion of the women (364 or 28.1%) still wished to deliver their next baby at home (Table 7.4).

Table 7.4. Referral, prior plan for facility birth, and complications during delivery among women in Kersa district, eastern Ethiopia, 2017.

Variable	Frequency	Percentage
Referral to a higher facility (n=397)		
Yes	46	11.6
No	351	88.4
Prior plan for health facility delivery (n=397)		
Yes	317	79.8
No	73	18.4
Don't know	7	1.8
Presence of complication during delivery (n=1294)		
Yes	94	7.3
No	1197	92.5
Don't know	3	0.2
Type of complications during delivery* (n=94)		
Severe bleeding	28	29.8
Severe headache	25	26.6
Convulsions	8	8.5
High fever	12	12.8
Loss of consciousness	13	13.8
Labour lasting >12 hours	34	36.2
Placenta not delivered 30 minutes after the baby	14	14.9
Other (abdominal pain and severe vomiting)	2	2.1
Place where complication developed (n=94)		
Home	63	67.1
Health facility	29	30.9
On the way to a health facility	2	2.1
Sought assistance for complication during delivery (n=94)		
No	35	37.2
Yes	59	62.8
Future choice of delivery (n=1294)		
Health facility	764	59.0
Home	364	28.1
No plan for pregnancy	166	12.8
Recommend facility delivery to friends (n=397)		
Yes	307	77.3
No	90	22.7

Does not sum up to **total due to the possibility of multiple responses*

7.4.5 Factors associated with skilled delivery care utilization

7.4.5.1 Predisposing factors

Multiparous women who had educated family members had an increased odds of skilled delivery care attendance (AOR, 1.89; 95% CI: 1.26, 2.85) than women who had no educated family members. Primiparas women who had received education on maternal health had higher odds of using skilled delivery care (AOR, 2.22; 95% CI: 1.09, 4.53) than those who had not received maternal health education. Multiparous women with no previous experience of receiving skilled delivery care had lower odds of skilled delivery care utilization for subsequent births (AOR, 0.08; 95% CI: 0.05, 0.13) than their counterparts. Multiparous women whose best friends did not use maternal care had decreased odds of skilled delivery care use (AOR, 0.43; 95% CI: 0.29, 0.64) than multiparous women whose best friends used maternal care.

7.4.5.2 Enabling factors

Place of residence was significantly associated with skilled delivery care attendance in both multivariate logistic regression models. Urban residence had significantly increased the odds of skilled delivery care utilization ((AOR, 4.83; 95% CI: 2.58, 9.05) in *Model 1* and (AOR, 8.23; 95% CI: 2.26, 29.97) in *Model 2*).

7.4.5.3 Need factors

Multiparous women with unintended pregnancies had a decreased odds of skilled delivery care utilization (AOR, 0.54; 95% CI: 0.35, 0.84) than multiparous women with intended pregnancies. In both multivariate models, ANC attendance during the most recent pregnancy was positively associated with skilled delivery care utilization during the most recent birth ((AOR, 2.23; 95% CI: 1.48, 3.37) in *Model 1* and (AOR, 3.13; 95% CI: 1.51, 6.46) in *Model 2*) (Table 7.5).

Table 7.5: Factors associated with utilization of skilled delivery care among women in Kersa district, eastern Ethiopia, 2017

Variables	Categories	Skilled delivery care use *(n=1059) Model 1 (Multiparous women)*		Skilled delivery care use *(n=235) Model 2 (Primiparous women)*	
Predisposing factors		**COR (95% CI)**	**AOR (95% CI)**	**COR (95% CI)**	**AOR (95% CI)**
Educational status	Never attended	1	1	1	1
	Attended	3.55(2.62, 4.80)	1.37(0.84, 2.22)	4.89(2.81, 8.50)	1.09(0.50, 2.38)
Partner's educational level	Never attended	1	1	1	1
	Attended	2.06(1.57, 2.72)	0.86(0.58, 1.29)	4.50(2.52, 8.03)	1.97(0.91, 4.27)
Presence of another educated family member	Yes	2.05(1.55, 2.70)	**1.89(1.26, 2.85)**	5.77(2.95, 11.29)	1.36(0.51, 3.61)
	No	1	**1**	**1**	1
Educated about maternal health	Yes	1.50(1.14, 1.97)	1.17(0.80, 1.71)	2.66(1.57, 4.51)	**2.22(1.09, 4.53)**
	No	1	1	1	1
Mass media availability at home	Yes	1.98(1.50, 2.62)	0.99(0.64, 1.55)	2.30(1.36, 3.89)	0.88(0.41, 1.90)
	No	1	1	1	1
Telephone ownership at household level	Yes	2.37(1.76, 3.19)	1.07(0.66, 1.74)	4.03(2.30, 7.08)	1.58(0.69, 3.62)
	No	1	1	1	1
Birth order	≤3rd	1	1		
	>3rd	0.59(0.45, 0.78)	0.76(0.49, 1.18)		
Previous use of skilled delivery care	Yes	1	1		
	No	0.06(0.04, 0.08)	**0.08(0.05, 0.13)**		
Living in a model family	Yes	1	1		
	No	0.43(0.22, 0.87)	1.76(0.62, 5.02)		
Best friend's use of maternal care	Yes	1	1	1	1
	No	0.22(0.16, 0.29)	**0.43(0.29, 0.64)**	0.25(0.14, 0.43)	0.77(0.38, 1.56)
Enabling factors					
Residence	Rural	1	1	1	1
	Urban	14.42(9.09, 22.88)	**4.83(2.58, 9.05)****	23.71(8.18, 68.73)	**8.23(2.26, 29.97)****
Wealth index	Highest	1.88(1.21, 2.90)	1.80(0.98, 3.32)		
	Fourth	1.72(1.11, 2.67)	1.45(0.80, 2.64)		
	Middle	1.37(0.88, 2.24)	1.63(0.90, 2.94)		
	Second	0.83(0.52, 1.32)	0.81(0.44, 1.49)		
	Lowest	1	1		
Decision making on household expenses	Respondent	1	1	1	1
	Jointly	1.10(0.75, 1.61)	0.69(0.42, 1.12)	2.49(1.07, 5.78)	1.83(0.67, 4.97)
	Partner	1.95(1.20, 3.18)	1.65(0.84, 3.23)	1.83(0.70, 4.79)	2.90(0.87, 9.71)
Social support from friends	Yes	1	1	1	1
	No	0.34(0.18, 0.62)	0.58(0.27, 1.25)	0.30(0.14, 0.64)	0.71(0.29, 1.76)

Need factors					
History of infant death	Have no history	1	1		
	Have history	0.68(0.49, 0.95)	1.09(0.70, 1.72)		
Pregnancy intention	Intended	1	1		
	Unintended	0.50(0.37, 0.69)	**0.54(0.35, 0.84)**		
ANC attendance for the most recent pregnancy	Yes	5.10(3.70, 7.02)	**2.23(1.48, 3.37)****	6.96(3.86, 12.53)	**3.13(1.51, 6.46)****
	No	1	1	1	**1**

Key: COR: Crude Odds ratio, **AOR**: Adjusted Odds ratio (adjusting for the potential predisposing, enabling and need factors in full model), **CI**: Confidence Interval (95%), **Bold***statistically significant variables, **Bold****statistically significant variables in both models (*Model 1 and 2*)

7.5 Discussion

This study has attempted to explore the factors that influence the uptake of skilled delivery care among reproductive-aged women in a predominantly rural district in eastern Ethiopia; and definitively quantify use. Having an educated family member; receiving education on maternal health; previous use of skilled delivery care; and, best friend's use of maternal care were significantly associated predisposing factors. Place of residence was the only significantly associated enabling factor. The significant need factors were pregnancy intention and ANC attendance for the most recent pregnancy.

The results of the current study showed that the utilization of skilled delivery care among reproductive-aged women was 30.8%. This figure reflects findings of an Ethiopian national Demographic and Health Survey report (44), where 28% of the women delivered their most recent baby with the assistance of a skilled provider; as well as a study conducted in Southern Ethiopia (213) in which 31% of women utilized skilled delivery care during their delivery. However, our result is higher than several other studies in Ethiopia (119, 131, 132, 143). The relatively higher level of skilled delivery care utilization in our study may reflect current efforts to reduce home delivery using financial penalties for traditional birth attendants and local pregnant women who opt for home births. Moreover, the evolution of the Women's Development Army network at the village level might have contributed to better uptake of skilled delivery care through health discussions within the network during regular meetings. The varying level of service uptake underscores the requirement for local level research to highlight the setting-specific factors that either impede or facilitate service utilization, thereby informing the development of locally suitable programs.

The findings of the present study demonstrate that the predisposing factors associated with skilled delivery care utilization were having an educated family member: receiving education on maternal health: previous use of skilled delivery care: and, best friend's use of maternal care. Multiparous women who have an educated family member in their household have increased odds of utilizing skilled delivery care. The influence that the educated family member had on the woman's acceptance of utilizing material care is paramount. It has been shown (199) that living in close proximity to people with a higher

level of education can strongly influence the health service seeking behaviour of women. People with more education tend to have healthier behaviours, and good knowledge and understanding about the importance of health care utilization (310). In relation to this, primiparous women who had received education on maternal health have increased odds of skilled delivery care utilization than primiparous women who had not received maternal health education. Educating women about maternal health increases their understanding of the importance of attending maternal health services; and the possible catastrophic consequences of pregnancy or birth complications; contributing to their acceptance and uptake of skilled delivery care. This positive impact of maternal health knowledge on the uptake of skilled delivery care has been evidenced in a previous study in Nepal (311).

Previous experience of using skilled delivery care was significantly associated with skilled delivery care utilization. The finding may indicate that women perceived the delivery care services they had received during the previous birth to be quality and appropriate. The association of previous care experience with future use of skilled delivery care might also reflect the confounding effect of accessibility and availability of services. The women who previously used skilled delivery care that subsequently attend the same service might already have better accessibility to the service, which continues to be available for the subsequent births, unlike women who do not use the service. However, in a study conducted in north west Ethiopia (153) contrasting results were found, in that previous attendance of delivery care actually had a limited role in increasing the uptake of skilled delivery care for the subsequent birth. This difference may highlight the variation in terms of quality of care at different levels of primary health care facilities in Ethiopia. Moreover, in Ethiopia, concerted efforts should be made to improve the quality of obstetric care at health facilities to increase utilization of skilled delivery care.

Our findings showed that the best friend's non-use of maternal care is significantly associated with poor uptake of skilled delivery care. The result was comparable with a study conducted in Mali (199), where women's health seeking and utilization behavior towards maternal care use was significantly influenced by the care-seeking practices of the surrounding people in their areas of residence. Friends are often connected through providing moral support to one another which influences the decision either to refuse or accept a temptation (312). Women are more likely to adopt unhealthy/healthy behaviors from their best friends than strangers (300), especially in regard to gendered issues they

experience in common, such as pregnancy or birthing. During their interactions with friends, fear and stigma are decreased, allowing women to freely discuss their delivery choices and therefore adopt bad or good care-seeking behavior. This implies that there is possible benefit in organizing maternal health programs that target networks at the community level, as opposed to individuals. The Women's Development Army network, already established in most districts of Ethiopia, is an ideal platform and resource to facilitate such programs. Peer education programs customized specifically for women's social networks at the village level have great potential to accelerate improved attendance of skilled delivery care.

We also revealed in this study that place of residence is a significantly associated enabling factor for skilled delivery care utilization. Urban women have increased odds of utilizing skilled delivery care compared to rural women. The association of urban residence with better uptake of maternal care is consistent with the findings from other studies in Ethiopia (115, 140, 153, 213), and elsewhere in sub-Saharan Africa (313, 314) where the odds of skilled delivery care utilization is very low among rural-dwelling women compared to urban women. Better awareness of, and access to, maternal care may account for much of the difference between urban and rural women's uptake of skilled delivery care. Additionally, as urban women generally tend to have a higher level of economic status, they can better afford the financial burden associated with utilization of the service. Local efforts to improve maternal health should therefore focus on improving the accessibility and availability of delivery care services during birth, and the equitable distribution of health resources in urban and rural settings.

Moreover, ANC attendance for the index pregnancy was a statistically significant need factor that was associated with skilled delivery care utilization. Women who attended ANC for the index pregnancy have higher odds of attending skilled delivery care compared to women who did not attend ANC. The finding is in agreement with a swathe of other studies in Ethiopia (49, 115, 119, 153, 181) where the use of ANC for the woman's most recent pregnancy was strongly associated with an increased likelihood of attending skilled delivery care for the most recent birth. The women had physical interactions with the health workers and the facility during ANC that might, in turn, have helped them become more confident and familiar with the health facility allowing them to seek skilled delivery care (199). Moreover, during the ANC check-up, the women had the

opportunity to receive advice and information related to the benefits of skilled delivery care as well as the potential occurrence of obstetric problems during delivery which could increase their perceived susceptibility and motivate them to attend the care (93, 132, 218).

Women with unintended pregnancies have lower odds of skilled delivery utilization care compared to women with intended pregnancies. These findings are consistent with those of a previous Ethiopian study (110), which showed that skilled delivery utilization is higher among women who have intended rather than unintended pregnancies. The actual linking mechanism between pregnancy intentions and use of skilled delivery and other maternal care is unclear; however, it could be related to women's ability to having control over both their reproductive life and household resources. In addition, some women with unintended pregnancies may consider abortion as an alternative to maternal health service use. Unintended pregnancies are highly indicative of an unmet need for family planning; thus, access to appropriate family planning services should be improved.

7.5.1 Strengths and limitations

Limiting the reference time for retrospective questions to three years could minimize the introduction of recall bias. The use of a relatively higher sample size has given adequate power to the study. We used a digital survey tool with iPads to collect the data, which improved the quality of the data by ensuring its completeness and consistency. Incorporation of a greater number of predictor variables into the final multivariate model ensures better controlling for confounding factors. As the interviewers were resident HDSS data collectors who regularly interact with the community, social desirability bias might not be ruled out. Due to the social desirability bias, women might have tended to provide favorable responses regarding the current or past of use of delivery care and be hesitant to share their negative care experiences. Due to the cross-sectional nature of the survey design, establishing a causality inference is also difficult. Regardless of the limitations of the study, we believe that the current survey provides a quite strong indication of the factors influencing skilled delivery care utilization in a largely rural setting in Ethiopia.

7.6 Conclusion

More than a quarter of the surveyed women attended skilled delivery care for their most recent pregnancy. Place of residence; the presence of another educated family member; receiving maternal health education; previous use of skilled delivery care; best friend's use of maternal care; pregnancy intention; and ANC attendance for the index pregnancy; were statistically significant predisposing, enabling and need factors associated with skilled delivery care utilization. The study pointed out the key areas of possible interventions for maternal health program planners. Designing a maternal health program that entails equitable distribution of health infrastructure between rural and urban communities is recommended. Moreover, safe motherhood intervention efforts should aim to improve the quality of delivery care at health facilities which in turn retain women for subsequent attendance. Improving access to family planning services; establishing peer to peer maternal health educational programs; and increasing ANC utilization - an entry point for the attendance of the subsequent maternal care including skilled delivery care – are all strategies to be considered to increase maternal service uptake.

Chapter 8

Magnitude and correlates of postnatal care utilization among reproductive-aged women in a rural district in eastern Ethiopia: a Cross-sectional study

8.1 Foreword

Most maternal deaths occur during the postnatal care period. Evidence shows that postnatal care can reduce maternal mortality. This chapter seeks to examine patterns of postnatal care utilization at the community level in eastern Ethiopia, to address Aim 5: To explore the magnitude and correlates of postnatal care utilization in Kersa.

This chapter was published in *Journal of Midwifery:*
Tesfaye G, Chojenta C, Smith R, and Loxton D. Magnitude and correlates of postnatal care utilization among reproductive-aged women in a rural district in eastern Ethiopia: a cross-sectional study. *Midwifery*, 2019; 70, 22-30.

Abstract

Background: Postnatal care is critical to detect and manage postpartum complications in the early stages, as well as to prevent potentially life-threatening health conditions that lead to maternal death. However, postnatal care utilization is persistently low in Ethiopia. The aim of this study is to assess the magnitude and correlates of postnatal care utilization among reproductive-aged women in Kersa district, in eastern Ethiopia.

Methods: A community-based cross-sectional study was conducted in ten randomly selected sub-districts in Kersa district. Respondents were recruited using systematic random sampling techniques. Data were collected by an interviewer-administered questionnaire using iPads. A total of 1206 respondents' data were considered in the analysis. Frequency and percentage distributions of the variables were performed. Bivariate and multivariate logistic regression analyses were undertaken to identify the predisposing, enabling and need factors associated with postnatal care utilization. An Odds Ratio with 95% confidence interval was used to ascertain the direction and strength of the association.

Results: Less than one in thirteen women attended postnatal care after their most recent delivery in the study community. The multivariate analysis demonstrated that postnatal care utilization is associated with receiving education on maternal health; best friend's use of maternal care; head of the household; and experience of postpartum complications. Receiving education on maternal health (AOR, 2.32; 95% CI: 1.38, 3.89); and best friend's use of maternal care (AOR, 2.41; 95% CI: 1.39, 4.19); were significant predisposing factors that independently predicted postnatal care utilization. Furthermore, head of the household was a significantly associated enabling factor for postnatal care utilization (AOR, 0.24; 95% CI: 0.07, 0.81). The experience of postpartum complications (AOR, 0.10; 95% CI: 0.05, 0.20) was the only need factor that was associated with postnatal care utilization.

Conclusion: Postnatal care utilization was extremely low in the study district. Strengthening health education and promotion activities regarding maternal health; peer education programs within the women's social networks; strengthening women empowerment programs; and women's mobilization to seek postnatal care before the occurrence of complications, are essential actions that can improve postnatal care utilization.

Keywords: Postnatal care utilization, women, rural district, Eastern Ethiopia

8.2 Background

The burden of maternal mortality continues to be high in several developing countries. In sub-Saharan Africa, the rates are the highest with a maternal mortality ratio of 546 per 100,000 live births during 2015. Ethiopia experienced a high level of maternal mortality (353 per 100,000 live births) during the same year (5). Postpartum maternal conditions that lead to maternal mortality are well understood; such as postpartum hemorrhage and puerperal sepsis, particularly in African countries (20). Postnatal care (PNC) has been advocated as critical to preventing and managing these conditions and contributing to reducing maternal mortality (34, 165).

Postnatal care services aim to assess, maintain and promote the health of the postpartum mother and the newborn. Also, PNC services aim to maintain a supportive environment to satisfy the various health and social needs of the mother and newborn through detecting, diagnosing and treating various health conditions (164). In a developing country setting, apart from early detection and management of catastrophic postpartum complications (53), PNC services also include the provision of health messages pertaining to: exclusive breastfeeding and complementary feeding; continuous skin to skin contact for low birth weight and preterm newborns; insecticide-treated bed nets to prevent malaria; plus family planning counselling and service provision (163).

As the postnatal period is a stressful time, especially for mothers who gave birth for the first time, counseling and emotional support should be offered to lessen the risk of postnatal depression (161). In addition to missed opportunities to acquire health promotive behaviors, deprivation of health care services during the postnatal period can lead to maternal morbidity and mortality due to undetected or untreated postpartum complications (161). The majority of maternal deaths occur during the postnatal period (33). Proper utilization of PNC services has the potential to improve maternal outcomes and avert the majority of postnatal maternal deaths (164). The World Health Organization (WHO) recommends that postpartum women attend PNC as early as possible within the first 24 h after birth, and three additional postnatal contacts during the first six weeks after delivery (165). In Ethiopia, for normal deliveries the Ministry of Health recommends that the mother should attend four PNC visits: within 24 h, 1-2 days, 3-7 days and 8-42 days (96).

Even though the postnatal period is an essential time during which mothers should receive critical attention from a skilled care provider, this period is generally overlooked in many developing countries (164). Postnatal care is the weakest component of maternal health service along the continuum of care from pregnancy to the postpartum period (169). For instance, 62% of pregnant women in Ethiopia attended ANC at least once while 28% delivered with the assistance of skilled health workers, yet only 19% of the women utilized PNC services regardless of the place of delivery (44). Moreover, numerous previous studies in Ethiopia (56, 143, 307) reported staggeringly low PNC utilization rates; all below 10%.

In Ethiopia, evidence suggests that the utilization of PNC is influenced by a complex set of factors. These factors include woman's education; economic status; place of residence; decision-making power; knowledge about the benefit of the care; ANC use; distance to the nearest health facility; and, the presence of postpartum complications (110, 112, 172-174). However, the existing evidence is often inconclusive and not strategically relevant to give a complete picture of the problem across all districts in Ethiopia. It is, therefore, imperative to carry out studies to better understand the locally-relevant key factors that may be associated with PNC utilization at the district level in Ethiopia. Guided by the framework for health care utilization developed by Andersen and Newman (74, 75), we aimed to assess the uptake of PNC, and the associated factors among reproductive-aged women in Kersa district, in eastern Ethiopia.

8.3 Methods

8.3.1 Study area and period

The study was conducted in Kersa district, in Ethiopia from June to August 2017. The district is located in Oromia region, at about 486 km from the country's capital city. The administrative town of the district is Kersa town. In the district, there are 38 sub-districts (*kebele*), of which, 35 are rural and three are urban. The *kebele* is the smallest administrative unit in Ethiopia composed roughly of 1000 households. There are seven

health centres, thirty-four health posts and eight private pharmacies in the district. The district has 24 HDSS and 14 non-HDSS *kebeles*. The 24 HDSS *kebeles* are comprised of three from urban areas and the rest from rural areas. The Kersa HDSS baseline census was conducted in 2007 and since then it has been updated every 6 months, with the registration of demographic and health events, such as births, deaths, migrations, pregnancy status and outcomes, child morbidities, and nutrition.

8.3.2 Study design and population

A community-based cross-sectional study was carried out. The study population were women in the district who were aged 15-49 years, who had at least one birth in the three years preceding the survey and resided in the district for at least six months prior to the study. We excluded women who had experienced pregnancy that resulted in a miscarriage, were not willing to participate, were critically ill and physically or mentally disabled at the time of the survey.

8.3.3 Sample size and sampling procedure

The sample size was calculated for a larger research project on maternal health service utilization in Kersa district, in eastern Ethiopia. The sample size was calculated using single and double population proportion formulas (315) using appropriate scientific assumptions pertaining to the objectives of the study. A total of 1320 women were recruited from ten randomly selected *kebeles* to participate in the study. Regarding the sampling procedure, a two-stage sampling technique was followed where the first stage was the selection of *kebeles* from the district. The study district was stratified into rural and urban *kebeles*. Both rural and urban *kebeles* were further stratified into HDSS and non-HDSS. The second stage involved the selection of households from the included *kebeles*. An updated Health Extension Worker's health management information system registration log sheet was used to identify and list households with at least one eligible woman to determine the total number of households in each included *kebele*. Since there were variations in the number of households enumerated in the *kebeles*, we used probability proportional to size method to distribute the total sample (1320) to the

corresponding *kebeles*. Respondents were then recruited using systematic sampling techniques. If the household had two or more eligible women, only one of them was selected using the lottery method.

8.3.4 Measurement variables

8.3.4.1 Outcome variable

PNC utilization: Reproductive-aged women who had received PNC check-up for the mother-newborn pair or mother only at least once within the first six weeks (42 days) of their most recent delivery (Participants were asked "*After your last delivery, did anyone check on your health during the first six weeks after birth?*").

8.3.4.2 Explanatory variables

We framed the factors that influence PNC utilization based on the Andersen and Newman's behavioral model of health care utilization (*predisposing*, *enabling* and *need* factors) (74, 75). Hence, for this study the *predisposing factors* were: educational status; age; husband's education and occupation; receiving education on maternal health; presence of other educated family member; age at marriage; parity; availability of mass media and telephone at the household level; birth order; living in model family; and best friend's use of maternal care. The *enabling factors* were place of residence; type of *kebele*; wealth status; head of the household; distance of the nearest health institution; decision making autonomy at the household level; and social support. Whilst the *need factors* were the experience of postpartum complications; the frequency of ANC attendance; pregnancy intention; had a Health Extension Workers household visit; undergoing an abortion; history of infant death; and still-birth.

8.3.5 Data collection procedure

The data were collected by resident HDSS interviewers using an inbuilt offline mode of a digital survey tool (Survey Gizmo) using iPads. The questionnaire was adapted from

pertinent literature (53, 108, 274, 276, 277) including the standard tool used in Demographic and Health Survey (53). The questionnaire addresses socio-demographic information, obstetric characteristics, experience of PNC service use and future plan, the experience of obstetric complications, social network and social support. The survey tool was further developed to address the relevant research questions for the research project. The tool was translated from English into the local language (Oromiffa) by a bi-lingual faculty member. Then, the tool was translated back to English by another faculty member who is proficient in both languages to ensure its consistency. The English and local language questionnaires were integrated together in Survey Gizmo to have an easy flow of the interview and ensure the consistency of the questions.

8.3.6 Data quality control

Experienced HDSS interviewers and a supervisor completed the data collection. Two days of training was provided to the interviewers and supervisor regarding the purpose of the study; interview techniques using iPads; how to upload responses; and how to manage ethical issues. Pre-testing of the study tool was conducted among 65 reproductive-aged women who were residing in the adjacent district. The pre-testing enabled the data collectors to become more familiar with the administration of the interview using iPads; and make necessary amendments to the study tool based on the lessons drawn from the pre-testing. The supervisor daily repeated 10% of the interviews made by the data collectors to check for the validity of the completed responses. The interviewers used iPads for the data collection and daily uploaded the responses to the Survey Gizmo. To further ensure the completeness and quality of the responses, the lead author double-checked the uploaded responses in Survey Gizmo at the field level and gave feedback to the interviewers daily.

8.3.7 Statistical analysis

The data were directly exported to SPSS version 23 for data exploration, cleaning, and analysis. Some variables were transformed through recoding for univariate and multivariate analyses. For the univariate analysis, continuous variables, such as maternal

age, age at marriage and age at first pregnancy were transformed into categorical variables. Also, variables with "*Don't know*" category and legitimate system missing values due to skipping questions were recoded through collapsing them into an existing category (such as "*No*") for the multivariate analysis. Univariate analysis involving frequency and percentage distribution of the study subjects were explored to describe the characteristics of women included in the study. Summary statistics using measures of central tendencies were also computed for the appropriate variables. The findings of the study were presented in narratives, tables, and diagrams. Multicollinearity between the variables was checked using the Variance Inflation Factor which indicated its non-existence. To measure the relationship between the predictors and outcome variable, we undertook a two-stage analysis; bivariate analysis, followed by an analysis of all the predisposing, enabling and need factors in one multivariate logistic regression model. The final multivariate model was built in steps where Model-I included predisposing factors, Model-II included both predisposing and enabling factors and Model-III included all factors (*Appendix 8*). Only variables which were statistically significant at a p-value of < 0.05 in the bivariate analysis were further considered in the model building process and in the final multivariate logistic regression model to test for persistence of significance. Thus, the final multivariate logistic regression analysis model had adjusted the potential confounding variables and showed the independent effect of each predictor variable on the outcome variable. An Odds Ratio with a 95% CI and a p-value of < 0.05 was used to interpret the statistical significance of the association between the independent and dependent variables.

8.3.8 Ethics approval

Ethical approval was secured from the Human Research Ethics Committee of the University of Newcastle, Australia (reference number H-2016-0403). Additionally, the study obtained approval from the Institutional Health Research Ethics Committee of Haramaya University, Ethiopia (reference number IHRERC/129/2017). Letters of collaboration were also written to the district administration authorities and the health office. Informed verbal consent was obtained from each participant before conducting the interviews. The confidentiality of the information from the participants was ensured by removing personal identifiers from the study tool. Participants aged 15-18 years, were deemed able to give informed verbal consent as mature minors who were married, had had

at least one birth and assumed social responsibility to rear the child. Both ethics committees had approved the verbal consent procedure for the reproductive-aged women between 15 and 18 years as part of the ethical review process.

8.4 Results

8.4.1 Socio-demographic characteristics

Our study included 1294 eligible women (with a response rate of 98%). However, among those respondents, 88 (6.8%) were excluded from the present analysis as they had not completed the six weeks after their most recent birth to fully ascertain whether they received PNC or not. Therefore, the data of 1206 respondents were considered for this current analysis. With a mean age of 27.4 (±6.1) years, the majority (50.5%) of the respondents were aged 25-34 years. Around 1041 (86.3%) of the respondents were rural dwellers, 791 (65.6%) were living in HDSS sites and 1189 (98.6%) reported to be currently married. Nearly three quarters (72.7%) of the respondents never attended formal education. Almost all the respondents (96.9%) were Muslim and (98.5%) were from the Oromo ethnic group. Ninety-six percent of respondents were housewives and 89.1% of respondents' husbands were farmers (Table 8.1).

Table 8.1. Socio-demographic characteristics of the reproductive-aged women in Kersa district, eastern Ethiopia, 2017

Variables	Frequency	Percentage
Age (n=1206)		
15-24	385	31.9
25-34	609	50.5
35-49	212	17.6
Place of residence (n=1206)		
Rural	1041	86.3
Urban	165	13.7
Marital status (n=1206)		
Currently in marriage	1189	98.6
Currently out of marriage	17	1.4
Type of kebele (n=1206)		
HDSS	791	65.6
Non-HDSS	415	34.4
Religion (n=1206)		
Muslim	1169	96.9

Orthodox	31	2.6
Protestant	6	0.5
Ethnicity		
Oromo	1274	98.5
Others	20	1.5
Occupational status (n=1206)		
Housewife	1155	95.8
Government employee	23	1.9
Merchant	18	1.5
Farmer	10	0.8
Educational status (n=1206)		
Never attended	877	72.7
Elementary	247	20.5
Secondary and above	82	6.8
Husband's education (n=1191**)**		
Never attended	597	49.5
Elementary	408	33.8
Secondary and above	186	15.4
Husband's occupation (n=1191**)**		
Farmer	1075	89.1
Daily labourer	27	2.2
Government employee	62	5.1
Merchant	27	2.2
Availability of mass media (n=1206)		
Yes	426	35.3
No	780	64.7
Availability of telephone (n=1206)		
Yes	320	26.5
No	886	73.5

8.4.2 Obstetric characteristics

The study demonstrated that among the respondents, 1033 (85.7%) were married before the age of eighteen years, and 1072 (88.9%) had their first pregnancy at the age ≤ 20 years. The mean age of marriage was 16.7 (±2.2) years, and the mean age at first pregnancy was 18.2 (±2.3) years. More than four-fifths (83.1%) of the women had a history of more than one pregnancy, and 81.5% had experienced more than one delivery. Whilst 7.2% had a history of stillbirth, about 20.2% had a history of infant death and 7.5% had experienced an abortion. More than a quarter (29.5%) of the women's most recent pregnancy was unintended (Table 8.2).

Table 8.2. Reproductive characteristics of the respondents, Kersa district, eastern Ethiopia

Variables (n=1206)	**Frequency**	**Percentage**
Age of marriage		
<18 years	1033	85.7
≥18 years	173	14.3
Age at first pregnancy		

≤ 20 years	1072	88.9
> 20 years	134	11.1
Birth order		
≤3rd	632	52.4
>3rd	574	47.6
Birth outcome of the last child		
Live full term	1188	98.5
Live preterm	11	0.9
Stillbirth	7	0.6
Pregnancy experience		
Primigravida	204	16.9
Multigravida	1000	83.1
Delivery experience		
Primipara	223	18.5
Multipara	979	81.5
History of stillbirth		
No stillbirth	1119	92.8
Had stillbirth	87	7.2
History of abortion		
No history of abortion	1116	92.5
Had a history of abortion	90	7.5
History of infant death		
No history of infant death	962	79.8
Had a history of infant death	244	20.2
Pregnancy intention for last birth		
Intended	850	70.5
Unintended	356	29.5

8.4.3 Information and utilization of PNC

Around 251 (20.8%) of the women had heard about PNC, and of these majority 223 (88.8%) had heard from health care providers. Only 56 (5.7%) of the women had attended PNC after their previous birth. Less than one in thirteen (7.6%, 95% CI: 5.9%, 8.8%) of the reproductive-aged women reported having received PNC after their most recent birth. Out of these, only 12% received the first PNC within the critical first two days after delivery. The majority (54.3%) of the women had received PNC at government health centre and from nurse/midwives (67.4%). The major reason given for attending PNC was for immunization of the baby (51.1%) followed by attending due to the illness of the woman (30.4%) (Table 8.3).

Table 8.3. Postnatal care utilization among reproductive-aged women in Kersa district, in Ethiopia, 2017

Variable	Frequency	Percentage
Ever heard of PNC (n=1206)		
Yes	251	20.8

No	955	79.2
Source of information about PNC (n=251)		
Women's Development Army leader or members	2	0.8
Mass media (Radio/television)	20	8.0
Health care providers	223	88.8
Friends	5	2.0
Family/relatives	1	0.4
PNC use for previous births (n=984)		
Yes	56	5.7
No	928	94.3
PNC use for most recent birth (n=1206)		
Yes	92	7.6
No	1114	92.4
Professional who conducted the PNC (n=92)*		
Doctor	9	9.8
Health officer	5	5.4
Nurse/midwife	62	67.4
Health Extension Workers	23	25.0
Timing of the first PNC (n=92)		
Within 24 h	2	2.2
1-2 days	9	9.8
3-7 days	14	15.2
1-6 weeks	67	72.8
Place where women received PNC (n=92)		
Government hospital	14	15.2
Government health centre	50	54.3
Government health post	19	20.7
Private hospital/clinic	1	1.1
Home	8	8.7
Reason for PNC use (n=92)*		
Respondent was ill	28	30.4
Immunization for baby	47	51.1
Midwife told respondent	15	16.3
Wanted to start family planning	13	14.1
Delivered in a health facility	4	4.3

*Does not sum up to **total** due to multiple responses.

With regards to the frequency of PNC after the last birth, among women who attended PNC at least once 92 (7.6%), more than half (54.3%) of the women attended only once (Figure 8.1).

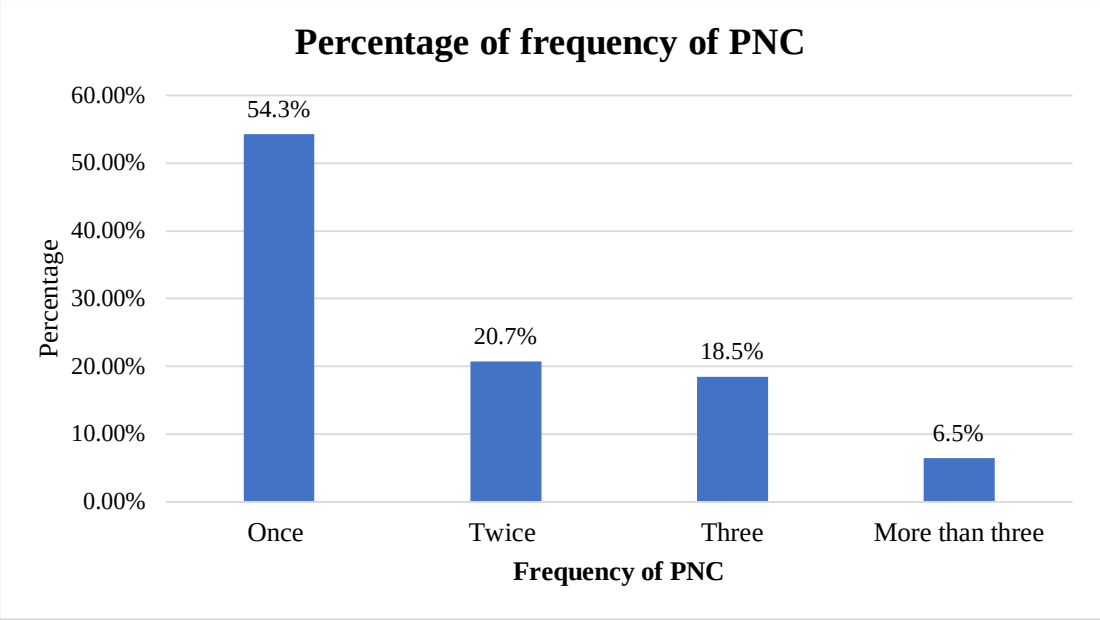

Figure 8.1. Number of PNC visits made by the women in Kersa district, in Ethiopia, 2017

A large majority (73.2%) of women with previous experience of PNC service re-attended the service for the succeeding most recent birth. Compared to women with no previous history of antenatal and delivery care attendance, a relatively higher proportion of women with previous exposure to the services attended PNC after the recent birth (Figure 8.2).

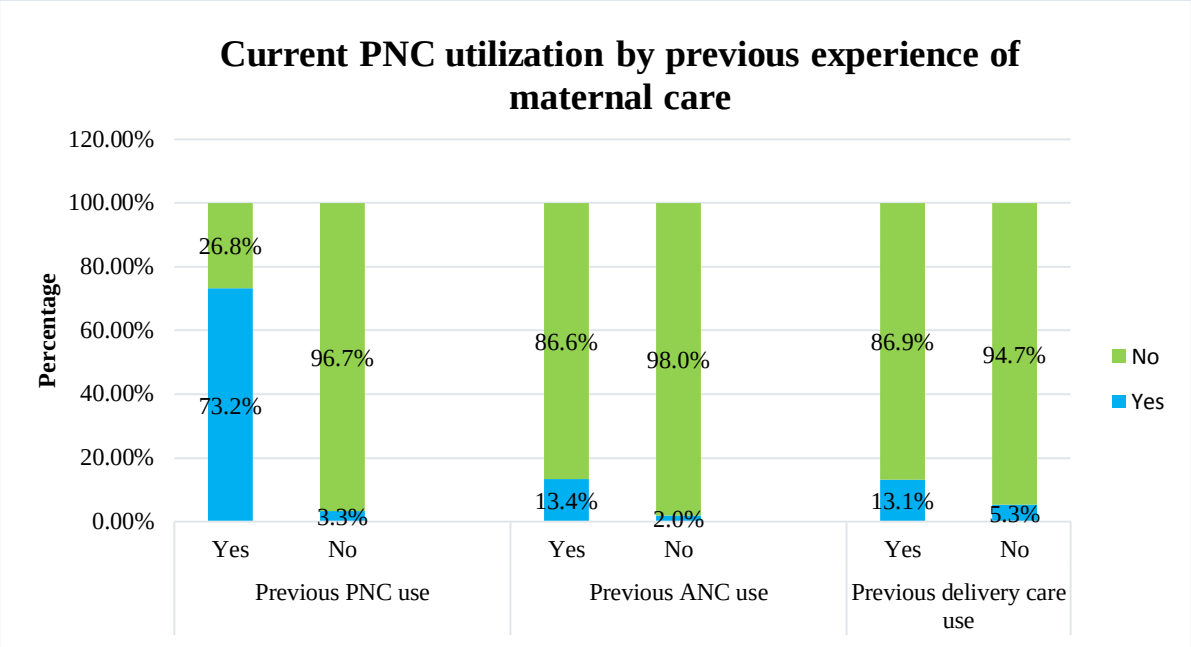

Figure 8.2. PNC utilization by previous exposure to maternal care among women in Kersa district, in Ethiopia, 2017

8.4.4 PNC service experience and postpartum complications

During the attendance of PNC, the women received immunization for their baby (45.7%), physical examination (43.5%), counseling on health (27.2%), family planning services (27.2%), breastfeeding education (21.7%) and antibiotics for illness (1.1%). Only 5.6% of the women reported having encountered a complication during the postnatal period, of which the majority (34.3%) had experienced severe postpartum hemorrhage followed by a severe headache (29.9%). Nearly three-quarters of the women who developed the complications were at home when they encountered the complications, and more than half of them had sought medical assistance for the complication. Approximately two-thirds of the participants had a plan to attend PNC for future births (Table 8.4).

Table 8.4. Type of PNC services and postpartum complications among women in Kersa district, in Ethiopia, 2017

Variable	Frequency	Percentage
Type of PNC service received (n=92)*		
Physical examination	40	43.5
Immunization of baby	42	45.7
Counselling on health	25	27.2
Family planning services	25	27.2
Breastfeeding education	20	21.7
Antibiotics treatment	1	1.1
Presence of postpartum complications (n=1206)		
Yes	67	5.6
No	1137	94.2
Don't know	2	0.2
Type of postpartum complications (n=67*)		
Severe bleeding	23	34.3
Severe headache	20	29.9
Severe weakness	18	26.9
High fever	13	19.4
Loss of consciousness	10	14.9
Convulsions	6	9.0
Abdominal pain	6	9.0
Difficulty breathing	6	9.0
Blurred vision	6	9.0
Swollen hands/face	5	7.5
Other complications	4	6.0
Place where the complication developed (n=67)		
Home	49	73.1
Health facility	17	25.4
On way to health facility	1	1.5
Sought assistance for the complication (n=67)		
Yes	36	53.7
No	31	46.3
Future wish to use PNC (n=1206)		
Yes	775	64.3
No	299	24.8

No plan for pregnancy/delivery	132	10.9

*Does not sum up to **total** due to multiple responses.

8.4.5 Factors associated with PNC utilization

In Model-I, variables such as receiving maternal health education (AOR, 2.16; 95% CI: 1.32, 3.55), husband's occupation (AOR, 1.94; 95% CI: 1.01, 3.70) and best friend's use of maternal care (AOR, 2.28; 95% CI: 1.36, 3.84) showed a statistical association. In Model-II, receiving maternal health education (AOR, 2.22; 95% CI: 1.35, 3.65), best friend's use of maternal care (AOR, 2.23; 95% CI: 1.32, 3.77) and head of the household (AOR, 0.26; 95% CI: 0.08, 0.90) showed a statistically significant association with PNC utilization. Controlling for all the variables in the final multivariate logistic regression model (Model-III), we examined the association between the predictor variables and PNC utilization. The predisposing factors such as receiving education about maternal health and best friend's use of maternal care remained significantly associated with PNC utilization.

Women who had received education about maternal health were more likely to utilize PNC (AOR, 2.32; 95% CI: 1.38, 3.89) relative to those who never received maternal health education. Women whose best friend utilized maternal care were more likely to use PNC (AOR, 2.41; 95% CI: 1.39, 4.19) than their counterparts. The head of the household was an enabling factor associated with PNC utilization. Women whose household was headed by partner or parents were less likely to utilize PNC (AOR, 0.24; 95% CI: 0.07, 0.81) than women whose household was headed by themselves. Experience of post-partum complications was the only need factor that significantly predicted PNC utilization. Women who had not experienced postpartum complications were less likely to attend PNC (AOR, 0.10; 95% CI: 0.05, 0.20) relative to women who experienced postpartum complications (Table 8.5).

Table 8.5. Factors associated with PNC utilization among reproductive-aged women in Kersa district, eastern Ethiopia, 2017 (n=1206)

Variables ***Predisposing factors***		**PNC use No (%)**	**Yes (%)**	**Unadjusted Odds Ratio: (95% CI)**	**Model-1 (AOR with 95% CI)**	**Model-II (AOR with 95% CI)**	**Model-III (AOR with 95% CI)**
Woman's education	Never attended	827(94.3)	50(5.7)	1	1	1	1
	Attended	287(87.2)	42(12.8)	2.42(1.57,3.73)	0.85(0.47,1.53)	0.83(0.46,1.50)	0.86(0.47, 1.57)
Husband's education	Never attended	566(94.8)	31(5.2)	1	1	1	1
	Attended	548(90.0)	61(10.0)	2.03(1.30,3.18)	1.19(0.70,2.04)	1.15(0.67,1.97)	1.14(0.65, 1.98)
Husband's occupation	Farming	1013(94.2)	62(5.8)	1	1	1	1
	Non farming job	101(77.1)	30(22.9)	4.85(2.99,7.86)	1.94(1.01,3.70)	1.47(0.66,3.27)	1.36(0.58, 3.16)
Education about maternal health	Yes	522(88.8)	66(11.2)	2.88(1.80,4.60)	2.16(1.32,3.55)	2.22(1.35,3.65)	**2.32(1.38, 3.89)***
	No	592(95.8)	26(4.2)	1	1	1	1
Age at marriage	Continuous	1114 (92.4)	92(7.6)	1.15(1.06,1.25)	1.07(0.98,1.17)	1.07(0.98,1.16)	1.08(0.99,1.19)
Mass media at household	Yes	373 (87.6)	53(12.4)	2.70(1.75,4.16)	1.36(0.81,2.92)	1.46(0.86,2.49)	1.51(0.87,2.62)
	No	741 (95.0)	39(5.0)	1	1	1	1
Telephone at household	Yes	274(85.6)	46(14.4)	3.07(1.99,4.72)	1.60(0.94,2.73)	1.55(0.90,2.66)	1.62(0.92,2.87)
	No	840(94.8)	46(5.2)	1	1	1	1
Living in model family	Yes	28(80.0)	7(20.0)	1	1	1	1
	No	1086 (92.7)	86 (7.3)	0.31(0.13,0.74)	0.66(0.26,1.71)	0.64(0.25,1.65)	0.72(0.27,1.90)
Best friend's use of maternal care	Yes	441(87.0)	66(13.0)	3.87 (2.42,6.20)	2.28(1.36,3.84)	2.23(1.32,3.77)	**2.41(1.39,4.19)***
	No	673 (96.3)	26 (3.7)	1	1	1	**1**
Enabling factors							
Residence	Rural	982(94.3)	59(5.7)	1		1	1
	Urban	132(80.0)	33(20.0)	4.16(2.62,6.61)		1.44(0.67,3.09)	1.40 (0.63,3.13)
Head of the household	Respondent	16(80.0)	4(20.0)	1		1	1
	Partner/parents	1098(92.6)	88(7.4)	0.32(0.11,0.98)		0.26(0.08,0.90)	**0.24(0.07,0.81)**
Need factors							
Post-partum complications	Yes	46(68.7)	21(31.3)	1			1
	No	1068 (93.8)	71(6.2)	0.15(0.08,0.25)			**0.10(0.05,0.20)***
Frequency of antenatal care visits	<4 visit	1028(93.1)	76(6.9)	1			1
	≥4 visit	86(84.3)	16(15.7)	2.52(1.41,4.51)			1.52(0.78,2.96)

Keys: **Model I** (Predisposing factors only), **Model II** (Predisposing and enabling factors), **Model III** (Predisposing, enabling and need factors). **AOR**: Adjusted Odds Ratio, **CI:** Confidence Interval. **Bold***: Indicate statistically significant variables.

8.5 Discussion

Only 7.6% of the study participants had received PNC after their most recent birth. Among the predisposing factors, receiving education about maternal health and a woman's best friend using any maternal care showed a statistically significant association with PNC utilization. The head of the household was the enabling factor that showed a statistically significant association with PNC utilization in the full multivariate logistic regression model; whilst the experience of postpartum complications was the sole need factor that predicted PNC utilization. The results add to current knowledge about maternal health service use in Ethiopia, where previous studies have largely focussed on antenatal and intrapartum care.

The level of PNC utilization was extremely low in the study area with less than one in every thirteen reproductive-aged women (7.6%) accessing PNC during the first six weeks after their most recent birth. The low level of PNC utilization in this study corroborates the idea that PNC is the weakest and most poorly recognized component of maternal health services in Africa (161, 169). The level observed in this study is lower than that of the national Demographic and Health Survey report of Ethiopia (19%) and the estimate for Oromia region (10.3%) in 2016 (44). This might be explained by the fact that the Demographic and Health survey included women with a live birth only, unlike the current study, which included women regardless of the birth outcome. The inclusion of women with birth outcomes such as stillbirth, might have increased the number of women who are expected to undertake PNC (the risk group), which could result in a reduced proportion of PNC utilization in this study. The lower estimate might also be due to omitting women who had received immediate post-delivery service that had been provided as an integral component of skilled delivery care; and the exclusion of postnatal women who did not complete the first six weeks after delivery at the time of the survey. However, the finding is almost in line with a study conducted in Gondar (6.3%) (307), and Tigray (5.3%) (143) in northern Ethiopia.

In the present study, the significant predisposing factors that were associated with PNC utilization were receiving education on maternal health and the woman's best friend use of maternal care. It is possible that PNC service use was higher due to the educational

programs encouraging a positive perception towards the service. This has practical program implication to improve women's level of awareness about PNC service through designing health education and promotion programs on maternal health, either in the community or a health facility setting. The positive influence of educating women about maternal health and women's better knowledge about PNC on improved uptake of the service was also established in other prior studies in Ethiopia (112, 316) and Malawi (317).

People often seek the opinions and advice of their peers or best friends regarding various decisions including whether to use health services (303). In this study, having a best friend who used maternal care had positively influenced the woman's use of PNC services. It was also evidenced in Timor-Leste that a woman's kinships, peers and close members of the family were reliable sources of information regarding pregnancy and delivery related issues (197). The result highlights that prevailing social networks play a key role in ameliorating or worsening of women's behavior towards PNC utilization. Women whose best friend in their network practice maternal care (including PNC) tend to be influenced to adopt the behavior and continue to use PNC services as they are more likely to imitate a friend's actions and decisions.

The results of this study indicate that the "*person who heads the household*" was the enabling factor associated with PNC utilization. Women living in a partner or parents-headed household have decreased odds of utilizing PNC services compared to women from female-headed households. Previous studies reported that living with parents and within a household headed by the partner (318, 319) were deterrent factors for women's access and utilization of maternal health services. Being the head of a household related to being autonomous in household matters, including making judicious reproductive health choices or visiting health facilities (320). The decision-making process and power dynamics within the household determine women's ability to access maternal care as the decision to use the service is not solely made by the women, but also under the influence of people who live with them, particularly the person who heads the household (173, 320, 321). The result underscores the need to strengthen interventions that aim to improve women's social status and decision-making ability through women's empowerment and capacity building initiatives.

The only significant need factor associated with PNC utilization was the experience of postpartum complications after the index birth. Women who had not experienced postpartum complications were less likely to attend PNC services compared with women who had experienced post-partum complications. A similar finding was reported in a review of studies on PNC utilization in African countries (184) which showed that the absence of obstetric problems during the post-partum period has a negative association with PNC utilization. The result may be explained by the fact that postpartum women who are healthy in the postnatal period could be less motivated to seek health care as they may not be aware of the need to visit health facilities for a medical check-up while being apparently healthy. On the other hand, the women with complications tended to have a high perceived susceptibility to experience adverse consequences of the health problem and were likely to engage in healthy practices (such as visiting health facilities) to receive treatment. Thus, the women attended the PNC service for treatment of the complications, rather than deliberately seeking care for a postnatal check-up and maintaining their well-being. Therefore, continued efforts should be made to mobilize women to seek and receive PNC before the occurrence of life-threatening postpartum complications.

The results of the study demonstrate that the uptake of PNC in the study community was far below the recommended level. Though there were substantial variations in the uptake of PNC services across different districts in Ethiopia, the estimate from the current study was still poor in comparison. Given that in Ethiopia a high proportion of women give birth at home; and women in rural or hard to reach communities have poor access to health facilities; a postnatal home visit by community health workers, such as Health Extension Workers, could be an alternative strategy to enhance women's service uptake. To improve PNC utilization through the postnatal home visit, collaborative community activities including notification of labour or birth to community health workers by family members, relatives or friends should be encouraged (322). Regarding the factors that influenced PNC utilization, receiving education on maternal health and best friend's use of maternal care are amenable factors that require program and policy intervention.

8.5.1 Strengths and limitations of the study

There are several strengths to this study. Collection of responses pertained only to the

three years preceding the survey minimized recall bias. We used a digital survey tool which minimized the occurrence of incomplete and missing data. We also maintained a reflective urban-rural mix of the sample population to increase the scope and relevance of the study. However, the results of our study should be interpreted considering the following limitations. Since the occurrence of both the outcome and the predictor variables were assessed cross-sectionally, the results should be cautiously interpreted regarding the causality of the factors. Use of self-reported responses to measure the study variables is also a weakness of the study. Despite the limitations, the findings of the study are relevant for informing the development of future programs and policy in the maternal health arena.

8.6 Conclusion

Postnatal care utilization remains very poor; less than one in thirteen reproductive-aged women received care after their most recent birth. Receiving education on maternal health, best friend's use of maternal care, head of the household, and experience of postpartum complications were significant predictors of PNC utilization. Women's peer education programs at the community level should be established to promote the utilization of PNC services. Interventions should be continued to mobilize women to seek and receive PNC as a matter of course, before the occurrence of life-threatening postpartum complications. Initiatives designed to empower and build the capacity of women should be further extended to the grassroots level. Sustained efforts should also be made to strengthen health education and promotion campaigns regarding maternal health and the value of maternal health services.

Chapter 9

Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study

9.1 Foreword

Delays in seeking, reaching, and receiving maternal health services are associated with high maternal mortality. The quantitative studies (Chapters 6 to 8) identified numerous factors that impede maternal health service utilization. However, these studies did not adequately reflect on the underlying contextual socio-cultural and community factors that contribute to delays in use of maternal health services. A further study that explores the societal and community determinants of maternal health service use was therefore required. The purpose of this chapter is to explore the reasons why women delay, and are delayed from, seeking and using maternal health services, in order to address Aim 6: To explore and identify factors that contribute to delayed use of maternal health services in Kersa.

This paper was accepted for publication in *Women and Birth.*
Tesfaye G, Chojenta C, Smith R, and Loxton D. Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study. *Women and Birth*, 2019

Abstract

Background: In Ethiopia, maternal health service utilization is still unacceptably low. The societal and cultural factors that constrain women from attending these services have not yet been sufficiently explored. Using qualitative methods, we aimed to explore the factors that delay maternal health service utilization in eastern Ethiopia.

Method: A total of 13 audio-recorded focus group discussions were conducted comprising a total of 88 participants. We conducted separate group discussions with reproductive-aged women, mothers-in-law, traditional birth attendants, husbands, and Health Extension Workers to capture their knowledge, practices, feelings, thoughts and attitudes towards maternal health service utilization. The recorded sessions were transcribed into Oromiffa and then translated into English for analysis.

Result: The study identified several factors that may delay maternal health service utilization. Factors were grouped using the Three Delays model as a framework. Low level of awareness regarding need, poor involvement of husband, perceived absence of health problems, social power, community misperceptions and cultural restrictions, negative attitudes towards male midwives, acceptance of traditional birth attendants and poor social networking were Delay One factors. Lack of physical accessibility and high transportation costs were categorized as Delay Two factors for skilled birth care attendance. Perceived or experienced poor quality of care were categorized as Delay Three factors for both skilled birth and postnatal care utilization.

Conclusion: Despite the ongoing government measures to improve maternal health service utilization in Ethiopia, numerous factors continue to contribute to delays in service use, which in turn contribute to high maternal mortality.

Keywords: Delay, Maternal health services, Prenatal care, Qualitative study, astern Ethiopia

9.2 Background

The magnitude of maternal mortality in Ethiopia (353 per 100,000 live births) is among the world's highest rates of maternal deaths (5). For every 1,000 live births in Ethiopia, about four women die during pregnancy, birth or within 42 days of birth. One explanation for high maternal death rates and poor health outcomes among women in Ethiopia is underutilization of maternal health services (antenatal, skilled birth and postnatal care) by a large proportion of women in the country (94, 292). Facility-based maternal health services are a proximate determinant of maternal morbidity and mortality (178) and proven health interventions for preventing maternal morbidity and mortality, mainly among women in resource-poor settings (49). Hence, increasing access to and utilization of skilled maternal care during the pregnancy, birth and postnatal period, especially within an enabling environment where there are sufficient or appropriate facilities, is crucial (26, 33, 34).

Antenatal care (ANC) plays a critical role in reducing maternal deaths by detecting and managing pregnancy-related problems early (50). However, not all causes of maternal death can be averted by ANC, especially those resulting from complications arising during birth and the immediate postpartum period (23). Hence, subsequent skilled birth and postnatal care (PNC) are essential in the continuum of maternal health service. Skilled birth care can avert most maternal deaths that occur around the time of birth through active management of the third stage of labour and administering uterotonic medicines to reduce hemorrhage (323). PNC has the potential to reduce maternal deaths through the identification and treatment of post-partum complications (53) and enable health workers to provide health promotion as well as preventive interventions (163).

The Ethiopian government is putting great efforts (programmatic and policy initiatives) in place to increase access to, and utilization of, maternal health services through the rapid expansion of primary health care facilities, mass training of midwives, and subsidization of maternal health service (48, 210). Consequently, there have been substantial improvements in the uptake of maternal health services over the past decade in Ethiopia (17, 95). However, the level of maternal health services utilization is still unacceptably low (44, 108, 132). Approximately 62% of pregnant women attended ANC at least once,

28% of the women gave birth with the assistance of skilled health personnel, and only 19% of women received care during the postnatal period (44). Moreover, the level of maternal health service utilization was much lower for rural women compared with urban women (44, 108, 275).

A multiplicity of factors has been identified as barriers to women's attendance of maternal health services in Ethiopia and are linked with factors that operate at different levels ranging from the individual to the facility level. These include personal factors such as poor awareness of the need for services, perception about the quality of services, women's decision-making autonomy and previous experiences of services (49, 196, 299). Identified community factors include the main source of earnings, cultural factors and road infrastructure (64, 95). Finally, facility-related factors identified include the quality of the service, the cost of clinical care, unavailability and poor linkage of the services (115, 150). Generally, in developing country settings the factors that delay the utilization of maternal health services are related to poor socioeconomic conditions, restrictive cultures and inadequate availability of health services (94).

Although many quantitative studies have been conducted, the underlying factors that delay women from attending maternal health services in Ethiopia have not yet been sufficiently explored using qualitative approaches. Most of the studies (49, 108, 110, 275) have also been limited to basic factors that are inherent at a personal or community level and have rarely explored the role societal or cultural factors play in women's decisions to seek, reach, and receive maternal health services. Given the rich socio-cultural, traditional and ethnic diversity of Ethiopia, it would be valuable to obtain an in-depth and broader understanding of contextualized factors that delay maternal health service utilization to inform the future development of locally appropriate interventions.

9.3 Methods

9.3.1 Research setting

The study was conducted in Kersa district, eastern Ethiopia. The data collection occurred

between June and August 2017. With an estimated 205,628 inhabitants, the district has thirty-eight sub-districts (*kebeles*) having three urban and thirty-five rural *kebeles*. More than ninety percent of the inhabitants live in rural areas. The proportion of the population who have physical access (within 5 km distance) to health services has reached 80%. In the district, there are seven health centres, thirty-four health posts, and eight private pharmacies (268). Health posts are staffed by Health Extension Workers. The Health Extension Workers not only provide preventive and health promotive services at the health post level but also train Women's Development Army leaders on various health issues including maternal health (59). The leaders hold regular meeting with their villagers (usually networked members) to transmit the health messages they gained from the Health Extension Workers' training (72). The health centres routinely provide the recommended packages of ANC, skilled birth care and PNC. Women initially attend their first ANC at a health centre and subsequently attend the rest of the visits in the health post. The government subsidizes maternal health services and in most public health centres the services are provided free of charge except for the cost of some medicines during ANC (210).

9.3.2 Study design

An interpretive qualitative study was conducted using focus group discussions (FGDs). The viewpoints of targeted participants were explored based on their lived experiences and perspectives to explore delaying factors for maternal health service utilization.

9.3.3 Target participants and sampling

In order to ensure a range of views were captured and to improve the reliability of the findings, we conducted the FGDs with varied types of participants. These participants included reproductive-aged women, mothers-in-law, traditional birth attendants, husbands, and Health Extension Workers. We selected the reproductive-aged women to learn more about their lived experience with the use of the services and the obstacles they might have faced whilst trying to use these services. We also included mothers-in-law who were directly involved in the process of decision making about whether the women used the

services or not during pregnancy, birth and the postpartum period. We included husbands because in Ethiopia they are the primary decision-makers on household matters, including whether or not their wives or children receive health care. Traditional birth attendants were also part of the study since they were specifically involved in the provision of birth assistance to women at the village level and they may play a pivotal role in either deterring or driving a woman's use of maternal health services. We also included Health Extension Workers as they are responsible for promoting and providing health services to women at the village level in the community.

With the assistance of village level facilitators and the Women's Development Army leaders, study participants were recruited using a purposive sampling technique from different *kebeles* in the study district. Voluntary research participants who were thought to play a role, who were knowledgeable, and who had lived experiences or were influential in relation to women's maternal health service utilization were identified and invited to take part in the group discussions. The facilitators recruited participants from different villages in each *kebele* to form a group. We only included participants who had lived in the district for at least six months, who had assumed no leadership role in the community and were familiar with the socio-cultural context of the area.

9.3.4 Data collection procedure

Separate focus groups were formed according to the type of target participants that were included in the study (Table 9.1). The start-up FGD guide was developed through a review of relevant literature and adapted to the research objective (110, 132, 217, 284). As the study progressed, the guiding questions were further refined after gaining insights from the first few discussions. Using the FGD guide, two moderators (male and female) who had experience in handling FGDs and were fluent in the local language conducted the group discussions. The focus groups averaged about 60 min (range = 40-80 minutes) and consisted of between six to ten participants per group. The group discussions were conducted in elementary schools, health posts, and health centres in the villages. The FGDs were moderated in Oromiffa and all were audio-recorded. Handwritten notes were also taken during each FGD. Information saturation was used to determine the number of FGDs per each target group.

Table 9.1. Description of the focus group participants

Target participants	Number of FGD from urban *kebeles*	Number of FGD from rural *kebeles*	Total FGDs	Total participants
Reproductive-aged women	1	2	3	20
Mothers-in-law	1	2	3	19
Traditional birth attendants	1	1	2	12
Husbands	1	2	3	24
Health Extension Workers	1	1	2	13
[Total]	**5**	**8**	**13**	**88**

9.3.5 Language translation

The FGDs were carried out in a setting where the lead author has a linguistic barrier and relied heavily on translators who are fluent in the local language to collect, transcribe, and translate the data. The moderators played an active role during the discussion sessions after they received training on the aims of the study and discussion guide. The language barrier of the lead author may have disadvantaged the study. For instance, the lead author was unable to pursue the whole sessions and couldn't inquire questions that might have emerged during these processes. Furthermore, evidence (324) shows that the use of translators for cross-cultural studies could have a negative impact in terms of translating participants' original words, depth of the transcribed contents, and the level of emphasis. Despite these challenges, the use of translators should not be considered as an obstacle to undertaking important studies across different languages.

9.3.6 Data quality

Orientation was provided to the moderators to highlight the purpose and procedure of the FGD including a briefing on the discussion guide. One male with a Master in Public Health and one female PhD student, both of whom were university academics having prior experience in handling qualitative data, and were bilingual, carried out the FGD. The lead

author followed the data collection process and held regular discussion meetings with the moderators to solve methodological challenges at field level. In order to avoid professional influence on the participants, the moderators built rapport by initiating the discussions through introduction of their affiliations and role. The audio recordings were transcribed into the local language (Oromiffa) and translated into English by the moderators. Samples of English transcripts were randomly double-checked with the local language transcripts and audio-recordings to validate linguistic consistency.

9.3.7 Data processing and analysis

The transcribed qualitative data were imported into the qualitative data analysis software (NVIVO version 11) (288) to organize the transcripts for coding and categorization. We followed a thematic analysis approach to analyse the data (289, 290). This analysis approach is a flexible method to allow for comparison within the transcribed texts and involves the categorization of the commonly recurring concepts onto themes. Coding was performed by identifying the concepts described in the transcriptions that were related to the research questions and aggregating them into themes. The coding was carried out in an iterative process and involved capturing and coding concepts from the transcript. Upon concluding the coding process, the codes were further categorized into themes. The emergent themes were reviewed and compared, and where necessary, re-classified into those with similar concepts. The transcripts were read once more in view of the emerging themes to ensure the thematic evidence was reflected in the transcript. The analysis process was guided and structured by the three delay model (84). Delay One factors are related to recognizing the need for, and the decision to seek health services, which occurs when a woman is at home and unable to make an early decision to use maternal health services. Delay Two factors are related to identifying and physically reaching the facility to receive the services in a timely manner. Delay Three factors are problems that hinder obtaining proper services at the health facility. The model is suitable for the analysis as it supports a critical and integrated analysis approach on how personal, societal and service side factors deter maternal health service utilization. We mapped the main factors that were drawn from the thematic analysis into the relevant category of the model. During the write up of the study findings, selected typical response quotations representing the verbal expression of the respondents were inserted into the descriptions to supplement the issues

being elaborated in the themes.

9.3.8 Rigour of the study

The rigour of the study was determined based on evaluative criteria used by previous studies (285-287). The criteria, such as dependability, confirmability, credibility, and transferability were addressed to assess the rigour of the study. Experienced moderators who were native speakers of the local language, who originated from the same socio-cultural background as the participants, and who were familiar with the local norms and traditions, conducted the FGDs. We are cognizant that due to the high social status of the moderators (being academic professionals, highly educated, and coming from urban area), there might exist power dynamics that could influence the relationship between the moderators and the participants. This relationship dynamics might have made some participants reluctant to voice their opinions on certain issues raised by the moderators. However, we attempted to minimize this power differential by recruiting participants via local facilitators, building rapport, using plain and simple language during the discussion, ensuring moderators' neutral position, creating more interactive discussions by proactively encouraging participants to share their thoughts, and conducting the discussions at a time and location convenient to participants. The interaction between the participants and the moderators was based on mutual trust and respect. The discussions took both an insider and outsider orientation, where participants share experiences or thoughts among themselves and sometimes address the moderators (325). Participants expressed their opinion without pressure and freely shared their lived experiences. The discussion was skillfully facilitated, and the moderators encouraged the group in a neutral manner while tracking the discussion within the intended topic. Consequently, even though most participants rate the services as important, they were able to express their opinion on important barriers that delay women's utilization of maternal health services. The participants also presented criticism about the general health care provision in government health facilities and lack of good governance of the local administration to the moderators, though this was not specifically asked for. As part of enhancing the dependability and confirmability of the study, the NVIVO software allowed auditing of the findings and helped minimize the possibility of focusing on irrelevant findings. Using the software, we ran queries and used referring back techniques to contextualize the transcripts so as to

discern whether the findings reflected in the themes were sufficiently supported by the raw data from different participant groups.

To enhance the credibility of the results, data were sourced from five different target groups to learn their perspectives. In each target group of participants, the number of FGDs were determined by information saturation. Triangulation of the information was carried out to ensure the completeness of the evidence and to increase the potential for an in-depth understanding of the problem. The coding process was reviewed by an expert in qualitative research and modifications were made.

With regards to transferability of the findings, the study was conducted in a largely rural context where there is a low literacy level, underdeveloped socio-economic conditions, poor accessibility to transport and road condition, and deeply rooted socio-cultural practices. The findings might be applicable to settings with similar socio-economic and cultural conditions in or beyond Ethiopia. However, in order for readers to make their own judgment about the transferability of the finding to a specific context, we provided descriptions of the context of the study and examples of raw data in the form of direct quotations.

9.4 Results

9.4.1 Participant characteristics

A total of thirteen FGDs were conducted with eighty-eight participants. The target participants comprised reproductive-aged women (n=20), mothers-in-law (n=19), traditional birth attendants (n=13), husbands (n=24) and Health Extension Workers (n=12). The majority of the participants were not literate, married and of Muslim faith. All the participants were members of the Oromo ethnic group (Table 2).

Table 9.2. Focus group participant characteristics

Variables	Target groups				
	Reproductive-aged women	Mothers-in-law	Traditional birth attendants	Husbands	Health Extension Workers
Age range (years)	21-44	40-80	28-72	42-70	21-37
Education					
Not literate	13	19	10	20	-
Elementary	3	-	2	3	-
Secondary (+)	4	-	-	1	13
Religion					
Muslim	18	16	12	24	9
Non-Muslim	2	3	-	-	4
Marital status					
Single	-	-	-	-	3
Married	19	16	12	24	10
Widowed or separated	1	3	-	-	-
Occupation					
Housewife	18	19	12	-	-
Farmer	-	-	-	22	-
Government employee or merchant	2	-	-	2	13

9.4.2 Overall perception about maternal health services

Most participants across the FGDs viewed a pregnant woman's attendance at ANC as positive. Participants described the importance of ANC to monitor the progress of the pregnancy and ensure the health of the woman and unborn child. Participants described typical ANC visits as including pregnant women being provided with a tablet (an iron supplement), having their blood pressure measured and obtaining vaccinations. However, to a large extent, participants were vague in terms of describing what they understood regarding anemia and blood pressure.

"….During pregnancy follow up, all of the necessary check-ups will be done...like blood pressure status, to know whether the woman is anemic or not…There is a tablet given that improves her anemia in the health facility and …start the tablet if there is a problem [anemia]…there is also vaccine given for mothers..." 52 year old mother-in-law

Whilst appreciating some aspects of skilled birth care at health facilities, participants perceived that attending the service is beneficial for the improvement of women's health. Moreover, participants on multiple occasions reported that skilled attendants provide medicine that facilitates labour. *"There is a medicine given for labouring women with glucose that help the labouring mother to facilitate, give strength and shorten the time of labour, so she will give birth immediately. If she was assisted at home, she could stay labouring up to 3 days"* 24 year old reproductive-aged woman

Furthermore, most participants shared the view that women should obtain check-ups after birth to maintain the health of the woman and her child, and to receive advice and counseling services.

"During check-up after birth, all mothers are advised about family planning, how to breastfeed, about their diet…checked for anemia… The advantage is for vaccination and checking about health status…" 50 year old husband

9.4.3 Delaying factors for maternal health service utilization

While participants positively described the importance of attending maternal health services, a number of factors relating to delays in obtaining care were described. Several interconnected themes were identified and emerged from the analysis to explain the factors that contribute for delay in seeking, reaching and receiving care during pregnancy, birth and the postnatal period (Table 3). The themes were predominantly categorized as Delay One while fewer factors related to Delay Two and Three.

Table 9.3. Summary of delaying factors for maternal health service utilization

Category	Factors	Phase of maternal care		
		ANC	SBC	PNC
Delay I	Low level of awareness	✓	✓	✓
	Social power	✓	✓	✓
	Poor involvement of husband	✓		
	Perceived absence of health problems	✓		✓
	Poor social networking	✓		
	Community misperceptions & cultural restrictions	✓	✓	✓
	Acceptance of traditional birth attendants		✓	
	Negative attitudes towards male midwives		✓	
Delay II	Lack of physical accessibility		✓	
	High transportation costs		✓	
Delay III	Perceived or experienced poor quality of care		✓	✓

Key:- ***ANC***: Antenatal care, ***PNC***: Postnatal care, ***SBC***: Skilled birth care

9.4.3.1 Delay One factors

Participants pointed out a range of factors that may limit women from seeking maternal health services in a timely manner. The common limiting factors for seeking maternal

health services reported by most of the participants included the following: low level of awareness, social power, poor involvement of husband, absence of health problems, poor social networking, community misperceptions and cultural restrictions, acceptance of traditional birth attendants, and negative attitudes towards male midwives.

9.4.3.1.1 Low level of knowledge regarding need

Even when maternal health services are available from health facilities in close proximity, women were reluctant to use the services due to having a limited understanding of the need to attend the care. One reason frequently voiced by the participants for non-attendance of ANC was a lack of awareness about the benefits of making ANC visits.

"…Most of the pregnant women do not know how they will benefit by visiting the health facility except for acquiring an illness or killing their precious time" 29 year old reproductive-aged woman

Indeed, participants partly attributed having poor knowledge about the service to the lack of means to obtain information about the importance of ANC.

"…When women are in their homes, only Health Extension Workers sometimes teach those women living in nearby villages. For those who are far from the health facility and the main road, there is no mechanism to get information about it…" 57 year old mother-in-law

Like ANC, having a poor understanding and low literacy status was one of the reasons suggested for low utilization of skilled birth care.

"…At this time some women still prefer to give birth at home…since most of our communities are not educated, they do not have awareness about the importance of giving birth at health facility…" 39 year old husband

Lack of knowledge regarding the benefits and importance of PNC was another reason indicated by many participants for poor attendance of PNC.

"*…I have given birth to my first child at home and didn't visit a health facility for check-up and nothing happened to the child. So, I don't want to waste my time by going there…"* 23 year old reproductive-aged woman

Furthermore, another participant attributed the lack of awareness about the advantage of PNC to the poor literacy status of women and the community members.

"*…Since the community members are uneducated, we have to convince them by repeatedly teaching and advising them about the care after birth"* 25 year old Health Extension Worker

9.4.3.1.2 Social power

Another important reason mentioned by many of the participants was the intergenerational influence on non-attendance at health services during pregnancy. Women were influenced by the practice of the older generation and they mostly learn about maternal health services from their mothers and grandmothers. Participants suggested that women became submissive in the face of social traditions and tend to follow the practices of elders.

"I heard that many women do not attend pregnancy care because their mothers and grandmothers didn't attend the care… they say 'what is different with us'…" 30 year reproductive-aged woman

Similarly, a Health Extension Worker stated that: *"…They tell us that their mothers and grandmothers had been giving birth at home and they had faced no problems…"* 30 year old Health Extension Worker

In addition, since most of their predecessors did not visit a health facility during the first 42 days after birth, the women tended to avoid attending PNC.

"..There is no trend to go to a health facility during the period after birth in our community starting from our grandmothers and our mothers" 34 year old reproductive-aged woman

9.4.3.1.3 Poor involvement of husband

It was apparent in this study that husbands have poor involvement in attendance of ANC with their wives. Husbands were unlikely to be involved in ANC due to locally held beliefs that men should have no role in the affairs of women. Husbands generally neither accompany their pregnant wives to the health facility nor support their idea to seek care during pregnancy.

"…Some of us fear or are shy to discuss maternal health issues such as pregnancy with our wives or health professionals and also we do not like to accompany them to the health facility…" 50 year old husband

Some participants also emphasized that husbands were not always supportive of their spouses' idea to attend pregnancy care while they are healthy.

"Husbands only bring their pregnant wives to a health facility after they developed complications ...They do not support their wives to go to a health facility if they are healthy." 25 year old Health Extension Worker

9.4.3.1.4 Perceived absence of health problems

The perceived absence of pregnancy-related problems was deemed to delay women from seeking maternal health services. Participants reported that women don't think it is vital to visit a health facility for care during pregnancy or after birth unless they encounter dangerous complications. They also suggested that husbands will only send their wife to a health facility after she has developed complications, and only during emergency conditions. Women themselves usually wait until they recognize that they have developed complications or become critically ill before attending ANC.

"Women and all other community members perceive that health service visits during pregnancy are only needed during illness or complications" 29 year old reproductive-aged woman

Similar to the situation with ANC, most postnatal women tend to remain at home until they experience complications and illness. Participants felt that there was no need to attend

care unless the woman or her child became sick after birth. Moreover, women and their families did not anticipate the unpredictable occurrence of obstetric complications and hence they are likely to advise against the use of the health facility for a check-up.

"…After giving birth it is not important for the woman to go a health facility or no need for check-up unless she faces health problems, because she is healthy, and the newborn is also fine..." 45 year old husband

A traditional birth attendant also stated that*: "…It's good for the woman to show up at a health centre after giving birth and check herself in, but she may say 'I am fine now, what do I do in the health centre'?"* 60 year old traditional birth attendant

9.4.3.1.5 Poor social networking

Participants felt that since most women do not regularly attend Women's Development Army meetings, they are thereby missing an opportunity to gain information about ANC. Information is shared initially from Health Extension Workers to Women's Development Army leaders, and the leaders inform all members of the network during regular meetings; subsequently, the women inform their peers in their village. Participants reported that the Women's Development Army was an effective method of providing information to modify behavior, but that non-attendance of the meetings was a major barrier.

"…Most of the women do not attend the group meeting in our village which is an important opportunity for obtaining information about maternal and health services like pregnancy follow up…" 24 year old reproductive-aged woman

9.4.3.1.6 Community misperceptions and cultural restrictions

A range of cultural norms and local behaviors negatively influenced women's use of maternal health services. Participants emphasized that women were unlikely to use ANC due to the deep-rooted cultural belief that pregnancy should be concealed from anyone unless it is physically noticeable, or during birth. Women tend to keep their pregnancy secret partly because of feelings of shame and fear of criticism or stigma from the villagers, which is particularly the case for primigravida mothers.

"…They keep it a secret about their pregnancy and they do not come for pregnancy follow up…they desire that no one hears about their pregnancy. No one! Except when it is visible, or she gives birth…" 37 year old Health Extension Worker

Participants reported that community members may also have culturally-related misconceptions that labour and birth are natural life events and God helps women throughout the childbearing process. The existing cultural norms may restrict women from using skilled birth service.

"….Since birth and reproduction are natural processes …there is no need to interfere with the natural process and go to another place during birth…..." 44 year old reproductive-aged woman

The participants also associated this belief with the community members' religious system.

"They tell us that it is only because of Allah's (God's) help that they gave birth to all their previous children…" 25 year old Health Extension Worker

There was also a concurrence of views among participants that the entrenched community misperceptions or superstitions were delaying women from accessing PNC in a timely way. There were persistent superstitions about attending care after birth. One such superstition is the evil eye: women's families do not want the parturient women to leave the home for two months after birth for fear of this.

"…The families do not want the women to go out of home before two months of birth for fear of the evil eye…" 29 year old reproductive-aged woman

Participants also reported a prevalent norm that women should stay home after giving birth due to fear of diseases that result from cold weather and being outside in the sun.

"When the women get out from home…they handle some objects and they put a metal object on their head or hair, fearing that they could get 'Michi' [disease condition when

they are outdoors]" 42 year old traditional birth attendant

9.4.3.1.7 Acceptance of local traditional birth attendants

For women, particularly in rural villages, it is still the norm to use birthing services provided by traditional birth attendants. Participants reported that some community members continue to prefer traditional birth attendants to assist women during labour and birth. Women feel that their privacy is protected when they give birth at home assisted by traditional birth attendants.

"…When they give birth at the health facility they are made to sleep on the couch and their legs are spread over the couch and they think their privacy is compromised… But, when they give birth at home with the assistance of traditional attendants they are attended privately by covering them with clothes and no one is allowed to enter into the room…" 31 year old Health Extension Worker

Participants criticized the traditional birth attendants for giving negative advice to the women about skilled birth care at the health facility and their reluctance to send the women to a health facility.

"*…There were traditional attendants in our community who gave false information about giving birth in the health facility to our women because they get money from them…"* 56 year old husband

9.4.3.1.8 Negative attitudes towards male midwives

The poor acceptance of male midwives by the community, including husbands, emerged as a critical delaying factor that may hinder women from attending skilled birth care. The women themselves also reported feeling ashamed of exposing their bodies to male midwives during labour and birth.

"Women are afraid of male birth attendants; there should be female attendants…even husbands don't want their wives' touched by a man…" 53 year old traditional birth attendant

Participants reported that it is against their religion and culture for a male person other than the husband to see the private parts of a female, so husbands also strongly opposed their wives giving birth at a facility with the assistance of male midwives.

"…We called the village representative to call the ambulance driver, but [name]'s husband did not agree to send his wife to the health centre because of male health workers. He warned his wife not to give birth at the health facility, and that if a male midwife touched or looked at her body he would divorce her, and he finally told his mother to attend her…'' 61 year old mother-in-law

9.4.3.2 Delay Two factors

The second maternal delay is often related to problems that occur due to the long distance to health facilities, unavailability of transportation, bad terrain or poor road conditions and associated costs. In this study, it was demonstrated that women were unable to physically reach the health facility early to receive skilled birth care due to high transportation costs and physical inaccessibility of the services.

9.4.3.2.1 High transportation costs

The monetary constraints associated with travelling to a health facility to attend maternal health services were reported to delay women from attending the services. For most of the women traveling to a higher-level facility (e.g. hospital) to attend skilled birth care entailed an out-of-pocket cost for transportation.

"…Since the health facility is far away from our home we spend a lot of money to transport the labouring woman and it affects our livelihood…" 36 year old husband

Furthermore, participants reported that there was no home transportation service in the area and hence the woman and her family could be exposed to extra out-of-pocket expenditure whilst traveling back home.

"…The ambulance that carries the labouring women to the health facility do not return

them back to their home…" 27 year old Health Extension Worker

9.4.3.2.2 Lack of physical accessibility

Most participants attributed lack of accessibility to the long distances, inadequacy of ambulance services, and poor road infrastructure for labouring women. Hence, it was not only a question of access to money that may hinder a woman from attending the care, but also access to the means of transport and proximity to health facilities. For most women, traveling to hospital or a higher-level facility located a long distance from their home was another delaying factor for skilled birth care use.

"…The mothers think that there is no reason to go to the health facility by travelling this far and again returning by walking all this long way…" 21 year old Health Extension Worker

Participants also persistently mentioned both lack of ambulances and absence of return ambulance transportation services.

"…We have ambulance scarcity; we need additional ambulance. There is only one ambulance for the entire district. This ambulance goes to many areas, and it's difficult to use the service" 60 year old traditional birth attendant

The road condition was another persistently raised issue by the participants. In some cases, there is no road at all from the woman's home to the facility, and in the other cases, there is no road that connects the woman's home with the main road. The situation is particularly grave in some remote rural villages of the district. The road condition became worse during the rainy season as the road gets muddy making transportation even more difficult.

"Since Bajaj [tricycle vehicle] and ambulances can't enter the village because of the difficult road for vehicles, it would be good if the roads connecting the village to the main road are constructed …" 58 year old mother-in-law

9.4.3.3 Delay three factors

The third maternal delay is mostly related to health system factors or problems in the service side. The most common problem mentioned across many of the focus groups regarding what delayed women from receiving skilled birth and postnatal care, was perceived or experienced poor quality of care at health facilities.

9.4.3.3.1 Perceived or experienced poor quality of care

Often the quality of health care is expressed in terms of structure, process, and outcome of the services. Poor functioning of the structure (e.g. poor setup and lack of supplies) and process (e.g. disrespectful staff and slow speed of services) components of quality of care were identified by most participants as delaying factors for service use. Poor quality of obstetric care was found to delay skilled birth care use and participants commonly mentioned mistreatment, disrespect and impolite approaches from health staff.

"My sister was referred to [name of nearby hospital] and during the night there were too many labouring mothers. During the night all the health workers went to sleep, and we were begging them to check the progress of the labour. But they refused… They then shouted at me and told me to bring the card… when I brought the card they went back to sleep …. She was bleeding on the coach, and they did nothing for her…" 25 year old Health Extension Worker

A mother-in-law noted the health staffs' impolite approach to women and lack of compassion.

"…There were some problems from the health workers side as they were not polite to a labouring woman and they do not give service with their full attention …" 50 year old mother-in-law

Participants also complained that there was limited availability of medical equipment and supplies such as drugs and medicines in health facilities to receive skilled birth care.

"…the health workers usually order us to buy drugs from a pharmacy located outside of

the facility with our own money...” 50 year old traditional birth attendant

Several FDGs discussed the longer clinic waiting times to receive care at the health facility as another delaying factor of skilled birth care utilization.

“Health workers don’t manage labouring woman as quickly as possible, instead they do their own activities and if you try to ask them…they say, ‘you can’t tell me what I do, this is my work not yours’….” 57 year old husband

As with the skilled birth service, for PNC there was also a lengthy clinic waiting time before receiving care. Additionally, even those mothers who visited the health facility for child vaccinations during the postnatal period had to return many times to obtain the service.

“…*Women in the village inform each other about the waiting time to receive the service after birth and discourage themselves from receiving the service*” 43 year old mother-in-law

9.5 Discussion

This study explored the key delaying factors for maternal health service utilization in eastern Ethiopia. Most participants had a positive view of the importance of maternal health services for maternal and child health. However, they also reported many factors that delay women from attending maternal health service. Factors that are related to the first delay were low level of awareness, poor involvement of husband, perceived absence of health problems, social power, poor social networks, community misperceptions, acceptance of traditional birth attendants, and negative attitudes towards male midwives. Factors related to the second delay were lack of physical accessibility and high transportation costs. Moreover, the only Delay Three factor that appeared to hinder maternal health service utilization was perceived or experienced poor quality of obstetric care at health facilities.

Despite reflecting a quite positive view towards maternal health services and generally

rating the services as important for women's health, participants were able to elicit a broad range of contextual barriers for service attendance. The participants expressed the problems far better than the importance of the service because they might feel the problems overshadow the advantages. The fact that participants were able to describe all the things that went wrong with women's utilization of the service supports the rigour of the study. This study allowed us to appreciate people's real-life experiences through uncovering their thoughts, behaviors, and values on maternal health service utilization. Generally, the delaying factors were related to the restrictive socio-cultural practices and belief systems, low social status of women, the state of poor community development and health care delivery system. These factors influenced the health behavior or practices of most women who live within this setting, particularly the uneducated. Women are direct bearers of the local cultural rituals and societal norms in the community and are vulnerable to the consequences of those practices. Cultural practices are prevalent around pregnancy and birth in Ethiopia, and therefore directly affect women's health and welfare (64).

The study demonstrated that poor awareness about the benefits of maternal health services delayed women from using the services. It was demonstrated that the Health Extension Workers are only educating the women nearby, through providing advice and information about maternal health services. Hence, women who had limited contact with the health service and those who lived far away from the health post had poor knowledge compared with the others. Participants further perceived that attending maternal health service is only necessary when there is an occurrence of obstetric complications and other morbid conditions, indicating a low perceived risk of complications. Even when there are problems, the woman and her family initially seek treatment from traditional birth attendants, and it is when the problem goes beyond traditional birth attendants' control that they opt for a health facility. The health facility is being sought as a last resort to receive treatment, and woman may die due to more advanced complications even before reaching there. The result of the study is similar to previous studies in Ethiopia (49, 110), which demonstrated that a lack of awareness about the benefits of maternal health services, and low perceived susceptibility to obstetric complications, were associated with poor utilization of the services. These findings highlight the importance of conducting more robust health promotion and communication campaigns to inform the benefits of the services to improve women's understanding.

The prevailing community misconceptions and cultural restrictions delayed women from seeking maternal health services early. Cultural restrictions such as the tradition of keeping pregnancy secret delayed initiation of ANC until the pregnancy is physically visible to others. In Ethiopia, pregnancy is usually not discussed openly until it is noticeable (63). These types of traditions are customary throughout the country, especially in rural areas (64). Moreover, it was revealed that the community's belief that labour and birth are natural processes was hindering women from attending skilled birth care. Again, the local traditional myths such as going out of the home during the postnatal period expose the woman to the evil eye and diseases are prevalent in the community, and consequently constrained women from using PNC during this critical period of motherhood. A review of literature in Ethiopia showed that deep-rooted community superstitions and misconceptions are huge challenges to maternal health service utilization (64). This illuminates the need to design and strengthen health education and behavioral change communication programs to avoid these misconceptions and cultural restrictions at the community level.

Furthermore, lack of husband's support during ANC was a significant delaying factor for women's attendance of the service. Husbands were found to be generally uninterested in accompanying their pregnant wife to a health facility, and hence women were discouraged from attending the service. Comparable findings were reported from other studies in Ethiopia (114, 275, 326) where partners' non-involvement in ANC has negatively influenced its use. Community mobilization activities targeting husbands should be conducted to change the husband's existing perceptions; furthermore, village-level husband's groups are important to facilitate spreading health messages.

The study identified social power as another Delay One factor for maternal health service utilization. The study revealed that the lessons and rules the women learn from their elders, especially from their mothers and grandmothers, negatively influenced women's decision to early seek maternal health services. As the women's understanding and practices were highly influenced by the social rules existing in their community, they were less likely to seek and use the services. A study in Indonesia (327) also showed that social power and belief systems have adversely affected women's use of maternal health services. Additionally, ANC uptake could be improved by stronger social networks within the Women's Development Army. This highlights that the wider social context within

which the women's decision occur plays a crucial role in shaping women's care-seeking behavior towards ANC.

The study also found that local traditional birth attendants were accepted as providers of birth care for labouring women and continued to provide the service in the community. Birth services from traditional birth attendants were highly valued by women and their families since they have been part of the community for a long time and already gained trust, are living in nearby villages, provide affordable services, have a long standing attachment with the community members and share similar cultural practices to the community. The finding underscores that the training and education of traditional birth attendants in the basic birth care skills should be further implemented to empower them to provide the service particularly for women in rural and hard-to-reach villages. Moreover, it has been shown that systematic integration of traditional birth attendants into the formal health care delivery system was effective in improving maternal health (156), and hence a strategic partnership between health professionals and traditional birth attendants should be established in communities like those we studied.

In contrast to traditional birth attendants, there is poor acceptance of male midwives or nurses as providers of birth care at health facilities by the women themselves, as well as their husbands and other community members. Male midwives were a strong disincentive for women to attend maternal health services, and women expressed that they were often afraid to expose their body to them as this is against the cultural societal norm.

Additionally, husbands did not want their spouses to be examined and attended by male caregivers. It was evidenced that especially for a typical Muslim woman in Ethiopia, there is a belief that no man other than the husband should see or touch her body, and this cultural or religious belief limits women from attending the service (64). Therefore, in Ethiopia, the pre-service health professionals' training policy should be revised and the enrolment of more female students to the midwifery field should be considered.

The findings of this study also demonstrated that a lack of physical accessibility to the service delayed women from attending skilled birth care. Despite the Ethiopian government's efforts to accelerate the improvement of accessibility of health facilities at *kebele* level, physical proximity of the health facility remains a significant factor that

delays women from reaching the health facility to use the service. The lack of physical accessibility is related to difficult terrain, poor road conditions, an inadequate number of ambulances to transport the labouring woman, and inadequate service from the ambulances. This study result is supported by previous studies in Ethiopia (27, 284) where skilled birth care utilization was associated with physical access to a health facility.

Ambulances were also not providing the urgently needed service to transport expectant mothers to and from a health facility. When women attempted to use health services, despite the remoteness of the health facility, they were exposed to high out-of-pocket expenses for travel. The present study revealed that the cost incurred during transportation to and from a health facility was another major constraint to attend skilled birth care. The influence of financial expenditure on woman's utilization of skilled birth care has been documented elsewhere (27). The Ethiopian government has made important initiatives to reduce costs, but there are still a number of hidden costs that are prohibitive (e.g. cost of a return trip from health facility).

The quality of obstetric services is a growing concern and among the main bottlenecks for maternal health service utilization in Ethiopia (64, 94). In this study, participants criticized mistreatment by health staff, limited availability of medical equipment and supplies, unclean facilities and lengthy clinic waiting hours as important delaying factors for skilled birth care and PNC utilization. A review of studies on 'third delay' indicated that the provision of inadequate or low quality care at health facilities was a major barrier for obstetric care use in developing countries (328). This signifies that improving the quality of obstetric care at health facilities is a crucial approach to increase the uptake of skilled birth care and PNC.

The study provides useful insights about service attendance that can inform program development. The study captured real life stories that occur at the ground level, and the evidence is strong enough to be adapted during program design and implementation that is sensitive to the social context. The findings also highlight the importance of addressing culturally embedded barriers to service access. In addition, filling the information gap within the community and infrastructure establishment needs to be accelerated. Policy initiatives and concerted government actions are needed to dismantle the numerous factors that delay access to and utilization of maternal health services, including those factors that

exist within the health care system.

9.5.1 Strengths and limitations

The limitations of the study must be acknowledged. Like all qualitative studies, the result of the present study might not be generalizable to the whole population and across other settings with different socio-cultural, economic and geographical contexts. By recruiting and including voluntary participants in the study, it is possible that potential respondents who prefer not to participate might have important views that are different from those who volunteered to participate. The use of the Three Delay model as an analytical framework for the study not only floated some factors from the model's predefined categories but also created a classification of factors that may not perfectly fit within a specific category. Another potential limitation is that there might be a loss of information during the translation of the transcripts from the local language to English, although the translations were performed by the moderators who are proficient in both languages and sections of the transcripts were double-checked for consistency. Nonetheless, the overall validity of the study findings is less likely to be affected by the inherent limitations. The study also has several important strengths. We included multiple target groups of participants in this study to capture a range of pertinent views, which increases the richness of the data.

Recruitment of respondents who live in different villages of both urban and rural areas enabled us to capture broader and contextually relevant factors affecting the use of maternal health services. We attempted to minimize the possibility of social desirability bias through the exclusion of those who assume leadership positions in the community and used indirect questioning during the discussion.

9.6 Conclusion

Despite participants' positive views regarding the importance of maternal health service utilization, there were many factors that delay women from utilizing the services. Low levels of awareness regarding need; poor involvement of husband; absence of health problems; social power; poor social networking; community misperceptions and cultural

restrictions; entrenched use of traditional birth attendants; and negative attitudes towards male midwives were contributing to the first delay. Lack of physical accessibility and high transportation costs were related to the second delay. The third delay was attributed to the poor quality of obstetric services at health facilities. Community-based systematic and culturally sensitive peer education programs should be implemented to improve the perception of the less literate and rural women, increase risk awareness of women and families about obstetric complications, and abolish restrictive cultural practices, thereby facilitating and encouraging optimal service use. More efforts are required to improve male involvement in ANC. Designing pragmatic and integrated strategies to improve the quality of obstetric services at health facilities should be a priority area of intervention.

Improving the functionality of ambulance services and particularly provision of return transportation services is also recommended. Enrolling more female students in professional midwifery training is an essential step. Lastly, increasing capacity at health posts to provide birth care; and involving community-based trained traditional birth attendants in providing birth care, especially to reach women in rural and remote communities, are important. For these interventions to be successful, and to be adapted and utilized by women at the village level, women and community members should receive appropriate communications through the Women's Development Army network and men's social groups.

Chapter 10

Discussion

In this thesis, empirical evidence on maternal mortality and maternal health service utilization in Ethiopia was provided. Maternal mortality was explored using secondary surveillance data while maternal health service utilization was assessed using community-based quantitative and qualitative data. This chapter presents the overall findings of the thesis by considering the research findings and existing literature; interpreting and giving meaning to these findings; before discussing the implications for future research and program design. The chapter begins by providing an overview of the problems, research approaches, and main findings. The main body of the chapter then relates the main findings to the research questions and existing literature, outlines the strengths and limitations of the study, and discusses the relevance of the study findings for future research and policy development.

10.1 Overview of the research problem, research approach, and main findings

This study addresses a public health issue that is of fundamental importance in Ethiopia. The magnitude of maternal mortality in Ethiopia is among the highest in the world (5, 44). It is one of the greatest burdens on the health care system, and one of the greatest challenges facing the country's public health sector. Maternal health service utilization is the best strategy for preventing maternal mortality, particularly in settings where the social status of women is low (49). Although studies report a high uptake in some districts (49, 110-112, 115), in general, maternal health service utilization in Ethiopia is below the recommended level (44, 96). As part of the ongoing efforts of the government to expand health coverage, maternal health services are now also being made available to women in peripheral parts of Ethiopia, although the quality of these services is questionable (150, 175, 329). Investigating maternal mortality and current maternal health service utilization

clarifies how to best design services to prevent maternal mortality in Ethiopia. Moreover, given that there are differences in geographical, socio-economic, and cultural factors between regions, an empirical understanding of the local burden of maternal mortality and the context-specific drivers of maternal health service utilization is needed. There is also a paucity of information regarding the local burden of maternal mortality and contextualized factors for maternal health service utilization in Kersa district, eastern Ethiopia.

The national level and predictors of delayed ANC use were determined using systematic review and meta-analyses. The level of maternal mortality among reproductive-aged women was determined using secondary surveillance data from the Kersa HDSS (Chapter 5). A community survey that aimed to assess the level of maternal health service utilization, and the factors associated with this utilization was conducted, in the same community. Moreover, the delaying factors for maternal health service utilization were assessed using focus group discussions.

The findings indicated a maternal mortality ratio of 324 per 100,000 live births among reproductive-aged women in the Kersa HDSS during the period from 2008 to 2014. This is consistent with the national level but lower than the sub-Saharan average (5). The subsequent community survey indicated that maternal health service utilization was as low as 53.5% for ANC, 30.1% for skilled delivery care, and 7.6% for PNC. Informed by the Andersen and Newman behavioral model of health care utilization (74, 75), this study identified several predisposing, enabling, and need factors associated with underutilization of maternal health services in the study community. The most influential predisposing factors were maternal education; the presence of an educated family member; previous use of care; best friend's use of maternal care; and receiving education on maternal health. The enabling factors included place of residence; wealth index; husband's attitude; and woman being head of the household. Health Extension Worker's home visits; perceived importance of care; and awareness and experience of obstetric complications were among the important need factors. The qualitative study also identified a range of contextual delaying factors for maternal health service utilization. These factors were generally linked to restrictive socio-cultural practices, the low social status of women, and underdeveloped community and health infrastructures.

10.2 Maternal mortality and maternal health care utilization

This study found high rates of maternal mortality among reproductive-aged women in Kersa. The most common cause of maternal death was post-partum hemorrhage, followed by hypertensive disorders of pregnancy, which reflects findings of a community-based study in northern Ethiopia (227). Of those who died due to maternal causes, only one in four accessed ANC during their pregnancies, and more than two-thirds delivered at home assisted by traditional birth attendants. Although our study did not allow us to assess the underlying risk factors for maternal death due to HDSS data limitations, we speculate from the available data that poor utilization of maternal health services could be a major contributing risk factor for the higher rates of maternal deaths in the study district.

As antenatal care is the foundation for the rest of maternal care in the safe motherhood continuum (49, 93, 110, 199), poor uptake of this service is likely to predict poor uptake of the remaining services along the continuum. The findings of our community survey showed that ANC utilization in Kersa (53.6%) was low compared to most other studies (81-88%) in Ethiopia (108, 110, 111, 114). Despite the WHO recommending all pregnant women attend a minimum of four ANC visits during their pregnancies; our findings from the community survey revealed that only 15.3% of pregnant women in Kersa attended four or more ANC visits. The utilization rate of four or more ANC visits was also found to be low in this study compared to the national rate reported by the Ethiopian Demographic and Health Survey (44), which found that 32% of women attended four or more ANC check-ups. This finding highlights that access to ANC services is inadequate to achieve the desired aims of service utilization at the community level. Intervention efforts should move beyond addressing coverage of maternal health services to incorporate actions that ensure regular use of these services once women are enrolled. Furthermore, the results of the present study indicated that the rate of ANC initiation within the first trimester was particularly low, at 32.6%. The systematic review of Ethiopian studies found similar results, as more than two-thirds of pregnant women commenced antenatal care consultations after their first trimester (refer to Chapter 3). Pregnant women delay their first ANC consultation not only because they are unaware of the benefits of early attendance, but also because of socio-cultural barriers (64, 208). Delays are also common in general health service seeking in rural Ethiopian communities, due to deeply rooted

cultural norms and traditional misperceptions. The Three Delays model argues that treatment-seeking behavior begins at the home and village level (84). However, personal and community barriers also contribute to women's resistance to seeking care before the occurrence of advanced complications (330, 331).

Since intrapartum obstetric complications are unpredictable, giving birth under the attendance of skilled personnel is crucial for safeguarding maternal life (129). Provision of skilled delivery care is therefore considered key to maternal survival (6). A small proportion of women in this study (30.8%) delivered with the assistance of skilled health personnel. This rate was lower than those reported in some Ethiopian studies (40.0% (142) and 48.0% (196)), but higher than those reported in other Ethiopian studies (5.0% (143), 7.0% (210) and 12.0% (119)). The rate, however, is in line with both a study conducted in southern Ethiopia (31%) (213), and the national survey report (28%) (44).

Maternal deaths occurring during the postnatal period can be prevented through postnatal care. In this study, a small proportion (7.6%) of women attended care during the postnatal period. This was consistent with previous Ethiopian studies, where utilization rates were similarly low, at 5.0% (143) and 6.0% (307). However, another study conducted in northern Ethiopia reported a much higher proportion (67.0%) of PNC utilization (173). One possible reason for the higher estimate in the later study could be that it was conducted near to a big city with relatively good access to health facilities. Along the continuum of maternal care, the utilization rate for PNC was substantially lower than that for ANC, indicating difficulties in retaining and successfully referring women to subsequent services. Given that in Ethiopia most women give birth at home and women in rural or remote communities have poor access to health care facilities, postnatal home visitation by health workers could be an important intervention to enhance PNC utilization.

10.3 Factors associated with maternal health service utilization

The present study examined factors associated with maternal health service utilization using bivariate and multivariate logistic regression analyses (Chapter 6 to Chapter 8). The results indicated that there were a range of contextual factors that influence antenatal,

skilled delivery, and postnatal care utilization. In addition, the qualitative study highlighted key barriers that delay maternal health service utilization in the Kersa district of eastern Ethiopia (See Chapter 9). The study pinpointed factors that consistently influence three components of maternal health service: antenatal, skilled delivery, and postnatal care. These included best friend's use of maternal care from the quantitative study; as well as the level of awareness, social power, and restrictiveness of culture from the qualitative study. The following section thematically organizes the factors associated with maternal health service utilization from the findings of the quantitative and qualitative studies with a focus on modifiable factors. Using the Andersen-Newman behavioral model (74, 75), the factors are grouped into predisposing, enabling and need factors.

10.3.1 Predisposing factors

Predisposing factors are demographic and socio-cultural characteristics that exist prior to women developing health conditions. These factors include education; previous experience of care; best friend's use of maternal care; maternal health education and awareness of the benefits of care; social power and culture; and the poor acceptance of male care providers.

10.3.1.1 Education

The findings showed that educated women have increased odds of ANC utilization compared to uneducated women (Chapter 6). The positive effect of education on ANC use was well evidenced in previous studies in Ethiopia (111, 172, 181). More often, educated women are well informed, empowered, and economically able to make decisions on the use of health services during pregnancy. Furthermore, this study highlighted that women who have educated family members in their homes have higher odds of using skilled delivery care than those who do not (Chapter 7). Educated family members might teach or transmit knowledge gained from formal education directly to women or help women to make positive decisions about birth practices. People can be influenced by individuals who surround them, such as family members or friends. If these influencers prefer facility-based delivery services, then women might use these services even if they do not have

positive attitudes towards them. This finding broadly supports those of another study conducted in eastern Ethiopia (108), in which it was found that family members' education positively predicted women's skilled delivery care utilization in a health institution.

10.3.1.2 Previous experience of care and quality of health services

The findings show that women who have previous experience of using maternal care had higher odds of using maternal care for their subsequent pregnancies and births (Chapter 6 and Chapter 7). Women with at least one ANC experience in a previous pregnancy were significantly more likely to use antenatal care in a more recent pregnancy. Similarly, women who had used skilled delivery care in a previous birth were more likely to use this service in a more recent birth. Those women who obtained information, advice, or knowledge from a service provider during their contact with the health facility are more likely to seek out health services during their next pregnancy or birth, thus bringing about behavioral change. Women who had positive experiences with health facilities during their previous service contacts tended to use the same services for subsequent pregnancies or births. The qualitative results also supported this finding, as perceived or experienced poor quality of care at health facilities delayed women from receiving services (Chapter 9). Women who particularly experienced disrespectful and abusive behaviors from health workers are less likely to use the service for their future pregnancy or birth as they fear experiencing the same treatment upon their return. Disrespectful maternity care including physical and verbal abuse; poor privacy and confidentiality; or neglect and abandonment negatively impacts on women's maternal health care experience (quality of care) and maternal health outcomes (99). Women tend to avoid using maternal care services if they experience poor obstetric service provision or facilities are inadequate (27). On the other hand, women may prefer to give birth at home assisted by traditional birth attendants if they did not encounter problems during previous home deliveries (197). Additionally, in this study setting, giving birth at home assisted by traditional birth attendants or relatives is an accepted traditional norm.

The study findings also showed links between the phases of maternal health services, as use of ANC was associated with skilled delivery attendance (Chapter 7). A strong relationship between ANC use and skilled delivery attendance has also been reported in the literature (49, 115, 119, 181). It has been established that ANC is an entry service for

skilled delivery care (332). Women who used ANC had frequent interactions with health care providers and became familiar with health care settings and health care professionals, which encouraged them to obtain skilled assistance during delivery (199). Women who use antenatal care also receive counseling and education about both the importance of care during delivery and warning signs of pregnancy-related complications, which might further encourage them to use delivery care service (93, 132, 218). These results highlight that strategies to improve ANC utilization could be broadened to include other maternal health services, such as skilled delivery care, resulting in substantial cost savings. Nevertheless, the positive effect of previous maternal care experience on the future use of maternal care, and the prediction of antenatal care use on skilled delivery care use might also be due to the confounding effect of accessibility and availability of services. The women who previously utilized maternal care or attended ANC that subsequently use the same or different maternal care might already have better accessibility to the service than women who do not use the services. Additionally, previous pregnancies or births are important as they set up behaviors which encourage women to use (or not use) health care services for subsequent births.

10.3.1.3 Best friend's use of maternal care

According to McPherson (333), people naturally interact and form networks with others who are like them. As such, there is strong homogeneity among personal networks regarding variables including behavior, gender, ethnicity, race, and socio-economic status. This homogeneity has powerful implications on the advice or messages people receive, their attitudes and practices, and their interpersonal relationships. In this study, having a best friend who used maternal care positively predicted uptake of all three components of maternal health services (Chapter 6 to Chapter 8). We found that women who had a best friend who used maternal care were more likely to use ANC, skilled delivery care, and PNC. Social networks play a substantial role in contributing to knowledge and behavioural change, as they facilitate diffusion of health messages throughout the networked members (74, 300, 303). Social networks consist of families, friends, and peer groups and include opinion leaders who have the power to positively influence several others in the networks to become aware of, and adopt, good health behaviours (300-303). The qualitative arm of the study also revealed that poor social networking hinders ANC utilization, although this was not the case for skilled delivery and postnatal care utilization; previous studies in

developing countries have found similar results (197, 300). Apart from having best friends who use maternal care, women who discussed pregnancy-related issues with friends could have been exposed to persuasive interpersonal communication, including advice and information about how to access and utilize maternal health services at health facilities, and the benefits of doing so. The reverse might also be true if friends within the woman's network hold negative opinions about the use of maternal health services, the woman is most likely to avoid the use of the services. Most commonly, women seek information from their best friends when they want to use health services but do not know where or how to access them, giving their friends the opportunity to persuade them to use these services. In a study in Ghana, researchers found that women who reported having discussions with friends about obstetric matters were more likely to utilize skilled delivery care than women who discussed these issues with other people (334).

Maternal health education about, and awareness of, the benefit of attending care

The quantitative findings indicated that receiving education about maternal health was positively associated with women's use of skilled delivery and postnatal care (Chapter 7 and Chapter 8). Educating women on maternal health issues, and equipping them with knowledge about both the benefits of attending maternal care and the danger signs of grave obstetric complications, can improve their maternal health knowledge (311). Women with higher levels of maternal health knowledge are more motivated and better able to make decisions about seeking and using maternal health services (330). These findings were supported by the qualitative study, where a lack of knowledge about the need to attend care is found to be a barrier to maternal health service utilization from pregnancy through to post-delivery (Chapter 9). Women with low levels of awareness about the need to obtain maternal care may not understand the severity of complications that might arise during the pregnancy, delivery, and postnatal periods. In line with these results, previous studies have demonstrated that awareness of the importance of maternal care was significantly associated with increased uptake of services (117, 196, 211).

Similarly, the quantitative findings demonstrated that women who perceive that attending ANC is important were more likely to attend the care than women who perceive it is not important (Chapter 6). Although awareness is necessary, it may not be sufficient to ensure service use, suggesting the need to implement further behavioral change programs regarding maternal health.

10.3.1.4 Social power and culture

Both social power and cultural restrictions were barriers to the uptake of all the three components of maternal health services (antenatal, skilled delivery, and postnatal care) (Chapter 9). Older people might influence women to follow in their footsteps and forego health care during pregnancy, birth, and post-delivery in several ways. First, women tend to adopt similar behaviors to their mothers and grandmothers, and if a woman breaches this cultural rule to go to a health care facility, she faces disrespect and also brings shame on her family (335, 336). Second, women tend to obey the advice and restrictive practices of older generations and thus resist change in terms of receiving reproductive health services (337). Third, in Africa, there are widespread cultural and spiritual beliefs relating to pregnancy and birth; these strongly promote concealment of pregnancy status and encourage belief in help from supernatural powers during birth, which is seen as a natural event (338). Therefore, women tend to avoid attending ANC whilst pregnant (particularly during the initial period, when their pregnancy status has not been revealed) and rely on supernatural help during labour or birth. Additionally, PNC utilization was low because it might contradict the traditional customs of confinement at home. There is a deep-rooted belief that if a woman leaves her home in the immediate postnatal period, she may be exposed to evil spirits and develop diseases, and this belief prevents women from attending PNC services. As a result, these factors need to be considered during program design and implementation.

10.3.1.5 Poor acceptance of male care providers

Local perceptions about male care providers at health facilities constituted an emerging concern that constrained skilled delivery care utilization (Chapter 9). According to this study, this is in part because women were afraid of exposing or unwilling to expose their bodies to male providers at health facilities. However, it is also because husbands and family members did not wish women to be attended to by male care providers during birth. Similar findings were reported in a qualitative study from southern Ethiopia (330), in which women and their families preferred female delivery attendants over male delivery attendants during birth. In addition, the qualitative study found that traditional birth attendants were highly preferred providers of delivery care for women in the Kersa

district, and often families or relatives will call these providers for assistance during home deliveries in the first instance. Women are at a crossroads when it comes to attending skilled delivery care at health facilities, where the push factor is misperceiving the male care provider in health facilities and the pull factor is the value of traditional birth attendants as considered by the community; the women seemed to prefer the latter.

10.3.2 Enabling factors

Enabling factors relate to the means of obtaining health care services and determine the ability of individuals to use these services. These factors include place of residence, wealth index, husband's attitudes and women's decision-making power, and physical accessibility.

10.3.2.1 Place of residence

Women residing in urban areas have more opportunities to use skilled delivery care services than women living in rural areas (Chapter 7). Living in urban areas provides women with access to health care infrastructure and expedites travel to health care facilities. In addition, women living in urban areas are more exposed to electronic and mass media, enabling them to obtain information about health issues, including the importance of health care utilization. Indeed, in one Ethiopian study, it was found that differential exposure to mass media explained the disparities in the use of skilled delivery care between urban and rural women (339). In addition, rural health facilities tend to be understaffed and underequipped with medical supplies, resulting in a compromised quality of care (340). This may deter women from using delivery care in rural settings, and lead them to seek care from unprofessional attendants outside health facilities; indeed, several Ethiopian studies have established that rural women are less likely to use skilled delivery care than urban women (115, 140, 213, 307).

10.3.2.2 Wealth status

The economic status of a household affects the ability of its women to cover the costs of health care, food, and travel services. In this study, wealth index was associated with ANC utilization, as women in the fourth wealth quintile were more likely to use health care

services than women in the lowest wealth quintiles (Chapter 6). This is in accordance with a previous study (111), which showed that women in higher wealth quintiles had higher odds of ANC attendance than women in lower wealth quintiles. It is likely that women from wealthier households attend more ANC services because they can afford the costs associated with these services more readily than others. Although the quantitative study did not find a significant association between wealth index and skilled delivery care, it was revealed in the qualitative study that the inability of women and their families to afford high transportation costs prevented women from attending skilled delivery care at health facilities (Chapter 9). Community-based financing systems should be strengthened, especially for the rural poor, to enable women to enjoy maternal health services with an affordable minimum cost contribution. It was further shown that being a member of a community-based insurance scheme has a positive association with maternal health service utilization (341).

10.3.2.3 Husband's attitude and women's decision-making power

Promotion of male involvement during pregnancy, birth and the postpartum period is recommended to enhance and support improved utilization of maternal health services. Husbands play a substantial role in their wives use of maternal health services (342). In this study, women whose husbands had negative or neutral attitudes towards ANC were less likely to use this service than women whose husbands had positive attitudes towards ANC (Chapter 6). This was corroborated by the qualitative findings, in which husbands' lack of involvement emerged as an important delay factor for ANC utilization (Chapter 9). The effect of husbands' attitudes on their wives' ANC utilization has been well-documented in other studies conducted in different parts of the country (114, 305). In Ethiopia, where there is a predominantly patriarchal family system (204), husbands are the autonomous decision-makers in most household matters, including allowing their wives or children to attend health facilities and receive health care services (64, 205). As such, women often lack access to and control over resources, further reducing their ability to use health care services. This observation is further strengthened by the finding that women who lived in households headed by their partner or parents had lower odds of attending four or more ANC consultations. The same finding holds true for PNC utilization, where women from parents or partner headed families were less likely to attend the service than women from female-headed families. Therefore, intervention efforts aimed at improving

maternal health service utilization in Ethiopia should include programs that mitigate husbands' lack of involvement, change husbands' attitudes towards ANC, and improve women's decision-making power.

10.3.2.4 Lack of physical accessibility

The Ethiopian government has made great strides in improving the physical accessibility of health services at the community level by constructing health facilities, training large volumes of professionals to staff these facilities (48, 134), and allocating ambulances to rural districts to provide transportation during emergencies (including obstetric emergencies) (134). However, some accessibility issues remain unresolved and continue to prevent women in Ethiopia from attending skilled delivery care. These included the long distances between women's homes and health facilities, the absence or poor condition of roads, and the lack of ambulance transportation services to take women home post-delivery (Chapter 9). These findings are consistent with those of another Ethiopian study, in which it was shown that a lack of ambulance transportation services to take women home posed a huge problem to women attending skilled health services(150).

10.3.3 Need factors

Need factors reflect perceived health status and are the most immediate determinants of health care service use. These factors include Health Extension Worker's home visits, awareness of obstetric complications, and pregnancy intentions.

10.3.3.1 Health Extension Workers home visits

Since its inception, the Health Extension Program in Ethiopia has been successful in bringing about health behavior change in rural communities and underserved populations in Ethiopia (17, 71, 73, 95). Improving maternal health service utilization is one important goal of the Health Extension Program (95). Health Extension Workers provide health messages related to maternal health through home visits, and mass education through outreach campaigns and community gatherings (71). The current study found that women

who received Health Extension Workers' home visits were more likely to attend at least one ANC visit than those who did not receive home visits (Chapter 6). However, the findings were not significant for skilled delivery care or PNC, highlighting that Health Extension Workers' visits may not be effective in improving the uptake of these two services. One possible explanation for these results is that Health Extension Workers not only advise women about ANC but also provide routine services during their home visits. However, when it comes to skilled delivery care and PNC, Health Extension Workers have limited capacity to offer these services, as they lack the necessary medical equipment and supplies. The ineffectiveness of Health Extension Workers in improving uptake of skilled delivery care and PNC was also evidenced in another Ethiopian study (143). Task shifting of behavioral change communication activities on maternal health onto lower-level health workers, to increase the coverage and utilization of maternal health services, is recommended by WHO (160). The qualitative study also emphasized that Health Extension Workers were more involved in providing house-to-house health education sessions about ANC than other maternal health services.

10.3.3.2 Awareness of obstetric complications

Birth preparedness and complication readiness programs are critical in increasing utilization of skilled obstetric care services and preventing pregnancy or birth-related complications, thereby contributing to the reduction in maternal mortality (160, 343, 344). Birth preparedness involves ensuring the presence of a skilled provider at birth by making a prior arrangement between the woman and the care providers about when, where, and how the care will be obtained. Complication readiness enables the raising of awareness for expectant mothers, their families and community members about obstetric danger signs; and facilitates the early identification and prompt response to a possible complication. In this study, women who were knowledgeable about pregnancy-related complications were more likely to attend ANC than those who were not (Chapter 6). This implies that awareness about complications leads to ANC, though this could also occur in the other directions that ANC might have raised women's awareness about complications. To explain the former concept, it might be that women who are aware of pregnancy complications have an increased perceived susceptibility to such complications relative to women who do not. In addition to awareness of pregnancy complications, the actual

experience of these complications was related to PNC use. These findings were supported by those of the qualitative study, in which the perceived absence of complications was a delaying factor for maternal health service utilization (Chapter 9). In this case, delays related to not knowing about complications, not expecting complications to occur, and waiting until problems arose to access services. Furthermore, in Ethiopia, many women with obstetric complications attend health facilities only after trying traditional options at home (68). Such delays can reduce their chances of survival and aggravate obstetric complications.

10.3.3.3 Pregnancy intention

In this study, women who had unintended pregnancies were less likely to use skilled delivery care than those who had intended pregnancies. There are two possible reasons for this. First, when pregnancies are intended, women are more likely to be mentally and economically ready to participate in the activities needed to safeguard their own health and the health of their unborn babies (345). If women are aware of the importance of skilled delivery care for their own health and that of their unborn babies, and other barriers (for example, husband disapproval, the service being out of reach, economic inaccessibility) are absent, they are unlikely to forego such care. However, when pregnancies are unintended, the reverse is true, and women perhaps are unable to be actively involved in their own health care and that of their babies. Second, women may be stigmatized for having unintended pregnancies (66). If this occurs, women might resort to having unsafe abortions, committing suicide, or hiding at home. Even if they do not resort to such extreme measures, women are unlikely to attend skilled delivery care in the face of stigma from community members and give birth at home. The findings of the current study support those of another study in Ethiopia which confirm that pregnancy intentions determine skilled delivery care utilization (110).

10.4 Summary

Overall, the study demonstrated a high rate of maternal mortality and relatively low uptake of maternal health services in the study community. The study highlighted numerous

contextual factors associated with maternal health service utilization, using both quantitative and qualitative data. Specifically, maternal health service utilization was related to *predisposing factors* such as education, previous experience of care, best friend's use of maternal care, social power and culture, maternal health education and awareness of the benefits of care, and poor acceptance of male care providers; *enabling factors* such as place of residence, wealth index, husband's attitudes and women's decision making power, and physical accessibility; and *need factors* such as Health Extension Workers' home visits, awareness of obstetric complications, and pregnancy intentions. Future intervention programs and strategies should be developed to target these contextual factors to improve maternal health service utilization, thereby reducing maternal mortality.

10.5 Strengths and limitations

10.5.1 Strengths

There were many strengths to this research project. The application of a multi-method approach to the research questions (systematic review, secondary surveillance data analysis, quantitative survey, and qualitative survey techniques) is one strength of the study. The advantage of a multi-methods approach is that it enables multiple data sources to be used to produce complementary research findings that give a comprehensive understanding of the research problem. The use of population-based surveillance data to understand maternal mortality enabled examination of changes over time and systematic characterization of the cause of death patterns, which might be impossible with other methods. The cross-sectional design of the quantitative study allowed the measurement of multiple outcomes (point prevalence of antenatal, skilled delivery, postnatal care) and the many exposure variables under investigation. Moreover, the community-based qualitative inquiry, unlike previous facility-based qualitative studies allowed participants to share their thoughts and feelings towards maternal health service utilization free from possible influences of health facilities.

Most of the specific strengths of the cross-sectional survey were mentioned in Chapter 6 through Chapter 8. The use of a digital electronic survey tool downloaded onto iPads for

the survey enabled the minimization of incomplete or missing data. In addition, the reference period in the house-to-house survey was reduced to three years to minimize recall bias. This study also had a low refusal rate (of 2%), which increased our likelihood of obtaining unbiased estimates of the study variables and resulted in a large sample size that gave adequate power to the study. The house-to-house interviews were also conducted by experienced research assistants who have been working as enumerators for the Kersa HDSS. These data collectors were familiar with the local and socio-cultural contexts, which eased the overall data collection process.

The qualitative study also has some specific strengths, most of which are discussed in Chapter 9. The use of multiple target groups in the qualitative study increased the richness and rigour of the data by capturing a broad range of viewpoints. Recruitment of respondents who lived in different villages and in both urban and rural areas enabled the capture of a broad range of contextually relevant factors that affected maternal health service use. In addition, the possibility of a social desirability bias was minimized by excluding those in leadership positions in the community and using indirect questioning techniques.

Finally, this study was informed by the two most commonly used theoretical frameworks in health service research. The quantitative study was guided by the Andersen and Newman behavioral model of health care utilization (74, 75), whilst the qualitative study was guided by the Three Delays model (84). These models enabled the investigation of the factors related to maternal health service utilization in an integrated way; for example, during model building, several predictors from the predisposing, enabling, and need domains of the framework were considered in the final multivariate model to control for potential confounders.

10.5.2 Limitations

This research project also had several limitations that need to be acknowledged. Using the current maternal death surveillance data, it was not possible to make inferences that compare the women who died with the women who survived childbirth. The secondary surveillance data also contained some incomplete variables, restricted variable data, and

missing records. In addition, the causes of death in reports obtained from lay informers in the Verbal Autopsy data might not be in accord with those that could be obtained from the death certificates. Even the causes of death obtained from verbal autopsies might not be absolute, as different assessors might have arrived at different conclusions (346). Thus, maternal mortalities might have been systematically misclassified due to errors in medical reporting, cause of death certifications, and ICD code applications (18). This may have resulted in an underestimation of the maternal mortality rates as reported in this study. In addition, because pregnancy-related deaths were reported by family members as deaths that occurred during pregnancies (rather than deaths with medically classified pregnancy-related causes), the number of maternal deaths might have been under-reported. This may exclude deaths that occurred early in the gestation period due to abortions and ectopic pregnancies, as the families might not have known the pregnancy status of the woman at all or felt shame talking about it. Finally, as the sample size used in the secondary surveillance study was small, caution should be used when interpreting the results and extrapolating the findings to the general population.

Due to the cross-sectional nature of the study design used in Chapters 6 to 8 resulted in some limitations, such as, temporal relationships could not be established between predictors and outcomes. The study variables were all measured at one point in time, and thus it was not clear whether predictor variables preceded or followed the outcome. The survey also focused on factors that drive maternal health service utilization from the perspective of individual women, and so might not have captured all facility-based factors that contribute to this outcome (such as the quality of care provided). In addition, data were gathered through self-report, which can be unreliable, and in some cases unverifiable. Although the enumerators were able to verify some responses (for example, to questions about having a mobile telephone), it was not possible to do this for all survey questions. Attempts were made to minimize interviewer bias through intensive training on interview skills and questioning techniques as this is one method of reducing errors introduced by enumerators (347). However, as interviewers were resident HDSS data collectors who regularly interacted with the community, social desirability bias might not be ruled out.

Finally, like all qualitative studies, the results of the qualitative study might not be generalizable to the broader population or other sociocultural settings. However, the results might be applicable to many parts of Ethiopia as the health care delivery system,

professional training policy, and health management are very similar. Additionally, as the study relied on voluntary participation, the views of non-volunteers were excluded; these might differ from the views of volunteers in significant ways. Minimal involvement of the lead author in directly moderating the discussion sessions, transcriptions and translations due to the language barrier might have disadvantaged the qualitative data acquisition process, although these processes were undertaken by research assistants fluent in the local language. There might also have been a loss of information during the translation of transcripts from the local language into English. However, translations were performed by research assistants proficient in both languages, and sections of the transcripts were checked for consistency. The use of the Three Delays model as an analytical framework for the qualitative study led to floating of some factors from the model's predefined categories, and few factors did not perfectly fit within a specific category.

In general, caution should be taken in generalizing the overall study findings relative to Ethiopia as a whole. Ethiopia is a diverse country in terms of its culture, geography, and socio-economic conditions (17, 61). The study district (Kersa) has relatively poor community and health infrastructures relative to other districts, although the level of access to health facilities in most *kebeles* is on par with the rest of the country. Although most areas in the district are mountainous, they are connected by rural unsurfaced roads. Much of the population lives in rural areas and practices cultural rituals during pregnancy, delivery, and post-delivery. Women's literacy rates are extremely low. There is no hospital within the district, and most people travel to nearby districts to obtain hospital-level services. As a result, the overall uptake of maternal health services is low in Kersa relative to the rest of Ethiopia. However, not all districts in Ethiopia have equal access to health care facilities, equal levels of literacy, or equal social and health infrastructure development. Consequently, the estimated level of antenatal, skilled delivery, and postnatal care uptake in this study might not be generalized to Ethiopia as a whole. Nevertheless, findings underscore the importance of undertaking community-level studies to understand the complex issues that encourage or discourage maternal health service utilization.

10.6 Implications for future research

There are some unanswered questions raised by this study that require further exploratory research. The present study raises the possibility of determining maternal mortality by analysing surveillance data from HDSS. An implication of this is that the data collected through the routine HDSS can be used to determine the local burden of maternal mortality and inform the design of tailored interventions. Further studies might consider conducting maternal mortality research in this kind of setting with an increased sample size and over an extended surveillance timeframe to better understand maternal mortality trends over time. Moreover, to develop a full picture of the problem at a national level, future researchers might consider pooling secondary data from several HDSS sites around the country to develop more representative findings relating to maternal mortality. There are more than six HDSS sites in Ethiopia that routinely collect, store, and organize surveillance data (348), creating fertile opportunities for scaling up such studies.

In addition, the community survey on maternal health service utilization did not address all factors that were implied in the Andersen-Newman behavioral model of health care utilization (74, 75). Factors external to the individual such as environmental, political, and state factors that play a substantial role in shaping women's decisions to use (or not use) maternal health services were not addressed in the study. Further contextual studies should explore the environmental and political determinants of maternal health service utilization to ensure a balanced view of service barriers and guide future policy direction in the maternal health arena. Furthermore, future research may explore the mechanisms by which the aspects of the model can be further enhanced to increase the adaptability of the model when it is specifically utilized in empirical studies of maternal health service utilization. A separate analysis of each component of care in the maternal health services continuum might lead to the fragmented (a) measurement of service uptake and (b) assessment of facilitating (or impeding) factors. To comprehensively understand the uptake of maternal health services, future research could consider combining all these services into a single composite variable that reflects service use (or non-use). This could enable determining the synergistic factors associated with maternal health service utilization to design interventions that could be systematically integrated and implemented to tackle poor service uptake.

In this study, one of the outcome variables, “skilled delivery care utilization,” was defined based on whether the woman was assisted by skilled health personnel, regardless of the place of birth. The basic assumption behind this is that whether the birth occurs in a health facility (or not), women’s lives would be saved if attended by skilled care providers. However, the assistance of a skilled provider during non-health facility delivery does not fulfil the WHO criteria of having all necessary equipment and support for emergency obstetric care, including referral and transport facilities for emergency cases (34). Further studies could, therefore, measure both the assistance of skilled providers and enabling environmental factors (such as the presence of equipment and support during delivery) in accordance with the “skilled delivery care” definition of WHO.

Furthermore, there is an intolerably high rate of home delivery in Ethiopia (44, 140, 155), although maternal health planners in the country have little information as to why most women choose home birth. This study lacked detailed information about home delivery practices and associated factors. Therefore, a more detailed investigation is required to understand why most women choose a home, where they are usually assisted by non-skilled personnel such as traditional birth attendants, as their place of delivery. Future research may consider exploring home delivery practices and the associated societal or cultural factors in Ethiopia using participatory qualitative research methods by involving key community members. Furthermore, future evaluative research on the relevance of providing home-based delivery care services by skilled health workers using intervention studies is suggested.

Findings relating to the low acceptance of male delivery care providers as opposed to the high value placed on traditional birth attendants has immediate implications. Future research could examine why traditional birth attendants are still preferred by large segments of the Ethiopian population, and how their involvement in maternal health service provision could be improved. The issue of poor acceptance of male providers in part highlights the need to examine health care providers’ routine operations during obstetric service provision, and the possibility of modifying professional health care training policies in Ethiopia. Future research could also focus on ways of facilitating the provision of delivery care services by female and male health care workers, developing interventions to improve service provision by providers, and amending professional health

care training policies to include female trainees.

The present study found that quality of care was a great concern and remained a deterrent factor for maternal health service attendance. However, more comprehensive research is required to fully evaluate the current quality of maternal health services provided at varying levels. Health facilities need to be assessed based on the health care providers' competency; clients' viewpoints; auditing and performance of the facilities; and health care system planning and administration, to create a better picture of maternal health care quality and inform future programs and policies. Importantly, further research into the quality of maternal health care could focus on the fundamental quality gaps that were identified in this research such as unattractive or unclean facilities, health care providers' poor treatment of clients, inadequate availability of medical equipment and supplies, and slow services to gain a deeper understanding of this issue.

Moreover, very little was found in the literature regarding social networking and its influence on maternal health service utilization in Ethiopia (349). Controlling for individual level characteristics, the present study attempted to determine the role that women's social networks (including their best friends, Women's Development Army networks, and village level women's groups) play in facilitating (or hindering) maternal health service use using logistic regression models. Yet there are areas that this study did not address: these include understanding the influence of the density (network size) or network patterns; strength of ties (or cohesions) within the Women's Development Army network; level of advice endorsement; and homogeneity within the Women's Development Army network (or other women's social networks) on maternal health service utilization using social network analysis. A further study entirely focusing on the patterns of women's social networks and the types of network formation, including outside their own kinship groups, is therefore suggested to explicitly examine the effect of social networking characteristics on maternal health service utilization.

10.7 Implications for policy and practice

Establishing evidence-based practice in health care delivery systems is essential for ensuring that these systems are working properly; and that maternal health service

programs are improving the health status of women in general, and underserved and marginalized women in particular. Program design and implementation should consider the contextual barriers to maternal health service utilization rather than focusing on the general determinants of service use, to effectively bring about change and reduce maternal mortality in the country. The findings from both the quantitative and qualitative arms of the present study have enormous significance for programs, policies, and practice.

Based on the lessons learned from, and successes of, the consecutive implementations of the four Health Sector Development Programs I to IV, Ethiopia launched an ambitious five-year Health Sector Transformation Program in 2016 as the first phase of a new twenty-year health sector strategic plan (48). Improving reproductive and maternal health is among the top priority areas in this five-year Health Sector Transformation Plan. One of the principal targets to be reached by the end of the program is to reduce Ethiopia's MMR to 199 per 100,000 live births by ensuring equitable access to, and promoting utilization of, high impact and quality maternal health interventions, such as antenatal, skilled delivery, and postnatal care services. The program includes ambitious plans to increase the rate of maternal health service utilization to over 90% at the national level by the time it finishes.

The Ethiopian Ministry of Health could make use of research evidence in this thesis to inform health program implementation, as this will ensure that efforts to improve maternal health in this country are evidence-based. Although the country is in the implementation phase of the Health Sector Transformation Plan, there are still opportunities to revise intervention strategies as part of the annual reviews, and the summative evaluation of phase one of the plan. This could include putting research evidence into practice to improve maternal health care service provision and utilization. The findings from this study could, therefore, assist in transforming the maternal health program component of the Health Sector Transformation Plan. Improving the quality of care, mitigating distance and transportation barriers, systematic involvement of traditional birth attendants in maternal care, setting up peer education programs, educating and empowering women, expanding Health Extension Workers home visits, and strengthening the links between maternal health services are interventions deemed relevant to the Health Sector Transformation plan.

One key area for improvement is the quality of the skilled delivery and postnatal care services administered to women during health facility visits, as this hugely influences women's choices about service utilization. Specific interventions could focus on improving the availability of necessary medicines and medical supplies, the overall technical performance and ethics of health care professionals through appropriate in-service training, and the availability of service-controlled transport to ensure timely access to health care services when the need arises. Interpersonal interactions between women and health care providers should ensure respectful provision of maternal health services with full emotional and professional support. To enhance service uptake, health facilities that provide maternal health services should also be extensively audited to identify areas for improvement, and health care resources should be more evenly distributed between urban and rural areas.

Distance from a health facility is a critical factor that prevents women from receiving treatment and contributes to maternal mortality. The current initiative by the Ethiopian Ministry of Health to pilot a drone to transport lifesaving blood and medicine for emergency cases is encouraging and should be rolled out to other areas once the pilot project has been successfully implemented (350). In addition to transporting emergency equipment and supplies, this effort could be broadened to include helicopters that transport pregnant women with emergency obstetric conditions from remote villages to health care facilities. The Ministry of Health, the Ministry of Defense, and the Ministry of Science and Technology should collaborate to maximize the impact of this intervention, as this could save lives that are lost due to preventable pregnancy-related causes. Further, different options can be implemented to overcome maternal delay due to physical inaccessibility; these are providing delivery care at home, establishing birth centres and maternity waiting homes, and administration of ambulances in collaboration with local community leaders. Local leaders living in the community could identify and prioritize emergency cases and are likely to coordinate ambulance deployment equitably in collaboration with the district health office to ensure the community has improved medical transportation. In addition, the community-based health insurance system that has been implemented in Ethiopia should be extended to finance the transportation of obstetric emergency cases, as well as basic health care costs (48). Government efforts to distribute free four-wheel drive ambulances to most districts in Ethiopia in order to strengthen the referral link between villages and health facilities should also be further intensified (134).

In addition, there is a need to empower lower level health practitioners (such as Health Extension Workers) to provide maternal health services to women, especially in rural and remote communities. Furthermore, traditional birth attendants are still socially acceptable providers of delivery care in the study community. Ensuring traditional birth attendants are adequately trained in the provision of delivery care is a strategy that would require the development of additional maternal health policies. From the evidence in this study, it is clear that deploying trained traditional birth attendants to provide delivery care, especially to women in hard-to-reach rural communities, could be an effective strategy for improving service uptake, thus reducing maternal mortality.

A culturally sensitive community-based peer education program could also be designed to spread information about the benefits of service attendance during pregnancy, birth, and the postnatal period. Existing women's groups such as the Women’s Development Army network, which is present in almost all Ethiopian districts (95), could assist in organizing this program. As women learn about how to access and use maternal care and exchange information about the quality of care from their peers or best friends more readily than from other sources, a cost-effective and sustainable way of improving the uptake of maternal health care would be to integrate peer education into women’s social networks and groups at the village level. These community-based programs could provide information about the importance of attending maternal health services, obstetric danger signs, and the catastrophic and unpredictable nature of obstetric complications. The programs could also address common superstitions and misperceptions about maternal care (including the ability of male midwives to provide skilled delivery care), as well as cultural beliefs and norms that prevent women from attending services. Peer education programs should target women (particularly those who have low levels of education and awareness of maternal care, and who do not use maternal health care services), their husbands, and influential members of the community. Prior studies in resource-poor settings established that similar community-based peer education programs were effective in improving maternal health outcomes by enhancing service uptake (351, 352).

In Ethiopia, the Health Extension Program has been in place for more than a decade (17, 73, 95). A central aim of the Health Extension Program is to communicate knowledge about maternal health to women to raise their awareness and encourage service attendance.

The effectiveness of the Health Extension Program was reinforced in the present study, where Health Extension Worker home visits were found to increase ANC attendance. Health Extension Workers should expand their home visits to include all households in their assigned catchment areas and increase their outreach services in the community to improve ANC attendance. The Ministry of Health and other stakeholders should design a mechanism to provide incentives to Health Extension Workers who travel to remote villages to visit households and provide health messages about maternal health.

Women's education and empowerment are essential non-maternal specific strategies that potentially reduce maternal mortality (33). Empowerment initiatives need to be strengthened to equip women to make decisions at the household, community, and national levels. One such initiative might be to increase school enrolments among women who are still teenagers and who are not yet made busy by matrimonial and social responsibilities. Women's education will have a long term impact on maternal health service uptake, thereby improving maternal health status, and enhancing women's participation in economic, political and social activities. Education not only empowers women to make their own decisions but also increases their awareness about the importance of their health. Autonomous women are more likely to make wise decisions about their own health and use health care services to meet their reproductive health goals (44, 142, 203, 205). They are also less likely to be influenced by their husbands' decisions, and more likely to resist pressure from their husbands. Another synergistic measure that could improve women's decision-making and capacity to use health care services is the improvement of their economic status through an existing productive Safety Net program that targets rural Ethiopian communities (353). In the Safety Net program, establishing a women-centered financial administration system is recommended. Moreover, through this program, women should be given priority to receive credit arrangements in the form of loans and household packages (loans in the form of assets such as poultry or agricultural equipment) should be distributed to women in poorer families in the community rather than solely to women in richer families (who are thought more likely repay the loan). Additionally, interest rates should be reduced for women who obtain loans from program development agents. The micro-economic activities that women engage in their communities could also help them to cover the costs of travel and required medicines independent of their spouses, and also improve their decision-making abilities as they receive training on life skills.

The link between different maternal health services is another area that needs policy attention. The evidence in this study demonstrated that there is link between ANC and other maternal health services, such as skilled delivery care. Health messages delivered during ANC about attending skilled delivery care could encourage women to subsequently use this service. Ensuring that pregnant women receive such messages and experience good quality ANC means that they will be less reserved about, and more likely to plan to attend, skilled care during birth. Working on one aspect of maternal health services enables improvement of the uptake of the remaining services in the continuum of care. This highlights that strengthening the links between maternal health services is important and needs to be considered during maternal health program and intervention design.

10.8 Conclusion

The magnitude of maternal mortality remains relatively high in the study district. The most common cause of maternal death was postpartum hemorrhage, followed by hypertensive disorders of pregnancy. A substantial percentage of women who died due to maternal causes did not use ANC or skilled assistance at birth. Among the reproductive-aged women surveyed, a large proportion did not use antenatal, skilled delivery, or postnatal care. The proportion of women who initiated their ANC early and used the service regularly with the recommended number of visits was very low. An enormous number of women were attended by traditional birth attendants during delivery. Most PNC users attended the service late, in the six weeks after delivery.

This research revealed that women's maternal health service utilization was related to various predisposing, enabling, and need factors. Firstly, the predisposing factors that influenced women's maternal health services attendance were maternal education; previous use of maternal care; best friend's use of maternal care; the presence of an educated family member; and exposure to education about maternal health. Secondly, type of *kebele*, place of residence, wealth index, and husband's attitudes were significant enabling factors associated with maternal health service utilization. Lastly, the main need factors included Health Extension Workers' home visits, perceived importance of care, and awareness and experience of obstetric complications. The qualitative study also identified

factors that delayed women from seeking maternal health services: these included low levels of awareness; poor involvement by the husband; perceived absence of health problems; social power and misperception on the services; poor social networking; high acceptance of traditional birth attendants; and negative attitudes towards male midwives. The factors that contributed to delays in reaching health facilities to use maternal health services were physical inaccessibility and high transportation costs. Finally, other factors that contributed to delays in receiving maternal health services were perceived or experienced poor quality of obstetric care in health facilities.

Overall, there was a high rate of maternal mortality with a contrasting and insufficient level of maternal health service utilization in the study community. Maternal health programs should be reformed or redesigned by incorporating key context-specific interventions that target the most important driving factors for maternal health service attendance. The interventions may generally extend from improving the care-seeking behavior of women to improving the quality of routine maternal health services at health facilities. Community enlightenment initiatives should be strengthened to improve the understanding of the importance of maternal health service attendance. Collaborative measures should be put in place to improve women's educational enrolment. In addition to equitable distribution of health resources to urban and rural health facilities, the quality of routine maternal health services should be improved by: adequately supplying the health facilities with the necessary equipment and consumables; increasing training to create more competent health workers; providing timely services; and improving cleanliness and privacy to create a conducive environment for women. Collaborative efforts are needed to ensure that women have improved access to family planning services and can choose to avoid unintended pregnancies. Community-based peer education programs should be established to disseminate maternal health information. Partners involvement in women's use of maternal health services should be encouraged by providing recognition of partners who actively support and encourage their wives to attend services.

Effective and sustainable women's empowerment programs that focus on improving women's economic and decision-making power should be established. Health Extension Workers' home visitation programs should be scaled up and further strengthened. The training programs for traditional birth attendants should be revisited; and transformative approaches should be sought to improve their involvement in maternal health service

provision as a complement to midwives. Improving the administration and service provision of ambulances is suggested. Professional midwifery training policy should be revised to consider the enrolment of a larger proportion of female trainees. Increasing the capacity of health posts to provide basic maternal health services to reach women in rural and remotely located communities is essential. In general, improving maternal health requires joint actions from all stakeholders including advocates of women's affairs, health managers, health care professionals, influential community members, and perhaps most importantly, women themselves.

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Appendices

Appendix 1

Quantitative study protocol for the household survey

Participant information statement for household survey

Chief Investigator: Prof Deborah Loxton
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Title of the research project: Maternal Mortality and Maternal Health Service Utilization in Eastern Ethiopia: The case of Kersa District

Primary supervisor: Prof Deborah Loxton
Co-supervisor: Dr.Catherine Chojenta
Co-Supervisor: L/Prof Roger Smith
Student researcher: Gezahegn Tesfaye Girma
School of Medicine and Public Health,
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Document version:1, **Date**: 21/10/2016

You are invited to participate in the research project identified above which is being conducted by Gezahegn Tesfaye Girma, a PhD student from the School of Medicine and Public Health, Faculty of Health and Medicine at the University of Newcastle, Australia. The research is part of a doctoral degree supervised by Professor Deborah Loxton, Dr. Catherine Chojenta, and Laureate Professor Roger Smith from the School of Medicine and Public Health, Faculty of Health and Medicine at The University of Newcastle, Australia.

Why is the research being done?

The purpose of the research is to investigate maternal health service utilization and its associated factors in your district. The study will help to design locally suitable and effective community-based intervention programs that could address the root causes of poor utilization of maternal health services at community level.

Who can participate in the research?

We are seeking women aged 15-49 years who have had at least one birth in the past three years before the interview date and have lived in the district for at least six months. Women who have a physical disability such as hearing or speaking problems, or a mental disability (based on family report and on spot observation), and critically ill will not be part of the study.

What will you be asked to do?

If you agree to participate in the study, you will be invited to participate in an interviewer-administered survey. The interviewer will ask you questions about you and your family, your reproductive history and personal experience of maternal health service use, and will write your answers on the iPads.

What choice do you have?

Participation in this research is entirely your choice. Only those women who give their informed verbal consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the project at any time until the completion and submission of your completed questionnaire. Please note that due to the anonymous nature of the survey, you will not be able to withdraw your response after it has been submitted. If you wish to have a break at the middle of the interview or would like to finish the interview in two visits, you have the right to do so.

How much time will it take?

The interview will take 1-2 hours, on average, depending on the speed and length of your responses.

What are the risks and benefits of participating?

Participating and giving answers to the questions in this study will have no direct benefit for you. However, by providing information for this study, you will have the opportunity to share your experience of maternal health services during the pregnancy, childbirth or post-natal period and this will help us discover the factors behind the poor utilization of maternal health service so that different suitable interventions will be designed to improve the situation at the local level. In addition, your participation will assist in improving the services provided by the public health facilities in the district. Your participation in this research doesn't carry any risks to you. Some of the questions might deal with potentially sensitive issues, but if you find any of the questions upsetting, you can stop your participation at any time or simply choose not to answer the question.

How will your privacy be protected?

Since the survey questionnaire is anonymous, it will not be possible to identify you from your responses. The completed responses on iPads will be submitted online to the Survey Gizmo software to combine and pool the data into one data set. The data will then be extracted from the Survey Gizmo to the data storage and analysis software (SPSS) and retained in a password protected computer. The data will be retained for a minimum of 5 years as per University of Newcastle requirements and then destroyed in line with University of Newcastle policy provisions.

How will the information collected be used?

The collected data and the reports generated from the survey will contribute towards Gezahegn's PhD thesis and the findings of the study will be published in journals. Attempt will be made to present the results of the study in different scientific conferences, meetings, and seminars. The individual participants of the survey will not be identified in any reports arising from the project. Non-identifiable data may be shared with other parties to encourage scientific scrutiny and to contribute to further research and public knowledge, or as required by law. The summary of study findings will be submitted to Federal Ministry of Health of Ethiopia, Oromia Regional Health Bureau, Kersa District Health Office and Kersa Health Demographic Surveillance Survey Coordinating office for their prompt action to improve maternal health service utilization at the grass-roots level, based on the recommendations of the study.

What do you need to do to participate?

Please read or listen to this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or if you have any questions, please contact the researcher. If you would like to participate, please inform us that you are happy to take part in the research. This will be taken as your informed verbal consent to participate in the study. After that, we can arrange an interview venue and time.

Further information

If you would like further information, please contact Gezahegn Tesfaye Girma (+251913543209) or the district administrative body (telephone +251253360159), the Institutional Health Research Review Committee of Haramaya University (telephone +251254660708 or +2512566661899) or Prof Deborah Loxton at The University of Newcastle, Australia. Tel: +61 2 4042 0690 Email: deborah.loxton@newcastle.edu.au

Thank you for considering this invitation.

Signature _____	Signature _____
Prof Deborah Loxton	Gezahegn Tesfaye Girma
Chief Investigator	Student Researcher

Complaints about this research

Should you have concerns about your rights as a participant in this research, or a complaint to make about the manner in which the research is conducted, you should contact the student researcher (telephone +251913543209), email (gezites@gmail.com) or the district administrative body in your area (telephone +251253360159). It is also possible to contact the

Institutional Research Ethics Committee of Haramaya University, Harar, Ethiopia, telephone +251254660708 or +2512566661899, or appointed personnel email address (neggaberaki@gmail.com). If you wish to talk to a person independent of the project, contact the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone +612 49216333, email Human-Ethics@newcastle.edu.au.

Questionnaire

Double screening (checking) questions

1. Have you given birth (either a baby born alive or dead) at least once in the past three years?
2. Did you live for more than six months in this area (Kersa district)?

If the answer is no to one or more of the above questions, please stop the interview and move to the next participant.

Interviewer code :_____Sign_____ Date of interview_____
Questionnaire code :_____(interviewer code *slash* household ID)
Interview begins at : _____
Interview ended at : _____

Household/participants coding system: Consider the representation for "Urban" kebele=U, "Rural" kebele=R, HDSS=1, Non-HDSS=2, then start with "0001" for the first selected respondent household (e.g. write the household/participants ID (code) = "U-1-0001" for the first respondent household from urban HDSS kebele).

1. Household/participant ID (code): _____

2. Date of birth for your children in the past three years and the birth outcome

Birth order	**Date of birth** (DD/MM/YYYY)
Last birth (index child)	-----/-----/----------
Next to last birth	-----/-----/----------
Second to last birth	-----/-----/----------
Third to last birth	-----/-----/----------
Fourth to last birth	-----/-----/----------
Fifth to last birth	-----/-----/----------

Part one: Basic socio-demographic and reproductive characteristics of the participants				
1.1	**Socio-demographic characteristics of the respondents**			
No	**Questions**	**Coding categories**	**Skip**	**Code**
Q101	**Type of kebele** (to be completed by the interviewer)	1. HDSS kebele 2. Non-HDSS kebele	If (2), skip to Q103	1 2
Q102	**Duration since under HDSS** (interviewer**)**	----------years		
Q103	**Place of residence** (to be completed by the interviewer)	1. Urban 2. Rural		1 2

Q104	How old are you?	_____Age in completed years		
Q105	What ethnic group do you belong to?	1. Oromo 2. Amhara 3. Guraghe 4. Tigre 99. Other specify--------		1 2 3 4 99
Q106	What is your religion?	1. Muslim 2. Orthodox 3. Catholic 4. Protestant 99. Other specify--------		1 2 3 4 99
Q107	What is your main occupation?	1. Housewife 2. Farmer 3. Government employee 4. Merchant 99. Other specify-------		1 2 3 4 99
Q108	What is the highest level of formal education you have completed?	1. Never attended 2. Elementary (1-8) 3. Secondary (9-12) 4. Tertiary (12^{+})		1 2 3 4
Q109	What is your current marital status?	1. Married 2. Divorced 3. Widowed 4. Never married 5. Separated	If (4), skip to Q115	1 2 3 4 5
Q110	Age at marriage	_____Years	If (2, 3, 4) to Q109, skip to Q115	
Q111	If you are currently married, in what type of marital union are you now?	1. Polygamous 2. Monogamous	If (2), skip to Q113	1 2

Q112	Are you the first wife for your husband?	1. Yes 2. No		1 2
Q113	What is the highest level of formal education your husband completed?	1. Never attended 2. Elementary (1-8) 3. Secondary (9-12) 4. Tertiary (12+)		1 2 3 4
Q114	What is the main occupation of your husband?	1. Farmer 2. Daily labourer 3. Merchant 4. Government employee 99.Other specify ---------		1 2 3 4 99
Q115	Do you have any other family member in your household who received formal education?	1. Yes 2. No	If (no), skip to 117	1 2
Q116	What is the highest level of education this person has completed?	1. Elementary(1-8) 2. Secondary (9-12) 3. Tertiary (12+) 99.OtherSpecify_____		1 2 3 99
Q117	Has anyone ever taught you about maternal health?	1. Yes 2. No	If (no), skip to 119	1 2
Q118	By whom were you taught?	1. HEW 2. Health care providers 3. Community health agents 4. TBA 5. Family members 6. Mass media 7. WDA leader 99.Other specify _____		1 2 3 4 5 6 7 99
Q119	Do you have any health facility in your kebele?	1. Yes 2. No 88.Dont know		1 2 88

Q120	Which health facility is nearest to your home?	1. Health post 2. Health centre 3. Hospital 4. Private clinic		1 2 3 4
Q121	How do you usually get to the nearest health facility?	1. On foot 2. Ambulance 3. Transport (taxi/bus) 4. Own car 99.Other specify_____		1 2 3 4 99
Q122	How far is the nearest health facility from your home?	_____in-minutes (walk) ____in-minutes (vehicle)		
Q123	How do you usually get to the nearest hospital?	1. On foot 2. Ambulance 3. Transport (taxi/bus) 4. Own car 99.Other specify_____		1 2 3 4 99
Q124	How far is the nearest hospital from your home?	_____in-minutes (walk) ____ in-minutes (vehicle)		
Q125	What is your average monthly family income?	_____Ethiopia Birr		
Q126	Who is the head of the household?	1. Partner 2. Respondent 3. Parents (mother/father)		1 2 3
Q127	Who makes decisions about household expenses?	1. Respondent 2. Partner 3. Jointly 4. Parents		1 2 3 4
Q128	Has your household ever been visited by health Extension workers?	1. Yes 2. No		1 2
Q129	Do you have any means of communication (mass media) in your home?	1. Yes 2. No	If (no), skip to Q131	1 2

Q130	Which means of communication (or mass media)?	1. Radio 2. TV 3. Internet 99.Other specify_____		1 2 3 99
Q131	Do you have a telephone (cell phone, land telephone) in your household?	1. Yes 2. No	If (no), skip to Q133	1 2
Q132	Does your village have a network signal for your telephone?	1. Yes 2. No 88.Don't know		1 2 88
Q133	What is the birth order of the last child?	1.1st 2.2nd 3.3rd 4.>3rd	Cross Check	1, 2, 3, 4
Q134	Birth outcome for the last child	1. Live full term 2. Live preterm 3. Stillbirth	Cross Check	1 2 3
Q135	Do you have the following items/resources in your household?	1. Electricity? 2. Wall clock? 3. Radio? 4. Television? 5. Mobile phone? 6. Refrigerator? 7. Photo camera? 8. DVD/CD (Video deck) 9. Bed? 10. Table? 11. Cabinet/cupboard? 12. Bicycle? 13. Motorcycle? 14. Car or truck? 15. Piped water source? 16. Water safety means (bleaching, chlorine, water filter, boiling)? 17. Toilet facility? 18. Oxen? 19. Cows? 20. Sheep? 21. Goat? 22. Donkey? 23. Mules? 24. Horses? 25. Camels? 26. Poultry? 27. Own plough land? 28. Bee hive?		

		29. Charcoal/ wood stove? 30. Kerosene stove? 31. Sofa?		
1.2	**Reproductive characteristics of the participants**			
Q 135	Age of woman at first pregnancy	_____Years		
Q 136	Total number of pregnancies in lifetime	_____	Cross-check	
Q 137	Total number of deliveries in lifetime	_____	”	
Q 138	Lifetime number of live births	_____	”	
Q 139	Lifetime number of stillbirths	_____	”	
Q 140	Lifetime number of abortions (all types)	_____		
Q 141	Lifetime number of infant deaths (< 1 year)	_____		
Part two: General information about pregnancy and antenatal care				
2.1	**General information about pregnancy, attitude and knowledge of antenatal care**			
Q201	When you became pregnant with your last birth, was that pregnancy wanted?	1. Yes 2. No		1 2
Q202	Have you ever heard about antenatal care services (care given to women during pregnancy)?	1.Yes 2. No	If (no), skip to Q204	1 2
Q 203	From where did you hear about antenatal care services?	1. Heath facility 2. Mass media (Radio/TV) 3. TBAs 4. Community health agent 5. Relatives 6. WDA leaders 7. Other women group 99.Othersspecify_____		1 2 3 4 5 6 7 99
Q 204	Who do you think benefits from antenatal care?	1. For the mother’s health 2. For the child’s health 3. Both 88. Don’t know 99. Others specify_____		1 2 3 88 99
Q 205	Do you think a healthy pregnant woman should attend antenatal care clinics?	1. Yes 2. No		1 2
Q206	How useful do you think antenatal care is for a healthy pregnant woman?	1. Very useful 2. Somehow useful 3. Not useful		1 2 3
Q 207	From whom do you think a pregnant woman could get antenatal care?	1. Healthworker 2.TBAs 3. Community health agent		1 2 3 4

		4. Relatives/friends 5. WDA leader 99.Othersspecify_____		5 99
Q 208	At what month do you think a healthy pregnant woman should first start to attend antenatal care?	1. 1-3months 2. 4-6months 3. 7-9months 88.Don't know		1 2 3 88
Q 209	Are you aware of any dangerous pregnancy-related symptoms?	1. Yes 2. No	If (no), skip to Q211	1 2
Q 210	Can you mention some? (More than one answer is possible) (Don't read the options)	1. Persistent vomiting 2. Anemia 3. Leg swelling 4. Headache 5. Vaginal bleeding 6. Convulsions 7. Abnormal fetal position 8. Prolonged labor 9. Retained placenta 10. Blurred vision 11. Fever 99.Others specify_____		1 2 3 4 5 6 7 8 9 10 11 99
Q211	If you are married, what is your husband's attitude towards antenatal care?	1. Positive 2. Negative 3. Neutral 99.Don't know		1 2 3 99
Q212	If you are married, how often did you and your husband together discuss the issue of using antenatal care during your last pregnancy?	1. Very often (twice monthly) 2. Often (once monthly) 3. Less often (twice during pregnancy)		1 2 3 4 5

		4. Seldom (once during pregnancy) 5. None		
2.2	**Antenatal care practice and quality of service**			
Q213	Did you attend antenatal care during any of your previous pregnancies before the most recent pregnancy? (Cross check)	1. Yes 2. No 3. Have only one pregnancy		1 2 3
Q214	Did you attend an antenatal care for your last (most recent) pregnancy?	1.Yes 2. No	If (no) skip to Q244	1 2
Q215	Did your partner attend the antenatal care visit with you?	1. Yes 2. No		1 2
Q216	Who did you see for antenatal care for your last pregnancy? (more than one answer is possible)	1.Doctor/health officer 2.Nurse/midwife 4.Health extension worker 99.Other-specify _____		1 2 3 4 99
Q 217	How many months pregnant were you at your **first** antenatal checkup?	Month------ 88.Don'tknow		
Q 218	How many times in total did you receive antenatal care during your pregnancy?	1. Once 2. Twice 3. Three times 4. Four and more		1 2 3 4
Q 219	Where did you attend your antenatal care for your last pregnancy? (more than one answer is possible)	1. Government hospital 2. Government health centre 3. Government health post 4. Private hospital/clinics 5. Home 99. Others specify_____		1 2 3 4 5 99
Q 220	What made you decide to attend your antenatal care at that particular place? (multiple response is possible)	1. Close to where you live		1 2 3

	(Don't read the options)	2. Little or no expense 3. Good service from health workers 4. Convenient time of services 99. Other specify--------		4 99
Q 221	During your antenatal care visits for your last pregnancy did you ever have an injection in the arm to prevent against Tetanus?	1. Yes 2. No 88. Dont know	If (no) skip to Q223	1 2 88
Q 222	How many times did you receive such injections?	1. Once 2. Two or more		1 2
Q 223	What was the main reason you started attending antenatal care?	1. Due to health problem 2. To start regular checkups 3. Due to my previous experience 4. To check the pregnancy 5. Due to unplanned pregnancy 99. Other specify_____		1 2 3 4 5 99
Q 224	During any of your antenatal care visits, were you told by the health provider about signs of pregnancy complications?	1. Yes 2. No 88. Don't know	If (no), skip to Q226	1 2 88
Q225	Which sign of pregnancy complications were you told by the health provider? (circle all that applies) Don't read the options:	1. Vaginal bleeding 2. Heavy vaginal fluid 3. Severe headache 4. Blurred vision 5. Fever 6. Abdominal pain 7. Persistent vomiting 8. Anemia		1 2 3 4 5 6 7 8 9 10 11 99

		9. Leg swelling 10. Convulsions 11. Prolonged labor 99.Other_____		
Q226	Were you given information about delivering at a health facility during your antenatal care visit?	1. Yes 2. No		1 2
Q 227	Was blood pressure measured each time you went for antenatal care?	1. Always 2. On some visits 3. Never 88.Don't know		1 2 3 88
Q 228	Were you weighed during each antenatal care visit?	1. Always 2. On some visits 3. Never 88. Don't know		1 2 3 88
Q 229	Was a laboratory examination (blood, urine, stool…) done in the antenatal care clinic?	1. Yes 2. Never 88. Don't know		1 2 88
Q 230	Was a physical examination done in the antenatal care clinic during each visit?	1. Yes 2. No 88. Don't know		1 2 88
Q 231	Was your height measured during the antenatal care visit?	1. Yes 2. No 88. Don't know		1 2 88
Q 232	Did you ever pay for antenatal care?	1. Yes 2. No	If (no) skip to Q235	1 2
Q 233	How did you feel about payment for antenatal care?	1. High 2. Moderate 3. Low 4. None		1 2 3 4
Q 234	How much on average did you pay for	_____Birr		

	antenatal care service per visit?			
Q 235	Do you think that the waiting time was a problem while you were attending antenatal care?	1. Yes 2. No 88.Don'tknow		1 2 88
Q 236	Were the health workers respectful?	1. Yes 2. No		1 2
Q 237	How long did you wait to get antenatal care services?	1. < 2hours 2. 2-3hours 3. >3 hours		1 2 3
Q 238	Was there lack of privacy during your antenatal care?	1. Yes 2. No 88. Don't know		1 2 88
Q 239	How far is the health facility where you attended antenatal care from your home?	1. Within 5 km (very close) 2. 5-10 km (manageable) 3. 10 km (too far)		1 2 3
Q 240	During your antenatal care visit, were you able to ask your health provider any questions?	1. Yes 2. No		1 2
Q241	Did the provider tell you to come back to the facility for another visit?	1. Yes 2. No		1 2
Q242	Do you recommend antenatal care service to other women?	1. Yes 2. No		1 2
Q243	Will you attend antenatal care for your next pregnancy?	1. Yes 2. No 3. No plan for pregnancy		1 2 3
Q244	If you did not attend antenatal care at all for your last pregnancy, what were your reasons? (Multiple responses possible) (Don't read the choices)	1. No/little knowledge 2. Being in good health 3. Too busy to attend 4. ANC service too expensive 5. Clinic too far		1 2 3 4 5 6 7 8 9

		6. Waiting time is too long 7. Husband's disapproval 8. No good service 9. Religious reason 10. Mistreatment by health staff in previous service 11. No one to accompany me 99. Others specify _____		10 11 99
Part three: Questions on delivery choices and skilled delivery care utilization				
Q 301	Did you receive delivery care service from (a doctor, nurse/midwife, or health officer) for any of your births before the most recent birth?	1. Yes 2. No 3. Have only one delivery	If (3), skip to Q303	1 2 3
Q302	Where did you have your baby, the one before the most recent birth?	1. Government hospital 2. Government health centre 3. Government health post 4. Private hospital/clinic 5. Home 99. Others specify--------		1 2 3 4 5 99
Q303	Did you receive delivery care (from either a doctor, health officer, or nurse/midwife) for your last birth?	1. Yes 2. No		1 2
Q304	Where did you deliver your last (most recent) baby?	1. Government hospital 2. Government health centre 3. Government health post 4. Private hospital/clinic 5. Home 99. Other specify--------	If (5), skip to Q318	1 2 3 4 5 99
Q305	What made you decide to have your baby in that particular health facility?	1. Close to where I live 2. High-quality services 3. Helpfulness of health workers 4. Little or no expenses		1 2 3 4 99

		99.Other specify_____		
Q306	Who assisted with your last delivery at that health facility?	1. Doctor 2. Health officer 3. Nurse/midwives 4. Health extension workers 5. Other health personnel		1 2 3 4 5
Q307	Who made the final decision about where you would give birth?	1. Yourself 2. Your husband 3. Jointly with your husband 4. WDA leader 5. HEW 6. Mother-in-law 7. Father-in-law 8. TBA 9. Your parents 10. TBA 11. No one 99.Other specify_____		1 2 3 4 5 6 7 8 9 10 11 99
Q308	How did you get to the health facility for the delivery of your last baby?	1. Taxi/bus 2. Own car 3. Animal drawn cart 4. Tricycle vehicle 5. Ambulance 6. On foot 99.Other specify_____	If (6), skip to Q311	1 2 3 4 5 6 99
Q309	Did you face any financial problem to cover the costs associated with transporting to facility?	1. Yes 2. No	If no, skip to Q311	1 2
Q310	What did you do to overcome the financial problem?	1. Borrow from a friend 2. Sell personal or household property (like jewellery, etc) 3. Sell a piece of land 99.Other specify_____		1 2 3 99

Q311	Who accompanied you to the health facility?	1. Partner 2. WDA leader 3. HEW 4. TBA 5. No one 99. Other specify_____		1 2 3 4 5 99
Q312	Did you make an arrangement or birth plan for the birth of your last child? (*Where to deliver, Transport, Money , Blood donor, Who to inform in case of emergency* etc)	1. Yes 2. No 88.Don't remember		1 2 88
Q313	Were you referred to a higher level health facility for your last birth?	1.Yes 2. No	If no, skip to Q316	1 2
Q314	Did you comply with the referral?	1. Yes 2. No	If yes, skip to Q316	1 2
Q315	What made you to decline the referral?	1. Unable to afford the associated cost 2. Too far health facility 3. Family/husband disapproval 4. Prefer to back to home 99.Other specify_____		1 2 3 4 99
Q316	Is giving birth at health facility your prior plan or intention before ending up delivering at health facility?	1. Yes 2. No 88. Don't know		1 2 88
Q317	Did you recommend health facility delivery to other women?	1. Yes 2. No		1 2
Q318	During labor and birth of your last child, did you experience any serious health problems related to birth?	1. Yes 2. No 3. Don't know	If (no), skip to Q322	1 2 3
Q319	What problems did you experience? (More than one answer is possible)	1. Severe bleeding 2. Severe headache 3. Convulsions 4. High fever 5. Loss of consciousness 6. Labor lasting >12 hours 7. Placenta not delivered 30 minutes after baby 99. Other specify _____		1 2 3 4 5 6 7 99
Q320	Where were you when you developed this problem?	1. Home 2. Health facility		1 2

Q321	Did you seek assistance for this problem?	1. Yes 2. No		1 2
Q322	Where do you want to deliver your next baby?	1. Health facility 2. Home		1 2

Part four: Postnatal care (PNC)

Q401	Have you ever heard about postnatal care services (*a care given to a mother and new born within six weeks of delivery*)?	1. Yes 2. No	If (no), skip to Q403	1 2
Q402	From where did you hear about postnatal care services?	1. Health care provider 2. Mass media (Radio/TV) 3. Family/relatives 4. Friends 5. WDA leader or members 99.Other specify_____		1 2 3 4 5 99
Q403	After delivery of any of your previous babies before your last baby, did any one check your health during the first six weeks after birth?	1.Yes 2.No 3. Have only one delivery		1 2 3
Q404	After your last delivery, did anyone check on your health during the first six weeks after birth?	1. Yes 2. No	If (no), skip to Q412	1 2
Q405	During that time, who did the health check? (more than one answer is possible)	1.Doctor 2. Health officer 3. Nurse/midwife 4. Health extension workers 5. Traditional birth attendants 99. Other specify_____		1 2 3 4 5 99
Q406	How long after delivery was your first postnatal health check? (If less than one day, record hours. If less than one week, record days)	_____Hours _____Days _____Weeks		
Q407	How many postnatal checks did you have following the birth of your most recent child?	1. One 2. Two 3. Three 4. More than three		1 2 3 4
Q408	Where did you get the first postnatal health check following the birth of your most recent child?	1. Government hospital 2. Government health centre 3. Government health post 4. Private hospital/clinic 5. Home 99.Other specify_____		1 2 3 4 5 99

Q409	What was the main reason that you attended a postnatal health check? (more than on answer is possible)	1. You were ill 2. Immunization for baby 3. Midwife told you to do so 4. You wanted to start family planning 99.Other specify_____		1 2 3 4 99
Q410	Who accompanied you to seek postnatal care? (more than one answer is possible)	1. Partner/husband 2. WDA leader 3. HEW 4. TBA 5. No one 99. Other specify_____		1 2 3 4 5 99
Q411	What kind of services did you receive during your postnatal visit? (*more than one answer is possible*)	1. Physical examination 2. Immunization of baby 3. Counseling 4. Family planning services 5. Breastfeeding education 99. Other specify_____		1 2 3 4 5 99
Q412	During the first <u>2 days after</u> the birth of your child, did you experience any serious health problems related to the birth?	1. Yes 2. No 99. Don't know	If (no), skip to Q416	1 2 99
Q413	What problems did you experience? (Circle all responses given)	1. Severe bleeding 2. Severe headache 3. Blurred vision 4. Convulsions 5. Swollen hands/face 6. High fever 7. Malodorous vaginal discharge 8. Loss of consciousness 9. Difficulty breathing 10. Severe weakness 99.Other specify____		1 2 3 4 5 6 7 8 9 10 99
Q414	Where were you when you developed that problem?	1. Home 2. Health facility 3. On way to health facility		1 2 3
Q415	Did you seek assistance for the problem?	1. Yes 2. No 88.Don't know		1 1 88
Q416	Would you like to or have the plan to attend postnatal care if you give birth in the future?	1. Yes 2. No		1 2

Part five: Social networking related questions				
Q501	Is there a Women's Development Army network in your village?	1. Yes 2. No	If no, skip to Q509	1 2
Q502	Are you a member of the Women's Development Army network?	1.Yes 2.No	If no, skip to Q508	1 2
Q503	When did you become a member of the WDA network?	1. Less than one year ago 2. Two to three years ago 3. More than 3 years ago		1 2 3
Q504	Is there a regular WDA network meeting program in your village?	1. Yes 2. No	If no, skip to Q507	1 2
Q505	What is the frequency of the meeting with the WDA network?	1. Weekly 2. Fortnightly 3. Monthly 4. More than monthly		1 2 3 4
Q506	Have you ever missed the WDA regular meeting?	1. Yes 2. No		1 2
Q507	How many of the WDA network members do you have close contact with	1. None of them 2. One of them 3. Greater than 2 but less than 4 4. All of them		1 2 3 4
Q508	Are you living in a Women's Development Army (WDA) model family?	1. Yes 2. No		1 2
Q509	Does your best friend utilize/utilized any of the maternal health services (*antenatal care, delivery care or postnatal care*)?	1.Yes 2.No 88. Don't know		1 2 88
Q510	With whom have you had most frequent discussions about the use of any of the maternal health services?	1. Your best friend 2. Member in the network 3. Family member 4. Member of other women group 5. No one	If (5), skip to Q513	1 2 3 4 5
Q511	Does this person use any of the maternal health services?	1. Yes 2. No 88.Don't know		1 2 88

Q512	Does this person encourage you to use any of the maternal health services?	1. Yes 2. No 88.Don't know		1 2 88
Q513	Who is the most influential person in another aspects of your life?	1. Your best friend 2. Your husband 3. Relatives (mother or father) 4. Mother-in-law 99.Other specify_____		1 2 3 4 99
Q514	Are you a member of other community-based women's groups such as (*Edir*, *Ekub*) etc?	1. Yes 2. No		1 2
Part six: Social support questionnaire				
Q601	What type of help have you received from your best friend during your pregnancy, labour and post-delivery? (*don't mention the options but circle all that apply*)	1.Transportation, 2.Referral 3.Material 4.Financial 5.Labour/service 6.Emotional 7.Not obtained support 99.Other specify_____		1 2 3 4 5 6 7 99
Q602	Did you get any support from the WDA network or its members?	1. Yes 2. No	If no, skip to Q605	
Q603	What kind of social support did you get from the WDA network or its members? (*more than one answer is possible*)	1.Transportation, 2.Referral 3.Material 4.Financial 5.Labour/service 6.Emotional 99.Other specify_____		1 2 3 4 5 6 99
Q604	Are you satisfied with their support?	1. Very satisfied 2. Satisfied 3. Neither 4. Dissatisfied 5. Very Dissatisfied		1 2 3 4 5
Q605	Who do you feel comfortable sharing your thoughts and feelings with (both positive and negative)?	Relation: _____		Cat eg.
Q606	Who do you count on to lend you a hand when you need it (*e.g. take you to clinic when you are sick, accompany you when you are in labour…etc*)	Relation: _____		"
Q607	Who could you borrow money or significant items from if you need it?	Relation: _____		"

Q608	Who do you feel truly cares about you and would be supportive almost under any circumstances?	Relation: _____		“

Thank you for giving your time to provide us with this information

Appendix 2

Qualitative study tool (focus group discussion guide)

Participants information statements for focus group participants

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Title of the research project: Maternal Mortality and Maternal Health Service Utilization in Eastern Ethiopia: The Case of Kersa District

Primary supervisor: Prof Deborah Loxton
Co-supervisor: Dr.Catherine Chojenta
Co-Supervisor: L/Prof Roger Smith
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Document version:1, **Date**: 21/10/2016

You are invited to participate in the research project identified above which is being conducted by Gezahegn Tesfaye Girma, a PhD student from School of Medicine and Public Health, Faculty of Health and Medicine at the University of Newcastle, Australia. The research is part of a doctoral degree supervised by Professor Deborah Loxton, Dr.Catherine Chojenta, and Laureate Professor Roger Smith from the School of Medicine and Public Health, Faculty of Health and Medicine at The University of Newcastle, Australia.

Why is the research being done?

The purpose of the research is to investigate maternal health service utilization and its associated factors in your district. The study will help to design locally suitable and effective community-based intervention programs that could address the root causes of poor utilization

of maternal health services at a community level.

Who can participate in the research?

We are seeking key informants in the community such as women aged 15-49 years, traditional birth attendants, mothers-in-law, husbands, and health extension workers. Unfortunately, those key informants who have assumed a management position are not eligible to participate in the focus group discussion.

What would you be asked to do?

If you agree to participate in the study, you will be invited to participate in a focus group discussion with other key informants. We will ask you some basic information about you, and your opinions about women's maternal health service utilization in your community. The moderator will group participants and facilitate discussion with other group members, and record the session using an audio tape recorder. A note taker will write important information from the discussion in a note book. You are under no obligation to participate in the focus group discussion.

What choice do you have?

Participation in the focus group discussion is entirely your choice. Only those key informants who give their informed verbal consent will be included in the discussion. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the discussion at any time until we finalize the discussion and submit the audio records to the student researcher. Please note that due to the anonymous nature of the survey, you will not be able to withdraw your response after it has been submitted.

How much time will it take?

To complete a focus group discussion, it will take a maximum of two hours.

What are the risks and benefits of participating?

There will be no benefit to you in participating in this focus group discussion. However, by participating and giving responses to questions posed by the moderator in this study, you will have the opportunity to share your opinions about women's utilization of maternal health services in your community which will help us discover the community related factors that hinder a proper uptake of maternal health services, and will assist in developing appropriate interventions to improve the situation at a local level. Many mothers in your community will be benefit in the future from the community based maternal health programs that will be developed based on the results of the study. Your participation in this research doesn't carry any risks to you.

How will your privacy be protected?

Due to the anonymous nature of the survey, it will not be possible to identify you from your responses in the focus group discussion. The moderator and the note taker will sign a confidentiality agreement for the transcribing of the interview data. Before beginning the

discussion all focus group participants will be requested to maintain the confidentiality of the group discussion and not to tell anyone else outside the group about anything that was said in the discussion sessions. The audio recording will be retained for a minimum of 5 years as per the University of Newcastle requirements and the data will be securely destroyed in line with University of Newcastle policy provisions.

How will the information collected be used?

The data and the report produced from the focus group discussion will contribute towards Gezahegn's PhD thesis and the findings of the study will be published in journals. You will be able to review the audio recordings or the transcripts to edit or erase your contribution. Attempts will be made to present the results of the study at different scientific conferences, meetings, and seminars. The individual group discussion participants will not be identified in any reports arising from the project. Non-identifiable data may be shared with other parties to encourage scientific scrutiny and to contribute to further research and public knowledge, or as required by law. The summary of the study's findings will be submitted to the Federal Ministry of Health of Ethiopia, Oromia Regional Health Bureau, Kersa district Health Office and Kersa Health Demographic Surveillance Survey Coordinating Office for their prompt action to improve maternal health service utilization at the grass-roots level, based on the recommendations of the study.

What do you need to do to participate?

Please read or listen to this Information Statement and be sure you understand its contents before you consent to participate in the focus group discussion. If there is anything you do not understand, or if you have any questions, please contact the researcher. If you would like to participate, please inform us that you are happy to take part in the research. This will be taken as your informed verbal consent to participate in the study. After that, we can arrange a focus group discussion venue and time to start the discussion.

Further information

If you would like further information, please contact Gezahegn Tesfaye Girma (+251913543209) or the district administrative body (tele: +251253360159), the Institutional Health Research Review Committee of Haramaya University (tele: +251254660708 or +2512566661899) or Prof Deborah Loxton at The University of Newcastle, Australia. Tel: +61 2 4042 0690 Email: deborah.loxton@newcastle.edu.au

Thank you for considering this invitation.

Signature _____	Signature _____
Prof Deborah Loxton	Gezahegn Tesfaye Girma
Chief Investigator	Student Researcher

Complaints about this research

Should you have concerns about your rights as a participant in this research, or a complaint to make about the manner in which the research is conducted, you should contact the student researcher (telephone +251913543209), email (gezites@gmail.com) or the district administrative body in your area (telephone +251253360159). It is also possible to contact the Institutional Research Ethics Committee of Haramaya University, Harar, Ethiopia, telephone +251254660708 or +2512566661899, or appointed personnel email address (neggaberaki@gmail.com). If you wish to talk to a person independent of the project, contact the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone +612 49216333, email Human-Ethics@newcastle.edu.au.

Information to the moderator

***Procedure for group discussion*:** For the discussion a relatively quiet area or room in the nearby elementary or high school or health facility will be arranged. The focus group discussants sit in a circle to make better eye contact with each other, the moderator and the facilitator. Once every participant takes their seat and is ready for the discussion, the moderator will introduce him/herself and give each participant a chance to introduce themselves to the rest of the group. Then the moderator will give a brief introductory speech about the group discussion as well as the aim of the session by explaining the purpose of the focus group. After that, the tape recorder will be turned on and the focus group discussion will begin.

***Role of moderator*:** The responsibility of the moderator is to guide the discussion and raise a new discussion point after making sure that the issue under discussion has achieved a saturation level. However, the moderator will not give any sign that encourages or discourages the responses of the participants. Moderators also don't need to give any comment on the ideas of the participant. The moderator will oversee the overall discussion environment, participants' responses, nonverbal actions, the atmosphere of the session, as well as another important aspect of the session. The moderator is also in charge of controlling the scope or topic of the discussion when a discussant wanders away from the issue under discussion.

***Instructions*:** After ensuring everyone in the group has taken a seat and is ready for the

discussion, say "First we will talk about some introductory issues around the topic of today's discussion, and then we will be looking at several other issues around maternal health service utilization and factors that hinder or facilitate the use of these services. We will be asking you questions about your overall experience with maternal health service utilization in your community and circumstances surrounding it. We'll also look at questions pertaining to pregnancy related issues, antenatal care, skilled delivery attendance, post-natal care use and preferences for place of delivery".

***Role of the note-taker*:** After the moderator gives their introductory speech, you will say "Please bear in mind that, we are here to learn from you and there are no right and wrong answers. Please tell us your views, whatever they may be throughout our discussion. Before we go further, it would be useful if you could give me some basic information about yourself (age, education, religion, occupation, marital status, and how long have you lived in this area". [Note-taker: please before the beginning of the discussion write the basic characteristics of the participants as they give you the information and also the type of key informants group, etc. in a summary table].

***Target groups*:** Reproductive-aged women, traditional birth attendants, Husbands, Mothers-in-law, Health Extension workers. Separate focus groups for each target category of participants will be conducted

***Warm up questions*:** As initial ice breaker for our discussion: Would you please tell us about your knowledge of the maternal health situation in your area, and maternal health services?

To moderators **Use the following phrases to probe participants for each question wherever needed throughout the FGD (internalize the probing phrases)** Could you tell me a bit more about that? Could you give me an example? Has anyone else had the same experience? Is there anything else that comes to mind?
Target group coding reference: *Reproductive-aged women (RAW), traditional birth*

attendants **(TBA)**, *mothers-in-law* **(MIL)**, *husbands* **(HUS)**, *health extension workers* **(HEW),**

Area 1: Pregnancy-related risks, antenatal care, delivery care and postnatal care

FGD questions	**RAW**	**TBA**	**MIL**	**HUS**	**HEW**
Do you think a healthy pregnant woman should attend ANC? Can you explain why you think this way?	✓	✓	✓	✓	
What do you think are the main reasons for women not attending ANC, skilled delivery care and postnatal care? Can you tell us more about this?	✓	✓	✓	✓	✓
In your opinion, when shall a pregnant woman start ANC, and how many visits?	✓	✓	✓	✓	
What community values are around seeking early care during labour or delivery, and the post-natal period?	✓	✓	✓	✓	
What, if anything, encourages/discourages you to seek care from health facilities for ANC, delivery care, and post-natal care?	✓				
Do you think women should get health check-ups after giving birth? In what way could the women benefit? Are there disadvantages?	✓	✓	✓	✓	
What do you think are the main reasons for not attending health check-ups after giving birth (postnatal care)?	✓	✓	✓	✓	
How did transportation of pregnant women take place when there was an emergency or complication?		✓	✓	✓	✓
What would you suggest to improve the referral and transportation of labouring mothers from the village level to a health facility?		✓	✓	✓	✓

Can you explain about the problems in using ambulance during obstetric emergencies in your community? How does that affect the referral linkage?					✓
What difficulties did women face when they are referred to a higher level of care?	✓	✓			✓
How is the participation of husbands in encouraging maternal health service utilization in your community? Does husbands help their wife during obstetric emergency?	✓			✓	✓

Area 2: Social network and social support qualitative questions

FGD questions	RAW	TBA	MIL	HUS	HEW
What benefit did a woman living in WDA model family get with regards to maternal health services?	✓				
Do you think the WDA network is important to access information about maternal health services?	✓				✓
Can you describe the advice or information that a woman could receive about maternal health services from a Women's Development Army network, if any?	✓				
What is the importance of participating in the Women's Development Army network with regards to promotion and utilization of maternal health service?	✓				✓
How does the community or the villagers support a pregnant woman when	✓	✓	✓	✓	✓

she starts labouring or has pregnancy complications?					

Ending questions

Are there any issues, questions, comments that you would like to raise or points you wanted to add?

Thank you for giving your time to us

Appendix 3

Letter of approval from the Human Research Ethics Committee of the University of Newcastle

HUMAN RESEARCH ETHICS COMMITTEE

Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	**Professor Deb Loxton**
Cc Co-investigators / Research Students:	**Laureate Professor Roger Smith Doctor Catherine Chojenta**

Mr Gezahegn Tesfaye Girma

Re Protocol: **Maternal Mortality and Maternal Health service Utilization in Eastern Ethiopia: The Case of Kersa district**

Date:	**03-Feb-2017**
Reference No:	**H-2016-0403**
Date of Initial Approval:	**02-Feb-2017**

Thank you for your **Response to Conditional Approval (minor amendments)** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **Expedited** review by the Ethics Administrator. I am pleased to advise that the decision on your submission is **Approved** effective **02-Feb-2017**.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. *If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.*

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal *Certificate of Approval* will be available upon request. Your approval number is **H-2016-0403**.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants **You may then proceed with the research.**

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress*, *Reporting of Adverse Events*, and *Variations to the Approved Protocol* as detailed below.

PLEASE NOTE:

In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- *Monitoring of Progress*

  Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

- *Reporting of Adverse Events*

  It is the responsibility of the person **first named on this Approval Advice** to report adverse events.

  Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.

  Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the Approval Advice to the (HREC) by way of the Adverse Event Report form (via RIMS at https://rims.newcastle.edu.au/login.asp) within 72 hours of the occurrence of the event or the investigator receiving advice of the event.

  Serious adverse events are defined as:

  Causing death, life threatening or serious disability. Causing or prolonging hospitalisation.

  Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.

  Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.

  Any other event which might affect the continued ethical acceptability of the project.

  Reports of adverse events must include: Participant’s study identification number; date of birth; date of entry into the study; treatment arm (if applicable); date of event; details of event; the investigator’s opinion as to whether the event is related to the research procedure; and action taken in response to the event.

  Adverse events which do not fall within the definition of serious or unexpected, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

- *Variations to approved protocol*

If you wish to change, or deviate from, the approved protocol, you will need to submit an *Application for Variation to Approved Human Research* (via RIMS at https://rims.newcastle.edu.au/login.asp). Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented** except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (i.e. those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Dr Kerry Dally

Acting Chair, Human Research Ethics Committee

For communications and enquiries:

Human Research Ethics Administration
Research & Innovation Services Research Integrity Unit
NIER, Block C
The University of Newcastle Callaghan NSW 2308
T +61 2 492 17894
Human-Ethics@newcastle.edu.au

RIMS website - https://RIMS.newcastle.edu.au/login.asp

Appendix 4

Ethical clearance from the Institutional Health Research Ethics Review Committee of Haramaya University

Ref.No. IHRERC/ 129/2017

May 10/2017

To: Chief Executive Director; College of Health and Medical Sciences, Haramaya University, Harar Campus

From: Institutional Health Research Ethics Review Committee (IHRERC), Colleges of Health and Medical Sciences, Harar Campus

Chair-person

Haramaya University College of Health and Medical Sciences Harar Ethiopia Institutional Health Research Ethics Review Committee (IHRERC)

Subject: Ethical approval of research proposal

It is known that various research proposals are passing through the IHRERC for ethical reviews. To this effect **Gezahegn Tesfaye** who is academic staff of the College and now attending his PhD study in the UNIVERSITY OF NEWCASTLE, AUSTRALIA has submitted a research proposal entitled **"Maternal Mortality and Maternal Health Service Utilization in Eastern Ethiopia: The Case of Kersa district"** through your office to the IHRERC. The committee has scrutinized the proposal for ethical issues and made the investigator for correcting and incorporating essential elements. The investigator has incorporated all elements as enquired by the committee. The committee has, therefore, approved the herewith attached and stamped 181 page proposal unanimously through full consensus of all existing seven members of the IHRERC on 02/05/2017. The IHRERC congratulates the investigator for the concerted efforts he made to fulfill the recommendations of the Committee.

Finally the IHRERC requests your Office, to inform officially the investigator to commence his data collection process. However, since the IHRERC is bestowed to make follow-up of the research process, the investigator is informed with a copy of this letter to report any changes in the research procedure and submit an activity progress report to the IHRERC **every three months.** A copy of the final report is also expected.

At the back of this letter is signed and stamped copy of the approval format of the IHRERC.

With Regards

CC

Gezahegn Tesfaye((including one copy of the approved proposal)

Appendix 5

Letter of cooperation to conduct the survey (in official language)

HARAMAYA UNIVERSITY
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COLLEGE OF HEALTH AND MEDICAL SCIENCE
ጤናና ሕክምና ሳይንስ ኮሌጅ

138, Dire Dawa, Ethiopia
235, Harar, Ethiopia 025-666-74-39
025-553-03/19/22/21 251-025-553-25/31/54
ድሬደዋ ኢትዮጵያ email : Hararmaya.univ@ethio.net
251-666-80-81 ሐረር ኢትዮጵያ
email : chms@hararmaya.edu.et

ቁጥር
Ref. No ኮ/ጤ/ሠ/ዓ/ዐ/ተ/ጥ/ተ/ክ/09
ቀን
Date 29/9/09

ለቀርሳ ወረዳ አስተዳደር ጽ/ቤት

ለቀርሳ ወረዳ ጤና ጥበቃ ጽ/ቤት

ሐረማያ

ጉዳዩ፡- ትብብር ስለመጠየቅ

የሐረማያ ዩኒቨርሲቲ የጤናና ሕክምና ሳይንስ ኮሌጅ ባልደረባ የሆኑት አቶ ገዛኸኝ ተስፋዬ ከዚህ በታች በተገለጸው የምርምር ርዕስ ላይ የዶክትሬት ትምህርቱ አካል የሆነ ጥናት ያካሄዳሉ፡፡ በመሆኑም በጥናቱ ወቅት በተለያዩ ቀበሌዎች ውስጥ በመዘዋወር ለጥናቱ ግብዓት የሚሆን መረጃ ስለሚሰበስቡ ጥናቱ በሚካሄድበት ወቅት አስፈላጊውን ትብብር ይደረግላቸው ዘንድ በአክብሮት እየጠየቅን ለሚደረግላቸው ማንኛውም ትብብር በቅድሚያ እናመሰግናለን፡፡ የጥናቱም ርዕስ የሚከተለው መሆኑን እንገልጻለን

"Maternal Mortality and Maternal Health Services Utilization in Eastern Ethiopia".

ከሰላምታ

Tesfaye Gobena (PhD)
Chief Academic & Research Director

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ጤናና ህክምና ሳይንስ ኮሌጅ

In replying Please Quote Our Reference ሲጽፉልን የእኛን ደብዳቤ ቁጥርና ቀን ይጥቀሱ

Appendix 6

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist

Section and topic	Item No	Checklist item	Self-Evaluation
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	**YES, identified**
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	**Not applicable**
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	**PROSPERO(CRD42017064585)**
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	**YES, it was provided**
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	**YES, this was provided**
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	**Not applicable**
Support:			
Sources	5a	Indicate sources of financial or other support for the review	**Not applicable**
Sponsor	5b	Provide name for the review funder and/or sponsor	**Not applicable**
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	**Not applicable**
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	**Yes, this was done**
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	**Yes this was clearly stated**
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	**Yes this was specified**

Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	**Yes this was well described**
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	**Yes this provided as additional file**
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	**Yes this was described**
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	**Yes this was stated**
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	**Yes this was described**
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	**Yes this was provided**
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	**Yes this was done**
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	**Yes this was done**
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	**Yes this was described**
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	**Yes this was stated**
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	**Yes this was described**
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	**Yes this was described**
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	**Yes (NOS and NIH tool)**

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g 7647

Appendix 7

Search strategy for the systematic review and meta-analysis

Title of the review: Delayed initiation of antenatal care and associated factors in Ethiopia.

No	Database	Search filters (Year=01/01/2002 to 30/04/2017, Language=English), DATE OF THIS SEARCH [MAY 05, 2017]	
		Combined search phrase	**Search results**
1	**PubMed**	((((((((("Delayed initiation"[All Fields] OR "Late initiation"[All Fields]) OR "Delayed utilization"[All Fields] OR "late utilization"[All Fields] OR Delayed[All Fields] OR late[Title/Abstract] OR initiation[Title/Abstract] OR utilization[Title/Abstract] OR "Delayed attendance"[All Fields] OR "Attendance"[Title/Abstract]) OR "Late booking"[All Fields] OR "Booking"[Title/Abstract]) AND (((((((("Antenatal care"[All Fields] OR "First antenatal care"[All Fields] OR "Prenatal care"[Mesh]) OR "Antepartum care"[All Fields]) OR "ANC"[All Fields]) OR "PNC"[All Fields]) OR "Antenatal follow up"[All fields]) OR "Antenatal period"[All Fields]) OR "Antenatal service"[All Fields]) OR "Antenatal care visit"[All Fields]) OR "Antenatal presentation"[All Fields]) OR "Antenatal attendance"[All Fields]) OR "Perinatal care"[Mesh]) OR "Maternal health services"[Mesh]) AND ((("Associated factors"[All Fields] OR "Factors associated"[All Fields]) OR "Influencing factors"[All Fields]) OR "Predictors"[All Fields]) OR "Predicting factors"[All Fields]) OR "Correlates"[All Fields]) OR Determinants[All Fields]) OR "Risk factors"[Mesh]) AND "Ethiopia"[Mesh]) AND (("2002/01/01"[PDAT] : "2017/04/30"[PDAT]) AND English[lang])	**1011**
2	**Medline**	**#** **Searches** **Results** 1 'Delayed initiation'.mp. 590 2 exp Pregnancy/ or 'Late initiation'.mp. or exp Prenatal Care/ 833510 3 'Delayed utilization'.mp. 13 4 *Health Services/ or 'late utilization'.mp. or exp Prenatal Care/ 39335 5 Delayed.mp. 308828 6 late.mp. or exp Pregnancy/ 1169933 7 initiation.mp. 214560 8 utilization.mp. 174823 9 exp "Patient Acceptance of Health Care"/ or 'Delayed attendance'.mp. 209087 10 Attendance.mp. or exp Patient Compliance/ 85993	**611**

		11	exp Pregnancy Complications/ or exp Pregnancy Outcome/ or exp Pregnancy/ or exp Prenatal Care/ or 'Late booking'.mp. or exp Gestational Age/	882197	
		12	*Obstetric Labor Complications/ or exp Pregnancy/ or exp Prenatal Care/ or exp Pregnancy Complications/ or 'Antenatal care'.mp. or exp Pregnancy Outcome/ or exp Maternal Health Services/	867354	
		13	exp Pregnancy/ or exp Prenatal Care/ or 'First antenatal care'.mp. or exp Pregnancy Complications/	860196	
		14	exp Pregnancy/ or exp Prenatal Care/ or exp Pregnancy Complications/ or 'Prenatal care'.mp. or exp Maternal Health Services/	867282	
		15	exp Pregnancy Complications/ or exp Pregnancy/ or 'Antepartum care'.mp. or exp Maternal Health Services/ or exp Prenatal Care/	865783	
		16	exp Pregnancy/ or ANC.mp. or exp Prenatal Care/	835885	
		17	exp Pregnancy/ or PNC.mp. or exp Prenatal Care/	834055	
		18	exp Pregnancy Outcome/ or exp Pregnancy Complications/ or exp Pregnancy/ or *Obstetric Labor, Premature/ or 'Antenatal follow up'.mp. or exp Prenatal Care/	860180	
		19	exp Prenatal Care/ or exp Pregnancy/ or 'Antenatal period'.mp. or *Obstetric Labor Complications/ or exp Pregnancy Complications/	860377	
		20	exp Pregnancy/ or exp Prenatal Care/ or exp Pregnancy Complications/ or 'Antenatal service'.mp. or exp Maternal Health Services/	865783	
		21	exp Pregnancy/ or exp Prenatal Care/ or 'Antenatal care visit'.mp. or exp Maternal Health Services/	839235	
		22	exp Pregnancy/ or 'Antenatal presentation'.mp.	831456	
		23	exp "Patient Acceptance of Health Care"/ or exp Pregnancy/ or exp Prenatal Care/ or exp Maternal Health Services/ or exp Pregnancy Complications/ or 'Antenatal attendance'.mp.	1064368	
		24	exp Perinatal Care/ or 'Perinatal care'.mp.	9889	
		25	*Delivery, Obstetric/ or exp Pregnancy/ or exp Maternal Health Services/ or exp Prenatal Care/ or 'Maternal health services'.mp. or *Maternal Welfare/	841762	
		26	exp Cross-Sectional Studies/ or 'Associated factors'.mp.	255598	
		27	exp Risk Factors/ or 'Factors associated'.mp.	761229	

		28 'Influencing factors'.mp.	5740	
		29 Predictors.mp.	181574	
		30 'Predicting factors'.mp.	918	
		31 Correlates.mp.	144337	
		32 Determinants.mp. or exp "Social Determinants of Health"/	133112	
		33 exp Risk Factors/ or 'Risk factors'.mp.	864224	
		34 Ethiopia.mp. or exp Ethiopia/	12131	
		35 exp Pregnancy/ or exp Pregnancy Complications/ or booking.mp. or exp Prenatal Care/	860766	
		36 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 35	2050883	
		37 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25	1073570	
		38 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33	1463433	
		39 34 and 36 and 37 and 38	668	
		40 limit 39 to (english language and yr="2002 -2017")	611	
3	**EMBASE**	**#**	**Searches**	**Results**
		1	exp therapy delay/ or 'Delayed initiation'.mp.	9693
		2	exp prenatal care/ or 'Late initiation'.mp.	132377
		3	exp health care utilization/ or 'Delayed utilization'.mp.	53553
		4	'late utilization'.mp. or exp pregnancy/	705334
		5	Delayed.mp.	342066
		6	late.mp.	485524
		7	initiation.mp.	304064
		8	exp health care utilization/ or utilization.mp.	311668
		9	exp prenatal care/ or 'Delayed attendance'.mp.	131988
		10	exp patient attendance/ or Attendance.mp.	28661
		11	exp pregnancy/ or exp prenatal care/ or 'Late booking'.mp. or exp mother/ or exp prenatal diagnosis/	859069

		12 exp prenatal care/ or exp pregnant woman/ or exp pregnancy/ or booking.mp.	795139
		13 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12	2244549
		14 'Antenatal care'.mp. or exp prenatal care/	133994
		15 exp pregnancy/ or exp prenatal care/ or exp pregnant woman/ or 'First antenatal care'.mp. or exp pregnancy complication/	828364
		16 'Prenatal care'.mp. or exp prenatal care/	134573
		17 exp preeclampsia/ or exp prenatal care/ or exp pregnancy/ or 'Antepartum care'.mp. or exp fetus monitoring/ or exp pregnancy complication/	819790
		18 exp pregnancy/ or exp prenatal care/ or ANC.mp. or exp pregnant woman/	798998
		19 PNC.mp.	1204
		20 exp prenatal care/ or exp follow up/ or exp pregnancy/ or 'Antenatal follow up'.mp. or exp prenatal diagnosis/ or exp gestational age/	1962131
		21 'Antenatal period'.mp. or exp prenatal period/	9426
		22 exp pregnancy/ or exp maternal care/ or exp prenatal care/ or 'Antenatal service'.mp. or exp health service/ or exp pregnant woman/	5144221
		23 exp health service/ or exp pregnancy/ or exp pregnant woman/ or exp prenatal care/ or 'Antenatal care visit'.mp.	5144217
		24 exp prenatal diagnosis/ or exp pregnancy/ or 'Antenatal presentation'.mp.	756474
		25 exp pregnant woman/ or exp pregnancy/ or exp prenatal care/ or exp health care facility/ or 'Antenatal attendance'.mp.	2147974
		26 'Perinatal care'.mp. or exp perinatal care/	50592
		27 'Maternal health services'.mp. or exp maternal health service/	891
		28 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27	5936151
		29 exp prevalence/ or 'Associated factors'.mp. or exp cross-sectional study/	731241
		30 'Factors associated'.mp.	117675
		31 'Influencing factors'.mp.	7930
		32 Predictors.mp. or exp predictor variable/	261656
		33 'Predicting factors'.mp.	1581
		34 Correlates.mp.	182554
		35 Determinants.mp. or exp "social determinants of health"/	154332

		36 'Risk factors'.mp. or exp risk factor/	962833
		37 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36	2073703
		38 Ethiopia.mp. or exp Ethiopia/	12770
		39 13 and 28 and 37 and 38	826
		40 limit 39 to (english language and yr="2002 - 2017")	**778**
4	**CINAHL**		

EBSCOhost

#	Query	Limiters/Expanders	Last Run Via	Results
S8	S1 AND S4 AND S5 AND S6	Limiters - Published Date: 2002-01-01-2017-04-30; English Language Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	**79**
S7	S1 AND S4 AND S5 AND S6	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	79
S6	Ethiopia	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	2,957

		S5	Associated factors OR Factors associated OR Influencing factors OR Predictors OR Predicting factors OR (Correlates or determinants) OR (Determinants or factors) OR (risk factors or protective factors)	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	1,124,069
		S4	S2 OR S3	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	25,140
		S3	Perinatal care OR Maternal health services	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	10,468
		S2	(antenatal care or prenatal care) OR First antenatal care OR Prenatal care OR Antepartum care OR ANC OR PNC OR Antenatal follow up OR Antenatal period OR Antenatal service OR Antenatal care visit OR Antenatal presentation OR Antenatal attendance	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Complete	16,121
		S1	Delayed initiation OR Late initiation OR Delayed utilization OR late utilization OR Delayed OR late OR initiation OR utilization OR Delayed attendance OR Attendance OR Late booking OR Booking	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database -	282,576

						CINAHL Complete	

Appendix 8

Model building process to identify potential factors associated with antenatal care, and postnatal care utilization

Table 1. Model building process to identify potential factors associated with at least one antenatal care visit among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017 (n=1059, multiparous women)

Predisposing factors	*Categories*	**ANC** (at least one visit)		**COR (95% CI)**	**Model 1 (AOR at 95% CI)**	**Model 2 (AOR at 95% CI)**	**Model 3 (AOR at 95% CI)**
		No (%)	**Yes (%)**				
Maternal age	*Continuous*	498(47%)	561(53%)	0.99(0.97,1.02)	*Excluded*	*Excluded*	*Excluded*
Educational status	Never attended	431(52.7%)	383 (47.1%)	1	1	1	1
	Attended	67 (27.3%)	178 (72.7%)	2.99 (2.19,4.09)	1.47(0.93,2.32)	1.53(0.94,2.48)	1.50(0.92, 2.46)
Husband's education	Never attended	316 (55.4%)	254 (44.6%)	1	1	1	1
	Attended	182 (37.2%)	307 (62.8%)	2.10 (1.64,2.69)	1.34(0.95,1.90)	1.25(0.87,1.80)	1.21(0.83, 1.74)
Education on maternal health	Yes	201 (39.0%)	315 (61%)	1.89 (1.48,2.42)	1.33(0.95,1.85)	1.16(0.81,1.64)	0.96(0.66,1.40)
	No	297 (54.7%)	246 (45.3%)	1	1	1	1
Mass media availability	Yes	126 (36.2%)	339 (63.8%)	1.93(1.49, 2.52)	1.01(0.69,1.49)	1.01(0.66,1.52)	1.01(0.66,1.52)
	No	372 (52.3%)	397 (47.7%)	1	1	1	1
Telephone (mobile) ownership	Yes	90 (34.4%)	172 (65.6%)	2.01 (1.50,2.68)	0.84(0.55,1.30)	0.75(0.47,1.19)	0.73(0.45, 1.17)
	No	408 (51.2%)	389 (48.8%)	1	1	1	1
Age at first marriage	*Continuous*	498(47%)	561(53%)	1.03(0.98,1.09)	*Excluded*	*Excluded*	*Excluded*
Age at first pregnancy	*Continuous*	498(47%)	561(53%)	1.04(0.99,1.09)	*Excluded*	*Excluded*	*Excluded*
Birth order	≤3rd	188 (43.1%)	248 (56.9%)	1	1	1	1
	>3rd	310 (49.8%)	313 (50.2%)	0.77(0.60,0.98)	0.98(0.70,1.39)	0.99(0.69,1.43)	0.85(0.59, 1.25)
Previous use of ANC	Yes	49 (10.5%)	417 (89.5%)	1	1	1	1
	No	449 (75.7%)	144 (24.3%)	0.04(0.03,0.05)	0.05(0.04,0.07)	0.05(0.03,0.07)	**0.05(0.03, 0.07)**
Living in model family	Yes	6(15.2%)	28 (84.8%)	1	1	1	1
	No	493 (48.1%)	533 (51.9%)	0.19(0.07,0.50)	0.84(0.25,2.85)	0.99(0.28,3.52)	1.15(0.31, 4.24)
Best friend's use of care	Yes	110 (24.8%)	334 (75.2%)	1	1	1	1
	No/don't know	388 (63.1%)	227 (37.9%)	0.19(0.15,0.25)	0.37(0.26,0.52)	0.46(0.32,0.67)	**0.53(0.36, 0.78)**
Enabling factors							
Residence	Rural	475 (50.7%)	462 (49.3%)	1		1	1

	Urban	23 (18.9%)	99 (81.1%)	4.43(2.76,7.09)		0.62(0.29,1.35)	0.50(0.22, 1.14)
Type of kebele	HDSS	298 (42.0%)	411 (58.0%)	1.84(1.42,2.38)		1.65(1.13,2.43)	**1.60(1.07, 2.40)**
	Non-HDSS	200 (57.1%)	150 (42.9%)	1		1	1
Distance from nearest health facility	≥5Km	13 (36.1%)	23 (63.9%)	1			
	<5Km	485 (47.4%)	538 (52.6%)	0.63(0.31,1.25)		*Excluded*	*Excluded*
Wealth index	Highest	92 (44.9%)	113 (55.1%)	1.22(0.83,1.79)		1.34(0.76,2.37)	1.52(0.85, 2.70)
	Fourth	82 (39.4%)	126 (60.6%)	1.52(1.03,2.24)		1.96(1.12,3.42)	**2.14(1.22, 3.76)**
	Middle	119 (55.3%)	96 (44.7%)	0.80(0.55,1.17)		1.15(0.66,2.01)	1.21(0.69, 2.12)
	Second	101 (45.5%)	121 (54.5%)	1.19(0.81,1.73)		1.57(0.91,2.68)	1.68(0.98, 2.89)
	Lowest	104 (49.8%)	105 (50.2%)	1		1	1
Decision making on household expenses	Respondent	91 (52.0%)	84 (48.0%)	1		1	1
	Jointly	336 (45.1%)	409 (54.9%)	1.32(0.95,1.83)		1.58(0.96,2.58)	1.50(0.91, 2.48)
	Partner/parents	71 (51.1%)	68 (48.9%)	1.04(0.67,1.62)		1.27(0.65,2.51)	1.34(0.66, 2.71)
Head of the household	Respondent	6 (35.3%)	11 (64.7%)	1			
	Partner/parents	492 (47.2%)	550 (52.8%)	0.61(0.22,1.66)		*Excluded*	*Excluded*
Husband's attitude towards ANC	Positive	179 (31.3%)	393 (68.7%)	1		1	1
	Negative/neutral	319 (65.5%)	168 (34.5%)	0.24(0.19,0.31)		0.33(0.23,0.47)	**0.37(0.25, 0.54)**
Social support from friends	Yes	433 (45.2%)	525 (54.8%)	1		1	1
	No	65 (64.4%)	36 (35.6%)	0.46(0.30,0.70)		0.66(0.35,1.23)	0.69(0.37, 1.29)
Need factors							
HEW home visit	Yes	237 (38.6%)	377 (61.4%)	1			**1**
	No	261 (58.7%)	184 (41.3%)	0.44(0.35,0.57)			**0.57(0.38, 0.84)**
Pregnancy intention	Intended	299 (42.1%)	411 (57.9%)	1			1
	Unintended	199 (57.0%)	150 (43.0%)	0.55(0.42,0.71)			0.73(0.49, 1.09)
History of abortion	Has no history	465 (47.7%)	509 (52.3%)	1			
	Has history	33 (38.8%)	52 (61.2%)	1.44 (0.91,2.27)			*Excluded*
Awareness of pregnancy complications	Yes	183 (39.2%)	284 (60.8%)	1			1
	No	315 (53.2%)	277 (46.8%)	0.57(0.44,0.73)			**0.52(0.35, 0.79)**
History of still birth	Has no history	451 (46.7%)	514 (53.3%)	1			
	Has history	47 (50.0%)	47 (50.0%)	0.88(0.57,1.34)			*Excluded*
History of infant death	Has no history	368 (46.2%)	428 (53.8%)	1			
	Has history	130 (49.4%)	133 (50.6%)	0.88(0.66,1.16)			*Excluded*
Perceived importance of ANC	Not important	179(72.8%)	67(27.2%)	1			1
	Important	319(39.2%)	494(40.8%)	4.14(3.02,5.66)			**1.89 (1.17, 3.06)**

Keys: **Model 1** (Predisposing factors only), **Model 2** (Predisposing and enabling factors), **Model 3** (Predisposing, enabling and need factors). **AOR**: Adjusted Odds Ratios, **COR:** Crude Odds Ratios, **CI:** Confidence Interval. **Bold**: Indicate statistically significant variables.

Table 2. Model building process to identify factors associated with four or more antenatal care attendance among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017 (n=693)

Predisposing factors	***Categories***	**ANC 4+**		**COR (95% CI)**	**Model 1 (AOR with 95% CI)**	**Model 1 (AOR with 95% CI)**	**Model 1 (AOR with 95% CI)**
		No	**Yes**				
Maternal age	*Continuous*	587 (84.7%)	106 (15.3%)	0.98(0.95,1.02)	*Excluded*	*Excluded*	*Excluded*
Educational status	Never attended	374 (87.8%)	52 (12.2%)	1		1	1
	Attended	213 (79.8%)	54 (20.2%)	1,82 (1.20,2.77)	1.36(0.83,2.21)	1.13 (0.67,1.92)	1.18(0.69,2.02)
Husband's education	Never attended	250 (88.7%)	32 (11.3%)	1		1	1
	Attended	337 (82.0%)	74 (12.0%)	1.72 (1.10,2.68)	1.30(0.79,2.16)	1.16(0.69,1.95)	1.06(0.62,1.79)
Education on maternal health	Yes	332 (85.8%)	55 (14.2%)	0.83 (0.55,1.25)	*Excluded*	*Excluded*	*Excluded*
	No	255 (83.3%)	51 (16.7%)	1			
Mass media availability	Yes	245 (82.8%)	51 (17.2%)	1.29 (0.85,1.96)	*Excluded*	*Excluded*	*Excluded*
	No	342 (86.1%)	55 (13.9%)	1			
Telephone (mobile) ownership	Yes	193 (81.1%)	45 (18.9%)	1.51 (0.98, 2.30)	*Excluded*	*Excluded*	*Excluded*
	No	394 (86.6%)	61 (13.4%)	1			
Age at first marriage	*Continuous*	587 (84.7%)	106 (15.3%)	1.15(1.06,1.25)	1.06(0.90,1.24)	1.08(0.92,1.27)	1.09(0.92,1.28)
Age at first pregnancy	*Continuous*	587 (84.7%)	106 (15.3%)	1.15(1.06,1.25)	1.06 (0.91,1.25)	1.02(0.87,1.19)	1.03(0.88,1.21)
Previous use of ANC	Yes	356 (85.4%)	61 (14.6%)	1			
	No	128 (88.3%)	17 (11.7%)	0.77(0.44,1.38)	*Excluded*	*Excluded*	*Excluded*
Birth order	$\leq 3^{rd}$	314 (82.6%)	66 (17.4%)	1			1
	$>3^{rd}$	273 (87.2%)	40 (12.8%)	0.70 (0.46,1.07	*Excluded*	*Excluded*	*Excluded*
Living in model family	Yes	23 (71.9%)	9 (28.1%)	1	1	1	1
	No	564 (85.3%)	97 (14.7%)	0.44(0.20,0.98)	0.49 (0.21,1.14)	0.53(0.23,1.22)	0.58(0.25,1.35)
Best friend's use of care	Yes	350 (83.9%)	67 (16.1%)	1			1
	No/don't know	237 (85.9%)	39 (14.1%)	0.86(0.56,1.32)	*Excluded*	*Excluded*	*Excluded*
Parity	Primipara	104 (78.8%)	28 (21.2%)	1	1	1	1
	Multipara	483 (86.1%)	78 (13.9%)	0.60(0.37,0.97)	0.77(0.46,1.30)	0.77(0.46,1.31)	0.73(0.43, 1.25)
Enabling factors							

Residence	Rural	478 (87.4%)	69 (12.6%)	1		1	1
	Urban	109 (74.7%)	37 (25.3%)	2.35 (1.59,3.69)		1.56(0.91,2.67)	1.07(0.58,1.96)
Type of kebele	HDSS	436 (85.0%)	77 (15.0%)	0.92 (0.58,1.47)		*Excluded*	*Excluded*
	Non-HDSS	151 (83.9%)	29 (14.1%)	1			
Distance from nearest health facility	≥5Km	22 (84.1%)	4 (15.9%)	1			
	<5Km	565 (84.7%)	102 (15.3%)	0.99 (0.34,2.94)		*Excluded*	*Excluded*
Wealth index	Highest	125 (83.9%)	24 (16.1%)	0.84 (0.45,1.58)		*Excluded*	*Excluded*
	Fourth	132 (83.5%)	26 (16.5%)	0.87 (0.47,1.61)		*Excluded*	*Excluded*
	Middle	105 (87.5%)	15 (12.5%)	0.63 (0.31,1.27)		*Excluded*	*Excluded*
	Second	124 (87.3%)	18 (12.7%)	0.64 (0.33,1.25)		*Excluded*	*Excluded*
	Lowest	101 (81.5%)	23 (18.5%)	1			
Decision making on household expenses	Respondent	83 (85.6%)	14 (14.4%)	1			
	Jointly	436 (86.0%)	71 (14.0%)	0.97 (0.52,1.79)		*Excluded*	*Excluded*
	Partner/parents	68 (76.4%)	21 (23.6%)	1.83 (0.87,3.87)		*Excluded*	*Excluded*
Head of the household	Respondent	7 (58.3%)	5 (41.7%)	1		1	1
	Partner/parents	580 (85.2%)	101 (14.8%)	0.24(0.08,0.78)		0.16(0.05,0.56)	**0.16(0.05,0.58)**
Husband's attitude towards ANC	Positive	407 (82.1%)	89 (17.9%)	1		1	1
	Negative/neutral	180 (91.4%)	17 (8.6%)	0.43(0.25,0.75)		0.48(0.27,0.86)	**0.41(0.23,0.75)**
Social support from friends	Yes	541 (84.1%)	102 (15.9%)	1		1	1
	No	46 (92.0%)	4 (8.0%)	0.46(0.16,1.31)		*Excluded*	*Excluded*
Need factors							
Pregnancy intention	Intended	445 (83.8%)	86 (16.2%)	1			1
	Unintended	142 (87.7%)	20 (12.3%)	0.73 (0.43,1.23)			Excluded
History of abortion	Has no history	543 (85.6%)	91 (14.4%)	1			1
	Has history	44 (74.6%)	15 (15.4%)	2.03 (1.10,3.81)			**2.06(1.05,4.04)**
Awareness of pregnancy complications	Yes	286 (79.9%)	72 (20.1%)	1			1
	No	301 (89.9%)	34 (10.1%)	0.45 (0.29,0.70)			**0.51(0.30,0.85)**
History of still birth	Has no history	544 (84.3%)	101 (15.7%)	1			
	Has history	43 (89.6%)	5 (10.4%)	0.63 (0.24,1.62)			*Excluded*
History of infant death	Has no history	470 (84.1%)	89 (15.9%)	1			
	Has history	117 (87.3%)	17 (12.7%)	0.77 (0.44,1.34)			*Excluded*

Key*: AOR*: Adjusted Odds Ratio (adjusting for all the ***predisposing***, ***enabling*** and ***need*** factors in final model), ***CI:*** Confidence Interval (95%), **Bold*:*** statistically significant variables

Table 3. Factors associated with PNC utilization among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017 (*n=1206*)

Variables		**PNC use**		**Unadjusted Odds Ratio (95% CI)**	**Model 1 (AOR with 95% CI)**	**Model II (AOR with 95% CI)**	**Model III (AOR with 95% CI)**
Predisposing factors		**No (%)**	**Yes (%)**				
Age	Continuous	1114(92.4)	92(7.6)	1.01(0.97,1.04)	*Excluded*	*Excluded*	*Excluded*
Woman's education	Never attended	827(94.3)	50(5.7)	1	1	1	1
	Attended	287(87.2)	42(12.8)	2.42(1.57,3.73)	0.85(0.47,1.53)	0.83(0.46,1.50)	0.86(0.47, 1.57)
Husband's education	Never attended	566(94.8)	31(5.2)	1	1	1	1
	Attended	548(90.0)	61(10.0)	2.03(1.30,3.18)	1.19(0.70,2.04)	1.15(0.67,1.97)	1.14(0.65, 1.98)
Husband's occupation	Farming	1013(94.2)	62(5.8)	1	1	1	1
	Non farming job	101(77.1)	30(22.9)	4.85(2.99,7.86)	1.94(1.01,3.70)	1.47(0.66,3.27)	1.36(0.58, 3.16)
Education about maternal health	Yes	522(88.8)	66(11.2)	2.88(1.80, 4.60)	2.16(1.32,3.55)	2.22(1.35,3.65)	**2.32(1.38, 3.89)***
	No	592(95.8)	26(4.2)	1	1	1	1
Educated family member	Yes	490(91.1)	48(8.9)	1.39(0.91,2.13)	*Excluded*	*Excluded*	*Excluded*
	No	624(93.4)	44(6.6)	1			
Age at marriage	Continuous	1114 (92.4)	92(7.6)	1.15(1.06,1.25)	1.07(0.98,1.17)	1.07(0.98,1.16)	1.08(0.99,1.19)
Birth order	≤3rd	576 (91.1)	56 (8.9)	1			
	>3rd	538 (93.7)	36 (6.3)	0.69(0.45,1.06)	*Excluded*	*Excluded*	*Excluded*
Parity	Primipara	203 (91.0)	20 (9.0)	1			
	Multipara	911 (92.7)	72 (7.3)	0.80(0.48,1.35)	*Excluded*	*Excluded*	*Excluded*
Mass media at household	Yes	373 (87.6)	53(12.4)	2.70(1.75,4.16)	1.36(0.81,2.92)	1.46(0.86,2.49)	1.51(0.87,2.62)
	No	741 (95.0)	39(5.0)	1	1	1	1
Telephone at household	Yes	274(85.6)	46(14.4)	3.07(1.99,4.72)	1.60(0.94,2.73)	1.55(0.90,2.66)	1.62(0.92,2.87)
	No	840(94.8)	46(5.2)	1	1	1	1
Living in model family	Yes	28(80.0)	7(20.0)	1	1	1	1
	No	1086 (92.7)	86 (7.3)	0.31(0.13, 0.74)	0.66(0.26,1.71)	0.64(0.25,1.65)	0.72(0.27, 1.90)
Best friend's use of maternal care	Yes	441(87.0)	66(13.0)	3.87 (2.42, 6.20)	2.28(1.36,3.84)	2.23(1.32,3.77)	**2.41(1.39, 4.19)***
	No	673 (96.3)	26 (3.7)	1	1	1	**1**
Enabling factors							
Residence	Rural	982(94.3)	59(5.7)	1		1	1
	Urban	132(80.0)	33(20.0)	4.16(2.62, 6.61)		1.44(0.67,3.09)	1.40 (0.63, 3.13)
Type of kebele	HDSS	732 (92.5)	59 (7.5)	0.93(0.60,1.45)		*Excluded*	*Excluded*
	Non-HDSS	382 (92.0)	33 (8.0)	1			

Distance from the nearest facility	≥5km	35 (87.5)	5 (12.5)	1			
	<5km	1079 (92.5)	87 (7.5)	0.56(0.21,1.48)		*Excluded*	*Excluded*
Wealth index	Highest	227 (93.8)	15 (6.2)	1.01(0.48,2.09)		*Excluded*	*Excluded*
	Fourth	211 (88.7)	27 (11.3)	1.94(0.99,3.74)		*Excluded*	*Excluded*
	Middle	227 (93.0)	17 (7.0)	1.13(0.55,2.32)		*Excluded*	*Excluded*
	Second	222 (92.5)	18 (7.5)	1.23(0.60,2.50)		*Excluded*	*Excluded*
	Lowest	227 (93.8)	15 (6.2)	1			
Decision making on household expenses	Respondent	181 (92.3)	15 (7.7)	1			
	Jointly	757 (91.6)	69 (8.4)	1.1(0.62,1.97)		*Excluded*	*Excluded*
	Partner or parents	176 (95.7)	8 (4.3)	0.55(0.23,1.33)		*Excluded*	*Excluded*
Head of the household	Respondent	16(80.0)	4(20.0)	1		1	1
	Partner or parents	1098(92.6)	88(7.4)	0.32(0.11, 0.98)		0.26(0.08,0.90)	**0.24(0.07, 0.81)***
Social support from friends	Yes	993 (92.4)	82 (7.6)	1			
	No	121 (92.4)	10 (7.6)	1.01(0.51,1.98)		*Excluded*	*Excluded*
Social support from WDA	Yes	126 (90.6)	13 (9.4)	1			
	No	988 (92.6)	79 (7.4)	0.78(0.42,1.43)		*Excluded*	*Excluded*
Need factors							
HEW household visit	Yes	622 (91.6)	57 (8.4)	1			
	No	492 (93.4)	35 (6.6)	0.78(0.50,1.20)			*Excluded*
History of still birth	No still birth	1031 (92.1)	88 (7.9)	1			
	Have still birth	83 (95.4)	4 (4.6)	0.57(0.20,1.58)			*Excluded*
History of abortion	No abortion	1033 (92.6)	83 (7.4)	1			
	Have abortion	81 (90.0)	9 (10.0)	1.38(0.67,2.85)			*Excluded*
History of infant death	No infant death	890 (92.5)	72 (7.5)	1			
	Had infant death	224 (91.8)	20 (8.2)	1.10(0.66,1.85)			*Excluded*
Pregnancy intention	Intended	848 (92.5)	69(7.5)	1.10(0.69,1.75)			*Excluded*
	Unintended	351 (93.1)	26 (6.9)	1			
Post-partum complications	Yes	46(68.7)	21(31.3)	1			1
	No	1068 (93.8)	71(6.2)	0.15(0.08, 0.25)			**0.10(0.05, 0.20)***
Frequency of ANC visits	<4 visit	1028(93.1)	76(6.9)	1			1
	≥4 visit	86(84.3)	16(15.7)	2.52(1.41, 4.51)			1.52(0.78, 2.96)

Keys: **Model I** (Predisposing factors only), **Model II** (Predisposing and enabling factors), **Model III** (Predisposing, enabling and need factors). **AOR**: Adjusted Odds Ratios, **CI:** Confidence Interval. **Bold***: Indicate statistically significant variables

Appendix 9

Published articles

Tesfaye et. al. Reproductive Health (2017) 14: 150

Tesfaye *et al. Reproductive Health* (2017) 14:150
DOI 10.1186/s12978-017-0412-4

Reproductive Health

REVIEW Open Access

Delayed initiation of antenatal care and associated factors in Ethiopia: a systematic review and meta-analysis

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Abstract

Background: Antenatal care uptake is among the key indicators for monitoring the progress of maternal outcomes. Early initiation of antenatal care facilitates the timely management and treatment of pregnancy complications to reduce maternal deaths. In Ethiopia, antenatal care utilization is generally low, and delayed initiation of care is very common. We aimed to systematically identify and synthesize available evidence on delayed initiation of antenatal care and the associated factors in Ethiopia.

Methods: Studies published in English from 1 January 2002 to 30 April 2017 were systematically searched from PubMed, Medline, EMBASE, CINAHL and other relevant sources. Two authors independently reviewed the identified studies against the eligibility criteria. The included studies were critically appraised using the Joanna Briggs-MAStARI instrument for observational studies. Meta-analysis was conducted in RevMan v5.3 for Windows using a Mantel–Haenszel random effects model. The presence of statistical heterogeneity was checked using the Cochran Q test, and its level was quantified using the I^2 statistics. Pooled estimate of the proportion of the outcome variable was calculated. Pooled Odd Ratios with 95% CI were calculated to measure the effect sizes.

Result: The pooled magnitude of delayed antenatal care in Ethiopia was 64% (95% CI: 57%, 70%). Maternal age (OR = 0.70; 95% CI: 0.53, 0.93), place of residence (OR = 0.29, 95% CI: 0.16, 0.50), maternal education (OR = 0.49; 95% CI: 0.38, 0.63), husband's education (OR = 0.44; 95% CI: 0.23, 0.85), maternal occupation (OR = 0.75; 95% CI: 0.61, 0.93), monthly income (OR = 2.06; 95% CI: 1.23, 3.45), pregnancy intention (OR = 0.49; 95% CI: 0.40, 0.60), parity (OR = 0.46; 95% CI: 0.36, 0.58), knowledge of antenatal care (OR = 0.40; 95% CI: 0.32, 0.51), women's autonomy (OR = 0.38; 95% CI: 0.15, 0.94), partner involvement (OR = 0.24; 95% CI: 0.07, 0.75), pregnancy complications (OR = 0.23; 95% CI: 0.06, 0.95), and means of identifying pregnancy (OR = 0.50; 95% CI: 0.36, 0.69) were significantly associated with delayed antenatal care.

Conclusion: Improving female education and women's empowerment through economic reforms, strengthening family planning programs to reduce unintended pregnancy and promoting partner involvement in pregnancy care could reduce the very high magnitude of delayed antenatal care in Ethiopia.

Trial registration: CRD42017064585.

Keywords: Delayed antenatal care, Associated factors, Ethiopia, Systematic review, Meta-analysis

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Plain English summary

A professional care provided to women during pregnancy is called antenatal care. Antenatal care plays a great role in the improvement of maternal health. In Ethiopia and other sub-Saharan African countries, antenatal care utilization among pregnant women was low. Moreover, the pregnant women in Ethiopia and other developing countries tend to postpone their first antenatal care clinic visit into the later months of pregnancy. This study summarized the existing evidence on the level of late antenatal care visit and its contributing factors among pregnant women in Ethiopia. Using different databases and other sources, this review identified twenty two relevant studies that reported late antenatal care clinic visit and its influencing factors among pregnant women in Ethiopia. We summarized and analysed the reports from the twenty two studies and put a combined assessment result on the level of late antenatal care and associated factors. Based on our review, nearly two thirds of the pregnant women in Ethiopia made their first antenatal care clinic visit late in their pregnancy. Women's non-attendance of education, husband's non-attendance of education, women's older age, rural dwelling, having previous births, unintended pregnancy, women's unemployment, low monthly income, lack of knowledge about antenatal care, lack of women's decision making power, no partner involvement, and not facing problems during pregnancy were factors associated with higher level of women's late appearance to antenatal care. Nationwide all rounded efforts targeting the major contributing factors should be established to alleviate women's late antenatal care utilization in the country.

Background

The burden of maternal mortality remains hugely varied between developing and developed countries [1]. In developing countries, the overall life time risk of woman's death due to pregnancy and related causes is estimated to be 1 in 180, while for developed countries it is about 1 in 4900 [2]. The maternal mortality ratio in Ethiopia is still high at 353 per 100,000 live births in 2015 [3], and it remains among the highest in the world. In developing countries like Ethiopia, obstetric complications during pregnancy and childbirth are the leading causes of death among reproductive aged women [3, 4]. It is generally recognized that a lack of access to, and inadequate utilization of, antenatal care (ANC) during pregnancy contributes to adverse maternal health outcomes such as maternal mortality [5, 6], something which is more common in resource-poor settings. Antenatal care uptake is one of the key indicators for monitoring the progress of improving maternal outcomes. Early initiation of ANC facilitates the timely management and treatment of pregnancy complications to reduce maternal deaths [7].

In Ethiopia, the main direct causes of maternal mortality are haemorrhage, hypertensive disorders of pregnancy, unsafe abortion and puerperal sepsis [8, 9]. These complications can be averted or otherwise treated through providing skilled care during pregnancy, child birth and in the postnatal period [2]. In 2002, the World Health Organization (WHO) recommended that pregnant women make at least four ANC visits [10]; in 2016 this recommendation was modified to at least eight visits [11], with the first ANC visit to be undertaken before the 12th week of pregnancy. While there has been marked progress in the uptake of at least one ANC attendance in Ethiopia [12–17], there has been suboptimal attendance of the recommended visits [4, 13, 18, 19]. Of even more concern was the substantial proportion of women who delayed their first ANC visit to the second or third trimester of pregnancy [5, 19–21]. According to the National Demographic and Health Survey Report of Ethiopia [20], in 2014 more than three quarters of pregnant women initiated their first visit after 16 weeks of pregnancy. Early initiation of ANC plays a paramount role in enhancing maternal health as it provides an opportunity for the early screening, treatment and referral of pregnancy complications [11]. Evidence has shown that pregnant women who initiate ANC early were less likely to develop unfavourable obstetric outcomes as compared to women who entered into care after the first trimester [22, 23].

The key challenges that women face when seeking maternal health services were clearly explained in the three delays model [24]. This model described the barriers to utilizing maternal health services at three interrelated levels before the occurrence of maternal death. At the first level, the home or community level, women may be delayed from seeking ANC due to factors such as the low social status of women in relation to decision-making, poor awareness of pregnancy or birth complications, previous poor experience of care, traditional or social practices during pregnancy or childbirth, acceptance of maternal death as normal and financial dependency. In Ethiopia, there is huge gap in the level of income among women and men especially in rural parts of Ethiopia, and women are less empowered to access and control household resources [25]. This could influence their capacity to make decisions about utilization of maternal care. Moreover, the financial burden associated transportation to and from the facility and the costs incurred for the maternal care itself profoundly diminished the uptake of the care [26]. In the second level, there may be a delay in reaching a health facility which might be due to distance, unavailability of infrastructure (road or transportation) or difficult terrain. The third level of delay (delay in receiving adequate care) might be related to a shortage of, or inadequately trained health staff, and unavailability of medical supplies and equipment.

Several studies [27–33] have investigated factors affecting delayed attendance of ANC in Ethiopia. Nonetheless, none of these studies have systematically reviewed the factors to show their overall pooled effect on delayed initiation of ANC at the national level. In addition, there were inconsistencies in attributing the influence of the factors on late initiation of ANC across various studies. For instance, there were incongruent findings on the influence of maternal education [34–37], maternal age [32–34, 36], place of residence [28, 32, 38, 39], maternal occupation [30, 34, 37, 40], marital status [32, 36, 37], husband's education [31, 32, 41], previous experience of using ANC [32, 33, 35] and history of abortion [31, 32, 42] on delayed initiation of ANC among many other factors. Hence, demonstrating a pooled effect of the factors on delayed initiation of ANC was warranted.

Previous systematic reviews conducted in developing [43, 44] and developed [45] countries have mainly reviewed evidence on the adequacy of the utilization of ANC and its related factors. In particular, the reviews covered larger geographical regions and hence failed to reflect country specific situations. Moreover, these reviews did not centre on delayed initiation of ANC as a primary outcome of interest. The objective of this review is to systematically identify and synthesize existing evidence to understand the level of delayed initiation of ANC and associated factors among reproductive aged women in Ethiopia.

Method

Development of the review method

The methodology of this systematic review was developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) 2015 Statement [46] and the items in the PRISMA-P checklist were addressed (Additional file 1). The four phases that were drawn from the PRISMA flow chart ([47]) were documented in the results to show the study selection process from initially identified records to finally included studies. The protocol for this systematic review and meta-analysis was registered in international prospective register of systematic reviews (PROSPERO) and obtained the registration number (CRD42017064585).

Search strategy

The literature search was carried out by the primary author (GT). The search was limited to papers published in English from 1 January 2002 to 30 April 2017. The year 2002 was selected, since WHO had introduced the Focused ANC model [10] by this year. We applied MeSH terms, Emtree, CINAHL headings and combined key words to identify studies in the databases. Major medical electronic databases such as PubMed, Medline (OVID interface), Excerpta Medica (Embase) (OVID interface), and CINAHL (EBSCO host) were used to identify relevant literature for the review. To cover grey literature, we hand-searched literature using the Google search engine and Google Scholar; official WHO websites; online libraries of academic and government institutions and references of electronically identified articles. The search strings or terms were stemmed from the following key words: delayed initiation, ANC, associated factors, and Ethiopia. The search terms were used to retrieve relevant literature in combined form adapted to the requirement of the specific database. Further information regarding the search strategy of the selected databases is attached (Additional file 2).

Eligibility criteria

We included all observational studies as well as Demographic and Health Surveys (DHS) reports. We considered studies that examined the level and factors associated with delayed initiation of ANC among reproductive aged women (15–49 years) who were pregnant or gave birth at least once and who live in Ethiopia. We included studies that defined the main outcome variable "delayed initiation of ANC" as entry into care after at least 12 weeks of pregnancy, including studies that defined delayed initiation of ANC as entry into the care after 16 weeks of gestation. Studies that had been conducted in either a community or facility setting and which involved analysis of primary or secondary data were included. We included studies that had measure of association statistics or had test statistic that explicitly demonstrated the influence of the predictors on delayed initiation of ANC or had a crosstab showing the difference in magnitude of the outcome variable in the categories of the predicting variables. We excluded reviews, editorials, case series and case reports on delayed initiation of ANC. We also excluded studies that only reported qualitative findings on delayed ANC initiation. In studies that reported both quantitative and qualitative results, we only considered the quantitative findings.

Study selection procedure

Screening

First studies were identified through applying the search strings and the filters in the databases as well as other relevant sources. The identified studies were exported to the citation manager (EndNote) [48] and duplicates were excluded. The two authors (GT and AS) independently screened the studies based on the information contained in the titles and abstracts according to the inclusion criteria. Based on this screening, the titles and abstracts of the studies were classified as included, excluded, and undecided. We then obtained the full texts of all the included and the undecided studies for further eligibility assessment.

Eligibility of studies

The two authors (GT and AS) independently reviewed the full texts of the included and undecided categories of the studies against the eligibility criteria for final inclusion. Studies that were not eligible based on the examination of the full-text were excluded and the reasons for the exclusion were described. Disagreements between the two reviewers were resolved through discussion and consensus.

Quality assessment

All of the included studies were critically appraised for their validity. The two authors (GT and AS) checked the methodological robustness and validity of the findings using the JBI (Joanna Briggs Institute) Meta-Analysis of Statistics Assessment and Review Instrument (MAStARI) [49]. Particular attention was given to a clear statement of the objective of the study, inclusion criteria, randomness of subject selection, identification of the study subjects, and preciseness of measurement of outcomes of interest and use of appropriate statistical analysis method, as well as documentation of sources of bias or confounding. Uncertainties were resolved by joint discussion between the reviewers. The level of agreement between the two reviewers was judged using the Cohen's Kappa (K) coefficient statistics. To calculate "K" a two by two contingency table was constructed with "High" and "Low" categories of quality assessment provided independently by the two reviewers based on set of criteria. We obtained "K" value of (0.80), and thus the level of agreement was satisfactory. In order to minimize publication bias, we searched and included both published and unpublished literature. We obtained unpublished literatures (grey literatures) through hand-searching of online libraries of academic institutions, government organizations, and agencies in addition to using Google search engine and Google scholar. We also contacted an author to seek data that was not clearly reported in the article.

Data extraction process

A structured data extraction template in the form of summary table was constructed for the data abstraction. The two authors (GT and AS) systematically used the data extraction template to abstract data. The summary table contained list of items pertaining to the study characteristics to concisely present all the included studies. The specific list of items included; study year, design of the study, study setting, sample size, study subjects, data collection method, and study specific predicting factors. A quantitative data of cross-tabulation between the subject's characteristics (predicting factors) and the outcome variable was also systematically abstracted. During the data extraction of the exposure variables, we categorized the individual classifications shown for each variable in the studies into two (exposed with the outcome and non-exposed with the outcome). The non-exposed category was considered as the reference category of the variables (*e.g for place of residence, urban was the exposed and rural was the non-exposed category*). We then put the corresponding combined numerical value to make it ready for the quantitative synthesis. During the data extraction, one of the papers (Bayou et al. 2016) reported missing and incomplete data, and the principal author of the publication was contacted to request further data via email. We received a response from the author, and were provided with the requested data. Disagreements between the two review authors were resolved by face to face discussion and reached a consensus.

Data synthesis and statistical analysis

The individual studies were concisely described using a summary table. The summary table particularly described the characteristics of the included studies and the main findings. We conducted the quantitative synthesis using the Cochrane community Review Manager Software (RevMan version 5.3 for windows) [50]. Summary statistics (pooled effect sizes) in Odds Ratios with 95% confidence intervals were calculated. We classified the factors that showed significant association with the outcome variable into three groups based on the three delays model, though some overlapping exist between them. Forest plots were used to graphically present the meta-analysis results. The presence of statistical heterogeneity was checked by using the Chi^2 test (Cochran Q test) at p-value ≤ 0.05. The level of heterogeneity among the studies was quantified using the I^2 statistics [51] where substantial heterogeneity was assumed if the I^2 value was $\geq 50\%$. We conducted meta-analysis using Mantel–Haenszel random effects model when the studies were substantially heterogeneous (I^2 statistic $\geq 50\%$). Pooled estimate of the magnitude of the primary outcome variable was conducted using *stats direct* (http://www.statsdirect.com) statistical software [52] using Stuart-Ord (inverse double arcsine square root) method. We hypothesized that there could be variation in the factors that lead to delayed ANC between studies that defined delayed ANC based on the WHO [10] recommendation with (≥12 weeks) and country specific recommendation [53] (≥16 weeks) due to the obvious difference in magnitude of the outcome variable. Hence, subgroup analysis was conducted based on comparison of outcomes for studies that defined delayed initiation of ANC based on (≥12 weeks) and (≥16 weeks), provided an adequate number of studies were available in the two groups. The result of the review was reported according to the PRISMA guideline for reporting [54].

Results

Description of the studies

We retrieved 2975 studies through searching the major health and medical electronic databases and other relevant sources. From all the identified studies, 1006 articles were removed due to duplication while 1969 studies were retained for further screening. The remaining 1969 studies were then screened for their eligibility based on the title and abstract. Accordingly, 1867 studies were excluded because of the incompatibility of the content presented in the title and abstract of the studies with our review topic. Hence, the full text of the remaining 102 studies were assessed for eligibility. During the full text assessment, 80 studies were excluded from the review because of duplication, inconsistent study outcome, or irrelevant target participants. The remaining twenty two studies were critically appraised and included in the review. After the critical appraisal of the studies, we excluded one study from the quantitative synthesis due to the relatively poor methodological quality and inconsistent statistical report. Finally, twenty one studies were included for the pooled estimation of delayed initiation of ANC and factor analysis (Fig. 1). Among the included studies, there were seventeen published articles, three master theses, and one Ethiopian Demographic and Health Survey (DHS data). All of the included studies were cross-sectional by design and seventeen of the studies were conducted in a facility setting (Table 1). Ten of the studies included in the quantitative synthesis reported delayed initiation of ANC based on (≥ 12 weeks), and the remaining studies reported it based on (≥ 16 weeks).

With regards to the demographic characteristics, the study participants in the included studies were pregnant women or women who have at least had one birth in the five or three years prior to the studies. The age of the participants' were ranged from 15 to 49 years. Large majority of the participants in the included studies were urban residents. Moreover, higher proportion of the participants in the included studies were married and attended formal education (primary school and above).

Magnitude of delayed initiation of ANC

The pooled estimate of the magnitude of delayed initiation of ANC in Ethiopia was 64% (95% CI: 57%, 70%) (Fig. 2). The result of the analysis for the magnitude of delayed initiation of ANC based on the studies that reported the outcome variable with (≥ 12 weeks) was 66% (95% CI: 56%, 76%), whereas based on the studies that defined the outcome variable with (≥ 16 weeks) it was 62% (95% CI: 52%, 71%).

Factors associated with delayed initiation of ANC

The current review revealed various factors associated with delayed initiation of ANC in Ethiopia. Significantly associated delay one factors include maternal age, maternal education, husband's education, pregnancy intention, women's autonomy, knowledge on ANC, partner involvement, pregnancy complication, and parity. Significantly associated delay two factors were maternal occupation, monthly income and place of residence. Means of checking pregnancy was the only delay three factor that showed statistically significant association with delayed ANC. The review also demonstrated that delay one factors such marital status and history of abortion, and delay three factor (previous use of ANC) were not significant predictors of delayed attendance of ANC services (Table 2).

Maternal age

Maternal age was significantly associated with delayed initiation of ANC. Women aged between 15 and 30 were less likely to have delayed their first ANC booking as compared to women aged 31 to 49 years of age (OR, 0.70; 95% CI: 0.53, 0.93). However, the subgroup (delayed initiation ≥16 weeks) showed no association between maternal age and delayed booking of ANC (OR, 0.70; 95% CI: 0.42, 1.19). But it did not affect the overall association. Random effect model was employed for the analysis as the I^2 value was >50% (Fig. 3).

Maternal education

The meta-analysis showed that maternal education was significantly associated with delayed ANC initiation. The overall Odds Ratio 0.49 at 95% CI: 0.38, 0.63 indicated that women who have attended primary or above level of education were less likely to delay their first ANC visit as compared to women without formal education. In spite of the heterogeneity of the studies, the finding showed statistically significant association. The subgroup analysis for studies with (≥12 weeks) (OR, 0.57; 95% CI: 0.45, 0.72) and studies (≥16 weeks) (OR, 0.43; 95% CI: 0.28, 0.67) both showed significant association between the maternal educational status and delayed initiation of ANC. We used random effect model for the analysis since the I^2 value was 75% (Fig. 4).

Place of residence

According to the factor analysis of the included studies, place of residence was significantly associated with delayed initiation of ANC. Women who live in urban area were less likely to have delayed initiation of ANC (OR, 0.29, 95% CI: 0.16, 0.50). No difference was found in terms of the direction of association between place of residence and delayed initiation of ANC in the subgroups analysis. Random effect model was used for the analysis since the heterogeneity test showed an overall I^2 value of 89% (Fig. 5).

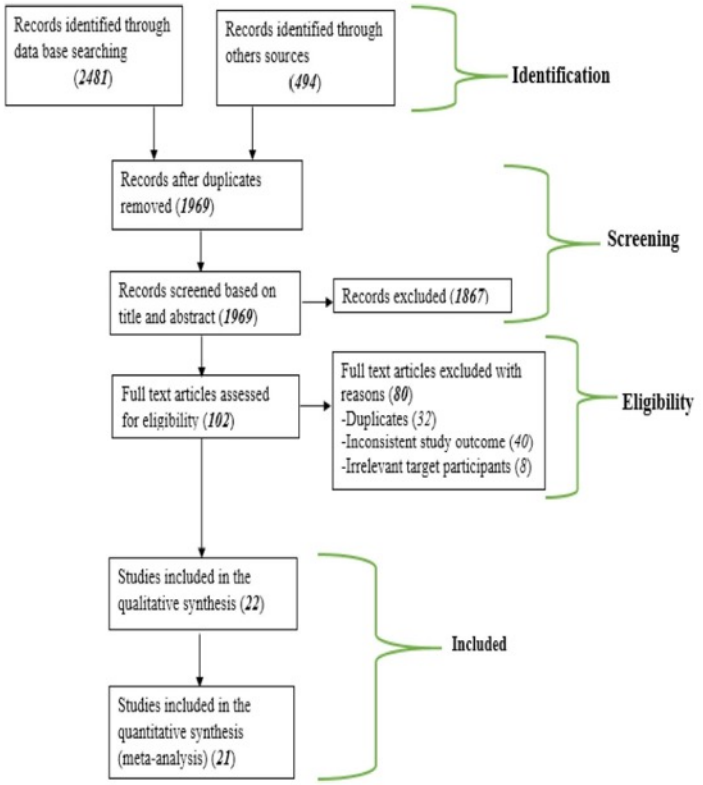

Fig. 1 Schematic presentation of the PRISMA flow diagram to select and include studies

Pregnancy intention

The review finding showed that women with intended pregnancy were less likely to delay their ANC initiation (OR, 0.49; 95% CI: 0.40, 0.60). There was no difference between the subgroups in the direction of association. As the heterogeneity test indicated an I^2 value of 59%, random effect was considered for the analysis (Fig. 6).

Below are the descriptions of other factors that are associated with delayed initiation of ANC with the meta-analysis test statistics (Table 3).

Family monthly income

Monthly average family income was significantly associated with delayed ANC initiation. It was demonstrated that there was increased odds of delayed initiation of ANC among women with an average family income of ≤1000 ETB (50USD) compared to those women whose average family income was >1000ETB (50USD) (OR, 2.06; 95% CI: 1.23, 3.45). The association between family monthly income and delayed initiation of antennal care was not consistent across the two subgroups, where the subgroup which defined the outcome variable based on (≥16 weeks) showed insignificant association between monthly income and delayed initiation of ANC (OR, 2.26; 95% CI: 0.96, 5.29), whereas the subgroup (delayed ANC ≥12 weeks) (OR, 1.77; 95% CI: 1.16, 2.72) showed significant association. Due to the heterogeneity of the studies ($I^2 = 91\%$), we used random effect model for the analysis.

Marital status

Our systematic review demonstrated that there was no significant association between marital status and delayed initiation of ANC (OR, 0.81; 95% CI: 0.56, 1.16). The same was true in the subgroup analysis which showed no association between marital status and delayed initiation of ANC. We assumed random effect model for the analysis since the I^2 statistics showed presence of heterogeneity (68%).

Maternal occupation

The overall Odds Ratio showed that there was significant association between maternal occupation and delayed initiation of ANC (OR, 0.75; 95% CI: 0.61, 0.93).

Table 1 Description of the study characteristics for the included studies in the review

No	Author and year	Setting of the study	Design of the study	Sample size	Study subjects	Data collection method	Primary Outcome of Interest	Delayed ANC (definition)	Study specific predicting factors for delayed uptake of ANC
1	Amentie et al. 2015 [39]	Community based study	Cross sectional	536	Reproductive aged women who had at least one birth in the five years prior to the study	Interviewer administered questionnaire	-Utilization of ANC (uptake) -Timing of first ANC initiation	Entry in to care after 12 weeks of gestation	Place of residence (living in rural area)
2	Abosse et al. 2010 [27]	Community based study	Cross sectional	710	Reproductive aged women who had at least one birth in the five years prior to the study	Interviewer administered questionnaire	-Utilization of ANC (uptake) -Timing of first ANC visit	Entry in to care after 12 weeks of gestation	Place of residence (living in rural area)
3	Abuka et al. 2014 [35]	Facility based study	Cross sectional	406	Pregnant women attending health facility	Interviewer administered questionnaire	- Timing of first ANC booking	Entry in to care after 12 weeks of gestation	Age (≥20 year), non-attendance of formal education, high parity, perceived that timely ANC is not important, not having information, previous non-use of ANC
4	Bayou et al. 2016 [36]	Community based study	Cross sectional	814	Reproductive aged women who had at least one birth in the three years prior to the study	Interviewer administered questionnaire	-Early initiation of ANC -At least four ANC visit -Adequacy of ANC	Entry in to care after 12 weeks of gestation	Unintended pregnancy and non-attendance of formal education
5	Belayneh et al. 2014 [34]	Facility based study	Cross sectional	369	Pregnant women attending ANC service in health facility	Face-to-face interview technique	-Timing of first ANC booking	Entry in to care after 12 weeks of gestation	Non-attendance of formal education, older age [30–49], previous early ANC visit, perceived sufficient number of ANC (4+)
6	Gudayu 2015 [37]	Facility based study	Cross sectional	390	Pregnant women attending ANC service in health facilities	Face-to-face exit interview technique	-Late ANC booking	Entry in to care after 12 weeks of gestation	Not obtaining information on right time to initiate, perceived right time to book ANC (12+ weeks), non-autonomy, and use of urine test to identify pregnancy
7	Gudayu et al. 2014 [30]	Facility based study	Cross sectional	407	Pregnant women attending health facility	Face-to-face exit interview technique	-Timing of first ANC booking	Entry in to care after 12 weeks of gestation	Age (>25), younger age at marriage, pregnancy checking by means other than urine test, perceived right time to start ANC (12+ weeks), and non-autonomy
8	Yilala and Sinishaw 2015 [33]	Facility based study	Cross sectional	407	Pregnant women attending antenatal care clinic in health facility	Face-to-face exit interview technique	-Late initiation of ANC	Entry in to care after 12 weeks of gestation	Non-attendance of formal education, poor knowledge of ANC, not receiving advice from HEW, not getting advice on ANC booking, perceived right time of ANC (12+ weeks)
9	Zegeye et al. 2013 [65]	Facility based study	Cross sectional	446	Pregnant women attending health facility	Face-to-face exit interview technique	-Early ANC visit	Entry in to care after 12 weeks of gestation	High parity, lack of knowledge of ANC, unintended pregnancy
10	Tariku et al. 2010	Facility based study	Cross sectional	612	Pregnant women attending health facility	Face to face exit interview	-Timing of first ANC booking	Entry in to care after 12 weeks of gestation	High parity, unintended pregnancy, obtaining advice on when to book first ANC
11	CSA 2014 [20]	Community based study	Cross sectional (DHS data)	1571	Reproductive aged women who had at least one birth in the five years prior to the survey	Interviewer administered questionnaire	-Timing of ANC initiation -At least one ANC visit	Entry in to care after 16 weeks of gestation	Place of residence (living in rural area)

Table 1 Description of the study characteristics for the included studies in the review *(Continued)*

No	Author and year	Setting of the study	Design of the study	Sample size	Study subjects	Data collection method	Primary Outcome of Interest	Delayed ANC (definition)	Study specific predicting factors for delayed uptake of ANC
12	Damme et al. 2015 [28]	Facility based study	Cross sectional	379	Pregnant women attending ANC service in health facilities	Face-to-face exit interview technique	-Timing of first ANC booking	Entry in to care after 16 weeks of gestation	Non-attendance of formal education, rural residence, low income, having no awareness on timing of ANC
13	Ewenetu et al. 2015 [29]	Facility based study	Cross sectional	178	Pregnant women attending ANC service in health facility	Interviewer administered structured questionnaire	Late ANC initiation	Entry in to care after 16 weeks of gestation	Non-attendance of education, rural residence, no history of premature birth, late recognition of pregnancy, and unintended pregnancy
14	Fisseha et al. 2015 [66]	Facility based study	Cross sectional	410	Pregnant women attending ANC service in health facilities	Interviewer administered structured questionnaire	Timing of First ANC Booking	Entry in to care after 16 weeks of gestation	No history of still birth, no pregnancy complications, lack of knowledge of time to initiate ANC, no partner involvement on ANC
15	Gebre meskel et al. 2015 [40]	Facility based study	Cross sectional	409	Pregnant women attending ANC service in health facility	Interviewer administered structured questionnaire	Timing of First ANC Attendance	Entry in to care after 16 weeks of gestation	Low income, not receiving advice on when to start ANC, household food insecurity, unintended pregnancy
16	Girum 2016 [38]	Facility based study	Cross sectional	362	Pregnant women attending ANC service in health facilities	Face to face exit interview	Timing of First ANC Visit	Entry in to care after 16 weeks of gestation	Rural residence, low income, non-attendance of education, not receiving advice on timing of visit and unintended pregnancy
17	Gulema and Berhane 2017 [67]	Facility based study	Cross sectional	960	Pregnant women visiting health facilities for the first time	Interviewer administered structured questionnaire	Timing of First ANC Visit	Entry in to care after 16 weeks of gestation	Unemployment, low income, perceived ANC initiation time (16 weeks +), unintended pregnancy, having pregnancy complications
18	Hailesilasie and Enquselasie 2010 [41]	Facility based study	Cross sectional	419	Pregnant women attending ANC at government health facilities	Face-to-face interview of pregnant women	Late Initiation of ANC Service Utilization	Entry in to care after 16 weeks of gestation	Younger age, non-attendance of formal education, low perceived benefit of ANC, unintended pregnancy, perceived ANC initiation time (4-6 months)
19	Hussen et al. 2016 [42]	Facility based study	Cross sectional	255	Pregnant women attending ANC at government health facilities	Interviewer administered structured questionnaire	Timely Initiation of First ANC Visit	Entry in to care after 16 weeks of gestation	Non-attendance of formal education, lack of knowledge of ANC, late recognition of pregnancy, high parity
20	Lerebo et al. 2015 [31]	Facility based study	Cross sectional	415	Pregnant women attending ANC at government health facilities	Face to face interview of pregnant women	Late Booking for ANC	Entry in to care after 16 weeks of gestation	High parity, unintended pregnancy, perceived right time to book ANC (16 weeks +), no history of abortion
21	Mohammed and Berhane 2014 [68]	Facility based study	Cross sectional	383	Pregnant women attending ANC at selected public health centres	Face to face interview of pregnant women	Timing of first ANC initiation	Entry in to care after 16 weeks of gestation	Younger age, non-attendance of formal education, incorrect perception of timing of ANC, being busy
22	Tekelab and Berhanu 2014 [32]	Facility based study	Cross sectional	401	Pregnant women attending ANC service at governmental health centres	Interviewer administered structured questionnaire	Late initiation of ANC	Entry in to care after 16 weeks of gestation	Age (≥25 year), non-attendance of formal education, low monthly income, high parity, previous non-use of ANC, unintended pregnancy

From all the identified studies, 1006 were excluded during screening for duplication, and 2953 during title, abstract and full text assessment
One study was excluded due to poor methodological quality and the rest 21 studies were included in the meta-analysis

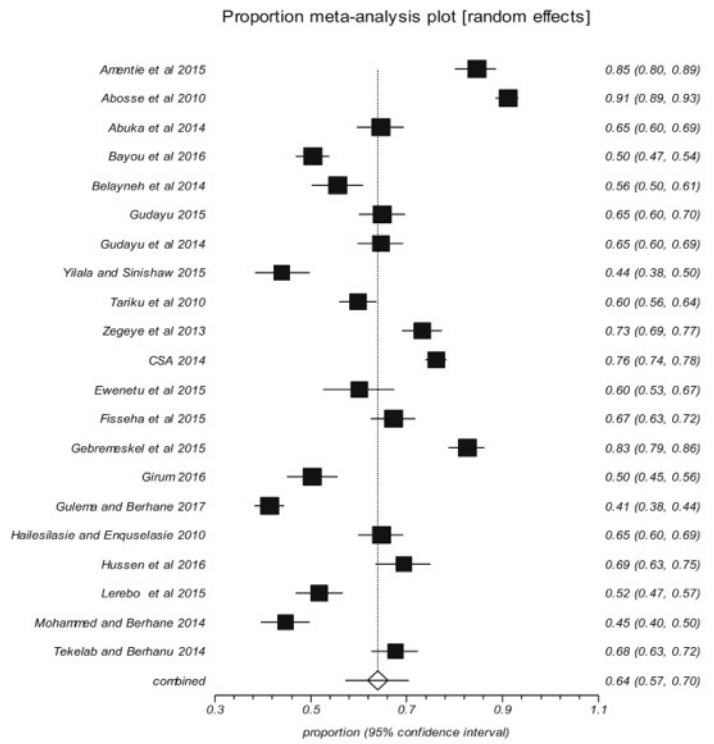

Fig. 2 Pooled estimation of delayed initiation of ANC in Ethiopia, 2002–2017. NB (◊: Overall combined pooled proportion, and ■: Original studies proportion)

Employed women were less likely to delay their ANC as compared to their counterparts. However, the subgroup (delayed ANC initiation ≥12 weeks) (OR, 0.76; 95% CI: 0.53, 1.09) showed no association between maternal occupation and delayed booking of ANC. But the overall association was not altered. The heterogeneity test showed an I^2 value of 74%, and therefore random effect model was considered for the analysis.

Husband's education

Association between husband's education and delayed initiation of ANC was carried out in one group of studies that

Table 2 Overview of factors associated with delayed initiation of ANC according to the three delay model in Ethiopia, 2002–2017

Category of the factors	Significantly associated with delayed ANC (COR at 95% CI)	
	Yes	No
Delay one	Maternal age Maternal education Husband's education Pregnancy intention Women's autonomy Partner involvement Knowledge on ANC Presence of pregnancy complication Parity	History of abortion Marital status
Delay two	Place of residence Maternal occupation Monthly income	
Delay three	Means of checking pregnancy	Previous ANC utilization

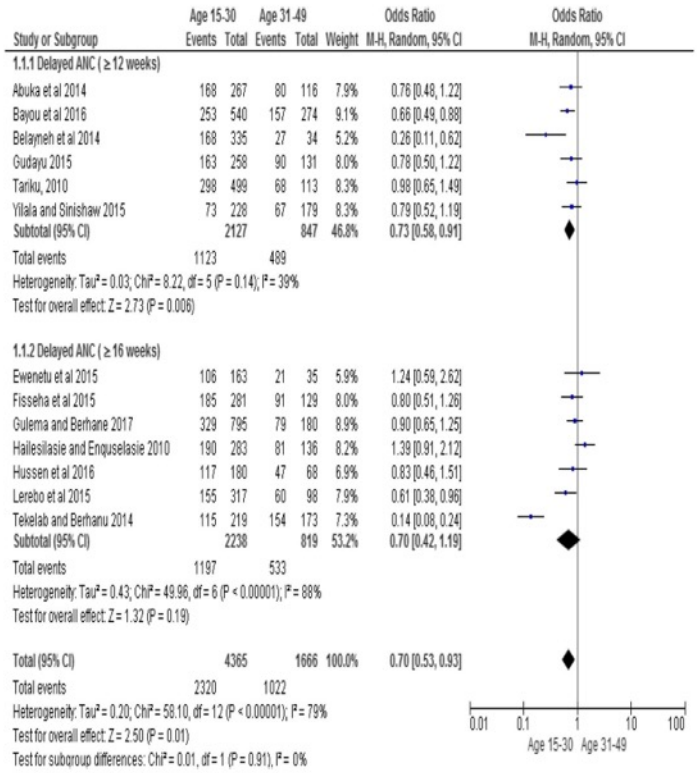

Fig. 3 Subgroup and overall association between maternal age (reference category: age 31–49) and delayed initiation of ANC in Ethiopia, 2002–2017

defined the outcome variable with (≥ 16 weeks), as this variable was not reported in the other group of studies. The analysis showed that women having a husband who attended formal education were less likely to delay their first antenatal visit as compared to those women whose husband had never attended formal education (OR, 0.44; 95% CI: 0.23, 0.85). Random effect model was implemented for the analysis since the I^2 value was greater than 50%.

Women's autonomy

We conducted analysis of a single group of studies that defined the outcome variable with (≥12 weeks) due to the unavailability of corresponding data about women's autonomy in the other group of studies. Accordingly, the analysis result revealed that women's autonomy has a significant association with delayed initiation of ANC (OR, 0.38; 95% CI: 0.15, 0.94). Autonomous women were less likely to initiate their first ANC later than non-autonomous women. Random effect model was used for the analysis as the I^2 test result is 89%.

Previous use of ANC

The finding revealed that there was no significant association between previous utilization of ANC and delayed initiation of ANC (OR, 0.62; 95% CI: 0.34, 1.11). This was the case in both subgroups of the studies, and the overall analysis result. We assumed a random effect model for the analysis as the I^2 value 85% showed substantial heterogeneity between the studies.

Parity

Parity was another predicting factor that affected delayed initiation of ANC. In this regard, women with no parity (nulliparous) were less likely to have delayed their ANC initiation as compared to women who were primipara and above. This was demonstrated in the overall Odds Ratio, 0.46 at 95% CI: 0.36, 0.58. There was no difference in the association between parity and delayed initiation of ANC in the subgroup analysis. Since the I^2 value was 67%, indicating considerable heterogeneity of the included studies, we assumed a random effect model for the analysis.

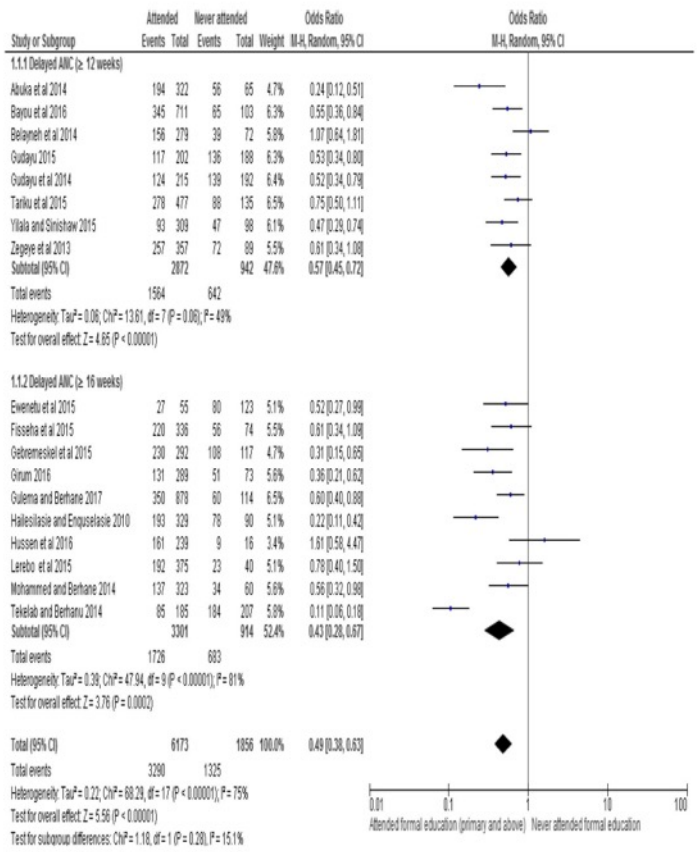

Fig. 4 Subgroup and overall association between maternal education (reference category: never attended formal education) and delayed initiation of ANC in Ethiopia, 2002–2017

Partner involvement

We conducted the analysis using studies from both subgroups and it was found that partner involvement has a significant association with delayed initiation of ANC. Women who had a partner who was involved in ANC were less likely to delay thier first ANC initiation compared with women with no partner involvement in ANC (OR, 0.24; 95% CI: 0.07, 0.75). We considered a random effect model for the analysis because the I^2 value was 85%.

Knowledge of ANC

The overall analysis of both groups of studies showed that knowledge of ANC has association with delayed initiation of ANC. Knowledgeable women were less likely to delay their ANC booking as compared to non-knowledgeable women (OR, 0.40; 95% CI: 0.32, 0.51). Fixed effect model was assumed for the analysis as the Chi square test (7.08) with the *p*-value (0.21) showed statistically insignificant heterogeneity among the included studies for this factor analysis.

History of abortion

We found no significant association between history of abortion and delayed initiation of ANC (OR, 1.16; 95% CI: 0.79, 1.69), and this was true in the analysis result of both subgroups of studies. We assumed a random effect model since the I^2 statistics (77%) showed substantial heterogeneity.

Pregnancy complications

There was significant association between the presence of complications during pregnancy and delayed initiation of ANC on a single group analysis (delayed initiation of ANC ≥ 16 weeks). Women who experienced complications during pregnancy were less likely to delay their first ANC attendance compared to women who did not

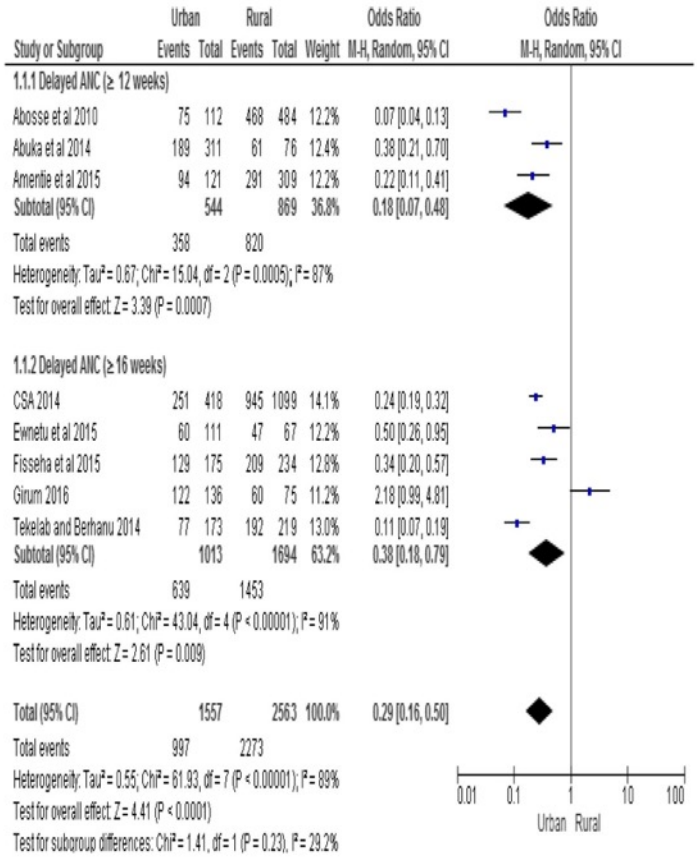

Fig. 5 Subgroup and overall association between place of residence (reference category: rural) and delayed initiation of ANC in Ethiopia, 2002–2017

experience complications during pregnancy (OR, 0.23; 95% CI: 0.06, 0.95). Random effect model was used for the analysis since the I^2 value was greater than 50%.

Means of identifying pregnancy

No sub-group analysis was performed due to lack of relevant statistics with regards to means of identifying pregnancy in one group (delayed initiation of ANC ≥ 16 weeks). Single group (delayed initiation of ANC ≥ 12 weeks) analysis however showed a significant association between means of identifying pregnancy with delayed initiation of ANC. Women who identified their pregnancy with a urine test were less likely to delay their first ANC visit as compared to women who identified their pregnancy using other means (OR, 0.50; 95% CI: 0.36, 0.69). We considered random effect model for the analysis since the I^2 value was greater than 50%.

Discussion

Maternal age, maternal education, husband's education, maternal occupation, place of residence, parity, knowledge of ANC, women's autonomy, partner involvement, pregnancy intention, presence of pregnancy complications, and means of identifying pregnancy were significantly associated factors for delayed initiation of ANC in Ethiopia. We found out that nearly two thirds of the women in Ethiopia initiated their first ANC late after 12th week of pregnancy. Marital status, history of abortion and previous use of ANC showed no significant association with delayed initiation of ANC.

Timely initiation and continuous attendance of ANC is believed to improve maternal health outcomes [23, 55]. This is the case particularly in developing countries where the health status of women is very poor. It is imperative to understand the overall level of delayed initiation of ANC and the contributing factors at the country level to inform

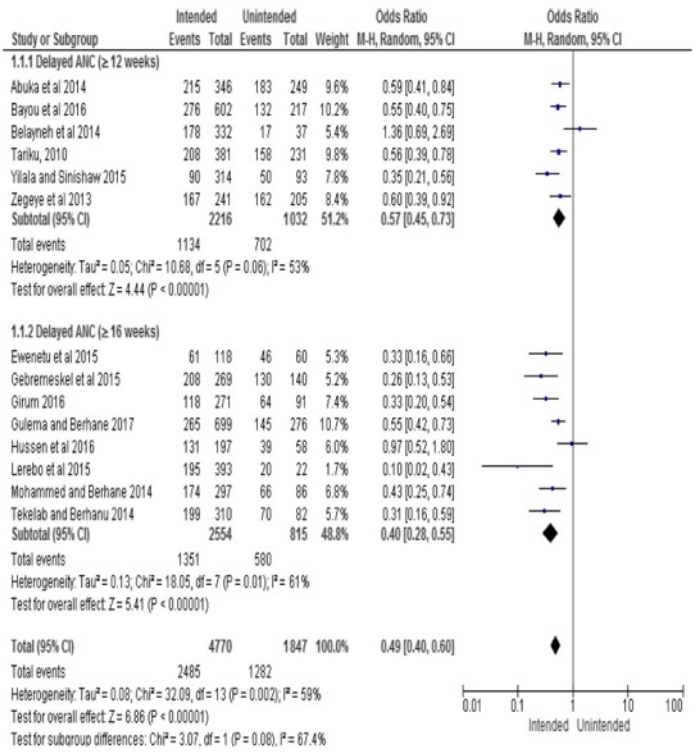

Fig. 6 Subgroup and overall association between pregnancy intention (reference category: unintended) and delayed initiation of ANC in Ethiopia, 2002–2017

current efforts to improve maternal outcomes through adequate utilization of ANC in Ethiopia. The current systematic review supplied a summary of available evidence on the level of delayed initiation of ANC and associated factors in Ethiopia. The importance of systematic reviews to provide relevant information to transform health care delivery system and policy modification or ratification was well documented [56]. This systematic review summarized up-to-date empirical evidence and fleshed out key areas of action regarding delayed initiation of ANC in Ethiopia. This is an important step-forward to ensure maternal health program planners and policy makers in the country make informed decisions regarding where the corrective measures should be instituted and maximized.

Even though the WHO [10, 11] recommended initiation of ANC attendance not later than the first trimester of pregnancy, the reviewed evidence showed that the magnitude of delayed initiation of ANC is very high, at 64% in Ethiopia. This figure was almost in line with a comparative report of demographic and health survey data of twenty one sub-Saharan African countries [21] where, on average, more than two-thirds of the reproductive aged women initiated their first ANC after the first trimester of pregnancy. This might be due to several socio-cultural, economic and contextual factors including women's poor decision making power at a household level due to deeply rooted gender inequality, poor educational status, and poverty, which in turn could limit the women's ability to seek care earlier. The decision to early seek care and assistance during pregnancy among Ethiopian women especially in rural areas are linked with many cultural practices [57, 58], which were barrier to accessing services throughout a woman's pregnancy. Delayed initiation of ANC was a significant risk factor for maternal death, particularly among the disadvantaged women [22]. Hence countries need to prioritise efforts to improve the initiation of ANC.

According to this review, maternal age and education, husband's education, parity, knowledge of ANC and women's autonomy were influencing factors for delayed first ANC attendance in Ethiopia. The result of the current review was in agreement with the systematic review of studies [43, 44, 59] conducted in other settings where maternal age, maternal education, husband's education, and

Table 3 Summary of the test statistics of association between the remaining delay one, two and three factors with delayed initiation of ANC in Ethiopia, 2002–2017

Predictor variable	Subgroup	OR (95%CI)	I^2	Combined OR (95% CI)	Overall I^2
Monthly income [≤1000ETB(50USD)]	I	1.77(1.16, 2.72)	65%	2.06(1.23, 3.45)	91%
	II	2.26(0.96, 5.29)	94%		
Marital status [In marriage]	I	0.92(0.55, 1.54)	77%	0.81(0.56, 1.16)	68%
	II	0.68(0.38, 1.22)	57%		
Maternal occupation [Employed]	I	0.76(0.53, 1.09)	83%	0.75(0.61, 0.93)	74%
	II	0.74(0.57, 0.97)	66%		
Husband education [Attended primary/above]	II	0.44(0.23, 0.85)	80%		
Women's autonomy [Autonomous]	I	0.38(0.15, 0.94)	89%		
Previous use of ANC [Previous use]	I	0.65(0.42, 1.02)	45%	0.62(0.34, 1.11)	85%
	II	0.53(0.17, 1.67)	92%		
Parity [Nulliparity]	I	0.51(0.42, 0.61)	0%	0.46(0.36, 0.58)	67%
	II	0.42(0.27, 0.66)	81%		
Partner involvement [Involved]	I	0.44(0.21, 0.91)	85%	0.24(0.07, 0.75)	85%
	II	0.14(0.08, 0.22)	85%		
Knowledge of ANC [Knowledgeable]	I	0.32(0.22, 0.46)	4%	0.40(0.32, 0.51)	29%
	II	0.46(0.35, 0.62)	54%		
History of abortion [Have history of abortion]	I	1.19(0.85, 1.66)	0%	1.16(0.79, 1.69)	77%
	II	1.14(0.67, 1.95)	77%		
Pregnancy complication [Presence of complication]	II	0.23(0.06, 0.95)	97%		
Means of identifying pregnancy [Urine]	I	0.50(0.36, 0.69)	67%		

Subgroup: I = Studies that defined delayed initiation of ANC (after 12 weeks of gestation), Subgroup: II = Studies that defined delayed initiation of ANC (after 16 weeks of gestation), I^2 is the percentage of total variance due to between study heterogeneity

parity were the influencing factors for delayed initiation of ANC. The possible reason for older women aged 31 to 49 delaying their first ANC might be that they most likely are uneducated, have poor knowledge of ANC, have experienced pregnancies without complications previously, are less fearful unlike younger women and may be more likely to be multiparous. Education of the mother and husband could play a great role in improving awareness of health matters in general, and the importance of ANC in particular. Having a better awareness may enable women to seek ANC and utilize the service early in pregnancy. This was particularly reflected in the systematic review of studies among non-western women in industrialized countries [45] where women's low level of educational status was associated with late entry into ANC.

Furthermore, a lack of knowledge about ANC is positively associated with delayed initiation of ANC. Women who had been provided with information regarding ANC, pregnancy risks and danger signs were more likely to initiate ANC early compared to women who did not have knowledge of these issues. This could motivate the women to initiate ANC early to better avoid the risks associated with pregnancy. It is anticipated that well informed women were more likely to make judicious choices about the proper utilization of ANC. It was also found that women's autonomy was a significant predictor of delayed initiation of ANC where non-autonomous women were more likely to postpone ANC, which could be due to the fact that they were under the influence of their partner or family (especially in male headed households), restricted to comply with family norms, had lack of family or social support, and a partner who was not available or who refused to accompany them. This was demonstrated in a systematic review of studies in the developing countries [44], where social support from family members, extent of ties within social networks, and obtaining health information from these sources highly influence timely utilization of ANC.

Additionally, the meta-analysis revealed that place of residence, maternal occupation, monthly income, and partner involvement were significantly associated with delayed ANC initiation. Rural women were more likely to delay their first ANC attendance than urban women. This could be explained by the fact that urban women would most likely have easy access to health care facilities, have a good awareness of health matters, and have better exposure to media. Moreover, unemployed women were more likely to delay initiation of ANC as compared to employed women. A similar finding was reported in other systematic reviews [43, 45] where not being in employment

explained women's delayed entry into the care. It was also evidenced that women with high economic status were more likely to receive ANC earlier than those with a lower economic status [43, 44]. These financial constraints are in turn related to other barriers to seeking help, including transportation costs, the cost of obtaining care, or laboratory tests [60, 61].

Moreover, our finding suggests that women whose partner was involved in ANC were less likely to delay their first ANC attendance than women whose partner was not involved in ANC. Partner involvement in terms of initiating and/or supporting the idea to utilize ANC early, or by accompanying the pregnant mother to the health facility may have an important impact on the early attendance of ANC. In many traditions, the involvement of men in reproductive health has not been considered an important issue. In general male partners did not accompany their wives to attend ANC and other maternal health services [43]. The husband's lack of involvement in ANC may immensely affect the women's capability to initiate ANC early. It was found in a systematic review [62] that the involvement of men in ANC has a positive influence on the overall uptake of the service and its early attendance.

Furthermore, the meta-analysis identified factors such as pregnancy intention, presence of pregnancy complications and means of identifying pregnancy as an important factors that affect delayed initiation of ANC. This finding is consistent with a systematic review of small scale studies conducted in both developed and developing countries [63] on the relationship between pregnancy intention and timely initiation as well as obtaining adequate ANC. It was revealed that unintended pregnancy has a strong association with delayed initiation of first ANC services. Another systematic review [44] confirmed that women whose pregnancy was unintended tended to initiate ANC later than the first trimester of pregnancy. With regards to complications during pregnancy, the findings of this study is similar to a systematic review of literature [43] conducted in developing countries where pregnant women who did not experience obstetric complications were more likely to delay their first ANC compared to their counterparts.

In the current systematic review and meta-analysis, we observed some discrepancies in the included studies in defining the outcome variable "delayed initiation of ANC". Half of the included studies defined delayed initiation of ANC based on the cut-off point of 12 weeks of gestation, whereas the rest of the studies defined it based on 16 weeks. However the WHO [10, 11] defined late ANC initiation as entry into care after 12th week of pregnancy. Conversely, in this review we noticed a contrasting type of definition across several studies [27–42] as well as ANC practice in health facilities [53], implying that there was poor compliance of the WHO recommendation on the timing of first ANC initiation in Ethiopia. Countries might prefer to adapt or contextualise the original clinical practice guidelines with some changes, depending on their setting, to effectively implement the recommendations. Even if recommendations from the parent clinical practice guidelines can be adapted, how they are implemented needs to address local issues. Thus countries may need to contextualise guideline by addressing those implementation issues so that care becomes more relevant to the local environments [64]. However, at least there should not be inconsistencies between the implemented specific health recommendation within the country's health care delivery system and the health research arena. Hence, we recommend to concerned parties in the health sector in Ethiopia, particularly the health research scholars, that there is a need to adhere to the WHO recommended guideline on the timing of ANC initiation. Moreover, any further adapted or contextualised guideline on the timing of ANC initiation needs to be followed or implemented consistently in a standardized way.

The current systematic review and meta-analysis was not without limitations. The first limitation was the exclusion of qualitative studies from the review, which might reveal other important factors affecting women's behaviour to delay ANC attendance or might otherwise corroborate the quantitative findings. Secondly, since our meta-analysis used Crude Odds Ratios, it might be difficult to fully ascertain the effect of the exposure factors on the outcome of interest. Thirdly, as all the included studies were cross-sectional by design, it is difficult to establish temporal relationship between the outcome and exposure variables. Lastly, conducting meta-analysis despite the inherent heterogeneity between the included studies might have affected the quantitative findings. Our systematic review and meta-analysis also has some strengths. In this regard, we considered selection and inclusion of both published and unpublished literature which has the potential to minimize publication bias. Moreover, our search strategy was extensive using a number of major medical databases and other search engines. Lastly, we conducted a sub-group analysis of studies that employed different definitions of delayed initiation of ANC to appreciate the independent subgroup findings.

Conclusion

The current review revealed that nearly two thirds of women were delaying their first ANC visit in Ethiopia. The review pointed out various factors attributed to high level of delayed initiation of ANC in Ethiopia. Among these maternal age, place of residence, maternal education, husband's education, maternal occupation, family monthly income, pregnancy intention, parity, knowledge

of ANC, women's autonomy, partner involvement, problem during pregnancy, and means of identifying pregnancy showed significant association with delayed initiation of ANC. Therefore, intervention efforts to improve ANC utilization in Ethiopia require targeting these impeding factors. Moreover, strategies should be designed to intensify advocacy of female education, women's empowerment activities need to be continued through economic reforms, family planning programs should be strengthened to reduce unintended pregnancies, and partner involvement in ANC should be promoted through different means of communication. Further qualitative studies are recommended to gain further insight into the societal and health system barriers that contribute to delayed initiation of ANC in Ethiopia.

Additional files

Additional file 1: PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*. (DOC 85 kb)

Additional file 2: Search Strategy. (DOCX 28 kb)

Abbreviations
ANC: Antenatal care; CI: Confidence interval; DHS: Demographic and Health Survey; ETB: Ethiopian birr; JBI: Joanna Briggs Institute; MAStARI: Meta-Analysis of Statistics Assessment and Review Instrument; M-H: Mantel–Haenszel; NSW: New South Wales; OR: Odds ratio; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols; USD: United States Dollar; WHO: World Health Organization

Acknowledgments
We are very grateful to the University of Newcastle, Australia for providing a full scholarship for the corresponding author, and free access to the digital online library to search the electronic databases that were considered for this review. We also would like to acknowledge Haramaya University for providing free internet access and an office.

Ethical approval and consent to participate
Not applicable.

Funding
Not applicable.

Availability of data and materials
The data that support the review findings of this study are available upon submitting a reasonable request to the corresponding author.

Authors' contributions
GT, DL, CC, RS conceptualized the design of the systematic review. GT drafted the manuscript and is the guarantor of the review. All authors contributed to the development of the article search strategy, setting study selection criteria, the strategy for assessment of risk of bias, and data abstraction form. GT and AS involved in the screening, assessment of eligibility, selection of studies and critical appraisal as well as data extraction. DL, CC, AS and RS have participated in critically revising the manuscript for important intellectual contents. All authors read, provided feedback and approved the final manuscript.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Publisher's Note

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Received: 18 July 2017 Accepted: 8 November 2017
Published online: 15 November 2017

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Tesfaye *et al. BMC Women's Health* (2018) 18:198
https://doi.org/10.1186/s12905-018-0690-1

BMC Women's Health

RESEARCH ARTICLE Open Access

Magnitude, trends and causes of maternal mortality among reproductive aged women in Kersa health and demographic surveillance system, eastern Ethiopia

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Abstract

Background: Despite efforts at curbing maternal morbidity and mortality, developing countries are still burdened with high rates of maternal morbidity and mortality. Ethiopia is not an exception and has one of the world's highest rates of maternal deaths. Reducing the huge burden of maternal mortality remains the single most serious challenge in Ethiopia. There is a paucity of information with regards to the local level magnitude and causes of maternal mortality. We assessed the magnitude, trends and causes of maternal mortality using surveillance data from the Kersa Health and Demographic Surveillance System (HDSS), in Eastern Ethiopia.

Method: The analysis used surveillance data extracted from the Kersa HDSS database for the duration of 2008 to 2014. Data on maternal deaths and live births during the seven year period were used to determine the maternal mortality ratio in the study. The data were mainly extracted from a verbal autopsy database. The sample was comprised of all reproductive aged women who died during pregnancy, childbirth or 42 days after delivery. Chi-squared test for linear trend was used to examine the significance of change in rates over time.

Results: Out of the total 311 deaths of reproductive aged women during the study period, 72 (23.2%) died during pregnancy or within 42 days of delivery. The overall estimated maternal mortality ratio was 324 per 100,000 live births (95% CI: 256, 384). The observed maternal mortality ratio has shown a declining trend over the seven years period though there is no statistical significance for the reduction ($\chi^2 = 0.56$, $P = 0.57$). The estimated pregnancy related mortality ratio was 543 per 100,000 live births (95% CI: 437, 663). Out of those who died due to pregnancy and related causes, only 26% attended at least one antenatal care service. The most common cause of maternal death was postpartum haemorrhage (46.5%) followed by hypertensive disorders of pregnancy (16.3%).

Conclusion: The magnitude of maternal mortality is considerably high but has shown a decreasing trend. Community -based initiatives that aim to improve maternal health should be strengthened further to reduce the prevailing maternal mortality. Targeted information education and communication should be provided.

Keywords: Maternal mortality, Reproductive aged women, Kersa HDSS, Eastern Ethiopia

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Introduction

Improving women's health and reducing maternal mortality has been a global public health priority for the United Nations international development agenda [1, 2]. Globally, the Maternal Mortality Ratio (MMR) declined from 385 in 1990 to 216 in 2015. However, during the same period, the MMR reduction in sub-Saharan Africa remained stalled and most countries in the region registered sluggish progress in reducing maternal mortality [3–5]. According to World Health Organization (WHO) estimates, even though the magnitude of MMR in Ethiopia remains high, the level has shown a steady decline from 1250 in 1990 to 353 in 2015 [3]. In the Sustainable Development Goal (SDG) period, the goal is to reduce the global MMR to less than 70 per 100,000 live births by 2030 with no country having MMR over 140 per 100,000 live births [6].

In Ethiopia, the Federal Ministry of Health (FMOH) has applied multi-pronged approaches to reducing maternal morbidity and mortality. These approaches have included improving access to and strengthening facility-based maternal health services [7]. Ethiopia's Health Sector Development Plan target was to reduce MMR to 267 per 100,000 live births by the year 2015 but the country was unable to meet this target [8]. It was well recognized that the huge burden of maternal mortality in Ethiopia remains the single most serious challenge to the health sector [9]. In the country, the efforts to end preventable maternal mortality is at the top of the health sector's agenda in line with the SDGs as the issue was targeted in the 2015 health sector transformation plan [10].

The highest number of maternal deaths has been reported in countries where women are least likely to deliver their babies with the assistance of skilled practitioners, such as a nurse/midwife, doctor and other health workers [11]. In many countries, it is those women who are living in rural areas, at the lowest wealth quintile and with less education who are most susceptible to maternal mortality [4, 11]. High maternal mortality levels are also an indication of deep-seated gender inequalities that hinder women's ability to make decisions about household resources, which in turn could limit their ability to obtain social support and to access maternal health services [12].

Despite efforts at curbing maternal morbidity and mortality, developing countries are burdened with high maternal morbidity as well as mortality and are still facing the challenge of addressing the problem with very limited personnel and material resources [13]. More than 50% of all maternal deaths were from just six countries: Ethiopia, India, Nigeria, Pakistan, Afghanistan, and the Democratic Republic of Congo [14, 15]. The modelled estimate by WHO and the World Bank for Ethiopia showed a MMR of 353 per 100,000 live births in 2015 [3].

In Ethiopia, most studies on maternal mortality have been conducted in a facility setting [16–18]. Given that a small number of mothers deliver at health institutions in Ethiopia, maternal mortality measurement from facility -based data might not reflect the actual image on the ground [7, 19]. In addition, there is a paucity of information with regards to the local level magnitude and causes of maternal mortality at the community setting in Ethiopia. Furthermore, the differential results in the magnitude of maternal mortality across different estimates for Ethiopia calls for more rigorous and locally generated evidence [3, 7, 20]. This study therefore aimed to investigate the magnitude of, trends in, and causes of maternal mortality among reproductive aged women using surveillance data in a community setting in Eastern Ethiopia.

Methods

Study setting

The study was conducted in the Kersa HDSS site, Kersa district, Eastern Ethiopia. The HDSS is a member of INDEPTH network [21]. According to the country's 2014 population projection, the district has an estimated total population of 205,628. The district has 38 kebeles (the smallest administrative units in Ethiopia with an average population of 5000), of which three are urban and 35 are rural kebeles [22, 23]. The Kersa HDSS baseline census was conducted in 2007 and since then it has been updated every six months, with the registration of demographic and health events. In Kersa HDSS catchment population, there are six health centres, 20 health posts, and five clinics. From 2008 to 2014, there were 12 kebeles under the Kersa HDSS and the current study considered the data that was drawn from this surveillance population.

Study design

The study used longitudinal population based surveillance design and we carried out secondary data analysis through extracting data for the seven consecutive years (2008–2014).

Population

All women of reproductive age at the Kersa HDSS site during the period (2008–2014) were the source population. The study population were all reproductive aged women who died during 2008–2014 and were recorded by the Kersa HDSS. Data on the deceased women who used to live in the study area for less than six months were excluded from the analysis as they were not confirmed to be permanent residents.

Source of data and data collection methods

The primary source of the data was the Verbal Autopsy (VA) database of the Kersa HDSS. VA is a method of interviewing close relatives or caregivers of the dead person about the circumstances, signs, and symptoms that occurred before the death event and the respondent will answer in his/her own words [24]. Once the interview is completed, the VA questionnaires were passed on to at least two physicians to assign the cause of death using the International Classification of Diseases (ICD)-10 codes. After checking the agreement of physician-assigned cause of death based on VA coding, discordant cases were sent to a third physician for independent review and diagnosis. If any two of these three physicians assigned the same cause of death, then that was considered as the final cause of death; otherwise, the causes were labelled as undetermined. In addition to the information on the VA database, some basic data such as religion and ethnicity of the deceased women were obtained from the main household registration system database of the Kersa HDSS.

The data extraction procedure from the VA database was elucidated as follows. From all the deceased individuals who have VA data in the database, males of all age were excluded. Then from all the deceased women in the database, the data of all women of age less than 15 years and greater than 49 years were excluded. From all the women deaths in the reproductive age, the data of those women who were not pregnant or beyond 42 days after birth during the time of death were excluded. Finally the remaining data of all deceased women during pregnancy, birth or within 42 days of delivery were considered for the analysis.

Data quality control

Quality assurance measures were embedded into all aspects of the surveillance process. In the Kersa HDSS, if inconsistent or missing data were detected at any step during the data collection process, the questionnaire was returned to the data collectors for checks and corrections. In addition, the supervisor selected 5% of questionnaires and visited the houses where the data were collected to check whether the information was accurate or not. The field coordinator checked 1% of the questionnaires in a similar manner. Similar measures of quality assurance procedures have also been applied to the data collection process that makes use of the VA questionnaires for a deceased person. The surveillance also made use of a standardized study tool. During the data extraction, cross-checking of the electronic version of the data with the archived hardcopy was carried out through tracing the information back on a sample of deceased women. Data cleaning and adjustments were conducted to avoid errors in the labelling or order of the variables of interest.

Data analysis

Descriptive statistics consisting of frequency and proportion were performed to summarize the main variables. The analysis was conducted in STATA software. Some of the major statistical parameters computed were the following: MMR, pregnancy related death ratio, maternal mortality rate, lifetime risk of maternal deaths, and proportion of maternal deaths among female deaths. The overall level of MMR was calculated by dividing the total number of maternal deaths (from the VA data) from 2008 to 2014 with the total number of live births in the same period and then converted in to 100,000 live births. The level of MMR for each year starting from 2008 and up to 2014 were calculated in the same manner and the trend at different years were plotted. The temporal trend of maternal mortality was also conducted to demonstrate the seasonal variation. We used Chi-squared test to determine the significance of the trend over time. "*Pregnancy related death*" was the number of deaths of women while they were pregnant or within 42 days after termination of pregnancy irrespective of the cause divided by a total number of live births in the same period. "*Proportion of maternal deaths among female deaths*" was the number of maternal deaths divided by the total number of deaths among reproductive aged women in the same period. The "*Life Time Risk (LTR) of maternal death*" was approximated by [LTR = 1-(1-Maternal mortality rate) [35]]. To obtain the LTR, we first calculated maternal mortality rate (Mmrate) by dividing the number of maternal deaths by the total number of reproductive aged women in the study area during the same period. The LTR of maternal death is an important measure of the cumulative loss of life due to maternal deaths over a woman's life course [25].

Results

General findings

Out of the total number of reproductive aged women (34,101) during the study period, there were a total of 311 deaths. Of these, 72 (23.2%) (95% CI: 18.6, 28.2%) occurred during pregnancy or within 42 days after delivery. Out of all the women who died during pregnancy or within 42 days after delivery, 43 (59.7%) with 95% CI (47.5, 71.1%) died due to pregnancy or related causes based on the ICD codes. In the same period, the total number of live births was 13,269. Hence, based on this, the MMR was 324 per 100,000 live births (95% CI: 256, 384). The Pregnancy Related Mortality Ratio was 543 per 100,000 live births (95% CI: 437, 663), the proportion of maternal deaths among female deaths was 13.8% (95% CI: 10.2, 18.2%), and the lifetime risk of maternal death was calculated by $(LTR = 1\text{-}(1\text{-}Mmrate)^{35}) = 1\text{-}(1-0.00126)^{35}$, $LTR = 1-0.95683166$, $LTR = 0.0432 \sim 4.3\%$ (approximately one in 23).

Basic socio-demographic characteristics

The mean age of the women who died due to maternal causes was 27.6 (SD = 7.5) years. The majority of the mothers who died due to maternal causes were illiterate (83.7%), married (90.7%), a house-wife (72.1%), of Muslim religion (93.1%) and Oromo by ethnicity (93.1%) (Table 1).

Magnitude and trends of maternal mortality

The overall MMR was 324 per 100,000 live births with 95% CI (256, 384) in the study area during the reference period. The number of maternal deaths per each year and the corresponding MMRs with confidence intervals are presented in Table 2. Across the study years the trend of the MMR varied, the lowest being in 2013 with 172 per 100,000 live births and the highest peak observed in 2011 with 636 per 100,000 live births. There was a slowly declining trend in MMR during the reference period in the study area with a gradient of 29.643 on linear scale (Fig. 1), though there is no statistical significance for the reduction ($\chi^2 = 0.56$ and $P = 0.57$). Furthermore, as shown in Fig. 2, except in 2010, 2012 and 2013, the highest rates of maternal mortality persistently occurred in the age group 20–29 years. Moreover, the study revealed an observed temporal (seasonal) variations in MMR in the study area. Throughout the study period, the highest rate of death was observed during the winter season. At the beginning of the surveillance year, the MMR overlapped at 124 per 100,000 live births for the three seasons (winter, autumn and summer). In subsequent years, however, the rate persistently became higher in the winter season until the end of the surveillance period with the highest rate observed in 2011 (Fig. 3).

Table 1 Distribution of women who died due to pregnancy related causes by socio-demographic characteristics, Kersa HDSS, 2008–2014

Variables	All pregnancy related deaths ($n = 72$)	
	Maternal deaths, no (%)	Non-maternal deaths, no (%)
Age		
15–19	5 (11.6)	5 (17.2)
20–29	21 (48.8)	8 (27.6)
30–39	13 (30.2)	15 (51.7)
40–49	4 (9.3)	1(3.4)
Marital status		
Never married	1 (2.4)	0
Married	39 (90.7)	28 (96.6)
Widowed	3 (6.9)	1 (3.4)
Occupational status		
Farmer	5 (11.6)	4 (13.8)
House maid	4 (9.3)	2 (6.9)
House wife	31 (72.1)	20 (69)
Merchant	1 (2.3)	1 (3.4)
Student	2 (4.7)	0
Daily labourer	0	2 (6.9)
Educational status		
Illiterate	36 (83.7)	25 (86.2)
Grade 1–4	2 (4.7)	3 (10.3)
Grade 5–8	2 (4.7)	1 (3.4)
Grade 9–10	2 (4.7)	0 (0.0)
Grade 12+	1 (2.3)	0 (0.0)
Ethnicity		
Oromo	40 (93.1)	29 (100)
Amhara	3 (6.9)	0 (0.0)
Religion		
Muslim	40 (93.1)	29 (100)
Orthodox Christian	3 (6.9)	0 (0.0)
Residence		
Urban	5 (11.6)	4 (13.8)
Rural	38 (88.4)	25 (86.2)

Causes of maternal death

The maternal morbidities that lead to maternal deaths were identified using the ICD codes. This was generated from the VA database using the corresponding VA code. Accordingly, the main cause of death among the 43 (59.7%) mothers who died due to pregnancy or its related causes was postpartum haemorrhage (46.5%), followed by hypertensive disorders of pregnancy (16.3%) (Fig. 4). It is worth noting that, among the pregnancy related deaths, a significant percentage (14%) of the mothers died due to partner violence and transport accidents. Though not statistically significant ($P = 0.40$), there was an observed variation in the cause of maternal death across different years (Fig. 5). For instance, though postpartum haemorrhage persisted in being the leading cause of maternal death from 2008 to 2013, in 2014 however, the leading cause of maternal death was hypertensive disorders of pregnancy.

Table 2 Annual maternal mortality ratios over the seven years period (2008 to 2014), Kersa HDSS

Year	Number of maternal deaths	Number of live births	MMR with 95% CI
2008	6	1615	372 (186, 557)
2009	5	1757	285 (114, 445)
2010	8	2019	396 (198, 502)
2011	10	1572	636 (382, 827)
2012	5	1808	221 (111, 442)
2013	4	2319	172 (60, 245)
2014	5	2179	229 (92, 335)

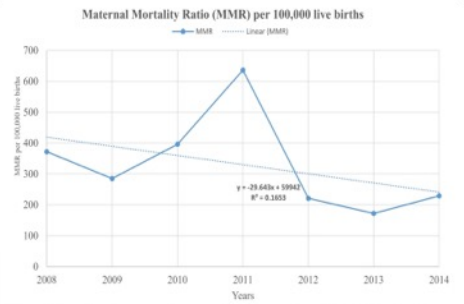

Fig. 1 Trends of maternal mortality ratio in Kersa HDSS, 2008–2014

Fig. 3 Temporal variation of maternal mortality in Kersa HDSS, 2008–2014

Place of death

Regarding the place of maternal death, most (56%) of the deaths occurred at home, followed by the hospital (33%), other places (9%), and health centre (2%). The majority (63%) of maternal deaths occurred after giving birth, and among which 18 (67%) give birth at home and 9 (21%) delivered at health facility. Among those who gave birth at home, 27% died in a hospital and other lower level health facilities.

Previously known morbidities

Based on the information from the respondents, there were previously known morbidities among the deceased mothers such as high blood pressure (9.3%), diabetes (2.3%), malnutrition (2.3%), tuberculosis (2.3%) and other diseases such as anaemia (4.7%). With regards to injuries or accidents, only 3% of the deceased mothers were known to have a history of injuries or accidents, such as suicide and insect bites, surrounding their deaths.

Obstetric measurements and health service use

Nearly a quarter (26%) of the deceased mothers attended at least one antenatal care consultation for their pregnancy. With regards to the timing of death during the course of pregnancy, among the deceased mothers, 27 (62.8%) died after giving birth, the majority of those (55.6%) within the first day. Among those who died after giving birth, the majority (66.7%) gave birth at home. The majority of the deliveries were assisted by untrained Traditional Birth Attendants (TBAs) (48.1%) (Table 3).

More than half (60.6%) of the deceased mothers received some treatment for the condition that led to their death. The main treatment modality the mothers received before their death was oral and injection antibiotics (46.2%). Other treatments included intravenous fluid and Oral Rehydration Salt (34.6%), nasal treatment (15.4%) such as food or fluid that passed through the nose, and one woman received blood transfusions (3.8%). With regards to the place of treatment, among the mothers who received some treatment, a substantial proportion (80.8%) received treatment at home assisted by traditional healers. However, a larger proportion (84.6%) of the mothers at same time received treatment at government clinics during the course of the health condition that led to their death. Only 2.3% of the interviewees declared that the deceased mothers had a history of smoking cigarettes.

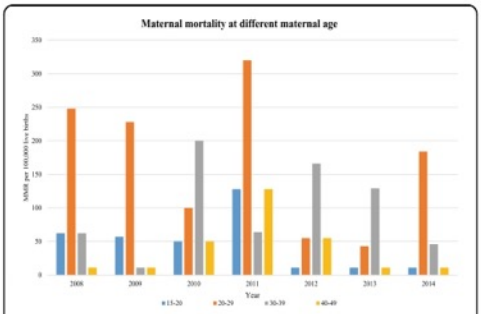

Fig. 2 Age wise distribution of maternal mortality in Kersa HDSS, 2008–2014

Discussion

Using surveillance data, this study was intended to assess maternal mortality and identify the causes of death among reproductive aged women over a seven-year period in Kersa HDSS, Eastern Ethiopia. The study showed a cumulative average MMR of 324 per 100,000 live births with a decreasing trend over the study period. The main causes of maternal death were postpartum haemorrhage (46.5%) and hypertensive disorders of pregnancy (16.3%). Most of the mothers (56%) died at home, and the majority (62.8%) of the mothers died after giving birth.

For every 1000 live births in the study area during the seven year period, about three women died during pregnancy, childbirth or within 42 days of childbirth. This finding is almost similar to the national average (353 per 100,000 live births) but below the sub-Saharan average

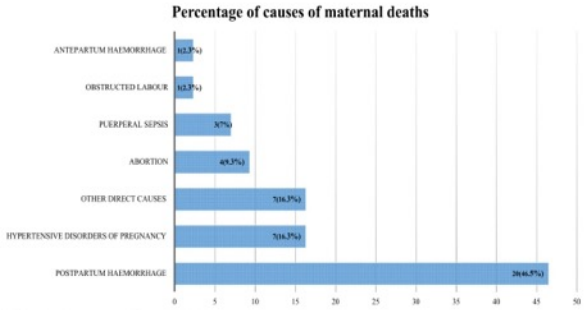

Fig. 4 Proportion of maternal deaths by cause, Kersa HDSS, 2008–2014

(546 per 100,000 live births) [3]. Even though the MMR is below the sub-Saharan Africa average, it is higher than the world average, as is the case with other sub-Saharan African countries such as Sudan, Ghana, and Rwanda (Fig. 6) [3]. The overall cumulative average of maternal mortality in the present study is considerably high and is deemed to require government action. However, the observed MMR across the seven-year period appears to decline. The result of the present study is almost in agreement with the finding that was reported from a review of studies conducted in Ethiopia, where the level of maternal mortality was found to decline slightly [17]. The decreasing level of maternal mortality in this study might be related to the current government efforts to improve maternal health by implementing community-based programs that involve community mobilization. Moreover, it might also be explained by the fact that the population under surveillance (through the HDSS) most likely have better awareness and use of maternal health care, which could potentially lead to a lowered MMR. Furthermore, it was found that residing in a HDSS site has a positive influence on maternal health [26].

Nonetheless, the trend of maternal mortality has varied slightly over the years. For instance, there was an increase in MMR in 2011 but a decrease in 2013. The reasons for this are not clear but may have something to do with the relatively higher number of pregnancies and increased number of poor pregnancy outcomes in 2011 compared to 2013. There were more pregnancies in that year, which might be associated with a high agricultural production in the preceding year that enhanced an increased number of families formed among young couples in the district. Moreover, there was a high number of pregnancy failures and still-births in the same year [21]. In connection with this, in the same year compared to other years, the absolute number of maternal deaths may have increased. In addition, the study findings revealed that there had been temporally heterogeneous pattern in rates of maternal death, where MMR was highest during the winter season throughout the study

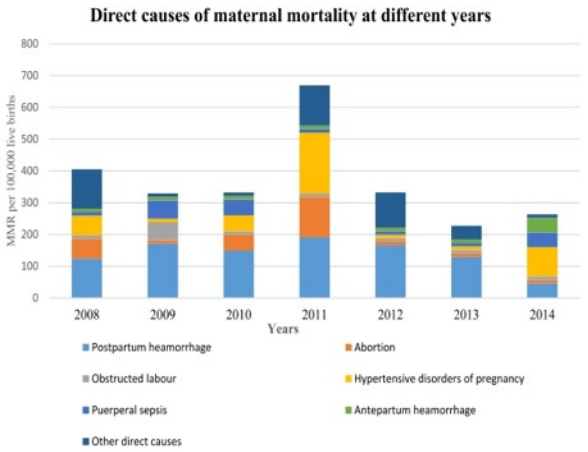

Fig. 5 Causes of maternal mortality across various years (2008–2014), Kersa HDSS

Table 3 Obstetric measurements of women who died due to maternal causes, Kersa HDSS, 2008–2014

Obstetric related variables (*N* = 43)	Frequency	Percent
Died during pregnancy (before delivery)	12	27.9
Gestational age at death (*n* = 12)		
First trimester	3	25
Second trimester	2	16.7
Third trimester (including in labour)	7	58.3
Died after giving birth	27	62.8
Died after undergoing abortion	4	9.3
Type of delivery (*n* = 27)		
Normal	21	67.7
Forceps/vacuum	4	19.9
Caesarean section	2	6.6
Died postnatally (*n* = 27)		
Within the first day	15	55.6
Between 1 and 7 days	8	29.6
Between 7 days –6 weeks	4	14.8
Place of delivery (n = 27)		
Home	18	66.7
Hospital	8	29.6
Health centre	1	3.7
Delivery attendants during delivery (n = 27)		
TBAs		
Untrained TBAs	13	48.1
Trained TBAs	3	11.1
Doctors	7	25.9
Nurses	2	11.1
Relatives	2	3.7

period. The finding highlights that since the winter season has heavy rain falls, the road may get muddy, the rivers might become full and rural bridges could be damaged. Hence the parturient family might not be able to transport the women to a health facility for delivery care and thus most women remain at home to deliver their baby, which might have contributed to the higher rates of maternal death. Moreover, during the rainy season there is an increased rate of malaria transmission, and pregnant women could in turn develop adverse maternal disorders (anaemia and eclampsia) which subsequently contribute to high rates of maternal deaths. It has been shown that malaria-associated anaemia and eclampsia tend to increase during the rainy season among pregnant women in sub-Saharan Africa [27].

Generally, we found the leading cause of maternal death during the study period to be postpartum haemorrhage. This finding is in accordance with other research results from developing countries and sub-Saharan Africa where haemorrhage is the leading direct cause of maternal death [28, 29]. A similar finding was also reported from a community-based study in northern Ethiopia [30]. The finding of the current study, however, is in contrast with a systematic review of studies in Ethiopia which showed the major cause of maternal death to be obstructed labour (36%) followed by haemorrhage (22%) [16]. This difference may be partly explained by the fact that the review only included facility-based studies where most pregnant women came to a health facility very late, with advanced complications such as obstructed labour which leads to prolonged labour [16, 31]. Another possible explanation for this may be that, as the VA data used in the present study is prone to misclassification of maternal deaths, the examiners might have misdiagnosed obstructed labour that leads to haemorrhage. The mothers, however, might have died due to initially developing obstructed labour which is typically not the cause of death but rather due to the haemorrhage that resulted from prolonged labour.

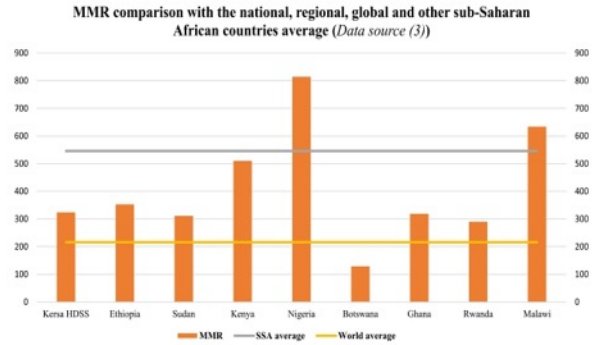

Fig. 6 Comparison of the maternal mortality ratio with the national, regional, global and other sub-Saharan African countries average

In the current study, there were 543 pregnancy-related deaths per 100,000 live births during the seven-year period. Though the majority of the pregnancy-related deaths were due to causes related to pregnancy or childbirth, non-obstetric causes such as partner violence and transport accidents were also contributors. This highlights that partner violence, including murder and other injuries or accidents to women, contributes to the rates of death among pregnant and postpartum women to a considerable extent in Ethiopia. This underscores the need to design programs that could address issues of gender-based violence at the community level to synergize with current efforts to improve maternal health. The results of the study are similar to a study conducted in Mozambique, in which it was reported that a combination of partner violence and injury were the fourth leading cause of maternal death [32]. The finding further highlights that the social status of women in the community might be a root factor for the high rate of maternal mortality in Ethiopia.

The findings of this study demonstrated that the lifetime risk of maternal death is nearly 1 in 23. This result is lower than a study finding from a community-based survey in southern Ethiopia which was conducted using the sisterhood method, where women have a one-in-ten lifetime risk of deaths [33]. However, this finding is higher as compared to the sub-Saharan African (1 in 39) and national level (1 in 52) [34, 35]. The reason for the observed high LTR of maternal death in the present study might be related to the less precise estimation of the indicator using Mmrate.

In this study, the majority (62.8%) of the mothers died after giving birth and more than half (55.6%) died within the first day. These findings indicate that the first few hours and days after giving birth are a critical period during which mothers should receive immediate attention from health care providers at a health facility to avert catastrophic maternal deaths. The aggregation of maternal death around delivery or immediately after delivery also means that mothers should have access to health facilities to receive skilled care during this period.

In the present study, more than half (60.5%) of the deceased mothers had sought health care services for the health condition that led to their death. However, a substantial proportion (80.8%) of them sought the service from traditional healers at home. This has implications for maternal health behavioural change programs. Traditional healers, including TBAs, still play a paramount role in rendering services at the community level but it has been shown that they are not effective in improving maternal health even when trained [36, 37]. Yet the reliance of local women on TBAs emphasizes the need to understand, at the grassroots level, why uptake of skilled delivery care is low in comparison with TBA utilisation. Perhaps strategies should be designed to provide focused training to TBAs so as to make them capable of recognizing the critical time to seek health care for women in their village [38]. Therefore, there is a need to consider revisiting the strategies for training of TBAs to make them contribute towards the improvement of maternal health.

Implications of the study

The measurement of maternal mortality using data from the direct surveillance system is the current gold standard method of determining the MMR. Using direct surveillance methods in the current study, it was possible to estimate the MMR. Hence, the study demonstrates the utility of estimating maternal mortality based on HDSS data to inform policy and enable locally appropriate program development. Despite efforts to maintain the data quality at every step of the surveillance process at Kersa HDSS, there was still some misclassification of deaths, which could be partly attributed to misreporting. For the data to be strong enough to support evidence-based decision making, it is crucial that data collection systems in HDSS sites institute ways to improve reporting from the community.

Limitations of the study

As the study used secondary data, there were incomplete or mislabelled variables, restricted variable data, inconsistent values, and missing records. In addition, the VA codes used to assign the cause of death were mainly limited to the direct causes, rather than the indirect causes. This could be related to the fact that the cause of death was determined by physicians using the VA questionnaire, which depends on the subjective response of the interviewee. This might most likely suffer from respondents' information bias, which may lead to misclassification of the underlying cause of death. Due to the sensitive nature of the issue, abortion-related maternal deaths were likely to be underreported. Using the current data, we are unable to make inferences that compare the women who died with the women who survived childbirth. Moreover, the use of a small sample for the analysis made it difficult to draw inferences to the general population. However, our intent was to describe maternal mortality at the local level in the Kersa HDSS.

Conclusion

The magnitude of maternal mortality is considerably high, though it has shown a declining trend. The major causes of maternal mortality were postpartum haemorrhage and hypertensive disorders of pregnancy. Community-based initiatives should be strengthened to further reduce the prevailing maternal mortality. Targeted information education and communication should be provided to illiterate

housewife women in their twenties. The health messages targeting these group of mothers should be tailored to their needs and match their level of literacy in order to bring better health outcomes. Future interventions on maternal health in this setting should also be tailored in such a way that women are educated through existing mother peer groups or Women's Development Army networks at the village level. Moreover, strategic actions are required to promote skilled delivery care attendance and attention should be given to availing community based trained delivery assistants in rural communities.

Abbreviations
CI: Confidence Interval; EPHA: Ethiopian Public Health Association; FMOH: Federal Ministry of Health; HDSS: Health and Demographic Surveillance System; ICD: International Classification of Diseases; LTR: Life Time Risk; MMR: Maternal Mortality Ratio; Mmrate: Maternal mortality rate; SDG: Sustainable Development Goal; TBA: Traditional Birth Attendant; VA: Verbal Autopsy; WHO: World Health Organization

Acknowledgements
The authors would like to acknowledge Kersa HDSS, Haramaya University for providing the data used for making the analysis and writing. We also would like to thank the University of Newcastle, Australia for financially supporting the travel expenses of the corresponding author for facilitation of data requisition and extraction.

Ethical approval and consent to participate
Ethical approval was obtained during the establishment of Kersa HDSS site from the Institutional Health Research Ethics Review Committee of Haramaya University (FOHS/00/9634/2008), and Ethiopian Public Health Association (EPHA) (IRB-00005684) [21]. Moreover, ethical approval was secured from the Human Research Ethics Committee of the University of Newcastle, Australia for the current data analysis (H-2016-0403). During the surveillance process, informed verbal consent was obtained from the head of the family or eligible adult among the family members before conducting an interview to capture the information on the occurrence of vital events such as death. Furthermore, no personal identifiers were shared with a third party.

Funding
The President's Emergency Plan for AIDS Relief (PEPFAR) through US Centre for Disease Control and Prevention (CDC) and EPHA support the routine surveillance activities of Kersa HDSS through financial and technical agreement GH001039–01 with Haramaya University. The University of Newcastle, Australia has supported the student. The findings and conclusions in this report are of the authors and not the funders.

Availability of data and materials
The data that support the findings of this study are available by requesting Kersa HDSS, Haramaya University.

Authors' contributions
GT has conceptualized the manuscript, performed extraction of the data, statistical analysis, made interpretation and drafting of the manuscript. DL, CC, and RS have critically revised the paper starting from its inception, design and planning of the study, statistical analysis, interpreted the findings and have participated in the drafting of the manuscript. NA has participated in data acquisition, data analysis, revision of the paper for intellectual content and have participated in the drafting of the manuscript. All authors reviewed and approved the final version.

Consent for publication
Not applicable.

Competing interests
The authors would like to declare that they have no competing interests.

Publisher's Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Received: 5 May 2017 Accepted: 22 November 2018
Published online: 05 December 2018

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RESEARCH ARTICLE

Application of the Andersen-Newman model of health care utilization to understand antenatal care use in Kersa District, Eastern Ethiopia

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OPEN ACCESS

Citation: Tesfaye G, Chojenta C, Smith R, Loxton D (2018) Application of the Andersen-Newman model of health care utilization to understand antenatal care use in Kersa District, Eastern Ethiopia. PLoS ONE 13(12): e0208729. https://doi.org/10.1371/journal.pone.0208729

Editor: Christine E. East, Monash University, AUSTRALIA

Received: May 13, 2018

Accepted: November 21, 2018

Published: December 6, 2018

Data Availability Statement: Due to the presence of potentially identifying patient information, data are available upon request. This requirement was imposed by both Ethics Committees which approved the research protocol. The data request may be submitted to the Research Centre for Generational Health and Ageing, University of Newcastle, Australia at rcgha@newcastle.edu.au or the principal supervisor at deborah.loxton@newcastle.edu.au.

Abstract

Background

In Ethiopia, the uptake of antenatal care services has been low. Moreover, there is less frequent and late attendance of antenatal care among women who attend. Using the Anderson-Newman model of health care utilization, this study identified factors that either facilitate or impede antenatal care utilization in Kersa district, Eastern Ethiopia.

Method

A community-based cross-sectional study was conducted. A total of 1294 eligible women participated in the study. Data were collected using face to face interviews with a pre-tested structured questionnaire administered with a digital survey tool. Data were collected in a house to house survey of eligible women in the community. Bivariate and multivariate logistic regression analyses were used to examine the predisposing, enabling and need factors associated with antenatal care utilization.

Result

Out of the 1294 respondents, 53.6% (95% CI: 50.8%, 56.3%) attended antenatal care at least once during their last pregnancy. Only 15.3% attended four or more antenatal care visits and just 32.6% attended prior to the 12th week of gestation. Educational status, previous use of antenatal care and best friend's use of maternal care were significant predisposing factors associated with at least one antenatal care visit. Type of *kebele*, wealth index and husband's attitude towards antenatal care were significant enabling factors associated with at least one antenatal care consultation. Health Extension Workers providing home visits, perceived importance of ANC and awareness of pregnancy complications were significant need factor associated with at least one antenatal care consultation. Husband's attitude

Funding: This research was supported by the University of Newcastle, Australia as part of the research training program for research higher degree students to cover the costs for the data collection operation. Haramaya University (my employer organization) arranged a vehicle to transport research assistants and the corresponding author to and from the field research site during the data collection. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

towards ANC, head of the household, awareness of pregnancy complications, and history of abortion were predictors of attending four or more antenatal care visits.

Conclusion

More than half of the women attended at least one antenatal care visit. A sizable proportion of women had infrequent and delayed antenatal care. Intervention efforts to improve antenatal care utilization should involve the following: improving women's educational achievement, peer education programs to mobilize and support women, programs to change husbands' attitudes, ameliorate the quality of antenatal care, increasing the Health Extension Worker's home visits program, and increasing the awareness of pregnancy complications.

Introduction

Maternal mortality remains a global public health priority, even in the era of Sustainable Development Goals (SDG) [1]. In many developing countries, including Ethiopia, obstetric complications that occur during pregnancy and parturition are the leading causes of maternal mortality among reproductive-aged women [2, 3]. Inadequate maternal care in resource-poor settings and insufficient utilization of available services, such as antenatal care (ANC), further aggravate the burden of maternal mortality [4]. Evidence has shown that providing timely and appropriate ANC leads to a reduction in maternal deaths [1, 5]. Antenatal care contributes to a reduction in maternal mortality, not only through facilitating prompt diagnosis and management of life-threatening obstetric complications but also through screening mothers who could potentially develop complications during childbirth [1, 6]. The ANC interventions offered during pregnancy include early detection and treatment of obstetric complications such as pre-eclampsia, antepartum haemorrhage, anaemia and nutritional problems. In developing countries, ANC also includes the provision of Tetanus Toxoid vaccination, early identification and treatment of sexually transmitted infections, provision of insecticide-treated bed nets, and prophylaxis medication for malaria [7].

The World Health Organization (WHO) recommends that all pregnant women access a minimum of four focused ANC check-ups with a skilled health worker [8, 9]. It was recommended that pregnant women should initiate the first ANC attendance during the first trimester [1, 9]. There has been good progress in ANC utilization in developing countries where the majority (80%) of women receive at least one ANC check-up [10]. However, only a small proportion (40%) of pregnant women in these countries have attended the minimum four ANC visits [11]. Furthermore, in sub-Saharan Africa, nearly three quarters (72%) of women initiate their first ANC check-up after the first trimester of pregnancy [10]. At the time this study was conducted, the WHO focused ANC model with a minimum of four visits and initiation of the first visit within the first trimester [9] was in place in Ethiopia and this research looked at the ANC practices of these recommendations.

In previous small-scale studies in Ethiopia [12–18], researchers demonstrated a fairly good level (70–88%) of at least one ANC consultation. Additionally, in the 2016 national Demographic and Health Survey report [19], almost two thirds (62%) of women received at least one ANC check-up for their most recent pregnancy. However, in many of these studies [13, 14, 16, 18] it was reported that the proportion of women who attended four or more ANC visits was

below 40%. Furthermore, a similar finding was reported in the national survey [19] where only 32% received four or more ANC check-ups. In rural areas, the proportion of pregnant women who attended four or more ANC check-ups was only 27% compared to 63% in urban areas. Moreover, although evidence has shown that early initiation is associated with better maternal health outcomes [20, 21], nearly two thirds (64%) of women in Ethiopia delay their first ANC enrolment to the second or third trimester of pregnancy [22].

There is empirical evidence [12, 23–26] that socio-demographic, reproductive and obstetric factors as well as previous experience of service use were associated with poor utilization of ANC. Yet there is a need to examine these factors in a systematic way within one study, to permit identification of the most important barriers and facilitators to ANC uptake. The Andersen and Newman Behavioural Model (ANBM) for health service utilization provides a framework that permits systematic identification of factors that influence individual decisions to use (or not use) available health care services [27, 28]. According to the ANBM, *predisposing factors* are those socio-cultural characteristics of the individual that exist prior to their health condition, *enabling factors* reflect the means or logistics required to obtain the services, and *need factors* are the most immediate cause of health service use and reflect the perceived health status of the individual.

In order to uncover the contextual factors that affect the uptake of ANC, it is crucial to carry out studies based on a health model which addresses most aspects of personal decision making regarding health care utilization. Therefore, using the ANBM for health service utilization, the present study aims to identify the key factors that affect ANC utilization among reproductive-aged women in Kersa district, Eastern Ethiopia.

Materials and method

Study setting

A community-based cross-sectional study was conducted in Kersa district, Eastern Hararghe zone of Oromia regional state, in Eastern Ethiopia from June to August 2017. The district capital is Kersa town, which is located 486 kilometres from the capital city, Addis Ababa. According to the population projection for Ethiopia published by the Central Statistical Agency in 2014, the district has an estimated total population of 205,628. The population is predominantly rural (92%). The district has 38 *kebeles* of which three are urban and 35 are rural [29, 30]. The *kebele* is the lowest administrative unit in Ethiopia consisting of around 1000 households, or an approximate population of 3000 to 5000 [31]. The district has 24 Health and Demographic Surveillance System (HDSS) *kebeles* and 14 non-HDSS *kebeles*. HDSS is a platform to regularly follow the health and demographic characteristics of a community residing in a distinct geographic area. It monitors new health threats, tracks the change in population number through fertility and migration rates, and measures the effect of interventions on communities [32, 33]. All *kebeles* have access to non-asphalt roads, though the terrain is mountainous in the majority of the rural *kebeles*. The district has seven health centres, thirty four health posts and eight private pharmacies at different locations within the district. In each *kebele*, there are two Health Extension Workers (HEWs) providing health promotion activities. According to the information from the district health office, the health coverage (physical accessibility of health facilities) of the district is more than 80% [34].

Population

The study population was all reproductive-aged women in the Kersa district who gave birth in the three years prior to the survey, regardless of the birth outcome. Women who had lived in the district for more than six months, and delivered their most recent baby after 28 weeks of

gestation were included. Women who did not volunteer to participate in the study, were critically ill and physically or mentally disabled during the data collection period, were excluded from the study.

Sample size and sampling procedure

The sample size (n = 1320) was primarily determined for a broad study on the level of maternal health service uptake and associated factors in Kersa district, Eastern Ethiopia. A total of ten *kebeles* (seven from areas where HDSS is conducted and three from non-HDSS areas) were included in the survey. Households with eligible women were identified using the HEW health management information system registration log sheet and the number of eligible women in each included *kebele* was determined. The total sample size of the study was proportionally allocated to each *kebele*. Respondents were selected through systematic random sampling techniques and invited to take part in the survey. When two or more eligible women were found within the selected household, one was selected by the lottery method and invited to do the interview.

Measurement variables

Outcome variables. ***At least one ANC attendance*:** Women who have attended at least one ANC check-up during their most recent pregnancy as reported by the participant.

***Four or more ANC attendance*:** Women who attended four or more ANC visits during their last pregnancy as reported by the participant.

Predictor variables. The predictor variables were conceptualized based on the ANBM of health care utilization and grouped into three set of factors: predisposing, enabling and need factors as shown in Table 1.

Source of data and data collection methods

To obtain the data, we used house-to-house interviews with eligible reproductive-aged women using a structured questionnaire. The study tool for the survey was adapted from pertinent literature. The study tool was first prepared in English and subsequently translated into the local language (Oromiffa) to collect the data. The tool was re-translated back to English to check for consistency. A template of the study tool was prepared using an online survey tool (*Survey Gizmo*) and downloaded onto iPads for offline data collection. The data was collected by resident HDSS data collectors who have extensive experience in conducting interviews in both urban and rural *kebeles* using the iPads. The principal author (GT) and a supervisor closely monitored the overall data collection process.

Data quality control. The study tool was pre-tested on 65 women living in a neighbouring district. All required revisions were made to the study tool based on the pre-test. Experienced HDSS data collectors and a supervisor were recruited and deployed for the data collection. A two-day intensive training course was provided to the data collectors and the supervisor about the aim of the study and sampling procedures; data collectors also performed simulated exercises on how to interview respondents. To ensure correct inclusion of the participants, the student researcher made the random selection of the *kebeles*, was responsible for the proportional allocation of the samples, and carried out the random selection of the interviewees. We used iPads for data collection to avoid missing or incomplete responses. The supervisor cross-checked the completed responses on the iPads by repeating the interviews with 10% of the respondents to check for correct completion of valid responses. The responses were uploaded into the online survey tool on a daily basis and the lead author double-checked for any inconsistencies and gave feedback to the interviewers on daily basis.

Table 1. Predictor variables for PNC utilization and their operational definitions.

Variable category	Operational definition
Predisposing factors	
Maternal education	Formal schooling status starting from attending elementary school
Mass media availability	Presence of communication tools such as TV, radio or internet in the household
Telephone ownership	Ownership of mobile telephone at the household level
Education on maternal health	Receiving education on maternal health (such as the use of maternity service, and nutrition) from any source
Age at marriage	Completed in years at the time when the respondent first married
Age at first pregnancy	Completed in years at the time when the respondent first got pregnant
Birth order	Birthing order of the index child in the woman's life
Previous use of ANC	Practice of ANC for any of the previous pregnancies in the woman's life
Living in a model family	A woman who lives in a family which adopted and implemented the full health extension service packages in Ethiopia
Best friend's use of maternal care	A friend who regularly shared the woman's feelings, emotions, and opinions and various behavioural practices important in the woman's life and uses services such as ANC, delivery care and PNC
Enabling factors	
Place of residence	*Urban* versus *rural* based on the *kebele* where the woman lives
Type of *kebele*	Based on the living site of the woman (*kebeles* under surveillance versus *kebeles* not under surveillance)
Wealth index	Produced from the existing variables (household assets ownership, household characteristics and access to utilities) from the data set through factor analysis using Principal Component Analysis (PCA)
Head of the household	A person who is responsible for heading the household
Decision making on household expenses	A person who decide on household matters including whether to visit health facilities during illness or emergency conditions
Husband's attitude	Respondent's judgement about the feeling of her husband towards ANC while she was pregnant
Social support	Type of help the woman received from her best friends during pregnancy, labour and post-delivery (prompted question)
Need factors	
Awareness of pregnancy complication	Respondents were asked whether they had knowledge of any dangerous pregnancy-related symptoms (such as bleeding)
Perceived importance of ANC	Women's perception of how useful ANC attendance is for a healthy pregnant woman
Pregnancy intention	Women's thinking on whether their last pregnancy was planned or not
HEW home visit	Receiving visit and health education by a HEW at woman's home
History of abortion	Lifetime number of abortion coded as Yes or No

https://doi.org/10.1371/journal.pone.0208729.t001

Data management and analysis

The data were directly exported from the digital survey tool into SPSS software version 22 for analysis. Before commencing data analysis, appropriate transformations were made on the variables and missing values were also managed as necessary. Descriptive statistics and appropriate measure of central tendencies were used to summarize the key variables. Variables with missing data due to the skipping nature of the question (*husband education* and *living in a model family*) were managed by re-coding the system missing value into an existing relevant category of the variable. Categories of some variables with negligible frequency, such as, "*don't know*" or categories not relevant for a particular inferential test due to small cell value were recoded into another related category. Before fitting the full multivariate model, all of the variables were considered for the multicollinearity diagnostics and all showed no multi-

collinearity with a variance inflation factor of less than five. Bivariate logistic regression analysis was conducted to examine the association between the predictor and outcome variables using the Crude Odds Ratio (COR) at a 95% confidence interval (CI). Factors that were significant with a p-value of less than 0.05 were retained for further consideration in three blocks of the multivariate logistic regression model. The three block models were built in such a way that, *model 1* contained only the *predisposing factors*, *model 2* included *predisposing* and *enabling factors*, and *model 3* (the final full model) considered all three factors simultaneously (*S1 and S2 Tables*). In the final multivariate model, factors with a p-value of less than 0.05 were declared statistically significant [35]. Two separate multivariate models were fitted for primiparous and multiparous women for the "*at least one ANC*" outcome variable. The factors that showed statistically significant association in the multivariate logistic regression analysis were mapped into the three domains: predisposing, enabling and need factors to streamline the analysis using the ANBM.

Ethics approval

The study was conducted after securing ethical approval from the Institutional Health Research Ethics Committee (IHREC) of the College of Health and Medical Sciences, Haramaya University, Ethiopia with approval number (IHRERC/129/2017) and the Human Research Ethics Committee (HREC) of the University of Newcastle, Australia with approval number (H-2016-0403). Informed verbal consent was obtained from each respondent before commencing interviews. The informed verbal consent procedure had been approved by both Ethics Committees. Participants read or listened to the Information Statement provided by the interviewer and it was expected that they understood its contents. Then, if they decided to participate, they informed the interviewer that they were happy to take part in the research, and this was taken as participant's informed verbal consent. For respondents aged 15–18 years, we obtained informed consent from themselves as they were married, had had at least one birth, assumed social responsibility and are considered to be mature minors. The Ethics Committees had also approved the minor consent procedure for women between 15 and 18 years. The confidentiality of the respondents was ensured by avoiding personal identification details in the study tool.

Results

Socio-demographic characteristics

A total of 1294 women participated in the study. More than half (652, 50.4%) of the respondents fell within the age range of 25–34 years with a mean age of 27.4(±6) years. The majority of women were married (1277, 98.7%) with a large majority (1205, 94.2%) being in a monogamous marital union and the highest proportion belonging to the Oromo ethnic group (1274, 98.5%). The majority of respondents were Muslim (1253, 96.8%), housewives (1240, 95.8%), had never attended formal education (941, 72.7%) and had a husband who had never attended formal education (645, 50.4%) and who was engaged in farming (1156, 90.4%) (Table 2).

Reproductive characteristics of respondents and knowledge about ANC

The majority of respondents (1114, 86.1%) were first married when they were under 18 years of age and 1155 (89.3%) became pregnant for the first time at or before 20 years of age. More than half (51.9%) of the women's most recent births were a third child or less in birth order. Nearly two thirds (63.8%) of the women had been pregnant three or more times in their lifetime. Moreover, 820 (63.4%) of the women had experienced three or more deliveries in their

Table 2. Basic socio-demographic characteristics of the respondents, Kersa district, Eastern Ethiopia.

Variables	Frequency	Percentage
Maternal age (n = 1294)		
15–24	411	31.8
25–34	652	50.4
35–49	231	17.9
Marital status (n = 1294)		
Married	1277	98.7
Others *(Single, divorced, widowed and separated)*	17	1.3
Type of marital union (n = 1279)		
Monogamous	1205	94.2
Polygamous	74	5.8
Ethnicity (n = 1294)		
Oromo	1274	98.5
Others (*Amhara, Arab*)	20	1.5
Religion (n = 1294)		
Muslim	1253	96.8
Others *(Orthodox Christian and protestant)*	41	3.2
Occupational status (n = 1294)		
Housewife	1240	95.8
Government employee	24	1.9
Merchant	19	1.5
Farmer	11	0.9
Educational status (n = 1294)		
Never attended	941	72.7
Elementary (1–8)	267	20.6
Secondary (9–12)	61	4.7
Tertiary (12+)	25	1.9
Wealth index (n = 1294)		
Highest	258	19.9
Fourth	261	20.2
Middle	260	20.1
Second	258	19.9
Lowest	257	19.9
Husband's education (n = 1279)		
Never attended	645	50.4
Elementary	438	34.2
Secondary	133	10.4
Tertiary	63	4.9
Husband's occupation (n = 1279)		
Farmer	1156	90.4
Daily labourer	29	2.3
Government employee	65	5.1
Merchant	29	2.3
Educated family member (n = 1294)		
Yes	574	44.4
No	720	55.6

https://doi.org/10.1371/journal.pone.0208729.t002

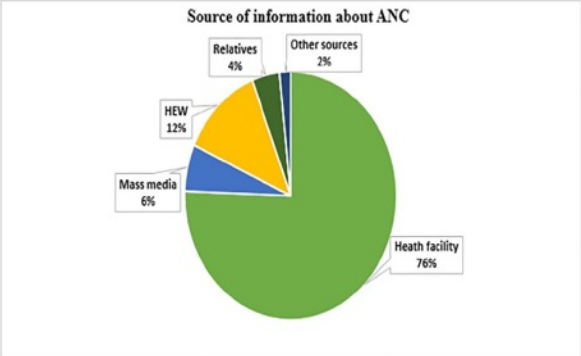

Fig 1. Sources of information about ANC among reproductive women in Kersa district, Eastern Ethiopia, 2017.

https://doi.org/10.1371/journal.pone.0208729.g001

lifetime. A total of 94 (7.3%), 95 (7.4%) and 264 (20.4%) had a history of abortion, still-birth and infant death respectively. Additionally, 917 (70.9%) women reported that their last pregnancy was intended, while for 377 (29.1%) of the women it was unintended.

With regards to women's knowledge of ANC, more than three-quarters (1000, 77.3%) had heard about ANC and 644 (49.8%) believed that ANC is beneficial for both the mother and the child. More than three quarters (76%) of the women had heard about ANC from a health facility, followed by a HEW (12%) (Fig 1). A total of 1242 (96%) respondents felt that pregnant women should get ANC from a health care provider. Only 384 (29.7%) respondents knew that a pregnant woman should first start to attend ANC within three months of pregnancy. About 712 (55.7%) of the women's partners had a positive attitude towards ANC, and 521 (40.7%) never discussed ANC with their partner. Moreover, less than half (556, 43%) had knowledge about pregnancy-related complications.

Health promotion activities and decision making in the household

More than half (672, 51.9%) of the women had received education on maternal health. The majority (524, 84.2%) received maternal health education from HEW, followed by mass media (47, 7.6%), health care providers (32, 5.1%), family members (14, 2.3%), community health agents (32, 0.5%) and WDA leaders (2, 0.3%). More than half (727, 56.2%) of the respondents' homes had been visited at least once by a HEW. More than ninety percent of the women lived in a partner-headed household, followed by a household headed by parents (21, 1.6%) and the respondents themselves (20, 1.5%). More than two thirds (900, 69.6%) of the women stated that decision making at the household level was made jointly with the partner, followed by the respondents (205, 15.8%), the partner (172, 13.3%) and parents (7, 1.3%).

Antenatal care utilization

About 43.8% of the women attended ANC for their previous pregnancy. Six hundred and ninety three (53.6%, 95% CI: 50.8%, 56.3%) of the women reported to have attended ANC at least once during their most recent pregnancy while only 106 (15.3%) made four or more visits. Of those who had attended at least one ANC, 226 (32.6%, 95% CI: 29.6%, 36.6%) initiated their first visit early (≤3 months of pregnancy). About one fifth (19.9%) of women were accompanied by their partner during the course of attending ANC (Table 3).

Table 3. Antenatal care utilization among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017.

Variable	Number	Percentage
Ever use of ANC for previous pregnancies (n = 1059)		
Yes	464	43.8
No	595	56.2
ANC utilization for most recent pregnancy (n = 1294)		
Yes	693	53.6
No	601	46.4
Partner accompanying during ANC (n = 693)		
Yes	138	19.9
No	555	80.1
ANC provider/s (n = 693)*		
Doctor/health officer	54	7.8
Nurse/midwife	470	67.8
Health extension worker	235	33.9
Other	14	2.1
Timing of first ANC initiation (n = 693)		
≤3 months (Early ANC)	226	32.6
>3 months (Late ANC)	457	67.9
Don't know	10	1.4
Frequency of ANC (n = 693)		
Once	79	11.4
Twice	163	23.5
Three times	345	49.8
Four and more	106	15.3
Place of ANC attendance (n = 693)*		
Government hospital	15	2.2
Government health centre	492	71
Government health post	204	29.4
Private hospital/clinics	44	6.3
Home	59	8.5
Other	3	0.4

*Does not sum up to the **total** due to the possibility of multiple responses

https://doi.org/10.1371/journal.pone.0208729.t003

Women had listed their personal reasons for not attending ANC, the most common being that they felt in good health (60.2%), followed by having no or little knowledge (54.4%), and being too busy to attend ANC (10%) (Fig 2).

Differentials in timing of the first ANC attendance

A higher proportion of women (42.5%) in urban areas initiated their first ANC visit during the first three months of pregnancy compared with rural women (30.5%). Likewise, significantly more women (37.1%) who previously used ANC presented for the first ANC during the first three months of pregnancy than women who had not used ANC previously (22.2%) (Fig 3).

Service experience of ANC attendees

Among women who had attended ANC at least once, a large proportion (621, 89.6%) had received tetanus toxoid (TT) injections during their ANC and the majority (87.6%) had

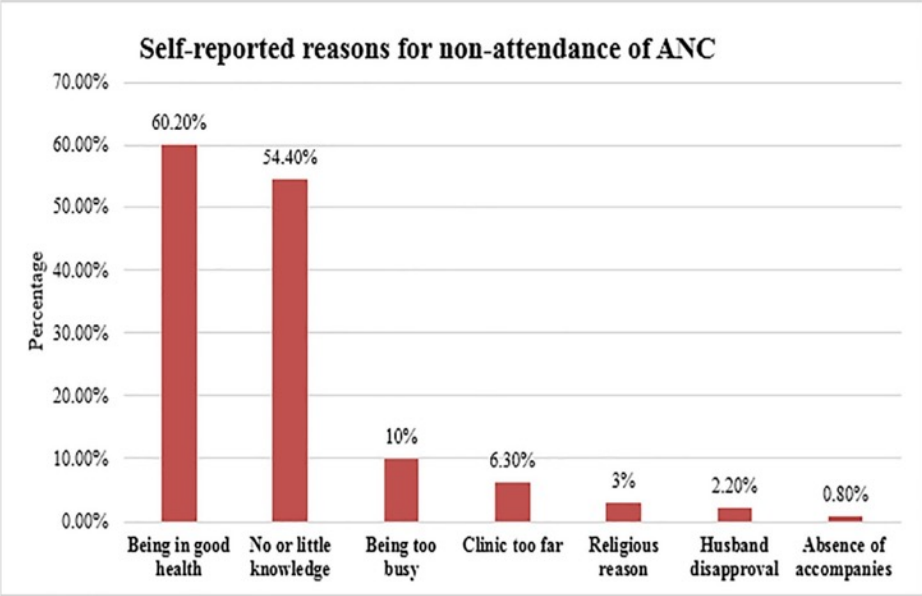

Fig 2. Commonly mentioned self-reported reasons for non-attendance of ANC among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017.

https://doi.org/10.1371/journal.pone.0208729.g002

received the injection two or more times. A large number (651 or 93.9%) of the women received information about delivery at a health facility from the provider. Blood pressure was measured always in 361 (52.1%) cases, in some visits in 173 (25%) cases, never measured in 144 (20.8%) cases, and 15 women reported that they didn't know (2.2%). Weight was reported as measured always by 337 (48.6%) respondents, on some visits by 182 (26.3%), never measured in 62 (23.4%), and 12 didn't know (1.7%). A laboratory examination was never carried out as reported by 330 (47.6%) women, whereas a physical examination was not done for 278 (40.1%) women. Health workers were reported as being respectful by 657 (94.8%) women during the ANC visit and 509 (73.4%) claimed that there was a lack of privacy while receiving ANC. About 440 (63.5%) women were able to ask questions of the provider and 582 (84%) women were reminded by the provider to return again for an ANC visit. Seventy one (10.2%) of the ANC attendees were requested to pay for the service, and only 35 (5.1%) of the women felt the waiting time was a problem, as most (644, 92.9%) of the women received ANC within 2 hr or less. A total of 578 (83.4%) women received ANC from a health facility which was located within 5 km of their home.

Factors associated with ANC utilization

The results of the multivariate logistic regression analysis are presented in Table 4. We fitted two separate models for the "*ANC at least one*" outcome for multiparous (*m1*) and primiparous women (*m2*). After adjusting for potential confounders in the multivariate logistic regression model of all factors of interest considered in the three domains of ANBM, educational status, previous use of ANC and best friend's use of maternal care were the predisposing factors that significantly predict an attendance of at least one ANC visit. Primiparous women who had attended formal education were three times more likely to attend at least one ANC

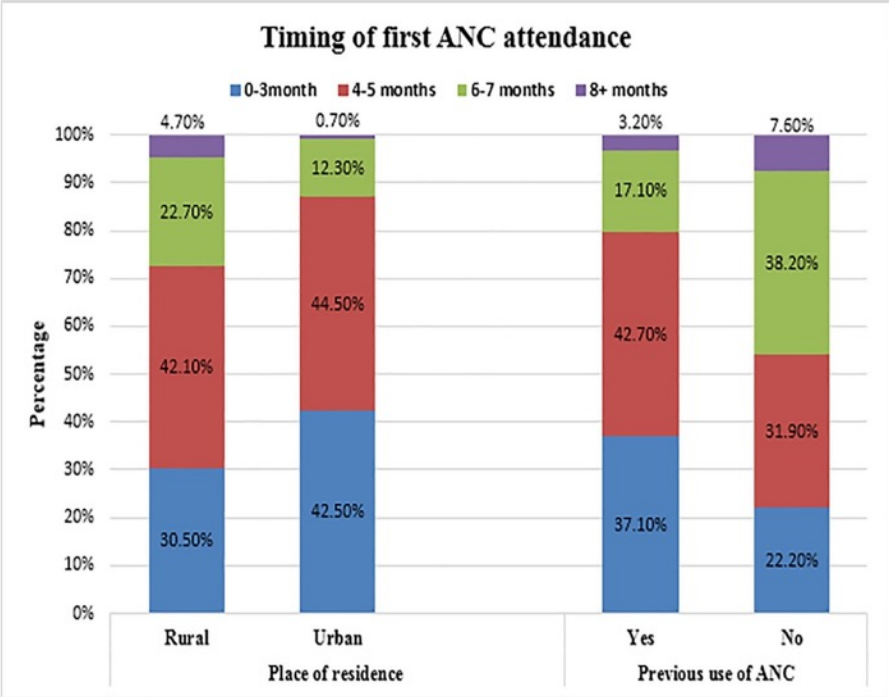

Fig 3. Timing of first ANC by place of residence and previous use of ANC among reproductive-aged women in Kersa district, Eastern Ethiopia, 2017.

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visit (AOR, 3.02; 95% CI: 1.26, 7.25) than those who never attended education. Multiparous women who had no previous experience of ANC attendance (AOR, 0.05; 95% CI: 0.03, 0.07) were less likely to attend ANC at least once compared to women who previously attended ANC. Women whose best friends did not utilize maternal care were less likely to attend at least one ANC ((AOR, 0.53; 95% CI: 0.36, 0.78) in *m1* and (AOR, 0.27; 95% CI: 0.12, 0.63) in *m2)* for their most recent pregnancy compared with women whose best friends utilized maternal care.

Enabling factors such as type of *kebele*, wealth index, and husband's attitude towards ANC showed statistically significant associations with attendance of at least one ANC visit for the most recent pregnancy. Wealth index and husband's attitude showed a statistically significant association in both models of at least one ANC. Multiparous women who lived in HDSS site had an increased chance of using at least one ANC consultation than those who lived in non-HDSS sites (AOR, 1.60; 95% CI: 1.07, 2.40). Women who belonged to the higher wealth quintiles (*especially in the fourth quintile*) were more likely to attend at least one ANC visit ((AOR, 2.14; 95% CI: 1.22, 3.76) in *m1* and (AOR, 5.90; 95% CI: 1.74, 20.03) in *m2*)) than women in the lower wealth quintiles. Women whose husbands had a negative or neutral attitude towards ANC (AOR, 0.37; 95% CI: 0.25, 0.54) in *m1* and (AOR, 0.27; 95% CI: 0.11, 0.62) in *m2*) were less likely to attend ANC at least once than women whose husbands had a positive attitude. The study also demonstrated that the odds of using four or more ANC check-ups is lower for women whose household was headed by their partner or parents (AOR, 0.16; 95% CI: 0.05, 0.58) compared to women whose household was headed by themselves. Moreover, women

Table 4. Factors associated with ANC utilization among reproductive aged women in Kersa district, Eastern Ethiopia, 2017.

Predisposing factors	*Categories*	ANC at least one AOR (95% CI) (*n = 1059*) *m1*	ANC at least one AOR (95% CI) (*n = 235*) *m2*	ANC 4+ AOR (95% CI) (*n = 693*)
Educational status	Never attended	1	1	1
	Attended	1.50(0.92, 2.46)	**3.02(1.26, 7.25)***	1.18(0.69, 2.02)
Husband's education	Never attended	1	1	1
	Attended	1.21(0.83, 1.74)	1.91(0.81, 4.48)	1.06(0.62, 1.79)
Education on maternal health	Yes	0.96(0.66, 1.40)	1.71(0.74, 3.97)	
	No	1	1	
Mass media availability	Yes	1.01(0.66, 1.52)	1.10(0.45, 2.62)	
	No	1	1	
Telephone (mobile) ownership	Yes	0.73(0.45, 1.17)	1.03(0.39, 2.77)	
	No	1	1	
Age at first marriage	*Continuous*			1.09(0.92, 1.28)
Age at first pregnancy	*Continuous*			1.03(0.88, 1.21)
Birth order	$\leq 3^{rd}$	1		
	$>3^{rd}$	0.85(0.59, 1.25)		
Previous use of ANC	Yes	1		
	No	**0.05(0.03, 0.07)***		
Living in a model family	Yes	1		1
	No	1.15(0.31, 4.24)		0.58(0.25, 1.35)
Best friend's use of maternal care	Yes	1	1	
	No/don't know	**0.53(0.36, 0.78)****	**0.27(0.12, 0.63)****	
Parity	Yes			1
	No			0.73(0.43, 1.25)
Enabling factors				
Residence	Rural	1	1	1
	Urban	0.50(0.22, 1.14)	0.94(0.21, 4.15)	1.07(0.58, 1.96)
Type of *kebele*	HDSS	**1.60(1.07, 2.40)***	1.61(0.66, 3.92)	
	Non-HDSS	1	1	
Wealth index	Highest	1.52(0.85, 2.70)	**6.87(1.81, 26.01)***	
	Fourth	**2.14(1.22, 3.76)****	**5.90(1.74, 20.03)****	
	Middle	1.21(0.69, 2.12)	**5.46(1.57, 18.95)***	
	Second	1.68(0.98, 2.89)	**3.97(1.12, 13.44)***	
	Lowest	1	1	
Decision making on household expenses	Respondent	1	1	
	Jointly	1.50(0.91, 2.48)	1.99(0.64, 6.20)	
	Partner/ parents	1.34(0.66, 2.71)	2.07(0.50, 8.03)	
Head of the household	Respondent			1
	Partner/ parents			**0.16(0.05, 0.58)**
Husband's attitude towards ANC	Positive	1	1	1
	Negative/ neutral	**0.37(0.25, 0.54)****	**0.27(0.11, 0.62)****	**0.41(0.23, 0.75)**
Social support from friends	Yes	1	1	
	No	0.69(0.37, 1.29)	0.67 (0.24, 1.83)	
Need factors				
HEW home visit	Yes	**1**		
	No	**0.57(0.38, 0.84)***		

(*Continued*)

Table 4. (Continued)

Predisposing factors	*Categories*	ANC at least one AOR (95% CI) (*n = 1059*) *m1*	ANC at least one AOR (95% CI) (*n = 235*) *m2*	ANC 4+ AOR (95% CI) (*n = 693*)
Pregnancy intention	Intended	1		
	Unintended	0.73(0.49, 1.09)		
History of abortion	Has no history			1
	Has history			**2.06(1.05, 4.04)**
Awareness of pregnancy complications	Yes	1	1	1
	No	**0.52(0.35, 0.79)****	**0.15(0.06, 0.40)****	**0.51(0.30, 0.85)**
Perceived importance of ANC attendance	Not important	1	1	
	Important	**1.89(1.17, 3.06)***	2.12(0.74, 6.08)	

Key: ***AOR***: Adjusted Odds Ratio (adjusting for all the ***predisposing***, ***enabling*** and ***need*** factors in final full model), ***CI***: Confidence Interval (95%)

Bold **: statistically significant variables

** statistically significant variables in the two models (*m1 and m2*) of "*at least one ANC*" outcome

https://doi.org/10.1371/journal.pone.0208729.t004

whose husbands have a negative or neutral attitude towards ANC have less odds of attending four or more ANC visits (AOR, 0.41; 95% CI: 0.23, 0.75) than women whose husbands have a positive attitude.

Lastly, HEW home visits, perceived importance of ANC and awareness of pregnancy complications were the need factors that showed a significant association with attending at least one ANC visit. However, only the factor "*awareness of pregnancy complication*" showed a significant association in both models. Multiparous women who had never received a HEW home visit (AOR, 0.57; 95% CI: 0.38, 0.84) were less likely to attend at least one ANC visit than their counterparts. Women who had no knowledge of pregnancy complications were less likely to attend at least one ANC compared to women who were aware of pregnancy complications (AOR, 0.52: 95% CI: 0.35, 0.79) in *m1* and (AOR, 0.15; 95% CI: 0.06, 0.40) in *m2*). Multiparous women who perceived that attending ANC is important were more likely to attend at least one ANC visit compared to those who perceived it is not important (AOR, 1.89; 95% CI: 1.17, 3.06). Women who had no awareness of pregnancy complications have less odds of attending four or more ANC visits compared to women who have awareness (AOR, 0.51; 95% CI: 0.30, 0.85). Women who had an abortion history were more likely to attend four or more ANC visits than their counterparts (AOR, 2.06; 95% CI: 1.05, 4.04).

Discussion

In this study, we set out to examine the factors associated with ANC utilization in Kersa district, Eastern Ethiopia. We found that women's education, previous use of ANC and best friend's use of maternal care were significant predisposing factors associated with at least one ANC attendance. Furthermore, type of *kebele*, wealth index and husband's attitude towards ANC were significant enabling factors influencing at least one ANC use. HEW household visits, perceived importance of ANC attendance, and awareness of pregnancy complications were significant need factors that predicted at least one ANC attendance. Being head of the household, having abortion history, having awareness about pregnancy complications and husband's attitude towards ANC were factors that predicted an attendance of four or more ANC visits.

In the study, it was demonstrated that 53.6% of the women received at least one ANC check-up for the index pregnancy. This finding is consistent with a study conducted in Tigray, Northern Ethiopia [24], where 54% of the women received ANC at least once for their last

pregnancy. The finding is also comparable with the Oromia region average (51%) where the current study district is located. However, the level of ANC uptake observed in this study is lower than that of the national average (62%) [19] and the findings from many other studies in different regions of Ethiopia [13, 14, 16, 18]. The exhibited disparities in the magnitude of ANC utilization might be attributed to the inter-regional difference in geographical area, socioeconomic and cultural settings in Ethiopia. For instance, in some regions of Ethiopia, there is an underdeveloped health care system whereas in others the people live in nomadic areas where health service is rarely available. Moreover, each region in Ethiopia has its own peculiar socio-economic features and cultural practices that can either positively or negatively influence health care utilization patterns. The current study was conducted in a largely rural area of the country where there are high socio-cultural barriers and poor community perceptions towards utilization of ANC [36] that would probably have reduced ANC uptake.

Furthermore, in this study, the proportion of women who attended four or more ANC visits was only 15.3%. This result is lower than in a study conducted in Kombolcha district, Eastern Ethiopia (38.3%) [18] but higher than in a study conducted in Tigray, Northern Ethiopia (6.4%) [17]. The differences may be related to the fact that the studies were conducted at different points in time and the level of safe motherhood primary health care activities might be different in various parts of the country. It is recommended that further studies be conducted at some period after the new WHO guideline (having a minimum of eight ANC visits) [1] is implemented in Ethiopia. Antenatal care is more effective in averting unfavourable pregnancy complications if given early in the pregnancy [21]. However, the current study showed that only one third (32.6%) of the women initiated ANC before the 12th week of gestation. The result is in line with a systematic review finding [22], where only 36% of pregnant women in Ethiopia started to attend ANC during the early stages of pregnancy.

The result of the multivariate analysis indicated that women's utilization of ANC is affected by predisposing, enabling and need factors. Predisposing factors including women's education, previous use of ANC and women's best friend's use of maternal care were predictors of ANC utilization. Women might be informed about the benefits of ANC utilization in various ways, such as exposure to mass media, information exchange with friends, community-based health education and previous exposure to health services. The current study provided evidence that shows multiparous women who had obtained ANC services for their previous pregnancy were more likely to attend at least one ANC consultation for subsequent pregnancies. It has been previously documented [5, 37] that obtaining maternal care in the previous pregnancy positively influenced the utilization of the service for the subsequent pregnancy. This might be related to the fact that women could be better informed about the benefit of ANC through the previous service attendance.

Women's education showed an association with ANC utilization, particularly among primiparous women. Demographically, primiparous women (*those who only had one delivery*) are often younger and more educated than multiparous women, which might make this variable more significantly predict ANC utilization for this group of women than multiparous women. Evidence suggests that younger women [16, 17, 38] and those with fewer deliveries [16, 38] have increased odds of ANC utilization. Education is a very important factor that influences behaviour and the changing attitudes of individuals [39]. Women's education helps not only to increase their empowerment but also transform their social value, which enables women to have improved access to maternal care and enhances their ability to utilize it. The positive influence of education on ANC utilization is well documented in several prior studies in Ethiopia [13, 16, 17, 25].

Best friend's use of maternal care is another predisposing factor associated with ANC utilization in this study. Women whose best friends use maternal care were more likely to attend at

least one ANC visit compared to women whose best friends did not use maternal care. It has been illustrated in the systematic review [40] of ANC utilization among non-western women that acquiring and following advice from friends or peers has facilitated better ANC utilization for pregnant women. A study in India [41], also reported that a woman's social network had a positive correlation with ANC utilization. Social networks significantly influence the decision-making and health-seeking behaviour of pregnant women towards ANC, which ultimately facilitates or hinders their access to and utilization of the service [27]. The social ties that individuals develop, whether their families, friends or peer groups are essential to spanning interactions with better informed opinion leaders inside the community who could, in turn, sway the people's behaviour or actions towards the use of preventive health care services [41–44]. Results that demonstrated the positive influence of best friends highlights a largely untapped resource for public health messaging in Ethiopia. Maternal health promotion activities should involve spreading messages regarding the benefit of attending ANC for the health of the mother and the child by targeting the social networks of women through peer education programs.

Enabling factors such as type of *kebele*, wealth index, and husband's attitude were independently associated with ANC utilization. Women in the fourth wealth index category were more likely to use ANC compared to women in other lower wealth categories. This was consistent with a study conducted in Southern Ethiopia [13], where women who belonged to the higher wealth quintiles had higher odds of ANC attendance that women in lower quintiles. This could be due to the fact that women with higher economic status could easily afford to cover health care and transportation costs. Moreover, women with high economic status tend to be more educated and this would, in turn, increase their service use. Therefore, economic reform activities in Ethiopia should involve women and poorer families to subsequently increase women's ANC uptake.

Multiparous women who live in the HDSS site were more likely to use ANC services than those who live out of the HDSS site. This was in line with a study conducted in southern Ethiopia [13] in which living in a HDSS site is to some extent protective of maternal death resulting from non-use of services. It is expected that demographic and health surveillance sites are exposed to continuous surveys and health information as there could be regular visits by field enumerators and researchers. Evidence [45] suggests that populations under HDSS have better health indicators compared to populations not under surveillance because of repeated data collection and measurements which could function as a passive intervention resulting in behaviour change.

A husband's attitude towards ANC also influenced women's utilization of ANC in this study. The risk of non-attendance of at least one ANC was high for women whose husband's attitude was negative or neutral. The effect of a husband's attitude on women's utilization of ANC has been well documented in other studies conducted in different parts of Ethiopia [12, 46]. A husband's attitude towards ANC influences their tendency to approve the care to their wives. As most women in developing countries need a husband's approval to seek health services, including ANC, a husband should have a supportive attitude towards health services, thereby allowing his wife to attend the services. Hence, intervention efforts should be in place to improve husband's attitudes towards ANC to increase the uptake of the service. One such intervention may be designing messages about maternal health and diffusing this through community-based men's social networks to improve their knowledge. Also, as more educated men tend to be more involved in their spouse care [47], improving men's educational status is essential.

HEW home visits, perceived importance of ANC attendance and awareness of complications that occur during pregnancy are significant predictors of at least one ANC consultation.

Women who received a HEW home visit were more likely to attend at least one ANC visit compared to women who never received a HEW visit. A similar study finding was reported from a study conducted in southern Ethiopia [48]. Access to HEW home visits should be further strengthened to reach women while they are at their home to effectively provide health messages and promote ANC utilization. Increasing the frequency of contact and improving the continuity of HEW home visits through expanding the HEW's outreach service operation hours is crucial, particularly for reaching pregnant women in underserved communities. Moreover, upgrading the capacity of the HEWs to provide the full package of home-based ANC services apart from the routine health education and promotion activity is required.

Perceived importance of ANC attendance showed a positive association with ANC utilization, where multiparous women who believe that attending the service is important were more likely to attend the care. The finding of the study was in accordance with a study conducted in Lao PDR [49] where women who had a positive attitude towards the benefits of ANC service were more likely to use these services than those with a negative attitude about the benefit of the service. Moreover, in a different study in Ethiopia, it was demonstrated that knowledge of the benefits of antenatal care services was significantly associated with women's utilization of early ANC services [50]. The finding highlights the need to establish strategies that aim to improve women's awareness of the importance of ANC attendance using community-based education programs, especially among multiparous women.

The current study also revealed that women who have an awareness of pregnancy complications were more likely to attend ANC than their counterparts. The results of this study were comparable with other studies in Ethiopia [14–16] where the odds of ANC utilization were higher among women with a better awareness of pregnancy complications than those with poor knowledge. The result highlights the need to design intervention strategies that involve promoting awareness about pregnancy-related complications among women.

Modifiable factors for program or policy consideration

The factors that are amenable to modification in the context of Ethiopia for further government and stakeholders' interventions to increase ANC uptake are illustrated below. Predisposing factors that can be targeted by the government to mitigate poor utilization of ANC include women's education, previous use of ANC and best friend's use of maternal care. Enabling factors such as husband's attitude towards ANC can also be targeted to increase ANC attendance. Lastly, increasing HEW home visits, increasing women knowledge on the importance of ANC attendance, and promoting awareness of obstetric complications could be potential areas of intervention to further improve ANC utilization in Ethiopia (Fig 4).

Strengths and limitations of the study

We believe that inclusion of data regarding only the most recent pregnancy that occurred within the three years preceding the survey could minimize the risk of recall bias. We considered many predictor variables from the three domains of ANBM into one model in order to better control for potential confounders. Use of iPads with digital survey tools for the data collection is another strength of the study because missing data are minimized. One limitation of the study was reliance on self-reporting of data. In addition, due to the cross-sectional nature of the study, it is difficult to establish a temporal relationship between the predictors and outcome variables. Though training was provided to the interviewers to inform respondents about the purpose of the study, the study might still be prone to social desirability bias. Despite these limitations, the findings of the study are sufficiently valid to inform program development.

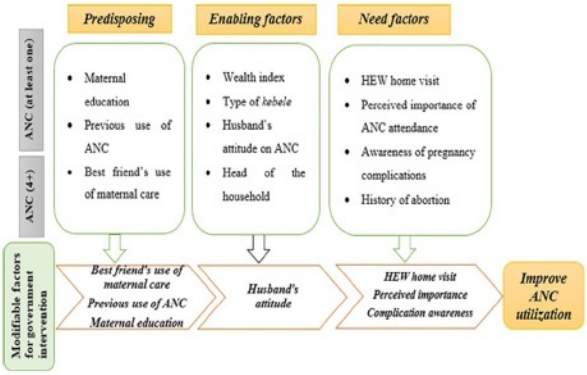

Fig 4. Modifiable predisposing, enabling and need factors associated with ANC utilization for government intervention based on ANBM, 2017.

https://doi.org/10.1371/journal.pone.0208729.g004

Conclusion

More than half of the women attended ANC at least once during their last pregnancy. A higher proportion of women attended less than four ANC check-ups and delayed their first ANC visit. Attending formal education, belonging to higher wealth quintiles, previous use of ANC, best friend's use of maternal care, living in HDSS site, husband's positive attitudes towards ANC, receiving HEW home visits, perceiving ANC attendance as important, and having an awareness of pregnancy complications were drivers for attendance of at least one ANC. Moreover, partner or parents being head of household, not experiencing an abortion, poor awareness of pregnancy complications, and husband's negative or neutral attitude towards ANC were deterrents for attending four or more ANC visits. Maternal health intervention efforts in Ethiopia should involve strategies that focus on the following key areas: improving women's education enrolment, designing women's peer education programs to mobilize and support women, programs to change husband's attitude through community mobilization, women-centred economic reforms, ameliorating service provision of ANC, strengthening the HEW home visits programs to further expand the health promotion and diseases prevention activities, and designing programs to increase awareness about pregnancy complications and importance of practicing ANC during pregnancy, especially for underprivileged women in rural areas.

Supporting information

S1 Table. Model building process to identify potential factors associated with at least one antenatal care visit among reproductive aged women in Kersa district, Eastern Ethiopia, 2017.
(DOCX)

S2 Table. Model building process to identify factors associated with four or more antenatal care attendance among reproductive aged women in Kersa district, Eastern Ethiopia, 2017.
(DOCX)

S1 File. Data collection tool for ANC section (English).
(DOCX)

S2 File. Data collection tool for ANC section (Local language).
(DOCX)

Acknowledgments

We are very grateful to the University of Newcastle, Australia for supporting the research and Haramaya University for facilitating the data collection process. We would also like to thank all study participants and study research assistants.

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Midwifery 70 (2019) 22–30

Contents lists available at ScienceDirect

Midwifery

journal homepage: www.elsevier.com/locate/midw

Magnitude and correlates of postnatal care utilization among reproductive aged women in a rural district in eastern Ethiopia: A cross-sectional study

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ARTICLE INFO

Article history:
Received 4 October 2018
Revised 15 November 2018
Accepted 2 December 2018

Keywords:
Postnatal care utilization
Women
Rural district
Eastern Ethiopia

ABSTRACT

Background: Postnatal care is critical to detect and manage postpartum complications in the early stages as well as to prevent potentially life-threatening health conditions that lead to maternal death. However, postnatal care utilization is persistently low in Ethiopia. The aim of this study is to assess the magnitude and correlates of postnatal care utilization among reproductive aged women in Kersa district, in eastern Ethiopia.

Methods: A community based cross-sectional study was conducted in ten randomly selected sub-districts in Kersa district. Respondents were recruited using systematic random sampling techniques. Data were collected by an interviewer-administered questionnaire using iPads. A total of 1206 respondents' data were considered in the analysis. Frequency and percentage distributions of the variables were performed. Bivariate and multivariate logistic regression analyses were undertaken to identify the predisposing, enabling and need factors associated with postnatal care utilization. An Odds Ratio with 95% confidence interval was used to ascertain the direction and strength of the association.

Results: Less than one in thirteen women attended postnatal care after their last delivery in the study community. The multivariate analysis demonstrated that postnatal care utilization is associated with receiving education on maternal health, best friend's use of maternal care, head of the household, and experience of postpartum complications. Receiving education on maternal health (AOR, 2.32; 95% CI: 1.38, 3.89) and best friend's use of maternal care (AOR, 2.41; 95% CI: 1.39, 4.19) were significant predisposing factors that independently predicted postnatal care utilization. Furthermore, head of the household was a significantly associated enabling factor for postnatal care utilization (AOR, 0.24; 95% CI: 0.07, 0.81). The experience of postpartum complications (AOR, 0.10; 95% CI: 0.05, 0.20) was the only need factor that was associated with postnatal care utilization.

Conclusion: Postnatal care utilization is extremely low in the study district. Strengthening health education and promotion activities on maternal health, peer education programs within the women's social networks, strengthening women empowerment programs, and women's mobilization to seek postnatal care before the occurrence of complications are essential actions that can improve postnatal care utilization.

Introduction

The burden of maternal mortality continues to be high in several developing countries. In sub-Saharan Africa, the rates are the highest with a maternal mortality ratio of 546 per 100,000 live births during 2015. Ethiopia experienced a high level of maternal mortality (353 per 100,000 live births) during the same year (WHO, 2015). Postpartum maternal conditions that lead to maternal mortality are well understood; such as postpartum haemorrhage and puerperal sepsis, particularly in African countries

Abbreviations: AOR, Adjusted Odds Ratio; CI, Confidence Interval; HDSS, Health and Demographic Surveillance System; PNC, Postnatal Care; WHO, World Health Organization.

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https://doi.org/10.1016/j.midw.2018.12.002
0266-6138/

(Say et al., 2014). Postnatal care (PNC) has been advocated as critical to preventing and managing these conditions and contributing to reducing maternal mortality (WHO, 2004; WHO, 2013).

Postnatal care services aim to assess, maintain and promote the health of the postpartum mother and the newborn. Also, PNC services aim to maintain a supportive environment to satisfy the various health and social needs of the mother and newborn through detecting, diagnosing and treating various health conditions (WHO, 2010). In a developing country setting, apart from early detection and management of catastrophic postpartum complications (CSA, 2011), PNC services also include the provision of health messages pertaining to exclusive breastfeeding and complementary feeding, promoting continuous skin to skin contact for low birth weight and preterm newborns, promoting use of insecticide-treated bed nets to prevent malaria, family planning counselling and service provision (Lawn et al., 2010).

Furthermore, as the postnatal period is a stressful time, especially for mothers who gave birth for the first time, counseling and emotional support should be offered to lessen the risk of postnatal depression (Warren et al., 2006). In addition to missed opportunities to acquire health promotive behaviours, deprivation of health care services during the postnatal period can lead to maternal morbidity and mortality due to undetected or untreated postpartum complications (Warren et al., 2006). The majority of maternal deaths occur during the postnatal period (Campbell O, 2006). Proper utilization of PNC services has the potential to improve maternal outcomes and avert the majority of postnatal maternal deaths (WHO, 2010). The World Health Organization (WHO) recommends that postpartum women attend PNC as early as possible within the first 24 h after birth, and three additional postnatal contacts during the first six weeks after delivery (WHO, 2013). In Ethiopia, for normal deliveries the Ministry of Health recommends that the mother should attend four PNC visits: within 24 h, 1–2 days, 3–7 days and 8–42 days (CSA, 2014).

Even though the postnatal period is an essential time during which mothers should receive critical attention from a skilled care provider, this period is generally overlooked in many developing countries (WHO, 2010). Postnatal care is the weakest component of maternal health service along the continuum of care from pregnancy to the postpartum period (Fort, 2012). For instance, 62% of pregnant women in Ethiopia attended antenatal care at least once while 28% delivered with the assistance of skilled health worker, yet only 19% of the women utilized PNC services regardless of the place of delivery (CSA, 2016). Moreover, numerous previous studies in Ethiopia (Worku et al., 2013; Medhanyie et al., 2012; Tarekegn et al., 2014) reported staggeringly low PNC utilization rates; all below ten percent.

In Ethiopia, evidence suggests that the utilization of PNC is influenced by a complex set of factors. These factors include woman's education, economic status, place of residence, decision-making power, knowledge about the benefit of the care, antenatal care use, distance to the nearest health facility, and the presence of postpartum complications (Dutamo et al., 2015; Regassa, 2011; Tesfahun et al., 2014; Aregay et al., 2014; Afework et al., 2014). However, the evidence is often inconclusive and not strategically relevant to give a complete picture of the problem across all districts in Ethiopia. It is therefore compelling to carry out studies to better understand the locally-relevant key factors that may be associated with PNC utilization at the district level in Ethiopia. Guided by the framework for health care utilization developed by Andersen (1995) and Andersen and Newman (1973) we aimed to assess the uptake of PNC and the associated factors among reproductive aged women in Kersa district, in eastern Ethiopia.

Method

Study area and period

The study was conducted in Kersa district, in eastern Ethiopia from June to August 2017. The district is located in Oromia region, at about 486 km from the country's capital city. The administrative town of the district is Kersa town. In the district, there are 38 sub-districts (*kebeles*), of which, 35 are rural and three are urban. The *kebele* is the smallest administrative unit in Ethiopia composed roughly of 1000 households. There are seven health centers, thirty-four health posts and eight private pharmacies in the district. The district has 24 HDSS (Health and Demographic Surveillance System) and 14 non-HDSS *kebeles*. The 24 HDSS *kebeles* are comprised of three from urban areas and the rest from rural areas. The Kersa HDSS baseline census was conducted in 2007 and since then it has been updated every 6 months, with the registration of demographic and health events, such as births, deaths, migrations, pregnancy status and outcomes, child morbidities, and nutrition.

Study design and population

A community-based cross-sectional study was carried out. The study population were women in the district who were aged 15–49 years, had at least had one birth in the three years preceding the survey and had resided in the district for at least six months prior to the study. We excluded women who had experienced pregnancy that resulted in a miscarriage, were not willing to participate, critically ill and physically or mentally disabled at the time of the survey.

Sample size and sampling procedure

The sample size was calculated for a larger research project on maternal health service utilization in Kersa district, in eastern Ethiopia. The sample size was calculated using single and double population proportion formulas (Hajian-Tilaki, 2011) using appropriate scientific assumptions pertaining to the objectives of the study. A total of 1320 women were recruited from ten randomly selected *kebeles* to participate in the study. Regarding the sampling procedure, a two-stage sampling technique was followed where the first stage was the selection of *kebeles* from the district. The study district was stratified into rural and urban *kebeles*. Both rural and urban *kebeles* were further stratified into HDSS and non-HDSS. The second stage involved the selection of households from the included *kebeles*. An updated *Health Extension Worker's* health management information system registration log sheet was used to identify and list households with at least one eligible women to determine the total number of households in each included *kebele*. Since there were variations in the number of households enumerated in the *kebeles*, we used probability proportional to size method to distribute the total sample (1320) to the corresponding *kebeles*. Respondents were then recruited using systematic sampling techniques. If the household had two or more eligible women, only one of them was selected using the lottery method.

Measurement variables

Outcome variable

PNC utilization: Reproductivea ged women who had received PNC check-up for the mother-newborn pair or mother only at least once within the first six weeks (42 days) of their most recent delivery

(participants were asked "*After your last delivery, did anyone check on your health during the first six weeks after birth?*").

Explanatory variables

We framed the factors that influence PNC utilization based on the Andersen and Newman's behavioural model of health care utilization (*predisposing, enabling* and *need* factors) (Andersen, 1995; Andersen and Newman, 1973). Hence, for this study the *predisposing factors* were educational status, age, husband's education and occupation, receiving education on maternal health, presence of other educated family member, age at marriage, parity, availability of mass media and telephone at the household level, birth order, living in model family and best friend's use of maternal care. The *enabling factors* were place of residence, type of kebele, wealth status, head of the household, distance of the nearest health institution, decision making autonomy at the household level and social support. Whilst the *need factors* were the experience of postpartum complications, the frequency of antenatal care attendance, pregnancy intention, had a Health Extension Workers household visit, the experience of abortion, history of infant death and stillbirth.

Data collection procedure

The data were collected by resident HDSS interviewers using an inbuilt offline mode of a digital survey tool (*Survey Gizmo*) using iPads. The questionnaire was adapted from pertinent literature (Ayele et al., 2014; Abuhay, 2008; Fenta, 2005; CSA, 2011; JHPIEGO, 2004) including the standard tool used in demographic and health surveys (CSA, 2011). The questionnaire addresses sociodemographic information, obstetric characteristics, experience of PNC service use and future plan, the experience of obstetric complications, social network and social support. The survey tool was further developed to address the relevant research questions of the research project. The tool was translated from English into the local language (Oromiffa) by a bi-lingual faculty member. The tool was translated back to English by another faculty member who is proficient in both languages to ensure its consistency. The English and local language questionnaires were integrated together in *Survey Gizmo* in order to have an easy flow of the interview and ensure the consistency of the questions.

Data quality control

Experienced HDSS interviewers and a supervisor completed the data collection. Two days of training were provided to the interviewers and supervisor about the purpose of the study, interview techniques using iPads, how to upload responses, and how to manage ethical issues. Pre-testing of the study tool was conducted among 65 reproductive aged women who were residing in the adjacent district. The pre-testing enabled the data collectors to become more familiar with the administration of the interview using iPads. The necessary amendments were also carried out on the study tool based on the lessons drawn from the pre-testing. The supervisor daily repeated 10% of the interviews made by the data collectors to check for the validity of the completed responses. The interviewers used iPads for the data collection and daily uploaded the responses to the *Survey Gizmo*. To further ensure the completeness and quality of the responses, the lead author double-checked the uploaded responses in *Survey Gizmo* at the field level and gave feedback to the interviewers on a daily basis.

Statistical analysis

The data were directly exported to Statistical Package for Social Sciences (SPSS) software version 23 for data exploration, cleaning, and analysis. Some variables were transformed through recoding for univariate and multivariate analyses. For the univariate analysis, continuous variables, such as maternal age, age at marriage and age at first pregnancy were transformed into categorical variables. Also, variables with "*Don't know*" category and legitimate system missing values due to skipping questions were recoded through collapsing them into an existing category (such as "*No*") for the multivariate analysis. Univariate analysis involving frequency and percentage distribution of the study subjects were explored to describe the characteristics of women included in the study. Summary statistics using measures of central tendencies were also computed for the appropriate variables. The findings of the study were presented in narratives, tables, and diagrams. Multicollinearity between the variables was checked using the Variance Inflation Factor which indicated its non-existence. To measure the relationship between the predictors and outcome variable, we undertook a two-stage analysis; bivariate analysis followed by an analysis of all of the predisposing, enabling and need factors in one multivariate logistic regression model. The final multivariate model was built in steps where Model-I included predisposing factors, Model-II included both predisposing and enabling factors, and Model-III included all factors (*Supplementary material 1*). Only variables which were statistically significant at a p-value of <0.05 in the bivariate analysis were further considered in the model building process and in the final multivariate logistic regression model to test for persistence of significance. Thus, the final multivariate logistic regression analysis model had adjusted the potential confounding variables and showed the independent effect of each predictor variable on the outcome variable. An Odds Ratio with a 95% CI and a p-value of <0.05 was used to interpret the statistical significance of the association between the independent and dependent variables.

Ethics approval

Ethical approval was secured from the Human Research Ethics Committee of the University of Newcastle, Australia (reference number H-2016-0403). Additionally, the study obtained approval from the Institutional Health Research Ethics Committee of Haramaya University, Ethiopia (reference number IHRERC/129/2017). Letters of collaboration were also written to the district administration authorities and the health office. Informed verbal consent was obtained from each participant before conducting the interviews. The confidentiality of the information from the participants was ensured by removing personal identifiers from the study tool. For participants aged 15–18 years, we obtained informed verbal consent from them since they were mature minors who were married, had at least one birth and assumed social responsibility to rear the child. Both ethics committees had approved the verbal consent procedure for the reproductive aged women between 15 and 18 years as part of the ethical review process.

Result

Socio-demographic characteristics

Our study included 1294 eligible women (with a response rate of 98%). However, among those respondents, 88 (6.8%) were excluded from the present analysis as they had not completed the six weeks after their most recent birth to fully ascertain whether they received PNC or not. Therefore, the data of 1206 respondents were considered for this current analysis. With a mean age of 27.4 ($\pm$6.1) years, the majority (50.5%) of the respondents were aged 25–34 years. Around 1041 (86.3%) of the respondents were rural dwellers, 791 (65.6%) were living in HDSS sites and 1189 (98.6%) reported to be currently married. Nearly three quarters

Table 1
Socio-demographic characteristics of the reproductive aged women in Kersa district, in eastern Ethiopia, 2017.

Variables	Frequency	Percentage
Age (n = 1206)		
15–24	385	31.9
25–34	609	50.5
35–49	212	17.6
Place of residence (n = 1206)		
Rural	1041	86.3
Urban	165	13.7
Marital status (n = 1206)		
Currently in marriage	1189	98.6
Currently out of marriage	17	1.4
Type of kebele (n = 1206)		
HDSS	791	65.6
Non-HDSS	415	34.4
Religion (n = 1206)		
Muslim	1169	96.9
Orthodox	31	2.6
Protestant	6	0.5
Ethnicity		
Oromo	1274	98.5
Others	20	1.5
Occupational status (n = 1206)		
Housewife	1155	95.8
Government employee	23	1.9
Merchant	18	1.5
Farmer	10	0.8
Educational status (n = 1206)		
Never attended	877	72.7
Elementary	247	20.5
Secondary and above	82	6.8
Husband's education (n = 1191)		
Never attended	597	49.5
Elementary	408	33.8
Secondary and above	186	15.4
Husband's occupation (n = 1191)		
Farmer	1075	89.1
Daily labourer	27	2.2
Government employee	62	5.1
Merchant	27	2.2
Availability of mass media (n = 1206)		
Yes	426	35.3
No	780	64.7
Availability of telephone (n = 1206)		
Yes	320	26.5
No	886	73.5

(72.7%) of the respondents never attended formal education. Almost all of the respondents (96.9%) were Muslim and (98.5%) were from the Oromo ethnic group. Ninety-six percent of respondents were housewives and 89.1% of respondents' husbands were farmers (Table 1).

Obstetric characteristics

The study demonstrated that among the respondents, 1033 (85.7%) were married before the age of eighteen years, and 1072 (88.9%) had their first pregnancy at the age ≤ 20 years. The mean age of marriage was 16.7 (± 2.2) years, and the mean age at first pregnancy was 18.2 (± 2.3) years. More than four-fifths (83.1%) of the women had a history of more than one pregnancy, and 81.5% had experienced more than one delivery. Whilst 7.2% had a history of still-birth, about 20.2% had a history of infant death and 7.5% had experienced an abortion. More than a quarter (29.5%) of the women's last pregnancy was unintended (Table 2).

Information and utilization of PNC

Around 251 (20.8%) of the women had heard about PNC, and of these majority 223 (88.8%) had heard from health care providers.

Table 2
Reproductive characteristics of the respondents, Kersa district, in eastern Ethiopia, 2017.

Variables (n = 1206)	Frequency	Percentage
Age of marriage		
<18 years	1033	85.7
≥18 years	173	14.3
Age at first pregnancy		
≤ 20 years	1072	88.9
> 20 years	134	11.1
Birth order		
≤3rd	632	52.4
>3rd	574	47.6
Birth outcome of the last child		
Live full term	1188	98.5
Live preterm	11	0.9
Stillbirth	7	0.6
Pregnancy experience		
Primigravida	204	16.9
Multigravida	1000	83.1
Delivery experience		
Primipara	223	18.5
Multipara	979	81.5
History of stillbirth		
No stillbirth	1119	92.8
Had stillbirth	87	7.2
History of abortion		
No history of abortion	1116	92.5
Had a history of abortion	90	7.5
History of infant death		
No history of infant death	962	79.8
Had a history of infant death	244	20.2
Pregnancy intention for last birth		
Intended	850	70.5
Unintended	356	29.5

Only 56 (5.7%) of the women had attended PNC after their previous birth. Less than one in thirteen (7.6%, 95% CI: 5.9, 8.8%) of the reproductive aged women reported having received PNC after their most recent birth. Out of these, only 12% received the first PNC within the critical first two days after delivery. The majority (54.3%) of the women had received PNC at government health center and from nurse/midwives (67.4%). The major reason given for attending PNC was for immunization of the baby (51.1%) followed by attending due to the illness of the woman (30.4%) (Table 3).

With regards to the frequency of PNC after the last birth, among women who attended PNC at least once 92 (7.6%), more than half (54.3%) of the women attended only once (Fig. 1).

A large majority (73.2%) of women with previous experience of PNC service re-attended the service for the succeeding most recent birth. Compared to women with no previous history of antenatal and delivery care attendance, a relatively higher proportion of women with previous exposure to the services attended PNC after the recent birth (Fig. 2).

PNC service experience and postpartum complications

During the attendance of PNC, the women received immunization for their baby (45.7%), physical examination (43.5%), counseling on health (27.2%), family planning services (27.2%), breastfeeding education (21.7%), and antibiotics for illness (1.1%). Only 5.6% of the women reported having encountered a complication during the postnatal period, of which the majority (34.3%) had experienced severe postpartum haemorrhage followed by a severe headache (29.9%). Nearly three-quarters of the women who developed the complications were at home when they encountered the complications, and more than half of them had sought medical assistance for the complication. Approximately two-thirds of the participants had a plan to attend PNC for future births (Table 4).

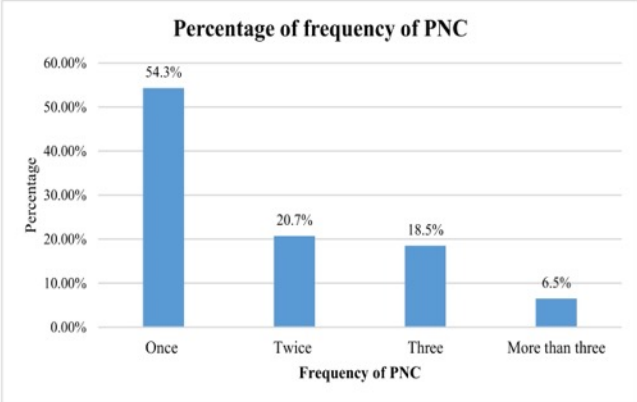

Fig. 1. Number of PNC visits made by the women in Kersa district, in eastern Ethiopia, 2017.

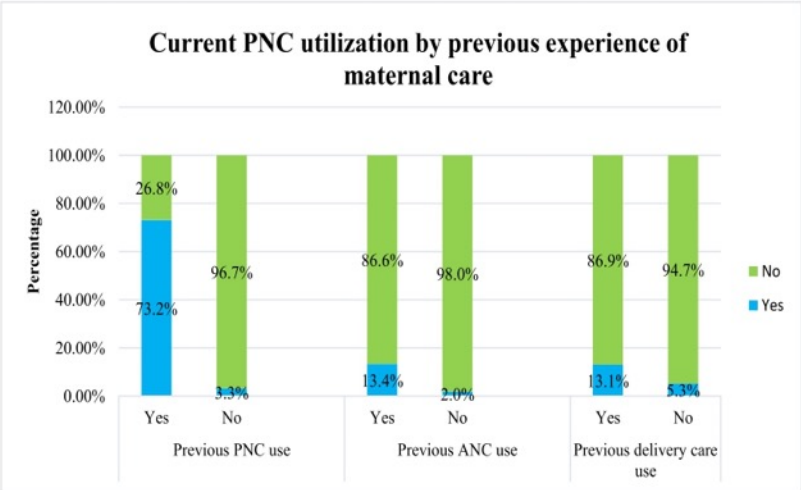

Fig. 2. PNC utilization by previous exposure to maternal care among women in Kersa district, in eastern Ethiopia, 2017.

Factors associated with PNC utilization

In Model-I, variables such as receiving maternal health education (AOR, 2.16; 95% CI: 1.32, 3.55), husband's occupation (AOR, 1.94; 95% CI: 1.01, 3.70) and best friend's use of maternal care (AOR, 2.28; 95% CI: 1.36, 3.84) showed a statistical association. In Model-II, receiving maternal health education (AOR, 2.22; 95% CI: 1.35, 3.65), best friend's use of maternal care (AOR, 2.23; 95% CI: 1.32, 3.77) and head of the household (AOR, 0.26; 95% CI: 0.08, 0.90) showed a statistically significant association with PNC utilization. Controlling for all the variables in the final multivariate logistic regression model (Model-III), we examined the association between the predictor variables and PNC utilization. The predisposing factors such as receiving education about maternal health and best friend's use of maternal care remained significantly associated with PNC utilization. Women who had received education about maternal health were more likely to utilize PNC (AOR, 2.32; 95% CI: 1.38, 3.89) relative to those who never received maternal health education. Women whose best friend utilized maternal care were more likely to use PNC (AOR, 2.41; 95% CI: 1.39, 4.19) than their counterparts. The head of the household was an enabling factor associated with PNC utilization. Women whose household was headed by partner or parents were less likely to utilize PNC (AOR, 0.24; 95% CI: 0.07, 0.81) than women whose household was headed by themselves. Experience of postpartum complications was the only need factor that significantly predicted PNC utilization. Women who had not experienced postpartum complications were less likely to attend PNC (AOR, 0.10; 95% CI: 0.05, 0.20) relative to women who experienced postpartum complications (Table 5).

Discussion

Only 7.6% of the study participants had received PNC after their last birth. Among the predisposing factors, receiving education about maternal health and a woman's best friend using any maternal care showed a statistically significant association with PNC utilization. The head of the household was the enabling factor that showed a statistically significant association with PNC utilization in the full multivariate logistic regression model, whilst the experience of postpartum complications was the sole need factor that predicted PNC utilization. The results add to current knowledge about maternal health service use in Ethiopia, where previous studies have largely focused on antenatal and intrapartum care.

Table 3
Postnatal care utilization among reproductive aged women in Kersa district, in eastern Ethiopia, 2017.

Variable	Frequency	Percentage
Ever heard of PNC (n = 1206)		
Yes	251	20.8
No	955	79.2
Source of information about PNC (n = 251)		
Women Development Army leader or members	2	0.8
Mass media (Radio/TV)	20	8.0
Health care providers	223	88.8
Friends	5	2.0
Family/relatives	1	0.4
PNC use for previous births (n = 984)		
Yes	56	5.7
No	928	94.3
PNC use for most recent birth (n = 1206)		
Yes	92	7.6
No	1114	92.4
Professional who conducted the PNC (n = 92)*		
Doctor	9	9.8
Health officer	5	5.4
Nurse/midwife	62	67.4
Health Extension Workers	23	25.0
Timing of the first PNC (n = 92)		
Within 24 h	2	2.2
1–2 days	9	9.8
3–7 days	14	15.2
1–6 weeks	67	72.8
Place where women received PNC (n = 92)		
Government hospital	14	15.2
Government health center	50	54.3
Government health post	19	20.7
Private hospital/clinic	1	1.1
Home	8	8.7
Reason for PNC use (n = 92)*		
Respondent was ill	28	30.4
Immunization for baby	47	51.1
Midwife told respondent	15	16.3
Wanted to start family planning	13	14.1
Delivered in a health facility	4	4.3

* Does not sum up to **total** due to multiple responses.

Table 4
Type of PNC services and postpartum complications among women in Kersa district, in eastern Ethiopia, 2017.

Variable	Frequency	Percentage
Type of PNC service received (n = 92)*		
Physical examination	40	43.5
Immunization of baby	42	45.7
Counselling on health	25	27.2
Family planning services	25	27.2
Breastfeeding education	20	21.7
Antibiotics treatment	1	1.1
Presence of postpartum complications (n = 1206)		
Yes	67	5.6
No	1137	94.2
Don't know	2	0.2
Type of postpartum complications (n = 67*)		
Severe bleeding	23	34.3
Severe headache	20	29.9
Severe weakness	18	26.9
High fever	13	19.4
Loss of consciousness	10	14.9
Convulsions	6	9.0
Abdominal pain	6	9.0
Difficulty breathing	6	9.0
Blurred vision	6	9.0
Swollen hands/face	5	7.5
Other complications	4	6.0
Place where the complication developed (n = 67)		
Home	49	73.1
Health facility	17	25.4
On way to health facility	1	1.5
Sought assistance for the complication (n = 67)		
Yes	36	53.7
No	31	46.3
Future wish to use PNC (n = 1206)		
Yes	775	64.3
No	299	24.8
No plan for pregnancy/delivery	132	10.9

* Does not sum up to **total** due to multiple responses.

The level of PNC utilization was extremely low in the study area with less than one in every thirteen reproductive aged women (7.6%) accessing PNC during the first six weeks after their last birth. The low level of PNC utilization in this study corroborates the idea that PNC is the weakest and most poorly recognized component of maternal health services in Africa (Fort, 2012; Warren et al., 2006). The level observed in this study is lower than that of the national Demographic and Health Survey report of Ethiopia (19%) and the estimate for Oromia region (10.3%) in 2016 (CSA, 2016). This might be explained by the fact that the Demographic and Health Survey included women with a live birth only, unlike the current study, which included women regardless of the birth outcome. The inclusion of women with birth outcomes, such as stillbirth might have increased the number of women who are expected to undertake PNC (the risk group), which could result in a reduced proportion of PNC utilization in this study. The lower estimate might also be due to omitting women who had received immediate post-delivery service that had been provided as an integral component of skilled delivery care and the exclusion of postnatal women who did not complete the first six weeks after delivery at the time of the survey. However, the finding is almost in line with a study conducted in Gondar (6.3%) (Worku et al., 2013), and Tigray (5.3%) (Medhanyie et al., 2012) in northern Ethiopia.

In the present study, the significant predisposing factors that were associated with PNC utilization were receiving education on maternal health and the woman's best friend use of maternal care. It is possible that PNC service use was higher due to the educational programs encouraging a positive perception towards the service. This has practical program implications to improve women's level of awareness about PNC service through designing health education and promotion programs on maternal health either in the community or health facility setting. The positive influence of educating women about maternal health and women's better knowledge about PNC on improved uptake of the service was also established in other prior studies in Ethiopia (Aregay et al., 2014; Gebrehiwot et al., 2018) and Malawi (Phiri et al., 2015).

People often seek the opinions and advice of their peers or best friends regarding various decisions including whether to use health services (Sharara et al., 2011). In this study, having a best friend who used maternal care had positively influenced the woman's use of PNC services. It was also evidenced in Timor-Leste that a woman's kinships, peers and close members of the family were reliable sources of information regarding pregnancy and delivery related issues (Kayli et al., 2010). The result highlights that prevailing social networks play a key role in ameliorating or worsening women's behaviour towards PNC utilization. Women whose best friend in their network practices maternal care (including PNC) tend to be influenced to adopt the behaviour and continue to use PNC services as they think their friend's actions and decisions are right.

The results of this study indicate that the "*person who heads the household*" was the enabling factor associated with PNC utilization. Women living in a partner or parents-headed household have decreased odds of utilizing PNC services compared to women from female-headed households. Previous studies reported that living with parents and within a household headed by the partner (Yaya et al., 2018; Zhang et al., 2016) were deterrent factors for women's access and utilization of maternal health ser-

Table 5
Factors associated with PNC utilization among reproductive aged women in Kersa district, in eastern Ethiopia, 2017 (n = 1206).

Variables *Predisposing factors*		PNC use No (%)	Yes (%)	Unadjusted Odds Ratio: (95% CI)	Model-I (AOR with 95% CI)	Model-II (AOR with 95% CI)	Model-III (AOR with 95% CI)
Woman's education	Never attended	827(94.3)	50(5.7)	1	1	1	1
	Attended	287(87.2)	42(12.8)	2.42(1.57,3.73)	0.85(0.47,1.53)	0.83(0.46,1.50)	0.86(0.47,1.57)
Husband's education	Never attended	566(94.8)	31(5.2)	1	1	1	1
	Attended	548(90.0)	61(10.0)	2.03(1.30,3.18)	1.19(0.70,2.04)	1.15(0.67,1.97)	1.14(0.65,1.98)
Husband's occupation	Farming	1013(94.2)	62(5.8)	1	1	1	1
	Non farming job	101(77.1)	30(22.9)	4.85(2.99,7.86)	1.94(1.01,3.70)	1.47(0.66,3.27)	1.36(0.58,3.16)
Education about maternal health	Yes	522(88.8)	66(11.2)	2.88(1.80,4.60)	2.16(1.32,3.55)	2.22(1.35,3.65)	**2.32(1.38,3.89)***
	No	592(95.8)	26(4.2)	1	1	1	1
Age at marriage	Continuous	1114 (92.4)	92(7.6)	1.15(1.06,1.25)	1.07(0.98,1.17)	1.07(0.98,1.16)	1.08(0.99,1.19)
Mass media at household	Yes	373 (87.6)	53(12.4)	2.70(1.75,4.16)	1.36(0.81,2.92)	1.46(0.86,2.49)	1.51(0.87,2.62)
	No	741 (95.0)	39(5.0)	1	1	1	1
Telephone at household	Yes	274(85.6)	46(14.4)	3.07(1.99,4.72)	1.60(0.94,2.73)	1.55(0.90,2.66)	1.62(0.92,2.87)
	No	840(94.8)	46(5.2)	1	1	1	1
Living in model family	Yes	28(80.0)	7(20.0)	1	1	1	1
	No	1086 (92.7)	86 (7.3)	0.31(0.13,0.74)	0.66(0.26,1.71)	0.64(0.25,1.65)	0.72(0.27,1.90)
Best friend's use of maternal care	Yes	441(87.0)	66(13.0)	3.87 (2.42,6.20)	2.28(1.36,3.84)	2.23(1.32,3.77)	**2.41(1.39,4.19)***
	No	673 (96.3)	26 (3.7)	1	1	1	**1**
Enabling factors							
Residence	Rural	982(94.3)	59(5.7)	1		1	1
	Urban	132(80.0)	33(20.0)	4.16(2.62,6.61)		1.44(0.67,3.09)	1.40 (0.63,3.13)
Head of the household	Respondent	16(80.0)	4(20.0)	1		1	1
	Partner or parents	1098(92.6)	88(7.4)	0.32(0.11,0.98)		0.26(0.08,0.90)	**0.24(0.07,0.81)**
Need factors							
Post-partum complications	Yes	46(68.7)	21(31.3)	1			1
	No	1068 (93.8)	71(6.2)	0.15(0.08,0.25)			**0.10(0.05,0.20)***
Frequency of antenatal care visits	<4 visit	1028(93.1)	76(6.9)	1			1
	≥4 visit	86(84.3)	16(15.7)	2.52(1.41,4.51)			1.52(0.78,2.96)

Keys: **Model I** (Predisposing factors only), **Model II** (Predisposing and enabling factors), **Model III** (Predisposing, enabling and need factors). **AOR**: Adjusted Odds Ratio, **CI**: Confidence Interval. **Bold***: Indicate statistically significant variables.

vices. Being the head of a household is related to being autonomous in household matters, including making judicious reproductive health choices or visiting health facilities (Matsumura and Gubhaju, 2001). The decision-making process and power dynamics within the household determine women's ability to access maternal care as the decision to use the service is not solely made by the women but also under the influence of people who live with them, particularly the person who heads the household (Tesfahun et al., 2014; Babalola and Fatusi, 2009; Matsumura and Gubhaju, 2001). The result underscores the need to strengthen interventions that aim to improve women's social status and decision-making ability through women's empowerment and capacity building initiatives.

The only significant need factor associated with PNC utilization was the experience of postpartum complications after the index birth. Women who had not experienced postpartum complications were less likely to attend PNC services compared with women who had experienced postpartum complications. A similar finding was reported in a review of studies on PNC utilization in African countries (Belemsaga et al., 2015) which showed that the absence of obstetric problems during the postpartum period has a negative association with PNC utilization. The result may be explained by the fact that postpartum women who are healthy in the postnatal period could be less motivated to seek health care as they may not be aware of the need to visit health facilities for a medical check-up while being apparently healthy. On the other hand, the women with complications tended to have a high perceived susceptibility to experience adverse consequences of the health problem and were likely to engage in healthy practices (such as visiting health facilities) to receive treatment. Thus, the women attended the PNC service for treatment of the complications, rather than deliberately seeking care for a postnatal check-up and maintaining their well being. Therefore, continued efforts should be made to mobilize women to seek and receive PNC before the occurrence of life-threatening postpartum complications.

The results of the study demonstrate that the uptake of PNC in the study community was far below the recommended level. Though there were substantial variations in the uptake of PNC services across different districts in Ethiopia, the estimate from the current study seemed very low. Given that in Ethiopia a high proportion of women give birth at home and women in rural or hard-to-reach communities have poor access to health facilities, a postnatal home visit by community health workers, such as health extension workers, could be an alternative strategy to enhance women's service uptake. To improve PNC utilization through the postnatal home visit, collaborative community activities including notification of labour or birth to community health workers by family members, relatives or friends should be advocated (Tesfaye et al., 2014). Regarding the factors that influenced PNC utilization, receiving education on maternal health and best friend's

use of maternal care are amenable factors that require program and policy intervention.

Strengths and limitations of the study

There are several strengths of this study. Collection of responses pertained only to the three years preceding the survey minimized recall bias. We used a digital survey tool which minimized the occurrence of incomplete and missing data. We also kept the urban-rural mix of the sample population to increase the scope and relevance of the study. However, the results of our study should be interpreted in light of the following limitations. Since the occurrence of both the outcome and the predictor variables were assessed cross-sectionally, the results should be cautiously interpreted regarding the causality of the factors. Use of self-reported responses to measure the study variables is also a weakness of the study. Despite the limitations, the findings of the study are relevant for informing the development of future programs and policy in the maternal health arena.

Conclusion

PNC utilization remains very poor; less than one in thirteen reproductive aged women received care after their most recent birth. Receiving education on maternal health, best friend's use of maternal care, head of the household and experience of postpartum complications were significant predictors of PNC utilization. Women's peer education programs at the community level should be established to promote the utilization of PNC services. Interventions should be continued to mobilize women to seek and receive PNC as a matter of course, before the occurrence of life-threatening postpartum complications. Initiatives designed to empower and build the capacity of women should be further extended to the grassroots level. Sustained efforts should also be made to strengthen health education and promotion campaigns on maternal health and the value of maternal health services.

Acknowledgments

We would like to acknowledge the University of Newcastle, Australia for funding GT's research higher degree studentship and financing the research undertaking. We would also like to extend our thanks to the University of Newcastle's Deputy Vice Chancellor (Research and Innovation) for partially funding the research. We thank the respondents, data collectors, supervisor and local collaborators who have cooperated during the data collection process at field level. Lastly yet importantly, we would like to thank Dr Ryan O'Neill for providing language revision and proof reading of the manuscript.

Conflicts of interest

None declared

Funding sources

The University of Newcastle, Australia has funded the research as part of the research training program for Ph.D. students. Research support was also provided by the University of Newcastle's Deputy Vice Chancellor (Research and Innovation). The funders have no role in the planning of the study, data acquisition, data processing and analysis, and interpretation of the findings of the study.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.midw.2018.12.002.

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G Model
WOMBI 963 No. of Pages 11

ARTICLE IN PRESS

Women and Birth xxx (2019) xxx–xxx

Contents lists available at ScienceDirect

Women and Birth

journal homepage: www.elsevier.com/locate/wombi

Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study

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ARTICLE INFO

Article history:
Received 11 January 2019
Received in revised form 16 April 2019
Accepted 16 April 2019
Available online xxx

Keywords:
Delay
Maternal health services
Prenatal care
Qualitative study
Eastern Ethiopia

ABSTRACT

Background: In Ethiopia, maternal health service utilization is still unacceptably low. The societal and cultural factors that constrain women from attending these services have not yet been sufficiently explored. Using qualitative methods, we aimed to explore the factors that delay maternal health service utilization in eastern Ethiopia.
Method: A total of 13 audio-recorded focus group discussions were conducted comprising 88 participants. We conducted separate group discussions with reproductive aged women, mothers-in-law, traditional birth attendants, husbands, and Health Extension Workers to capture their knowledge, practices, feelings, thoughts and attitudes towards maternal health service utilization. The recorded sessions were transcribed into the local language and then translated into English for analysis.
Result: The study identified a number of factors that may delay maternal health service utilization. Factors were grouped using the Three Delays model as a framework. Low level of awareness regarding need, poor involvement of husband, perceived absence of health problems, social power, community misperceptions and cultural restrictions, negative attitudes towards male midwives, acceptance of traditional birth attendants and poor social networking were Delay One factors. Lack of physical accessibility and high transportation costs were categorised as Delay Two factors for skilled birth care attendance. Perceived or experienced poor quality of care were categorised as Delay Three factors for both skilled birth and postnatal care utilization.
Conclusion: Despite the ongoing government measures to improve maternal health service utilization in Ethiopia, numerous factors continue to contribute to delays in service use, which in turn contribute to high maternal mortality.

Statement of significance

Problem or issue
Delays in seeking, reaching and receiving maternal health services are associated with high maternal mortality.

What is already known
Prior quantitative studies in Ethiopia identified numerous factors that delay women from attending maternal health services which operate at different levels from individual to facility. However, the underlying contextual socio-cultural and community factors have not yet been well studied using a qualitative approach to inform the development of appropriate programs.

What this paper adds
Using a qualitative design, this study identified a range of contextual delaying factors for maternal health service utilization. The factors are generally linked to restrictive socio-cultural practices, the poor social status of women, underdeveloped community and health infrastructures.

Introduction

The magnitude of maternal mortality in Ethiopia (353 per 100,000 live births) is among the world's highest rates of maternal deaths.[1] In other words, for every 1000 live births in Ethiopia, about four women die during pregnancy, birth or within 42 days of

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https://doi.org/10.1016/j.wombi.2019.04.006
1871-5192/

Please cite this article in press as: G. Tesfaye, et al., Delaying factors for maternal health service utilization in eastern Ethiopia: A qualitative exploratory study, Women Birth (2019), https://doi.org/10.1016/j.wombi.2019.04.006

birth. One explanation for high maternal death rates and poor health outcomes among women in Ethiopia is underutilization of maternal health services (antenatal, skilled birth and postnatal care) by a large proportion of women in the country.[2,3] Facility-based maternal health services are a proximate determinant of maternal morbidity and mortality[4] and proven health interventions for preventing maternal morbidity and mortality, mainly among women in resource-poor settings.[5] Hence, increasing access to and utilization of skilled maternal care during the pregnancy, birth and postnatal period, especially within an enabling environment where there are sufficient or appropriate facilities, is crucial.[6–8]

Antenatal care (ANC) plays a critical role in reducing maternal deaths by detecting and managing pregnancy-related problems early.[9] However, not all causes of maternal death can be averted by ANC, especially those resulting from complications arising during birth and the immediate postpartum period.[10] Hence, subsequent skilled birth and postnatal care (PNC) are essential in the continuum of maternal health service. Skilled birth care can avert most maternal deaths that occur around the time of birth through active management of the third stage of labour and administering uterotonic medicines to reduce haemorrhage.[11] PNC has the potential to reduce maternal deaths through identification and treatment of post-partum complications[12] and enable health workers to provide health promotion as well as preventive interventions.[13]

The Ethiopian government is putting great efforts (programmatic and policy initiatives) in place to increase access to and utilization of maternal health services through the rapid expansion of primary health care facilities, massive training of midwives and subsidizing the provision of maternal health service with no or little cost.[14,15] Consequently, there have been substantial improvements in the uptake of maternal health services over the past decade in Ethiopia.[16,17] However, the level of maternal health services utilization is still unacceptably low.[18–20] Approximately 62% of pregnant women attended ANC at least once, 28% of the women gave birth with the assistance of skilled health personnel, and only 19% of women received care during the postnatal period.[18] Moreover, the level of maternal health service utilization was much lower for rural women compared with urban women.[18,19,21]

A multiplicity of factors has been identified as bottlenecks to women's attendance of maternal health services in Ethiopia and are linked with factors that operate at different levels ranging from the individual to the facility level. These include personal factors such as poor awareness of the need for services, perception about the quality of services, women's decision-making autonomy and previous experiences of services.[5,22,23] Identified community factors include the main source of earnings, cultural factors and road infrastructure.[16,24,25] Finally, facility-related factors identified include the quality of the service, the cost of clinical care, unavailability and poor linkage of the services. [24,26,27] Generally, in developing country settings the factors that delay the utilization of maternal health services are related to poor socioeconomic conditions, restrictive cultures and inadequate availability of health services.[2]

In Ethiopia, though many quantitative studies have been conducted, the underlying factors that delay women from attending maternal health services have not yet been sufficiently explored using qualitative approaches. Most of the studies [5,19,21,28] have also been limited to basic factors that are inherent at a personal or community level and have rarely explored the role societal or cultural factors play in women's decision to seeking care, reaching and receiving maternal health service. Given the rich socio-cultural, traditional and ethnic diversity of Ethiopia, it would be valuable to obtain an in-depth and broader understanding of contextualized factors that delay maternal health service utilization to inform the development of future locally appropriate interventions.

Methodology

Research setting

The study was conducted in Kersa district, eastern Ethiopia. The data collection occurred between June and August 2017. With an estimated 205,628 inhabitants, the district has thirty-eight sub-districts (*kebeles*) having three urban and thirty-five rural *kebeles*. More than ninety percent of the inhabitants live in rural areas. The proportion of the population who have physical access (within 5 km distance) to health services has reached 80%. In the district, there are seven health centres, thirty-four health posts, and eight private pharmacies.[29] Health posts are staffed by Health Extension Workers. The Health Extension Workers not only provide preventive and health promotive services at the health post level but also train Women's Development Army leaders on various health issues including maternal health.[30] The leaders hold regular meeting with their villagers (usually networked members) to transmit the health messages they gained from the Health Extension Workers' training.[31] The health centres routinely provide the recommended packages of ANC, skilled birth care and PNC. Women initially attend their first ANC at a health centre and subsequently attend the rest of the visits in the health post. The government subsidized the maternal health services and in most public health centres the services are provided free of charge except for the cost of some medicines during ANC.[14]

Study design

An interpretive qualitative study was conducted using focus group discussions (FGDs). The viewpoints of targeted participants were explored based on their lived experiences and perspectives to explore delaying factors for maternal health service utilization.

Target participants and sampling

In order to ensure a range of views were captured and to improve the reliability of the findings, we conducted the FGDs with varied types of participants. These participants included reproductive aged women, mothers-in-law, traditional birth attendants, husbands, and Health Extension Workers. We selected the reproductive aged women to learn more about their lived experience with the use of the services and the obstacles they might have faced while they tried to use the services. We also included mothers-in-law who were directly involved in the process of decision making about whether the women used the services or not during pregnancy, birth and the postpartum period. We included husbands because in Ethiopia they are the primary decision-makers on household matters including whether or not their wives or children receive health care. Traditional birth attendants were also part of the study since they were specifically involved in the provision of birth assistance to women at the village level and they may play a pivotal role in either deterring or driving a woman's use of maternal health services. We also included Health Extension Workers as they are responsible for promoting and providing health services to women at the village level in the community.

With the assistance of village level facilitators and the Women's Development Army leaders, study participants were recruited using a purposive sampling technique from different kebeles in the study district. Voluntary research participants who were thought to play a role, who were knowledgeable, and who had lived

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experiences or were influential in relation to women's maternal health service utilization were identified and invited to take part in the group discussions. The facilitators recruited participants from different villages in each kebele to form a group. We only included participants who had lived in the district for at least six months, who had assumed no leadership role in the community and were familiar with the socio-cultural context of the area.

Data collection procedure

Separate focus groups were formed according to the type of target participants that were included in the study (Table 1). The start-up FGD guide was developed through a review of relevant literature and adapted to the research objective.[20,28,32,33] As the study progressed, the guiding questions were further refined after gaining insights from the first few discussions. Using the FGD guide two moderators (male and female) who had experience in handling FGDs and were fluent in the local language conducted the group discussions. The focus groups averaged about 60 min (range = 40–80 minutes) and consisted of between six to ten participants per group. The group discussions were conducted in the nearby elementary schools, health posts, and health centres in the villages. The FGDs were moderated in the local language (Oromiffa) and all were audio-recorded. Handwritten notes were also taken during each FGD. Information saturation was used to determine the number of FGDs per each target group.

Language translation

The FGDs were carried out in a setting where the lead author has a linguistic barrier and relied heavily on translators who are fluent in the local language to collect, transcribe, and translate the data. The moderators played an active role during the process of undertaking the discussion sessions as they received training on the aims of the study and discussion guide. The language barrier of the lead author might therefore disadvantaged the study. For instance, the lead author was unable to pursue the whole sessions and couldn't inquire questions that might have emerged during these processes. Furthermore, evidence[34] shows that the use of translators for cross-cultural studies could have a negative impact in terms of translating participants' original words, depth of the transcribed contents, and the level of emphasis. Despite these challenges, the use of translators should not be considered as an obstacle to undertake studies across different languages.

Data quality

Orientation was provided to the moderators to highlight the purpose and procedure of the FGD including briefing on the discussion guide. One male with a Master in Public Health and one female PhD student, both of whom were university academic members having prior experience in handling qualitative data and were bilingual, carried out the FGD. The lead author followed the data collection process and held regular discussion meetings with the moderators to solve methodological challenges at field level. In order to avoid professional influence on the participants, the moderators built rapport by initiating the discussions through introduction of their affiliations and role. The audio recordings were transcribed into the local language (Oromiffa) and translated into English by the moderators. Samples of English transcripts were randomly double-checked with the local language transcripts and audio-recordings to validate the linguistic consistency.

Data processing and analysis

The transcribed qualitative data were imported into the qualitative data analysis software (NVIVO version 11)[35] to organize the transcripts for coding and categorization. We followed a thematic analysis approach to analyse the data.[36,37] This analysis approach is a flexible method to allow for comparison within the transcribed texts and involves the categorization of the commonly recurring concepts onto themes. Coding was performed by identifying the concepts described in the transcriptions that were related to the research questions and aggregating them into themes. The coding was carried out in an iterative process and involved capturing and coding concepts from the transcript. Upon concluding the coding process, the codes were further categorized into themes. The emergent themes were reviewed and compared, and where necessary re-classified into those with similar concepts. The transcripts were read once more in view of the emerging themes to ensure the thematic evidence was reflected in the transcript. The analysis process was guided and structured by the Three Delays model.[38] Delay One factors are related to recognizing the need for and deciding to seek health services, which occurs when a woman is at home and unable to make an early decision to use maternal health services. Delay Two factors are related to identifying and physically reaching the facility to receive the services in a timely manner. Delay Three factors are problems that hinder obtaining proper services at the health facility. The model is suitable for the analysis as it supports a critical and integrated analysis approach on how personal, societal and service side factors deter maternal health service utilization. We mapped the main factors that were drawn from the thematic analysis into the relevant category of the model. During the write up of the study findings, selected typical response quotations representing the verbal expression of the respondents were inserted into the descriptions to supplement the issues being elaborated in the themes.

Rigour of the study

The rigour of the study was determined based on evaluative criteria used by previous studies.[39–41] The criteria, such as dependability, confirmability, credibility, and transferability were addressed to assess the rigour of the study. Experienced moderators who were native speakers of the local language, who originated from the same socio-cultural background as the participants, and who were familiar with the local norms and

Table 1
Description of the FGD participants.

Target participants	Number of FGD from urban kebeles	Number of FGD from rural kebeles	Total FGDs	Total participants
Reproductive aged women	1	2	3	20
Mothers-in-law	1	2	3	19
Traditional birth attendants	1	1	2	12
Husbands	1	2	3	24
Health Extension Workers	1	1	2	13
Total	5	8	13	88

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traditions conducted the FGDs. We are cognizant that due to the high social status of the moderators (being academic professionals, highly educated, and coming from urban area), there might exist power dynamics that could influence the relationship between the moderators and the participants. This relationship dynamics might have made some participants reluctant to voice their opinions on certain issues raised by the moderators. However, we attempted to minimize this power differential by recruiting participants via local facilitators, building rapport, making the discussion using plain and simple language, ensuring moderators' neutral position, creating a more interactive discussions by proactively encouraging participants to share their thoughts, and conducting the discussions at the participants' convenient time and locations. The interaction between the participants and the moderators was based on mutual trust and respect. The discussions took both an insider and outsider orientation, where participants share experiences or thoughts among themselves and sometimes address the moderators.[42] Participants expressed their opinion without pressure and freely shared their lived experiences about the problems as the discussion was skilfully facilitated and the moderators encouraged the group discussion in a neutral manner while tracking the discussion within the intended topic. Consequently, even though most participants rate the services as important, they were able to express their opinion on important barriers that delay women's utilization of maternal health services. The participants also appeared to present their criticism about the general health care provision in government health facilities and lack of good governance of the local administration to the moderators, though this was not specifically asked for. As part of enhancing the dependability and confirmability of the study, the NVIVO software allowed auditing of the findings and helped minimize the possibility of focusing on irrelevant findings. Using the software, we ran queries and used referring back techniques to contextualize the transcript so as to discern whether the findings reflected in the themes were sufficiently supported by the raw data from different participant groups.

To enhance the credibility of the results, data were sourced from five different target groups to learn their perspectives. In each target group of participants, the number of FGDs were determined by information saturation. Triangulation of the information was carried out to ensure the completeness of the evidence and to increase the potential for an in-depth understanding of the problem. The coding process was reviewed by an expert in qualitative research and modifications were made.

With regards to transferability of the findings, the study was conducted in a largely rural context where there is a low literacy level, underdeveloped socio-economic conditions, poor accessibility to transport and road condition, and deeply rooted socio-cultural practices. The findings might be applicable to settings with similar socio-economic and cultural conditions in or beyond Ethiopia. However, in order for readers to make their own judgment about the transferability of the finding to a specific context, we provided descriptions of the context of the study and examples of raw data in the form of direct quotations.

Results

Participant characteristics

A total of thirteen FGDs were conducted with eighty-eight participants. The target participants comprised reproductive aged women ($n = 20$), mothers-in-law ($n = 19$), traditional birth attendants ($n = 13$), husbands ($n = 24$) and Health Extension Workers ($n = 12$). The majority of the participants were not literate, married and of Muslim faith. All of the participants were members of the Oromo ethnic group (Table 2).

Overall perception about maternal health services

Most participants across the FGDs viewed the importance of a pregnant woman's attendance at ANC as positive. Participants described the importance of ANC to monitor the progress of the pregnancy, and ensure the health of the woman and unborn child. Participants described that typical ANC visits included pregnant women being provided with a tablet (an iron supplement), having their blood pressure measured and obtaining vaccinations. However, to a large extent, participants were vague in terms of describing what they understood regarding anaemia and blood pressure.

" . . . .*During pregnancy follow up, all of the necessary check-ups will be done . . . like blood pressure status, to know whether the woman is anaemic or not . . . There is a tablet given that improves her anaemia in the health facility and . . . start the tablet if there is a problem [anaemia] . . . there is also vaccine given for mothers . . .* "
52 year old Mother-in-law.

Table 2
Focus group participant characteristics.

Variables	Target groups				
	Reproductive aged women	Mothers-in-law	Traditional birth attendants	Husbands	Health Extension Workers
Age range (years)	21–44	40–80	28–72	42–70	21–37
Education					
Not literate	13	19	10	20	–
Elementary	3	–	2	3	–
Secondary (+)	4	–	–	1	13
Religion					
Muslim	18	16	12	24	9
Non-Muslim	2	3	–	–	4
Marital status					
Single	–	–	–	–	3
Married	19	16	12	24	10
Widowed or separated	1	3	–	–	–
Occupation					
Housewife	18	19	12	–	–
Farmer	–	–	–	22	–
Government employee or merchant	2	–	–	2	13

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Whilst appreciating some aspects of skilled birth care at health facilities, participants perceived that attending the service is beneficial for the improvement of women's health. Moreover, participants on multiple occasions reported that skilled attendants provide medicine that facilitates labour. "*There is a medicine given for labouring women with glucose that help the labouring mother to facilitate, give strength and shorten the time of labour, so she will give birth immediately. If she was assisted at home, she could stay labouring up to 3 days*" 24 year old reproductive aged woman.

Furthermore, most participants shared the view that women should obtain check-ups after birth to maintain the health of the woman and her child, and to receive advice and counseling services.

"*During check-up after birth, all mothers are advised about family planning, how to breastfeed, about their diet . . . checked for anaemia . . . The advantage is for vaccination and checking about health status . . .* " 50 year old husband.

Delaying factors for maternal health service utilization

While participants positively described the importance of attending maternal health services, a number of factors relating to delays in obtaining care were described. Several interconnected themes were identified and emerged from the analysis to explain the factors that contribute for delay in seeking, reaching and receiving care during pregnancy, birth and the postnatal period (Table 3). The themes were predominantly categorized as Delay One while fewer factors related to Delay Two and Three.

Delay One factors

Participants pointed out a range of factors that may limit women from seeking maternal health services in a timely manner. The common limiting factors for seeking maternal health services reported by most of the participants included the following: low level of awareness, social power, poor involvement of husband, absence of health problems, poor social networking, community misperceptions and cultural restrictions, acceptance of traditional birth attendants, and negative attitudes towards male midwives.

Low level of knowledge regarding need

Even when the maternal health service are available in health facilities in close proximity, women were reluctant to use the services due to having a limited understanding of the need to attend the care. One reason frequently voiced by the participants for non-attendance of ANC was a lack of awareness about the benefits of making ANC visits.

" . . . *Most of the pregnant women do not know how they will benefit by visiting the health facility except for acquiring an illness or killing their precious time*" 29 year old reproductive aged woman.

Indeed, participants partly attributed having poor knowledge about the service to the lack of means to obtain information about the importance of ANC.

" . . . *When women are in their homes, only Health Extension Workers sometimes teach those women living in nearby villages. For those who are far from the health facility and the main road, there is no mechanism to get information about it . . .* " 57 year old Mother-in-law.

Like ANC, having a poor understanding and low literacy status was one of the reasons suggested for low utilization of skilled birth care. " . . . *At this time some women still prefer to give birth at home . . . since most of our communities are not educated they do not have awareness about the importance of giving birth at health facility . . .* " 39 year old husband.

Lack of knowledge regarding the benefits and importance of PNC was another reason indicated by many participants for poor attendance of PNC. " . . . *I have given birth to my first child at home and didn't visit a health facility for check-up and nothing happened to the child. So, I don't want to waste my time by going there . . .* " 23 year old reproductive aged woman.

Furthermore, another participant attributed the lack of awareness about the advantage of PNC to the poor literacy status of women and the community members. " . . . *Since the community members are uneducated, we have to convince them by repeatedly teaching and advising them about the care after birth*" 25 year old Health Extension Worker.

Social power

Another important reason mentioned by the majority of the participants was the existing tradition of generational non-attendance at health services during pregnancy. Women were influenced by the practice of the older generation and they mostly learn about maternal health services from their mothers and grandmothers. Participants suggested that women became submissive in the face of social traditions and tend to follow the practices of elders.

"*I heard that many women do not attend pregnancy care because their mothers and grandmothers didn't attend the care . . . they say 'what is different with us' . . .* " 30 year reproductive aged woman.

Similarly, a Health Extension Worker stated that: " . . . *They tell us that their mothers and grandmothers had been giving birth at home*

Table 3
Summary of delaying factors for maternal health service utilization.

Category	Factors	Phase of maternal care		
		ANC	SBC	PNC
Delay I	Low level of awareness	✓	✓	✓
	Social power	✓	✓	✓
	Poor involvement of husband	✓		
	Perceived absence of health problems	✓		✓
	Poor social networking	✓		
	Community misperceptions & cultural restrictions	✓	✓	✓
	Acceptance of traditional birth attendants		✓	
	Negative attitudes towards male midwives		✓	
Delay II	Lack of physical accessibility		✓	
	High transportation costs		✓	
Delay III	Perceived or experienced poor quality of care		✓	✓

Key: ANC: Antenatal care; PNC: Postnatal care; SBC: Skilled birth care.

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and they had faced no problems . . . " 30 year old Health Extension Worker.

In addition, since most of their predecessors did not visit a health facility during the first 42 days after birth, the women tended to avoid attending PNC.

"*...There is no trend to go to a health facility during the period after birth in our community starting from our grandmothers and our mothers*" 34 year old reproductive aged woman.

Poor involvement of husband

It was apparent in this study that husbands have poor involvement in attendance of ANC with their wives. Husbands were unlikely to be involved in ANC due to locally held beliefs that men should have no role in the affairs of women. Husbands generally neither accompany their pregnant wives to the health facility nor support their idea to seek care during pregnancy.

" *. . . Some of us fear or are shy to discuss maternal health issues such as pregnancy with our wives or health professionals and also we do not like to accompany them to the health facility . . .* " 50 year old husband.

Some participants also emphasized that husbands were not always supportive of their spouses' idea to attend pregnancy care while they are healthy.

"*Husbands only bring their pregnant wives to a health facility after they developed complications . . . They do not support their wives to go to a health facility if they are healthy.*" 25 year old Health Extension Worker.

Perceived absence of health problems

The perceived absence of pregnancy-related problems was deemed to delay women from seeking maternal health services. Participants reported that women don't think it is vital to visit a health facility for care during pregnancy or after birth unless they encounter dangerous complications. They also suggested that husbands will only send their wife to a health facility after she has developed complications, and only during emergency conditions. Women themselves usually wait until they recognize that they have developed complications or become critically ill before attending ANC.

"*Women and all other community members perceive that health service visits during pregnancy are only needed during illness or complications*" 29 year old reproductive aged woman

Similar to the situation with ANC, most postnatal women tend to remain at home until they experience complications and illness. Participants felt that there was no need to attend care unless the woman or her child became sick after birth. Moreover, women and their families did not anticipate the unpredictable occurrence of obstetric complications and hence they are likely to advise against the use of the health facility for a check-up.

" *. . . After giving birth it is not important for the woman to go a health facility or no need for check-up unless she faces health problems, because she is healthy, and the newborn is also fine . . .* " 45 year old husband.

A traditional birth attendant also stated that: " *. . . It's good for the woman to show up at a health centre after giving birth and check herself in, but she may say 'I am fine now, what do I do in the health centre'?*" 60 year old traditional birth attendant.

Poor social networking

Participants felt that since most women do not regularly attend Women's Development Army meetings, they are thereby missing an opportunity to gain information about ANC. This information is shared initially from Health Extension Workers to Women's Development Army leaders, and the leaders inform all members of the network during regular meetings; subsequently, the women inform their peers in their village. Participants reported that the Women's Development Army was an effective method of providing information to modify behaviour, but that non-attendance of the meetings was a major barrier.

" *. . . Most of the women do not attend the group meeting in our village which is an important opportunity for obtaining information about maternal and health services like pregnancy follow up . . .* " 24 year old reproductive aged woman.

Community misperceptions and cultural restrictions

A range of cultural norms and local behaviours negatively influenced women's use of maternal health services. Participants emphasized that women were unlikely to use ANC due to the deep-rooted cultural belief that pregnancy should be concealed from anyone unless it is physically noticeable, or during birth. Women tend to keep their pregnancy secret partly because of feelings of shame and fear of criticism or stigma from the villagers, which is particularly the case for primigravida mothers.

" *. . . They keep it a secret about their pregnancy and they do not come for pregnancy follow up . . . they desire that no one hears about their pregnancy. No one! Except when it is visible or she gives birth . . .* " 37 year old Health Extension Worker

Participants reported that community members may also have culturally-related misconceptions that labour and birth are natural life events and God helps women throughout the childbearing process. The existing cultural norms may restrict women from using skilled birth service.

" *. . . .Since birth and reproduction are natural processes . . . there is no need to interfere with the natural process and go to another place during birth . . . ...*" 44 year old reproductive aged woman.

The participants also associated this belief with the community members' religious system.

"*They tell us that it is only because of Allah's (God's) help that they gave birth to all their previous children . . .* " 25 year old Health Extension Worker.

There was also a concurrence of views among participants that the entrenched community misperceptions or superstitions were delaying women from accessing PNC in a timely way. There were persistent superstitions about attending care after birth. One such superstition is the evil eye: women's families do not want the parturient women to leave the home for two months after birth for fear of this.

" *. . . The families do not want the women to go out of home before two months of birth for fear of the evil eye . . .* " 29 year old reproductive aged woman.

Participants also reported a prevalent norm that women should stay home after giving birth due to fear of diseases that result from cold weather and being outside in the sun.

"*When the women get out from home . . . they handle some objects and they put a metal object on their head or hair, fearing that they could get 'Michi'* [disease condition when they are outdoors]" 42 year old traditional birth attendant.

Acceptance of local traditional birth attendants

For women, particularly in rural villages, it is still the norm to use birthing services provided by Traditional Birth Attendants. Participants reported that some community members continue to prefer traditional birth attendants to assist women during labour and birth. Women feel that their privacy is protected when they give birth at home assisted by traditional birth attendants.

" *. . . When they give birth at the health facility they are made to sleep on the couch and their legs are spread over the couch and they*

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think their privacy is compromised . . . But, when they give birth at home with the assistance of traditional attendants they are attended privately by covering them with clothes and no one is allowed to enter into the room . . . " 31 year old Health Extension Worker.

The traditional birth attendants themselves were criticised for giving negative advice to the women about skilled birth care at the health facility and they seemed reluctant to send the women to a health facility. " . . . *There were traditional attendants in our community who gave false information about giving birth in the health facility to our women because they get money from them . . .* " 56 year old husband.

Negative attitudes towards male midwives

The poor acceptance of male midwives by the community, including husbands, emerged as a critical delaying factor that may hinder women from attending skilled birth care. The women themselves also reported feeling ashamed of exposing their bodies to male midwives during labour and birth.

"*Women are afraid of male birth attendants; there should be female attendants . . . even husbands don't want their wives' touched by a man . . .* " 53 year old traditional birth attendant.

Participants reported that it is against their religion and culture for a male person other than the husband to see the private parts of a female, so husbands also strongly opposed their wives giving birth at a facility with the assistance of male midwives.

" . . . *We called the village representative to call the ambulance driver, but [name]'s husband did not agree to send his wife to the health centre because of male health workers. He warned his wife not to give birth at the health facility, and that if a male midwife touched or looked at her body he would divorce her, and he finally told his mother to attend her . . .* " 61 year old Mother-in-law.

Delay Two factors

The second maternal delay is often related to problems that occur due to the long distance to health facilities, unavailability of transportation, bad terrain or poor road conditions and associated costs. In this study, it was demonstrated that women were unable to identify and physically reach the health facility early to receive skilled birth care due to high transportation costs and physical inaccessibility of the services.

High transportation costs

The monetary constraints associated with traveling to a health facility to attend maternal health service were reported to delay women from attending the services. For most of the women traveling to a higher level facility (e.g. hospital) to attend skilled birth care entailed an out-of-pocket cost for transportation.

" . . . *Since the health facility is far away from our home we spend a lot of money to transport the labouring woman and it affects our livelihood . . .* " 36 year old husband.

Furthermore, participants reported that there was no home transportation service in the area and hence the woman and her family could be exposed to extra out-of-pocket expenditure whilst traveling back home. " . . . *The ambulance that carries the labouring women to the health facility do not return them back to their home . . .* " 27 year old Health Extension Worker.

Lack of physical accessibility

Most participants attributed lack of accessibility to the long distances, inadequacy of ambulance services, and poor road infrastructure for labouring women. Hence, it was not only a question of access to money that may hinder a woman from attending the care, but also access to the means of transport and proximity to health facilities. For most women, traveling to hospital or a higher level facility which is located at a long distance from their home was another delaying factor for skilled birth care use.

" . . . *The mothers think that there is no reason to go to the health facility by traveling this far and again returning by walking all this long way . . .* " 21 year old Health Extension Worker

Participants also persistently mentioned both lack of ambulances and absence of return ambulance transportation services. " . . . *We have ambulance scarcity, we need additional ambulance. There is only one ambulances for the entire district. This ambulance goes to many areas, and it's difficult to use the service*" 60 year old traditional birth attendant.

The road condition was another persistently raised issue by the participants. In some cases, there is no road at all from the woman's home to the facility, and in the other cases, there is no road that connects the woman's home with the main road. The situation is particularly grave in some remote rural villages of the district. The road condition became worse during the rainy season as the road gets muddy and it is difficult for transportation.

"*Since Bajaj* [tricycle vehicle] *and ambulances can't enter the village because of the difficult road for vehicles, it would be good if the roads connecting the village to the main road are constructed . . .* " 58 year old Mother-in-law.

Delay three factors

The third maternal delay is mostly related to health system factors or problems in the service side. The most commonly mentioned problem that delayed women from receiving skilled birth and postnatal care across many of the focus groups was perceived or experienced poor quality of care at health facilities.

Perceived or experienced poor quality of care

Often the quality of health care is expressed in terms of structure, process, and outcome of the services. Poor functioning of the structure (e.g. poor setup and lack of supplies) and process (e.g. disrespectful staff and slow speed of services) components of quality of care were reflected from the perspective of most participants as delaying factors for service use. Poor quality of obstetric care was found to delay skilled birth care use and participants commonly mentioned mistreatment, disrespect and impolite approaches from health staff.

"*My sister was referred to* [name of nearby hospital] *and during the night there were too many labouring mothers. During the night all the health workers went to sleep, and we were begging them to check the progress of the labour. But they refused . . . They then shouted at me and told me to bring the card . . . when I brought the card they went back to sleep . . . . She was bleeding on the coach and they did nothing for her . . .* " 25 year old Health Extension Worker.

A mother-in-law noted the health staffs' impolite approach to women and lack of compassion. " . . . *There were some problems from the health workers side as they were not polite to a labouring woman and they do not give service with their full attention . . .* " 50 year old Mother-in-law.

Participants also complained that there was limited availability of medical equipment and supplies such as drugs and medicines in health facilities to receive skilled birth care. " . . . *the health workers usually order us to buy drugs from a pharmacy located outside of the facility with our own money . . .* " 50 year old traditional birth attendant.

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Several FDGs discussed the longer clinic waiting times to receive care at the health facility as another delaying factor of skilled birth care utilization. "*Health workers don't manage labouring woman as quickly as possible, instead they do their own activities and if you try to ask them . . . they say, 'you can't tell me what I do, this is my work not yours'* . . . ." 57 year old husband.

As with the skilled birth service, for PNC there was also a lengthy clinic waiting time before receiving care. Additionally, even those mothers who visited the health facility for child vaccinations during the postnatal period had to return many times to obtain the service. " . . . *Women in the village inform each other about the waiting time to receive the service after birth and discourage themselves from receiving the service*" 43 year old Mother-in-law.

Discussion

This study explored the key delaying factors for maternal health service utilization in eastern Ethiopia. Most participants had a positive view of the importance of maternal health services for maternal and child health. However, they also reported many factors that delay women from attending maternal health service. Factors that are related to the first delay were low level of awareness, poor involvement of husband, perceived absence of health problems, social power, poor social networks, community misperceptions, acceptance of traditional birth attendants, and negative attitudes towards male midwives. Factors related to the second delay were lack of physical accessibility and high transportation costs. Moreover, the only Delay Three factor that appeared to hinder maternal health service utilization was perceived or experienced poor quality of obstetric care at health facilities.

Despite reflecting a quite positive view towards maternal health services and generally rating the services as important for women's health, participants were able to elicit a broad range of contextual barriers for service attendance. The participants expressed the problems far better than the importance of the service probably because they might feel the problems overshadow the advantages. The fact that participants were able to describe all the things that went wrong with women's utilization of the service supports the rigour of the study. This study allowed us to appreciate people's real-life experiences through uncovering their thoughts, behaviours, and values on maternal health service utilization. Generally, the delaying factors were related to the restrictive socio-cultural practices and belief systems, low social status of women, the state of poor community development and health care delivery system. These factors influenced the health behaviour or practices of most women who live within this setting, particularly the uneducated. Women are direct bearers of the local cultural rituals and societal norms in the community, and are vulnerable to the consequences of those practices. Cultural practices are prevalent around pregnancy and birth in Ethiopia, and therefore directly affect women's health and welfare.[25]

The study demonstrated that poor awareness about the benefits of maternal health services delayed women from using the services. It was demonstrated that the Health Extension Workers are only educating the women nearby, providing advice and information about maternal health services. Hence women who had limited contact with the health service and those who lived far away from the health post had poor knowledge compared with the others. Participants further perceived that attending maternal health service is only necessary when there is an occurrence of obstetric complications and other morbid conditions, indicating a low perceived risk of complications. Even when there are problems, the woman and her family initially seek treatment from traditional birth attendants and it is when the problem goes beyond traditional birth attendants' control that they opt for a health facility. The health facility is being sought as a last resort to receive treatment, and the woman may die due to more advanced complications even before reaching there. The result of the study is similar to previous studies in Ethiopia,[5,28] which demonstrated that a lack of awareness about the benefits of maternal health services, and low perceived susceptibility to obstetric complications, were associated with poor utilization of the services. These findings highlight the importance of conducting more robust health promotion and communication campaigns to inform the benefits of the services to improve women's understanding.

The prevailing community misconceptions and cultural restrictions delayed women from seeking maternal health services early. Cultural restrictions such as the tradition of keeping pregnancy secret delayed initiation of ANC until the pregnancy is physically visible to others. In Ethiopia pregnancy is usually not discussed openly until it is noticeable.[43] These types of traditions are customary throughout the country, especially in the rural areas.[25] Moreover, it was revealed that the community's belief that labour and birth are natural processes was hindering women from attending skilled birth care. Again, the local traditional myths such as going out of the home during the postnatal period exposes the woman to the evil eye and diseases are prevalent in the community, and consequently, constrained women from using PNC during this critical period of motherhood. A review of literature in Ethiopia showed that deep-rooted community superstitions and misconceptions are huge challenges to maternal health service utilization.[25] This illuminates the need to design and strengthen health education and behavioural change communication programs to avoid these misconceptions and cultural restrictions at the community level.

Furthermore, lack of husband's support during ANC was a significant delaying factor for women's attendance of the service. Husbands were found to be uninterested in accompanying their pregnant wive to a health facility and hence women were discouraged from attending the service. Comparable findings were reported from other studies in Ethiopia [21,44,45] where partners' non-involvement on ANC has negatively influenced its use. Community mobilization activities targeting husbands should be conducted to change the husband's existing perceptions; furthermore, village level husband's groups are important to facilitate spreading health messages.

The study identified social power as another Delay One factor for maternal health service utilization. The study revealed that the lessons and rules the women learn from their elders, especially from their mothers and grandmothers, negatively influenced women's decision to early seek maternal health services. Since the women's understanding and practices were highly influenced by the social rules existing in their community, they were less likely to seek and use the services. A study in Indonesia[46] also showed that social power and belief systems have adversely affected women's use of maternal health services. Additionally, ANC uptake is influenced by poor social networks within the Women's Development Army. This highlights that the wider social context within which the women's decision occur plays a crucial role in shaping women's care-seeking behaviour towards ANC.

The study also found that local traditional birth attendants were accepted as providers of birth care for labouring women and they still continued to provide the service in the community. Birth services from traditional birth attendants were highly valued by women and their families since they have been part of the community for a long time and already gained trust, are living in nearby villages, provide affordable services, have a long standing attachment with the community members and share similar cultural practices to the community. The finding underscores that the training and education of traditional birth attendants in the basic birth care skills should be further implemented to empower

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them to provide the service particularly for women in rural and hard-to-reach villages. Moreover, it has been shown that systematic integration of traditional birth attendants into the formal health care delivery system was effective in improving maternal health,[47] and hence a strategic partnership between health professionals and traditional Birth Attendants should be established in a communities like those we studied.

In contrast to traditional birth attendants, there is poor acceptance of male midwives or nurses as providers of birth care at health facilities by the women themselves, as well as their husbands and other community members. Male midwives were a strong disincentive for the women to attend maternal health services and women expressed that they were often afraid to expose their body to them as this is against the cultural societal norm. Additionally, husbands don't want their spouses to be examined and attended by male caregivers. It was evidenced that especially for a typical Muslim woman in Ethiopia, there is a belief that no man other than the husband should see or touch her body, and this cultural or religious belief limits women from attending the service.[25] Therefore, in Ethiopia, the pre-service health professionals training policy should be revised and the enrolment of more female students to the midwifery field should be considered.

The findings of this study demonstrated that lack of physical accessibility of the service delayed women from attending skilled birth care. Despite the Ethiopian government's efforts to accelerate the improvement of accessibility of health facilities at kebele level, physical proximity of the health facility remains a significant factor that delays women from reaching the health facility to use the service. The lack of physical accessibility is related to difficult terrain, poor road conditions, an inadequate number of ambulances to transport the labouring woman, and inadequate service from the ambulances. This study result is supported by previous studies in Ethiopia [33,48] where skilled birth care utilization was associated with physical access to a health facility. Ambulances were also not providing the urgently needed service to transport expectant mothers to and from a health facility. When women attempted to use health services, despite the remoteness of the health facility, they were exposed to high out-of-pocket expenses for travel. The present study revealed that the cost incurred during transportation to and from a health facility was another major constraint to attend skilled birth care. The influence of financial expenditure on woman's utilization of skilled birth care has been documented elsewhere.[48] The Ethiopian government has made important initiatives to reduce costs, but there are still a number of hidden costs that are prohibitive (e.g. cost of return trip from health facility).

The quality of obstetric services is a growing concern and among the main bottlenecks for maternal health service utilization in Ethiopia.[2,25] In this study, participants criticized mistreatment by health staff, limited availability of medical equipment and supplies, unclean facilities and lengthy clinic waiting hours as important delaying factors for skilled birth care and PNC utilization. A review of studies on 'third delay' indicated that the provision of inadequate or low quality care at health facilities was a major barrier for obstetric care use in developing countries.[49] This signifies that improving the quality of obstetric care at health facilities is a crucial approach to increase the uptake of skilled birth care and PNC.

The study provides useful insights about service attendance that can inform program development. The evidence from the study portrayed real life stories that occur at the ground level, and the evidence is strong enough to be adapted during program design and implementation that is sensitive to the social context. The findings also highlight the importance of addressing culturally embedded barriers to service access. In addition, filling the information gap within the community and infrastructure establishment needs to be accelerated. Policy initiatives and concerted government actions are needed to dismantle the numerous factors that delay access to and utilization of maternal health services, including those factors that exist within the health care system.

Strengths and limitations

The limitations of the study must be acknowledged. Like all qualitative studies, the result of the present study might not be generalizable to the whole population and across other settings with different socio-cultural, economic and geographical context. By recruiting and including voluntary participants in the study, it is possible that potential respondents who prefer not to participate might have important views that are different from those who volunteered to participate. The use of the Three Delays model as an analytical framework for the study not only floated some factors from the model's predefined categories but also created a classification of factors that may not perfectly fit within a specific category. Another potential limitation is that there might be a loss of information during the translation of the transcripts from the local language to English, although the translations were performed by the moderators who are proficient in both languages and sections of the transcripts were double checked for consistency. Nonetheless, the overall validity of the study findings is less likely to be affected by the inherent limitations. The study also has a number of important strengths. We included multiple target groups of participants in this study to capture a range of pertinent views, which increases the richness of the data. Recruitment of respondents who live in different villages of both urban and rural areas enabled us to capture broader and contextually relevant factors affecting the use of maternal health services. We attempted to minimize the possibility of social desirability bias through the exclusion of those who assume leadership positions in the community and used indirect questioning during the discussion.

Conclusion

Despite participants' positive views towards the importance of maternal health service utilization, there were many factors that delay women from utilizing the services. Low levels of awareness regarding need, poor involvement of husband, absence of health problems, social power, poor social networking, community misperceptions and cultural restrictions, acceptance of traditional birth attendants, and negative attitudes towards male midwives were contributing for the first delay. Lack of physical accessibility and high transportation costs were related to the second delay. The third delay was attributed to the poor quality of obstetric services at health facilities. Community-based systematic and culturally sensitive peer education programs should be implemented to improve the perception of the less literate and rural women, increase risk awareness of women and families about obstetric complications, and abolish restrictive cultural practices, thereby facilitating and encouraging optimal service use. More efforts are required to improve male involvement in ANC. Designing pragmatic and integrated strategies to improve the quality of obstetric services at health facilities should be a priority area of intervention. Improving the functionality of ambulance services and particularly provision of return transportation services is also recommended. Revisiting the curriculum for midwifery professional training may be essential to consider enrolling more female students. Lastly, increasing capacity at health posts to provide birth care and involving community-based trained traditional birth attendants in providing birth care, especially to reach women in

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rural and remote communities, are important. For these interventions to be successful, and to be adapted and utilized by women, at the village level women and community members should receive appropriate communications through the Women's Development Army network and men's social groups.

Funding

The finance required to undertake this research is sourced from the University of Newcastle, Australia and the Deputy Vice-Chancellor (Research and Innovation). The research reports embedded in this paper are of the authors, not the funders.

Ethical statement

The study obtained an ethical approval from the Human Research Ethics Committee (HREC) of the University of Newcastle, Australia with approval number (H-2016-0403) and the Institutional Health Research Ethics Committee (IHREC) of Haramaya University, Ethiopia with approval number (IHRERC/129/2017). During the course of recruitment, the participants were verbally informed about the purpose and procedure of the study. Thus, informed verbal consent was obtained from each of the FGD participants. Participants were anonymously coded to identify them thereby to maintain the confidentiality of the information. The participant's identity was also kept confidential during the data collection, analysis and report writing. The audio-recordings were kept in safe place to avoid information leakage to another person other than the research team until they are destroyed in approximately five years' time.

Conflict of interest

None declared.

CRediT authorship contribution statement

Gezahegn Tesfaye: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Resources, Software, Writing - original draft. **Catherine Chojenta**: Conceptualization, Methodology, Data curation, Resources, Supervision, Writing - review & editing. **Roger Smith**: Conceptualization, Methodology, Data curation, Resources, Supervision, Writing - review & editing. **Deborah Loxton**: Conceptualization, Methodology, Data curation, Resources, Supervision, Writing - review & editing.

Acknowledgments

The authors are thankful to the University of Newcastle, Australia for providing Postgraduate Research Scholarship to GT and financing the research work as part of the Research Training Program for research higher degree students. We would also like to extend our gratitude to the University of Newcastle's Deputy Vice-Chancellor (Research and Innovation) who partially funded the research endeavour. We are grateful to the study participants and the research assistants.

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