



Disaster Preparedness Among Emergency Medical Services Worker in Saudi Arabia

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List of Abbreviations

CRED	Centre for Research on Epidemiology of Disasters
WADEM	World Association for Disaster and Emergency Medicine
WHO	World Health Organization
EMS	Emergency Medical Services
UNDRR	United Nations Office for Disaster Risk Reduction
SASEM	Saudi Association Society of Emergency Medicine
SAEMS	Saudi Association of Emergency Medical Services
DPET	Disaster Preparedness Evaluation Tool
MOH	Ministry of Health
NGHA	National Guard Health Affairs
HREC	Human Research Ethics Committee
UON	University of Newcastle
REDCap	Research Electronic Data Capture
HMRI	Hunter Medical Research Institute
SPSS	Statistical Package for the Social Sciences
ANOVA	Analysis of Variance
NHEOC	National Health Emergency Operations Centre
CPD	Continuing Professional Development

Keywords

- 1- Disaster preparedness
- 2- Knowledge
- 3- Skills
- 4- Preparedness
- 5- Emergency Medical Services
- 6- Barriers
- 7- Facilitators
- 8- Mixed Methods
- 9- Culture
- 10- Saudi Arabia

ABSTRACT

Disasters are unexpected events that impose destructive consequences which can adversely overwhelm countries' healthcare response systems. Countries are required to prepare their healthcare workers for disaster response effectively. A greater level of preparedness is associated with a more effective response to disasters. Emergency Medical Services (EMS) workers are vital and essential to effective disaster response in Saudi Arabia. This research aims to examine the perception of knowledge, skills, and preparation for disaster preparedness among EMS workers in Saudi Arabia. It further seeks to explore the needs of EMS workers and perceived barriers and facilitators of disaster preparedness within this context.

This study used an explanatory sequential mixed method design to examine disaster preparedness among EMS workers in Saudi Arabia. A descriptive cross-sectional survey using the Disaster Preparedness Evaluation Tool (DPET) was distributed to EMS workers in military and government hospitals across three Saudi Arabian cities (Riyadh, Jeddah, and Dammam) in phase one of the study. This phase aimed to explore the perceived disaster knowledge, skills, and preparedness levels of EMS workers in Saudi Arabia. The findings from Phase One were used to inform phase two by providing direction for interview questions. Participants who expressed their interest in phase one were interviewed in phase two. This phase aimed to explore the facilitators, barriers, and cultural factors that affect disaster preparedness among EMS workers in Saudi Arabia.

Two-hundred-and-eighty-seven EMS workers participated in this study. In phase one participants reported moderate knowledge, skills, and preparedness levels for disasters. However, EMS workers were underprepared in certain areas of disaster preparedness, specifically a lack of isolation and decontamination skills during bioterrorist or biological

attack (CBRNE). Interview findings showed that three factors influenced their preparedness levels: personal preparedness, workplace preparedness, and socio-cultural influences. Participants reported difficulties in accessing workplace policies and procedures, a lack of standardisation in managing and implementing EMS regulations, and irregularity in providing drills and exercise regimes in Saudi Arabia. Results also highlighted the socio-cultural impact on disaster knowledge, skills, and preparedness of EMS workers. Prevailing social-cultural expectations in Saudi Arabia are biased against women. This results in a predominantly male and patriarchal structure within the EMS profession. Consequently, women in this study had fewer opportunities to enhance their knowledge, skills, and preparedness than their male EMS peers.

This research was able to explore the perception of EMS workers' disaster knowledge, skills and preparedness from a geographically and demographic representative sample of the Saudi Arabia EMS workforce. Important insights from the study could advance the EMS workforce and increase disaster preparedness. These include providing equitable, standardised, and inclusive education and training opportunities for all EMS workers in Saudi Arabia. In addition, local, postgraduate programs would further support Saudi Arabia's disaster preparedness. Saudi Arabian workplaces will benefit from recruiting more female EMS workers and standardising staff rotation. This will empower EMS workers within all health care systems in Saudi Arabia. The Saudi Association of Emergency Medical Services (SAEMS) should implement these changes and be provided appropriate governance powers to regulate the profession.

Chapter 1: Introduction

1.1 Introduction

Disasters disrupt the functioning of a society and cause social, economic, and environmental harm. Some disasters occur naturally, while others are human-made, emerging from human action, negligence, and error (Centre for Research on Epidemiology of Disasters [CRED], 2019). Subsequently, the World Health Organization (WHO) has recommended preparatory actions for disaster management including disaster drills or simulation exercises (Inter-Agency Standing Committee, World Health Organization, 2011). The WHO has repeatedly stressed the importance of disaster preparedness due to the increasing number of disasters globally. The WHO further highlights the tangible link between disaster preparedness and saving lives (Inter-Agency Standing Committee, World Health Organization, 2011). This involves creating a framework that enables effective handling of disaster situations (CRED, 2019). One of the applied disaster management models globally is the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR, 2020). Member states adopted the framework at the United Nations World Conference on Disaster Risk Reduction in Sendai, Japan. A fundamental principle of the framework urges nations to take responsibility to manage, address, and mitigate disasters. Therefore, the focus is for nations to create effective disaster management systems and preparedness frameworks to reduce their exposure, risk, and economic and human losses. Another principle the Sendai Framework is to support local authorities to develop preparedness systems (CRED, 2019).

Emergency Medical Services (EMS) workers are vital to disaster management. Thus, it is important for countries to liaise with regional and local health partners to effectively prepare their EMS workers for disasters. This includes the identification of roles and responsibilities for health workers, the development of early warning mechanisms, and

stockpiling of necessary supplies needed when responding to a disaster (Catlett et al., 2011). Greater levels of preparation are associated with more effective disaster responses (Inter-Agency Standing Committee, World Health Organization, 2011). EMS workers are fundamental in disaster management as they form the first line of care in the disaster response (Catlett et al., 2011). Moreover, EMS workers play crucial roles in the disaster preparedness and response cycle. In Saudi Arabia, EMS workers are paramedics who also provide ambulance services.

This is the first chapter of the thesis entitled "*Disaster Preparedness among Emergency Medical Services Worker in Saudi Arabia*". The chapter lays a foundation for the entire thesis and provides an understanding of the contextual factors and literature informing the development of the study. It further provides a background on preparedness levels for prevailing disasters in Saudi Arabia, and as such, the rationale for the development of the thesis.

1.2 Background

The Centre for Research on the Epidemiology of Disasters (CRED) defines disasters as unprecedented events occurring within a short period of time (CRED, 2019). According to the International Federation of Red Cross and Red Crescent Societies (IFRC), disaster preparedness is defined as:

measures taken to prepare for and reduce the effects of disasters. That is, to predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences (The International Federation of Red Cross and Red Crescent Societies (IFRC), 2019).

This is not an overarching definition of preparedness as there is no clear definition of personal disaster preparedness. However, it is well accepted that disaster preparedness consists of knowledge, skills, and preparation (Gebbie et al., 2012).

1.2.1 Disaster Prevalence Globally and in Saudi Arabia

There have been over 22,000 recorded disasters globally since 1900 according to the emergency data (EM-DAT) international database on disasters. The database, managed by CRED, categorises disasters as either natural or technological disasters, while other classifications and definitions categorise technological disasters as human-made disasters. For example, natural conditions such as climatic changes, temperature rises, and changing rain patterns are all linked to human activities (Liu et al., 2010; Banholzer et al., 2014). Thus, the EM-DAT classifies them as natural and technological disasters rather than adopting the traditional natural and human-based disasters.

Disasters create significant impacts both locally and globally. The United Nations Office for Disaster Risk Reduction (UNDRR) reports a significant rise in disaster prevalence with corresponding increases in associated human and economic costs (UNDRR, 2020). The economic cost of disasters over the last two decades (2000-2019) has been estimated at \$2.97 trillion USD. With a rising trajectory compared to the two previous decades (1980-1999). An estimated 4,212 disasters were reported over this period. Equally, the human cost of disasters in 1980-1999 was an estimated 3.25 million people affected with an economic cost of \$1.63 trillion USD. Disasters have accounted for approximately 0.1% of all global deaths over the last decade, or 60,000 deaths annually (EM-DAT, 2020; CRED and UNDRR, 2020).

An examination of Saudi Arabia's existing physical environment and topography indicates a rising risk of disasters both in the present and the future (Alrehaili, 2021). Managing natural disasters remains a significant challenge. There is a need for Saudi Arabia to develop and establish sufficient preparedness among its responders, including EMS workers, to reduce mortality, injury, and economic loss. Therefore, the need to explore the nation's preparedness in handling such disasters has informed the development of this study. Saudi Arabia is prone

to different types of disasters. The country is predisposed to, and has historically faced, several natural and technological disasters due to its location in the Middle East (Figure 1).

Figure 1: Saudi Arabia



Note. Location of Saudi Arabia. Adapted from Google Maps.

Flooding is the most common natural disaster in Saudi Arabia with seven out of ten significant disasters being floods (Abosuliman et al., 2013). Since 1980, at least 4,660 people have died, 32,000 have been adversely affected, and \$4.65 billion USD worth of damage has been incurred (Al Thobaity et al., 2015). A notable Saudi Arabian disaster includes the 2009 Jeddah floods. Civil defence officials in the country described the floods as the worst in the last 27 years. More than 122 people died with approximately 350 people reported missing (Ameur, 2016; Youssef et al., 2016). The frequency of floods in the region remains high with recent floods in 2020 and 2021 (Al-Wathinani et al., 2021). The risk of extreme cyclones also remains a challenge in the region and the country. Some of the most affected regions within Saudi Arabia are the cities of Jeddah and Madinah. Jeddah is a large cosmopolitan city and is the second largest regional capital city in Saudi Arabia. It is located on the coastal plain area on the western coast of Saudi Arabia (Figure 1). A total of 113 people died in the 2009-2010 flash floods in this city. The economic losses were estimated at \$3 billion USD and over 10,000

homes were destroyed. Similar incidents occurred in 2019 and 2020, highlighting the need to develop guidelines and education programs to improve disaster preparedness in the country (Ameur, 2016; Elfeki & Bahrawi, 2017; Azeez et al., 2020).

1.2.2 Saudi Arabia Disaster Management

Disaster preparedness refers to the set of measures taken and executed by a country to reduce the potential effects of disasters. Efficient disaster management requires effective disaster preparedness. Saudi Arabia has established a disaster management and response system. Incidents such as the Hajj 2015 stampede that led to over 2,000 deaths demonstrate the need for an efficient, on-time, and effective emergency response system (Khan & Noji, 2016). The disaster management and response system is supported by the government through the Ministry of Health, with the main disaster management body in Saudi Arabia being the General Directorate of Civil Defence (GDCCD) (Alyami et al., 2020; Ledraa & Al-Ghamdi, 2020). This entity was established by royal decree in 1965 by King Faisal, and aimed to coordinate and centralise disaster management services to promote efficiency and effectiveness. The decree was revised in 1987 to improve the effectiveness of the disaster response. Civil defence law supports its operations in Saudi Arabia. This is a regulatory framework and set of rules that define the roles and responsibilities of the nation and its agencies to protect residents, public property, and private property against destruction and further losses in the event of a disastrous occurrence (Alyami et al., 2020; AlQahtany & Abubakar, 2020).

1.2.3 Emergency Medical Services Workers

The EMS profession is gradually evolving in the Middle East, especially in Saudi Arabia. Previously, emergency responsibilities and duties have been viewed as the collective role of existing healthcare industry professionals (Alshammari et al., 2017; Alanazy et al., 2021). Thus, Saudi Arabia did not have a specific EMS unit, but instead integrated emergency

response tasks into its different units. However, the existing literature describes the recent perceptual shift that has occurred related to the organisation and the approach to disaster response in Saudi Arabia. This has led to the recognition, funding, and actualisation of EMS units as a critical and core component of the nation's healthcare services system. As such, an environment has been provided for the EMS profession's evolution through its respective organisations (Alharthy et al., 2017; Alanazy et al., 2021).

The EMS field in Saudi Arabia is only 20 years old and has been open to females in the past few years (ALobaid et al., 2021). The first step in the evolution of EMS in Saudi Arabia was setting up the Saudi Association Society of Emergency Medicine (SASEM) (Alshammari et al., 2017; Alharthy et al., 2017). This society is mandated to manage emergency response services and is comprised of all medical professions connected to emergency response, including paramedics, doctors, and nurses. This was followed by the establishment of the Saudi Association of Emergency Medical Services (SAEMS) in the early 2000s. This association works to increase the focus on, and recognition of, EMS workers as unique healthcare professionals equipped with skills and operating in environments within the healthcare industry. As a result, the nation has developed the realisation of the EMS profession. The process was initiated with first aid and frontline responder's workplace training, which evolved into classroom and professional course provision in institutions, such as the rollout of emergency medical technician courses in the period between 2005 and 2012, which was later followed by the establishment and rollout of Bachelor's degrees in EMS for males across Saudi Arabian universities in 2007–present (Alshammari et al., 2017). Despite the evolution of the EMS field in Saudi Arabia, there were no places for females in the EMS programs of Saudi Arabian universities before 2015 (Alshammari et al., 2017). The need for female EMS workers in the field has increased, and the government has supported universities to offer a Bachelor of

EMS degree for females in 2015 (Alharthy et al., 2018). This was to support Saudi women and empower them to be equal to their male peers (Alharthy et al., 2018).

1.3 Significance of the Study

Saudi Arabian EMS workers face several challenges in their disaster preparedness despite the development of the profession recently. Examples include a lack of policy and framework guidelines, training limitations, and the changing scope and nature of disasters (Abosuliman et al., 2013; Al Thobaity et al., 2015).

Several studies on disaster management have been conducted in Saudi Arabia. Two of these (Al Thobaity et al., 2015; Ibrahim, 2014) found a lack of adequate knowledge of existing protocols and guidelines to disaster response among Saudi Arabian nurses. Alrazeeni (2015) distributed a survey to undergraduate EMS students and found insufficient knowledge, skills, and preparedness to deal with emergency or disaster situations, leading to a general lack of confidence among EMS workers in relation to their capacity to respond to disasters. There is a risk of poorly coordinated response in handling and managing disaster survivors when workers are unaware of the presence or the contents of response protocols. However, there is a lack of literature outlining EMS workers' disaster preparedness in Saudi Arabia (Alrazeeni, 2015; Al Thobaity et al., 2019).

The second challenge is the evolving nature of disasters and the response strategies needed. The global social and geographical landscape is drastically changing, leading to a need to consistently update EMS training and skills development. Unfortunately, there is a reliance on theoretical-based training strategies. Theory-based training is limited in enabling EMS workers to address the unique dimensions and occurrences in a variety of disasters. This creates a challenge among EMS workers in handling and managing survivors (Al Thobaity et al., 2015; Al Thobaity et al., 2019; Ibrahim, 2014).

The third challenge is that the EMS field in Saudi Arabia is a developing profession with a young workforce. This requires greater effort from the country to support young EMS workers to increase their preparedness for disasters (Alshammari et al., 2017; Alharthy et al., 2017). Thus far, there has been a lack of studies that explore disaster preparedness among EMS workers in Saudi Arabia, and this study will address this knowledge gap.

1.4 Research Questions

The research questions for this study are:

- What is the perceived knowledge, skills, and preparation EMS workers have toward disaster preparedness in Saudi Arabia?
- What are the needs of EMS workers that are specific to the Saudi Arabian disaster setting?
- What are the perceived barriers and facilitators for EMS workers toward disaster preparedness in Saudi Arabia?

1.5 Aim

This study aims to examine perceptions of knowledge, skills, and preparation for disaster preparedness among EMS workers in Saudi Arabia. The study also aims to understand the needs of EMS workers and explores the perceived barriers and facilitators of disaster management and preparedness within this context.

1.6 Objectives

The objectives of the study are to:

- Examine EMS workers' perceptions of their current knowledge, skills, and preparedness toward disaster management in Saudi Arabia

- Identify EMS workers' needs that are specific to the Saudi Arabian disaster management setting
- Explore the perceived barriers and facilitators for disaster management and preparedness among EMS workers in Saudi Arabia

1.7 Overview of the Study Methods

This study uses an explanatory sequential mixed-methods design to explore disaster preparedness among EMS workers in Saudi Arabia. Phase One consists of a quantitative approach with a cross-sectional survey design to determine the self-assessment of disaster preparedness among EMS workers through their perceptions of their knowledge, skills, and preparation for disaster management using the Disaster Preparedness Evaluation Tool (DPET). The findings from this phase were used to inform the semi-structured interview questions for Phase Two. Phase Two consists of a qualitative thematic approach using semi-structured interviews to understand EMS workers' perceptions of disaster preparedness, and additionally, to explore the perceived barriers and facilitators toward disaster preparedness. The interviews were analysed using Braun and Clarke's six step analysis.

1.8 Thesis Outline

This thesis includes seven chapters. Chapter One involves the introduction, background, the study significance, research questions and study aims, and an overview of the methods used.

Chapter Two presents published integrative literature review exploring the knowledge, skills, and disaster preparedness of healthcare workers, and the factors that affect their disaster preparedness. Also, it included an updated section that discussed new studies conducted after the published article. Chapter Three provides the overarching methodology/methods, describes the explanatory sequential mixed-methods design, and provides the rationale for using this

method. Also, it provides information on the study setting, the sample and target population, recruitment, the data collection methods, and the analysis methods for Phase One and Two. Additionally, this chapter will present the ethical considerations of the study.

Chapter Four and Five present the results from Phase One and Two respectively. It also provides the demographic data of the participants for each phase. Chapter Six provides a discussion of the findings from both phases. The chapter discusses the findings regarding the research aims and questions and the literature and integrates the findings from both phases. Chapter Seven, the final chapter, outlines the strengths and limitations of the study, and provides several recommendations and directions for future research.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews the international literature related to disaster knowledge, skills, and preparedness among healthcare workers. This includes an exploration of the factors that facilitate or limit the preparedness of healthcare workers for disasters. This chapter comprises an integrative literature review published in 2021, which is followed by an update of recently published literature from December 2020 to June 2022.

Citation

Almukhlifi, Y., Crowfoot, G., Wilson, A., & Hutton, A. (2021). Emergency healthcare workers' preparedness for disaster management: An integrative review. *Journal of Clinical Nursing*, 00, 1-16. <https://doi.org/10.1111/jocn.15965>

2.2 Emergency Healthcare Workers' Preparedness for Disaster Management: An Integrative Review

Abstract

Background: Around 2 billion people globally were affected by natural disasters between 2008 and 2018. The World Health Organization requires countries and governments to have disaster plans and emergency health workers ready and prepared at all times.

Objectives: To conduct an integrative review of literature of emergency healthcare workers' perceived preparedness for disaster management.

Methodology: An integrative literature review using the PRISMA checklist guidelines was conducted to explore physicians, nurses, emergency medical services, and allied medical

professionals' preparedness for disasters. Literature was searched from 2005, published in the English language and from MEDLINE (PubMed), Google Scholar, EMBASE, PsycINFO, SCOPUS, ProQuest and CINAHL databases. Reviews, case reports, clinical audits, editorials and short communications were excluded. Studies were critically appraised using the Mixed Methods Appraisal Tool.

Results: The initial search yielded 9589 articles. Twenty-seven articles were included following application of the eligibility criteria. Included studies were geographically diverse including North America, the Middle East, and the Asia Pacific. Most studies (n=24) assessed the knowledge of healthcare workers in general disasters. Studies using the Disaster Preparedness Evaluation Tool reported moderate disaster preparedness and knowledge, while studies using other instruments largely reported inadequate disaster preparedness and knowledge. Regional variations were recorded, with high-income countries' reporting a higher perceived preparedness for disasters than low-income countries.

Conclusion: The majority of the emergency healthcare workers appear to have inadequate disaster preparedness. Previous disaster experience and training improved disaster preparedness. Future research should focus on interventions to improve emergency healthcare workers preparedness for disasters.

Key Words: Disaster, preparedness, knowledge, skills, perception, emergency, health workers.

I. Introduction

The Centre for Research on the Epidemiology of Disasters (U Louvain, Brussels) (CRED), defines disasters as a situation or event that overwhelms local capacity, necessitating a request at the national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering (CRED, 2019). Disasters negatively impact the functioning of a society and cause social, economic, and environmental harm. Some disasters occur naturally while others are human-made and emerge from human actions, negligence, and errors. Additionally, disasters can be a combination of natural causes triggered or facilitated by human activities (The United Nations Office for Disaster Risk Reduction [UNDRR], 2020).

Disaster reporting has rapidly increased worldwide. CRED recorded 7348 major disasters between 2000 and 2019. This represents a substantial increase from the 4212 disasters recorded between 1980 and 1999. In the last two decades, disasters have claimed approximately 1.23 million lives and have directly or indirectly affected over 4.2 billion people. The economic burden for these disasters was assessed at \$2.97 Trillion USD (CRED, 2020).

Disaster preparedness defined as *“the creation of skills, and capabilities among emergency healthcare workers to respond and mitigates disaster risks. This includes the creation of awareness’ and expertise on handling disaster survivors in manner that not only reduced injuries and mortalities, but also promotes the survivor’s wellbeing. Preparedness among emergency healthcare workers is not only in the actual possession of the skills, but also in their perceived levels of preparedness”* (UNDRR, 2020). A positive perception on preparedness eliminates the risk of anxiety and doubts. Instead, it enhances the emergency healthcare workers confidence in handling disaster situations.

An increased level of disaster preparedness led to decline in mortality rates from disaster occurrences in the recent past (UNDRR, 2020). This is linked to increased responsiveness by nations and the front-line responders in their emergency healthcare services units. These responders offer quality care and provide timely and relevant medical and psychological support (Bachmann et al., 2015; Veenema, 2006). Disaster preparedness among emergency healthcare workers improves their effectiveness in handling any emerging cases and treating and supporting disaster survivors (Glow et al., 2013). This requires emergency healthcare workers to be empowered with adequate preparations for disaster management.

The level of skill and preparedness directly influences the humanitarian, social and economic outcomes of a disaster. UNDRR has established the Sendai framework for disaster management. The framework after its adoption by member States in 2015, guides the global disaster management strategies. Among its pillars in disaster management is the creation of a strong and motivated pool of disaster responders. These are the emergency healthcare workers (Pearson and Pelling, 2015; Mysiak et al., 2016). One avenue to ensuring the readiness of disaster responders to manage disasters is ensuring their preparedness levels are meet international and personal standards. Unfortunately, a preliminary analysis of existing literature indicates a focus on the emergency healthcare workers skills and actual expertise levels rather than their preparedness (Glow et al., 2013; Bachmann et al., 2015). This fails to include the role played by their perception. It is vital to investigate the existing literature focusing on the emergency healthcare workers perception on their preparedness levels.

II. Aims

This review aims to explore the scope of emergency healthcare workers' perceived preparedness for disaster management.

III. Methods

A) Integrated Literature Review Design

This literature review was conducted using an integrative review methodology based on the Preferred Reporting Items for Systematic and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) (Supplementary File 1: PRISMA checklist). The review focused on exploring the emergency healthcare workers' perceived preparedness for disaster management. The integrative literature review method was chosen because it summarises the current theoretical and empirical literature to present a more comprehensive understanding of a phenomenon. Also, it allows a combination of diverse methodologies, as disaster preparedness is discussed through a wide range of studies and reviews that are not only experimental in nature. Moreover, this method can be used to define concepts of disaster preparedness competencies for future studies (Grant & Booth, 2009; Russell 2005; Whitemore & Knafl 2005). The mixed methods appraisal tool was used as the scope of the study focused on collecting primary studies using both qualitative and quantitative methods (Pace et al., 2012). Thus, the use of a critical appraisal instrument that assessed both quantitative and qualitative studies allowed the authors to ensure both types of data were considered and appraised accordingly. The Whitemore and Knafl (2005) framework was applied in the development of this review. It comprises of five steps consisting of (1) identifying the purpose of the review, (2) searching for the relevant articles, (3) evaluating and extracting data, (4) analysing or synthesising the data, and (5) presenting the findings. Studies were analysed, themes evaluated, and the emerging similarities and differences described. Finally, the findings were analysed using thematic analysis (Pace et al., 2012).

B) Data Collection

Databases

The MEDLINE (PubMed), Google Scholar, EMBASE, PsycINFO, SCOPUS, ProQuest and CINAHL databases were searched for English language articles. The scope of the search was all listed articles published in those databases. The last search was conducted in December 2020. A search strategy was developed by the authors using key words, MeSH headings and phrases for the MEDLINE (PubMed) database. The search strategy used was ‘Disaster Preparedness’ OR ‘Disaster management’ AND ‘Preparation’, AND ‘Emergency Healthcare Workers’ OR ‘Healthcare Practitioner’. An example of this search strategy used for MEDLINE (PubMed database presented in Table 1. This search strategy was applied across all databases for uniformity of findings and complies with the aim of this review.

Table 1: MEDLINE (PubMed) search strategy

Search number	Query	Search Details	Results
1	"Health Personnel*"[Title/Abstract]	"Health personnel*"[Title/Abstract]	8,265
2	"Emergency Services*"[Title/Abstract] Medical	"Emergency medical services*"[Title/Abstract]	8,270
3	"Physicians*"[Title/Abstract]	"Physicians*"[Title/Abstract]	267,624
4	"Nurse*"[Title/Abstract]	"Nurse*"[Title/Abstract]	290,502
5	1 OR 2 OR 3 OR 4		548,377
6	"Disaster*"[Title/Abstract]	"Disaster*"[Title/Abstract]	28,438
7	"Disaster Preparedness*"[Title/Abstract]	"Disaster preparedness*"[Title/Abstract]	1,687
8	"Disaster Management*"[Title/Abstract]	"Disaster management*"[Title/Abstract]	1,393
9	"Emergency Management*"[Title/Abstract]	"Emergency management*"[Title/Abstract]	3,294
10	6 OR 7 OR 8 OR 9		31,104
11	5 AND 10		2,458

12	"Knowledg*"[Title/Abstract]	"Knowledg*"[Title/Abstract]	770,487
13	"Attitud*"[Title/Abstract]	"Attitud*"[Title/Abstract]	166,277
14	"Skill*"[Title/Abstract]	"Skill*"[Title/Abstract]	217,176
15	"Prepar*"[Title/Abstract]	"Prepar*"[Title/Abstract]	961,508
16	12 OR 13 OR 14 OR 15		1,979,038
17	11 AND 16		900

Inclusion and Exclusion Criteria

The articles identification process applied inclusion and exclusion criteria, illustrated in table 2 (Inclusion and Exclusion Criteria).

Table 2: Inclusion and Exclusion Criteria

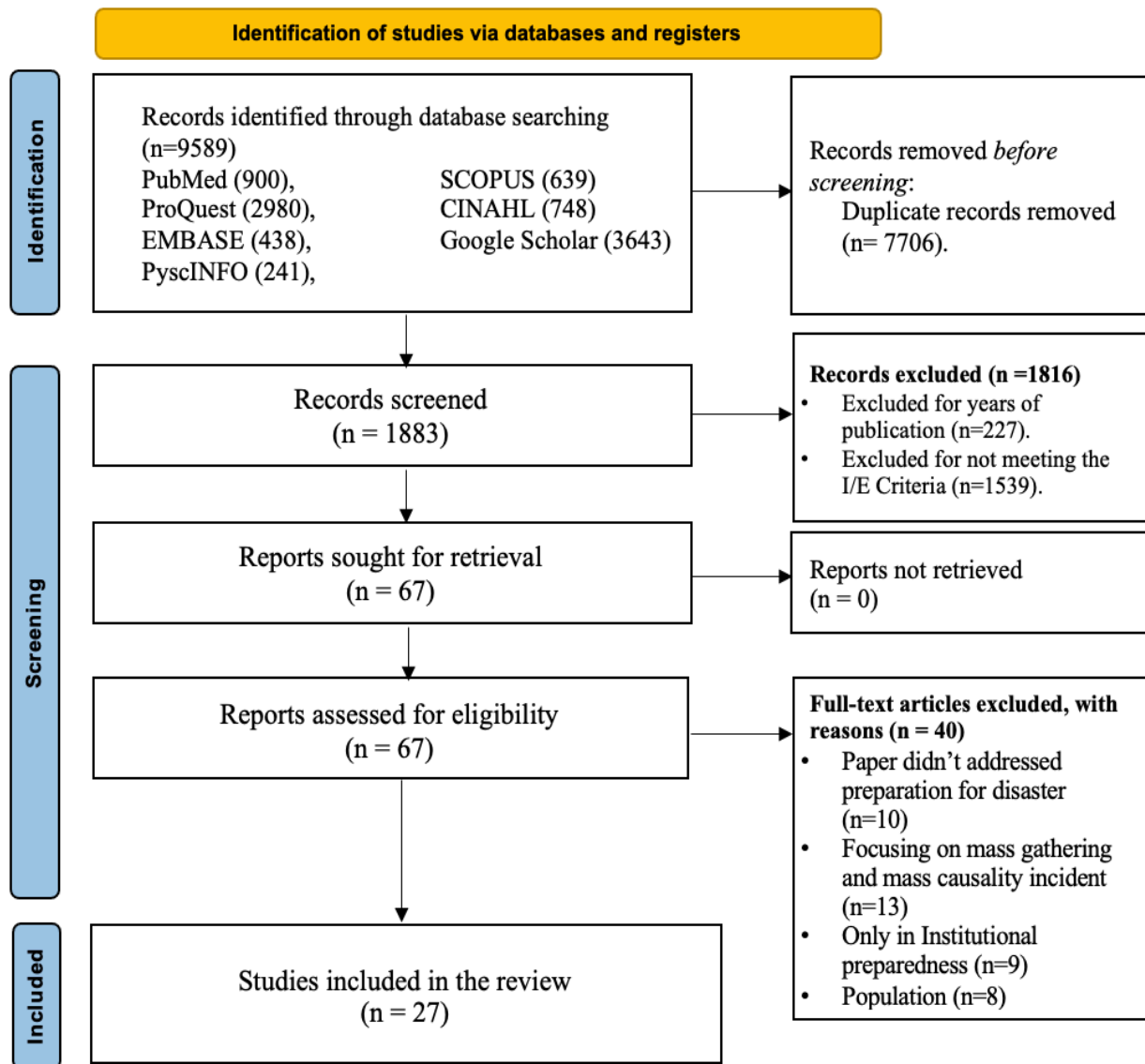
<p>Inclusion Criteria</p> <ul style="list-style-type: none"> • Published primary studies. • Studies published after 2005. This timeframe was chosen to ensure contemporary disaster literature was reviewed. • Studies published in English or at least had an English version. This was because the review published in English. • Studies focusing on disaster, disaster management, and disaster preparedness. • Studies that evaluated the perceived level of ‘preparedness’, or ‘perception’ of healthcare workers, such as physicians, nurses, and emergency medical service workers. • There was no geographic exclusion. The review was on all emergency healthcare workers regardless of their country of residence.
<p>Exclusion Criteria</p> <ul style="list-style-type: none"> • Studies relating to emergencies, mass gathering, and mass casualty incident (for example, road accidents). • Systematic reviews, narrative reviews, case reports, clinical audits, editor letters and short communications. • Studies including administrative, manager, or any other front-line workers rather than healthcare were excluded

Data Extraction and Analysis

The articles’ evaluation process is illustrated in Figure 2: PRISMA flow chart (Page et al., 2021). Search results were screened in abstract and full text by the authors (YA, AW, AH). All

conflicts were resolved by consensus. A data extraction form was developed in an Excel spreadsheet. Data extracted by the authors and conflict resolution were by consensus among the authors. A thematic approach was used to analyse the data. This thematic approach was based on the key review expected findings and outcomes. Thus, the extracted data was based on the basis of the authors, the key themes, key findings in the studies, and the study implications and limitations, respectively. The extracted data was therefore grouped based on the above dimensions which guided the entire analysis and results compilation process. The extraction and ranking of the studies were also based on the article's quality. In addition, the file contained data and groupings based on the number and type of participants (male and female), the type of emergency healthcare workers, the study instruments used, the main findings, and key study implications. Table 3 (Appendix 1) was developed as the evidence table for the review. The inclusion and exclusion are illustrated in Figure 2: PRISMA Flow chart (Page et al., 2021).

Figure 2: Prisma Flow Diagram for the Search Strategy & Results



IV. Results

The search revealed 9589 articles of which 7706 were removed following duplicate identification and application of the eligibility criteria. This yielded 1883 articles for screening in title and abstract, and further reduced to 67 after full text review, leaving 27 manuscripts for review, as described in the Figure (Figure 2: PRISMA Flow chart).

A) Quality Appraisal

The Mixed Methods Appraisal Tool was used to critically appraise the studies (Pace et al., 2012). Eleven studies passed all the criteria of methodological rigor (Ahayalimudin et al., 2012; Al Khalaileh et al., 2012; Al Thobaity et al., 2015; Al-Ali & Ibu Ibaid, 2015; Fung et al., 2008; Khan et al., 2017; Labrague et al., 2016; O'Sullivan et al., 2008; Özteki'n et al., 2016; Putra et al., 2011; Rizqillah & Suna, 2018). The studies by Lim et al. (2013) and Tzeng et al. (2016) did not clearly define their sampling strategy. Four studies (Berhanu et al., 2016; Goniewicz & Goniewicz, 2020; Nofal et al., 2018; Shahzad et al., 2018) used self-designed instruments which were not validated prior to the survey. The studies by King et al. (2019) and Brewer et al. (2020) had a high risk of non-response bias. These two studies were judged to be of strong methodological quality.

The study by Whetzel et al. (2013) was of weak quality as the sampling strategy was not clearly defined and a non-standardised, non-validated survey instrument was used. The study had a high risk of non-response bias and a very low response rate and the methodology did not describe which statistical method was used.

The studies by Hammad et al. (2011); Jacobson et al. (2010) and Duong (2009) only met two criteria and were judged to be of weak methodological quality. These three studies did not clearly define their sampling strategies, did not use a standardised or validated instrument and had a high risk of non-response bias. Risk of non-response bias was not clear in the studies by Baack and Alfred (2013) and Usher et al. (2015) but both studies were judged to be of strong methodological quality.

Even though some of the articles were evaluated as low quality, all were included. The authors of the Mixed Methods Appraisal tool recommended to include all the studies and their recommendation were considered (Pace et al., 2012). The obtained findings were analysed

thematically by the addressed themes and tools used in analysing and examining the perceived preparedness for disaster management.

B) Summary and Characteristics of the Studies

Majority of the studies included in this review were cross-sectional. A summary of the results and characteristics of the included studies can be found in Table 3 (Appendix 1). The table sorted by country to demonstrate the country of origin for each of the studies. Most studies were conducted in the USA; three in Australia, two were conducted in Saudi Arabia, Jordan, Pakistan and Indonesia (Table 3, Appendix 1). There were 31947 participants in the 27 studies included in this review. Of these, 17922 (56.1%) were female while 14175 (43.9%) were male. Six studies did not specify the gender of the participants (Baack & Alfred, 2013; Duong, 2009; Fernandez et al., 2011; Hodge et al., 2017; Jacobson et al., 2010; Whetzel et al., 2013). Most studies focused on the registered nurses working in emergencies (Fung et al., 2008; Khan et al., 2017; Özteki'n et al., 2016; Tzeng et al., 2016; Usher et al., 2015; Whetzel et al., 2013). Others included different healthcare workers, including doctors and paramedics (Al-Ali & Ibu Ibaid, 2015; King et al., 2019; Putra et al., 2011; Shahzad et al., 2018). A variety of assessment tools were used.

Most studies used the Disaster Preparedness evaluation tool (DPET) (Al Khalaileh et al., 2012; Al Thobaity et al., 2015; Al-Ali & Ibu Ibaid, 2015; Brewer et al., 2020; King et al., 2019; Özteki'n et al., 2016; Rizqillah & Suna, 2018; Usher et al., 2015). Other tools EPIQ/Nurses Assessment of Readiness (NAR) (Baack & Alfred, 2013; Hodge et al., 2017), and the Public Health Nurses' Perceived Ability to Practice Regarding Disaster Management Questionnaire (PHNPP-DMQ) (Nofal et al., 2018; Putra et al., 2011). All these instruments are self-report measures.

Twenty-four (n=24) studies assessed emergency healthcare workers' disaster preparedness in general disaster situations. Two studies assessed preparedness in response to bioterrorism (Fernandez et al., 2011; Jacobson et al., 2010). Three studies included natural disasters, disease outbreaks; nuclear/chemical/biological/radiological weapons attack (Lim et al., 2013; O'Sullivan et al., 2008; Rizqillah & Suna, 2018).

C) Perception of Disaster Preparedness

Ten studies focused on emergency health workers' perceptions of their disaster preparedness. These perceptions were based on their institutions' levels of preparedness including the existence of a disaster management plan, chain of command in disaster situation, and clear evacuation procedure to follow in disaster. Others included the workers perceived role in disasters and self-reported level of preparedness. The perception of preparedness varied (Al Khalaileh et al., 2012; Al-Ali & Ibu Ibaid, 2015; Berhanu et al., 2016; Khan et al., 2017; Özteki'n et al., 2016) with notable regional differences. Middle Eastern and Asian nations, such as Saudi Arabia, Jordan, Indonesia, and Pakistan, recorded a moderate or low perception of preparedness (Ahayalimudin et al., 2012; Al Thobaity et al., 2015; Al-Ali & Ibu Ibaid, 2015; Berhanu et al., 2016; Khan et al., 2017; Nofal et al., 2018; Rizqillah & Suna, 2018; Usher et al., 2015). This was in contrast to findings in countries such as the USA, and Australia which had a higher perception of disaster management preparedness (Baack & Alfred, 2013; Brewer et al., 2020; Duong, 2009; Fernandez et al., 2011; Hodge et al., 2017; Jacobson et al., 2010; King et al., 2019; Whetzel et al., 2013).

The perception of disaster preparedness also appeared to vary according to the qualifications and level of experience of emergency healthcare workers. Healthcare workers indicated a low-level perceived preparedness with a significant proportion not having read, or been aware of, preparedness guidelines, manuals, and policies (Duong, 2009; Khan et al., 2017;

Özteki'n et al., 2016; Shahzad et al., 2018). This was in contrast to the experienced nurses and healthcare workers who reported a higher level of preparedness (Ahayalimudin et al., 2012).

D) Factors Affecting Disaster Preparedness

Several factors were reported to influence emergency healthcare worker perceptions of disaster preparedness. These included the level of education/training (King et al., 2019; Lim et al., 2013; Özteki'n et al., 2016), place of work (Al-Ali & Ibu Ibaid, 2015; Hodge et al., 2017) and previous experience in disaster (Ahayalimudin et al., 2012; Al Thobaity et al., 2015; Brewer et al., 2020; Usher et al., 2015). Studies demonstrated male respondents reported a higher preparedness index than their female peers (O'Sullivan et al., 2008). Full time reported higher preparedness levels than part-time employees (Labrague et al., 2016; O'Sullivan et al., 2008). Also, emergency healthcare workers with more experience in managing disaster situations reported higher preparedness levels (Al Thobaity et al., 2015; Berhanu et al., 2016; Tzeng et al., 2016). This was due to the lessons learned and the significant reduction of other negative variables, such as the risk of fear and anxiety (Goniewicz & Goniewicz, 2020; King et al., 2019). Military workers who had increased experience reported higher preparedness and skills than emergency healthcare workers in other professions (Al Thobaity et al., 2015; Tzeng et al., 2016). Equally, the level of training and the extent of skills learnt in the training programs was illustrated as an influencing factor (Ahayalimudin et al., 2012; Al-Ali & Ibu Ibaid, 2015; Fernandez et al., 2011; Goniewicz & Goniewicz, 2020; King et al., 2019; Lim et al., 2013; Rizqillah & Suna, 2018; Tzeng et al., 2016).

The emergency healthcare workers with frequent, rigorous, and practical based skills, such as simulations and drills perceived they were more prepared than peers without access to such facilities (Ahayalimudin et al., 2012; Berhanu et al., 2016; Khan et al., 2017; Rizqillah & Suna, 2018). This correlates with the findings of several studies who demonstrated that hours

and quality of training were correlated to the level of preparedness (Khan et al., 2017; Usher et al., 2015; Whetzel et al., 2013). Overall, the studies in the review identified that participants were also better prepared to respond to infectious disease outbreaks and natural hazards rather than chemical, biological, radiological, and nuclear events (CRBN) (Hodge et al., 2017; Khan et al., 2017).

V. Discussion

The review findings indicate perceived preparedness varied according to the past experiences of emergency healthcare workers with disaster scenarios. Critical examinations of the findings indicate a geographical variance based on the national level of income. High-income nations had a higher preparedness perception index compared to the low preparedness perception pattern among low-income nations. As such, emergency healthcare workers in western countries reported a higher level of preparedness than those in developing countries. This disparity may be due to the differences in resourcing among the healthcare systems between developed and developing countries (Angamo et al., 2016). Developed countries, have established healthcare systems which include training, and the provision of equipment for their emergency healthcare workers (Angamo et al., 2016; Bayntun et al., 2012; Othman et al., 2014). Developed countries have a higher rate of disaster handling and protective equipment to increase their emergency healthcare workers' safety and well-being. The increased Gross Domestic Product (GDP) and economic growth allow for higher budgetary allocations to the healthcare and disaster management agencies, ensuring that they have modern state of the art equipment (Angamo et al., 2016; Bayntun et al., 2012).

Findings from the review indicate that emergency healthcare workers' perception is impacted by contextual factors such as level of training and exposure, work, experience levels, and the type of disaster. Thus, it appears that the level and nature of training directly impacts

the perceived preparedness for disaster management. The level of training also appears linked to the emergency healthcare workers' level of education. Emergency healthcare workers with a higher knowledge and training levels have better skills, expertise, and understanding of the strategic ways to handle and relate to disaster survivors. Those with a lower training index are less informed and less prepared in handling disaster situations and caring for the survivors (Labrague et al., 2016). One of the strategies and tools to improving the training programs is through virtual reality (VR). The simulated environments allow an interaction with the disaster scenarios, hence creating experience (Kilmon et al., 2010). With VR training, emergency healthcare workers indicate a higher disaster preparedness index. Disaster simulations are used to evoke exposure and trigger emergency disaster based decision-making process among the emergency healthcare workers. Exposure to simulated disaster situations increases workers' confidence in their skills and expertise (Farra et al., 2015; Kilmon et al., 2010).

The review demonstrated the variances in preparedness (knowledge) based on the type of disaster. Natural disasters such as floods, hurricanes, and earthquakes have a natural fault line meaning that they occur more in some areas than in others. Emergency healthcare workers had a higher perception of preparedness based on disasters with a high likelihood to occur in their locations. For instance, nations with an expansive coastline are at a higher risk of experiencing hurricanes and tsunami waves (Chapman & Arbon, 2008; Labrague et al., 2016). Equally, countries with fault lines are more likely to experience earthquakes, while flat and low-lying nations are predisposed to flooding. Nations develop and align their disaster management system according to their disaster risk register and matrix. Therefore, the emergency healthcare workers felt prepared for disasters that their respective countries and regions were predisposed to due to their respective governments' bias in training, skills development, and resource allocation. The findings indicate an emphasis on training and skills development. However, there is also the possibility that the perceived low preparedness index

among emergency healthcare workers in low-income countries could be as a result of the awareness levels. There is relatively limited information flow in the developing and low-income countries as contrasted to high-income countries. Thus, an alternative recommendation in improving perception is to not only focus on awareness generation, but also on increasing the preparedness strategies communication among and across all levels of the emergency healthcare workers (Farra et al., 2015; Kilmon et al., 2010).

This review's key strengths are in the geographically diverse approach. The review included studies from different sixteen countries. Also, this review looked for disaster preparedness under the CRED definition which ensures that all included studies adhered to the international standards for disaster preparedness. Additionally, the studies were all published post-2005. This timeframe was chosen to ensure contemporary disaster literature was reviewed. However, a limitation of the review was that it was not able to distinguish between natural and human-made disasters and could not therefore explore if there were differences in preparation. A further limitation of the review was based on its methodological approach. It focused predominantly on primary literature on the topic. This excluded a large pool of possible data and articles, thus their exclusion from the study. Equally, it only adopted and used articles published in the English language. The elusion meant that relevant and applicable studies in other languages that potentially have rich contents on disaster management and preparedness were excluded. Finally, the review had shortcomings on the lack of use of grey literature as none was established even after the search.

A limitation of this review was that included studies completed in low-income countries had relatively lower samples of executive level emergency healthcare workers. Additionally, they were conducted within limited periods of time. This represents a limitation in their design, applicability of their results, and could explain the low perceived preparedness. Comparatively,

studies from high-income countries incorporate a higher number of management and executive level emergency healthcare workers who are conversant with preparedness policy responsible for ensuring the emergency workers preparedness.

VI. Conclusion

The developed review has delivered on the aim of exploring the scope of emergency healthcare workers' perceived preparedness for disaster management. This review indicates that the perceived level of disaster preparedness varies among emergency healthcare workers. While some emergency healthcare workers perceive their preparedness as sufficient, others feel it is insufficient. This underscores the need to evaluate and consider the emergency healthcare workers perceptions on their preparedness and expertise before engaging them in a disaster situation. Understanding their perception helps structure their training and awareness programs. While as some nations and regions have an acceptable level of preparedness, there is a low to moderate preparedness index among developing counties. This is an aspect that needs addressing among the respective nations in the future.

Disaster training and experience are common factors that improved disaster preparedness. Additional improved training such as VR and disaster scenario simulations are needed. More work is required to improve emergency healthcare workers preparation for disasters. Further studies are required to examine the effectiveness of training strategies and how it varies from one country to the other.

VII. Relevance to Clinical Practice

The clinical practice implications are based on the emergency healthcare workers' perception of their preparedness for disaster management. It emerges that although nations and the international community has invested in developing their disaster preparedness, the emergency healthcare workers remain unconvinced of their preparedness. EMS workers feel they need

more preparation, which includes strategies for clinical preparedness. Moreover, the review findings show that more work is required to improve emergency healthcare workers preparation for disasters. The results demonstrate a relatively low and medium perception of preparedness for emergency healthcare workers in developing countries, such as Indonesia, Jordan, Pakistan, and Saudi Arabia. An understanding of the level of preparedness and the influencing factors on the healthcare workers' perceived preparedness levels is vital. This understanding would help inform policy and infrastructure including funding and legislation. In addition, the review indicates the impact of experience and training on perception of preparedness.

Source of Funding

No Funding.

2.3 Updated Literature Review

Several new studies have been published that assess the knowledge, skills, and preparedness of healthcare workers during disasters since the publication of the integrative review (Almukhlifi et al., 2021) in 2021. This section will discuss the relevant studies published after 2021 in two sections – (i) studies conducted on the knowledge, skills, and preparedness of healthcare workers in relation to general disasters, and (ii) studies conducted specifically on the preparedness of healthcare workers with respect to the COVID-19 pandemic.

The COVID-19 viral outbreak was declared a pandemic by the WHO on 11th March 2020. Emergency departments braced for unprecedented presentations of infected patients as the disease rapidly spread across the globe (O'Connor et al., 2021). Large infectious outbreaks are fundamentally different from sudden onset large-scale events as they require a prolonged and sustained response (Schreyer et al., 2020). The main challenges involved in such a response include frontline staff protection, surge capacity, and the segregation of potentially infected patients (Nadarajan et al., 2020; Paganini et al., 2020). This section will review studies assessing the disaster preparedness of healthcare workers in dealing with the COVID-19 pandemic.

2.3.1 Methodology

The MEDLINE (PubMed), Google Scholar, and ProQuest databases were searched using the same methodology as the published article from December 2020 to June 2022 (Section B-Data collection, Page 16). Hand searching of the reference lists of included articles was also completed to identify additional articles. The results of the search were subjected to title, abstract, and full text screening using the same eligibility criteria. The findings of the updated literature will be presented as two separate sections: 2.3.2) studies assessing the knowledge, skills, and preparation of healthcare workers related to disaster preparedness, and 2.3.3) studies

assessing the knowledge, skills, and preparation of healthcare workers in relation to COVID-19 pandemic.

2.3.2 Results

2.3.2.1 Studies conducted in relation to general knowledge, skills, and disaster preparedness of healthcare workers

2.3.2.1.1 General characteristics of the studies

Twenty-one studies have been added to the literature since the last published review that assess healthcare workers' knowledge, skills, and preparedness for disasters. These studies were conducted in a wide range of countries, and their characteristics are presented in Table 4 (Appendix 2). Seventeen studies were cross-sectional, and three were mixed-methods. A further study was qualitative. Eleven studies were conducted exclusively on nurses, seven on all health professionals, three on pharmacists, and one study focused on occupational therapists.

2.3.2.1.2 Knowledge of disaster preparedness

Nine studies assessed participants' knowledge in a variety of disaster types. The updated literature demonstrated different levels of knowledge in the included studies. Four studies used the Disaster Preparedness Evaluation Tool (DPET) (Hasan et al., 2021; Setyawan et al., 2021; Younus et al., 2021; Sulistyadi et al., 2021) to assess healthcare workers' knowledge about disasters, including assessment for attending disaster-related classes, seminars, research, and understanding of the chain of command (Hasan et al., 2021; Setyawan et al., 2021; Younus et al., 2021; Sulistyadi et al., 2021). Three studies reported a moderate level of disaster knowledge among participants (Hasan et al., 2021; Setyawan et al., 2021; Younus et al., 2021), while one study reported a higher knowledge level (Sulistyadi et al., 2021). Another study used the Emergency Preparedness Information Questionnaire (EPIQ) and reported lower knowledge of disaster preparedness (Tilahun et al., 2021).

Four studies assessed knowledge mean scores using a self-designed tool (Al-Wathinani et al., 2021; Al-Ziftawi et al., 2021; McCourt et al., 2021; Nofal et al., 2021). In Saudi Arabia, two studies used a self-designed tool to assess healthcare workers' knowledge and their operational procedures for flooding (Al-Wathinani et al., (2021) and nuclear attacks (Nofal et al., 2021). Most participants demonstrated a moderate level of knowledge and familiarity with roles within the hospitals' operation system (Al-Wathinani et al., 2021; Nofal et al., 2021). Another study developed a tool consisting of three sections to examine Qatari healthcare workers' knowledge, readiness, and attitudes regarding disaster preparedness (Al-Ziftawi et al., 2021). The knowledge sections included 22 yes/no questions. Most participants (58%, n=75) reported a moderate level of knowledge regarding disaster preparedness (Al-Ziftawi et al., 2021). Lastly, McCourt et al. (2021) used a self-designed tool to evaluate the disaster knowledge of Australian pharmacists regarding their understanding of types of disaster and their knowledge of disaster health effects. The study found that (70%, n=62) of the participants reported a moderate understanding of disasters (McCourt et al., 2021).

The knowledge of healthcare workers was compared with different variables (gender, age, roles and responsibilities, education, years of experience, previous experience, type of healthcare worker, and institution). Two studies found that gender significantly affected the disaster preparedness knowledge of healthcare workers (Al-Wathinani et al., 2021; Tilahun et al., 2021). Al-Wathinani et al. (2021) found that male (77%, n=174) workers reported more awareness of the hospital's standard operating procedure and confidence in managing a flood scenario (Al-Wathinani et al., 2021), while Tilahun et al. (2021) reported that male workers (66.7%, n=68) better understood their hospitals' roles and disaster procedures.

As well as gender, four studies found that the academic degree attained by healthcare workers increased their knowledge of disaster preparedness (Al-Ziftawi et al., 2021; Hasan et

al., 2021; Nofal et al., 2021; Younus et al., 2021). Two studies explored healthcare workers' knowledge, skills, and preparedness for disasters in Bangladesh (Hasan et al., 2021; Younus et al., 2021). The authors reported that healthcare workers with a master's degree reported higher knowledge than those with a diploma. Similarly, Al-Ziftawi et al. (2021) and Nofal et al. (2021) found that workers with a doctorate showed a higher knowledge score than workers with a bachelor's degree.

Age was an important predictor of disaster preparedness knowledge in seven studies (Al-Ziftawi et al., 2021; Hasan et al., 2021; Nofal et al., 2021; Younus et al., 2021; Schumacher et al., 2021; Setyawan et al., 2021; McCourt et al., 2021), positively correlating with prior disaster experience in these studies. Having prior experience in responding to disasters was positively associated with better knowledge scores. Studies using age and prior experience as a variable found that participants in the higher age groups showed significantly better knowledge scores than those in the lower age groups (Hasan et al., 2021; Nofal et al., 2021; Younus et al., 2021; Schumacher et al., 2021; Setyawan et al., 2021; McCourt et al., 2021). However, this was contradicted by Al-Ziftawi et al. (2021), who found that younger workers reported higher knowledge than their older peers. This association may be related to the increased training focus in the education system in Qatar recently (Al-Ziftawi et al., 2021).

Lastly, the type of hospital (military/government) affected the knowledge of healthcare workers in two studies (Al-Ziftawi et al., 2021; Hasan et al., 2021). Both studies reported that healthcare workers working in military hospitals had significantly better disaster knowledge than those working in public hospitals (Al-Ziftawi et al., 2021; Hasan et al., 2021).

2.3.2.1.3 Skills of disaster preparedness

Six studies in the updated literature review assessed skills related to disaster preparedness. Three studies used DPET to assess healthcare workers' disaster skills (Hasan et al., 2021;

Sulistyadi et al., 2021; Younus et al., 2021), and one used the EPIQ to assess disaster skills and competency among Swedish nurses (Murphy et al., 2021). Another study used the Nurses Perceptions of Disaster Core Competencies Scale (NPDCC) to assess disaster skills (Chegini et al., 2022). These skills and core competencies included critical thinking, general diagnostic skills, special diagnostic skills, and technical and communication skills. Finally, one study used a self-designed tool to evaluate the disaster skills of Australian pharmacists regarding their use of emergency kits, first aid, and wound aid certifications (McCourt et al., 2021). Despite using different scales to measure healthcare workers' disaster skills, all the studies reported a moderate skills level for disasters (Chegini et al., 2022; Hasan et al., 2021; McCourt et al., 2021; Sulistyadi et al., 2021; Younus et al., 2021; Murphy et al., 2021).

Five studies associated prior experience with higher disaster skills in two different ways (Chegini et al., 2022; Hasan et al., 2021; McCourt et al., 2021; Murphy et al., 2021; Younus et al., 2021). First, prior disaster response experience was positively associated with better disaster preparedness skills (Hasan et al., 2021; McCourt et al., 2021; Murphy et al., 2021; Younus et al., 2021), and secondly, prior clinical experience was also positively associated with better disaster preparedness skills (Chegini et al., 2022; Hasan et al., 2021; Murphy et al., 2021).

The type of hospital was a predictor of better disaster preparedness competency and skills in two studies (Younus et al., 2021; McCourt et al., 2021). Younes et al. (2021) found that nurses working in military hospitals reported better disaster skills than their peers working in the government. McCourt et al. (2021) reported the same finding that Australian pharmacists working in public hospitals reported better skills and confidence to respond to disasters. The authors also indicated that the pharmacists' role in the workplace correlated with increasing their disaster skills (McCourt et al., 2021).

Academic qualifications correlated with better disaster preparedness in four studies (Chegini et al., 2022; McCourt et al., 2021; Murphy et al., 2021; Younus et al., 2021). Healthcare workers with higher qualifications reported higher disaster skills. Murphy et al. (2021) reported that combining educational qualifications and teaching increased healthcare workers' skills for disasters (Murphy et al., 2021).

Lastly, two studies found that age correlated positively with disaster preparedness competency and skills (Chegini et al., 2022; Younus et al., 2021), while Hassan et al. (2021) revealed that professional growth is not enough to increase disaster skills, and so workers should take more disaster training to increase their skills for disasters.

2.3.2.1.4 Perceived disaster preparedness

Eighteen studies in this review described self-reported disaster preparedness among healthcare workers. Disaster preparedness was assessed and described by using different tools. Eight studies used standardised tools to assess disaster preparedness among healthcare workers, with four using the EPIQ (Baker, 2022; Emaliyawati et al., 2021; Murphy et al., 2021; Tilahun et al., 2021), three using the DPET (Hasan et al., 2021; Sulistyadi et al., 2021; Younus et al., 2021), and one using the NPDCC (Chegini et al., 2022). Mean disaster preparedness scores were obtained using self-designed closed-ended questionnaires in eight studies (Al-Wathinani et al., 2021; Goniewicz et al., 2021; McCourt et al., 2021; Nofal et al., 2021; Schumacher et al., 2021; Setyawan et al., 2021; Shah et al., 2021; Zhao et al., 2021), while two studies conducted in Pakistan used self-designed, semi-structured interviews (Khilji et al., 2021; Shah et al., 2021). Despite the differences in assessing disaster preparedness, none of the studies reported a higher level of disaster preparedness among healthcare workers. Four studies found low self-reported disaster preparedness (Al-Wathinani et al., 2021; Baker, 2022; Emaliyawati et al., 2021; Murphy et al., 2021), one found a low-moderate level (McCourt et al., 2021), and

six studies reported a moderate level of disaster preparedness (Chegini et al., 2022; Goniewicz et al., 2021; Hasan et al., 2021; Setyawan et al., 2021; Sulistyadi et al., 2021; Tilahun et al., 2021; Younus et al., 2021),

Demographic characteristics were shown to affect disaster preparedness positively among healthcare workers. Age demonstrated similar patterns in relation to preparedness as did knowledge and skills (Baker, 2022; Chegini et al., 2022; Tilahun et al., 2021; Younus et al., 2021). Baker et al. (2022) evaluated Saudi Arabian nurses' self-perceived familiarity with disaster preparedness according to their personal and workplace factors. The study categorised factors of disaster preparedness by three age groups (< 30 years, 31-40 years, and > 40 years). Nurses aged 31-40 years had better preparedness than other workers in the other age groups (Baker, 2022), although one study in Ethiopia divided age into two groups (20-30 years and 31-53 years) (Tilahun et al., 2021). A larger proportion (64.7%, n=66) of the study aged between 20-30 years reported better preparedness than their older colleagues (Tilahun et al., 2021). However, this reflected the younger population, which is inconsistent with other studies assessing nurses in Iran (Chegini et al., 2022) and Bangladesh (Younus et al., 2021). These studies found that older participants (>40 years) had better disaster preparedness than their younger counterparts (Chegini et al., 2022; Younus et al., 2021).

Similarly, Saudi male nurses (21.2%, n=70) reported better preparedness than their female counterparts (Baker, 2022), while other studies assessing nurses' preparedness in Iran (Chegini et al., 2022) and Ethiopia (Tilahun et al., 2021) reported that female workers showed better preparedness for disasters.

Perceptions of disaster preparedness also correlated positively with higher academic qualifications (Baker, 2022; Chegini et al., 2022; Hasan et al., 2021; McCourt et al., 2021; Murphy et al., 2021; Younus et al., 2021). For example, McCourt et al. (2021) and Younus et

al. (2021) found that healthcare workers with higher qualifications reported more confidence and preparedness for disasters than others.

Eight studies found that healthcare workers who had prior experience in responding to disasters showed greater preparedness than those without experience (Chegini et al., 2022; Emaliyawati et al., 2021; Hasan et al., 2021; McCourt et al., 2021; Murphy et al., 2021; Tilahun et al., 2021; Younus et al., 2021; Schumacher et al., 2021). Similarly, disaster training was shown to be associated with better disaster preparedness among healthcare workers (Balut et al., 2022; Emaliyawati et al., 2021; Goniewicz et al., 2021; Hasan et al., 2021; McCourt et al., 2021; Murphy et al., 2021; Tilahun et al., 2021; Younus et al., 2021).

2.3.2.2 Studies conducted on the preparedness of healthcare workers for the COVID-19 pandemic

2.3.2.2.1 General characteristics of the studies

COVID-19 has received significant research focus since the disease reached global pandemic proportions in 2020. Since the publication of the previous integrative review by Almukhlifi et al. (2021), ten studies have focused on the COVID-19 pandemic preparedness of healthcare workers. One used a qualitative design (Iddrisu et al., 2021), while the remaining studies were cross-sectional. These studies were performed in several different countries with most conducted exclusively on nurses. Some studies explored the disaster preparedness of other healthcare workers including pharmacists, physicians, and paramedics. The characteristics of these studies are summarised in Table 5 (Appendix 3).

2.3.2.2.2 Knowledge of COVID-19 pandemic preparedness

Six studies in the updated literature review assessed knowledge of COVID-19 pandemic preparedness. These studies assessed the knowledge of healthcare workers about the pandemic

and assessed healthcare worker knowledge of protocols and competencies required to prevent and manage the infection (Farghaly et al., 2022; Alrajhi et al., 2022; Hong et al., 2022; Iddrisu et al., 2021; Li et al., 2021; Suwaryo et al., 2022).

The studies graded the knowledge of the participants in different ways. Two studies used the DPET survey to assess healthcare workers' mean knowledge scores in Saudi Arabia (Farghaly et al., 2022) and Korea (Hong et al., 2022). Both studies reported a moderate knowledge level among the participants (Farghaly et al., 2022; Hong et al., 2022). Farghaly et al. (2022) reported a significant positive correlation between overall knowledge and level of education and previous training experience. Older participants with higher academic degrees and more years of experience had better knowledge of disaster preparedness (Farghaly et al., 2022). In contrast, the level of knowledge was unaffected by all demographic variables in the study by Hong et al. (2022). Suwaryo et al. (2022) used the EPIQ survey to determine the relationship between knowledge and disaster preparedness during COVID-19. The participants reported a moderate level of knowledge regarding COVID-19 preparedness. Female nurses (60%, n=39) showed more knowledge and awareness of COVID-19 than male nurses (Suwaryo et al., 2022).

Two studies used a non-standardised tool to assess knowledge of COVID-19 preparedness (Alrajhi et al., 2022; Li et al., 2021). One study assessed healthcare workers in Saudi Arabia regarding their preparedness knowledge and awareness for COVID-19 (Alrajhi et al., 2022). The study used three domains to assess knowledge of COVID-19 among healthcare workers (participants' precautionary measures; actions dealing with suspected, probable, confirmed cases; and transmission of the disease). Participants reported a high total knowledge score across all three domains (Alrajhi et al., 2022). However, participants in military hospitals had better knowledge than those working in government hospitals due to the

increased availability of equipment and training resources (Alrajhi et al., 2022). Another study examined Australian emergency clinicians' knowledge and experience in managing COVID-19 (Li et al., 2021). Participants were asked to rate their knowledge levels, with most rating their knowledge as either "good" (42%, n=205) or "very good" (24%, n=119) (Li et al., 2021). However, the authors did not assess the effect of various demographic characteristics on participants' knowledge regarding COVID-19 preparedness (Li et al., 2021).

2.3.2.2.3 Disaster competencies and preparedness during COVID-19

All studies in the literature review assessed disaster competencies and preparedness with respect to the COVID-19 pandemic except one (Alrajhi et al., 2022). These studies used different methodologies to assess disaster preparedness. Four used standardised instruments to grade the disaster preparedness of participants and found varying results (Farghaly et al., 2022; Hong et al., 2022; Suwaryo et al., 2022; Karnjus et al., 2021). Two studies that used the DPET found that overall disaster preparedness among participants was reported to be moderate (Farghaly et al., 2022; Hong et al., 2022). However, Hong et al. (2022) found the highest score for the prevention (pre-disaster) stage, followed by the mitigation (response) and recovery (post-disaster) stages, while another study using the EPIQ instrument reported a moderate to high level of disaster preparedness among the participants (Suwaryo et al., 2022). One study used the disaster nursing core competencies scale (DNCCS) to assess Slovakian nurses' disaster competencies regarding COVID-19 (Karnjus et al., 2021). The mean preparedness score was reported by measuring the nurses' perceived core competencies, roles, and responsibilities for disasters, and the potential barriers to building essential skills for disaster nursing. This study reported a high preparedness level among nurses in relation to the COVID-19 pandemic (Karnjus et al., 2021).

Five articles used non-standardised instruments to assess healthcare workers' disaster preparedness for COVID-19 (ElGeed et al., 2021; Moheimani et al., 2021; Richmond et al., 2021; Li et al., 2021; Iddrisu et al., 2021). One study in Iran utilised a unique approach to measuring the pandemic preparedness of healthcare workers (Moheimani et al., 2021). The authors used rough set mathematical theory proposed by Pawlak (1991) to manage inaccurate and incomplete data. The study employed three experts (experienced doctors in high-level administrative positions) from each hospital and used a self-designed questionnaire consisting of 13 items related to functional preparedness. The study did not provide overall pandemic preparedness scores but focused on indicators that lead to low or high preparedness (Moheimani et al., 2021). Another study that used non-standardised instruments reported that Australian emergency clinicians' were moderate to extremely prepared (Li et al., 2021). This was similar to a study conducted on pharmacists in Qatar that reported either agreement or strong agreement on adequate preparation for the COVID-19 pandemic (ElGeed et al., 2021).

A range of different factors were reported to affect the disaster preparedness of healthcare workers during the COVID-19 pandemic. The type of hospital or health facility in which the participants worked was significantly associated with disaster preparedness in three studies (ElGeed et al., 2021; Karnjus et al., 2021; Richmond et al., 2021). More years of experience was another important factor that led to better disaster preparedness (Farghaly et al., 2022; Hong et al., 2022; Iddrisu et al., 2021), as did prior training and a higher level of education/higher academic degree (Farghaly et al., 2022; Hong et al., 2022; Richmond et al., 2021). Similarly, older age and prior education on emerging infectious disease response positively correlated with better disaster preparedness (Hong et al., 2022).

Participants in four studies understood the importance of personal protection equipment (PPE) for self-protection against COVID-19 (Alrajhi et al., 2022; ElGeed et al., 2021; Li et al.,

2021; Richmond et al., 2021). Participants in two studies had already attended training for the use of PPE (Iddrisu et al., 2021; Li et al., 2021), and other participants attended training specifically for the proper putting on and removal of PPE (Hong et al., 2022; Iddrisu et al., 2021; Richmond et al., 2021). However, participants in two studies expressed concerns about the lack of PPE availability for pharmacists (ElGeed et al., 2021; Li et al., 2021).

Two studies in the present review stated that the shortage of emergency medical equipment and medicines affected the preparedness of healthcare workers (Li et al., 2021; Moheimani et al., 2021), while other studies reported that setting up emergency operations centres was correlated with better preparedness for the pandemic (Richmond et al., 2021).

2.3.3 Discussion

The present literature's findings are consistent with the integrative review published in 2021 (Almukhlifi et al., 2021). The previous finding of low to moderate knowledge, skills, and preparedness for disasters was reinforced in the updated literature with most studies reporting either low or moderate levels. The present literature review reported studies from a wide geographical region covering developed nations such as Australia, the USA, Sweden, and the UK, and developing nations such as Indonesia, Saudi Arabia, Bangladesh, Iran, and Pakistan. These developing nations reported moderate disaster preparedness, indicating an upward trajectory in disaster preparedness in these countries (Hasan et al., 2021; Younus et al., 2021; Al-Wathinani et al., 2021; Nofal et al., 2021; Chegini et al., 2022; Tilahun et al., 2021; Setyawan et al., 2021).

Most studies reported moderate to high knowledge of COVID-19 disaster preparedness. These studies also reported a moderate to high level of disaster preparedness for the pandemic. The global spread and standardised nature of the pandemic with its modes of spread, clinical presentation, prevention, and management strategies made it easier for healthcare workers to

replicate management strategies for the COVID-19 pandemic. Healthcare workers with prior experience managing infectious diseases or epidemics such as Ebola or MERS have also reported better preparedness for COVID-19 (Iddrisu et al., 2021), indicating the ease of replication of management strategies in such diseases, which does not align with general disasters. This may be one of the reasons why COVID-19 preparedness was higher than general disaster preparedness in this updated review.

The updated literature review noted significant variability in the tools used for data collection, despite the increased global focus on disaster preparedness among healthcare workers since 2021 (Almukhlifi et al., 2021). Most studies exploring the preparedness of healthcare workers for the COVID-19 pandemic used non-standardised survey instruments with a wide variety of items. Only a few studies used standardised instruments such as DPET, EPIQ, or NPDCC to assess healthcare workers' general preparedness (Hasan et al., 2021; Setyawan et al., 2021; Younus et al., 2021; Sulistyadi et al., 2021; Baker, 2022; Emaliyawati et al., 2021; Murphy et al., 2021; Tilahun et al., 2021; Chegini et al., 2022), or COVID-19 preparedness for disasters (Farghaly et al., 2022; Hong et al., 2022; Suwaryo et al., 2022; Karnjus et al., 2021). This lack of standardisation raises concerns about whether these self-designed tools have been validated. Therefore, this review highlights the need for a more rigorous approach to exploring healthcare workers' preparedness for disasters.

This review found previous disaster response experience and training as an important finding that positively increased healthcare workers' preparedness for disasters. For example, healthcare workers in a country prone to natural disasters, particularly floods and earthquakes such as Bangladesh, demonstrated high familiarity with potential disaster vulnerabilities in their communities concerning their disaster knowledge (Hasan et al., 2021; Younus et al., 2021). This finding underlines the need to conduct further research with other nations that have

less disaster response experience. A disaster can happen anywhere at anytime. Therefore, healthcare workers are required to be equipped to respond and mitigate the negative consequences of a disaster on the affected region or nation.

The nature of the research into disaster preparedness among healthcare workers has been altered by the explosion of research focused on the COVID-19 pandemic. This body of work has reshaped the focus of research in this area as there is a clear distinction in the impact and responses to pandemic disasters as opposed to general disasters. Pandemics, and more specifically the COVID-19 pandemic, is considered as a long-term public health emergency. This is because of the magnitude of social disruption and economic instability it has caused. The high mortality rates are much larger than in most natural disasters, which cause temporary damage to infrastructure and require a localised response that may vary between places, countries, and medical services (Wang et al., 2021).

Three studies found gender to be correlated with disaster knowledge and preparedness, whereas age was an inconclusive variable. For example, two studies conducted in Saudi Arabia reported gender as an important predictor of knowledge regarding disaster preparedness (Al-Wathinani et al., 2021; Baker, 2022). Both studies found that males were more knowledgeable and prepared for disasters, including in areas such as incident command systems, triage, hospitals' standard operating procedures, and managing a flood scenario (Al-Wathinani et al., 2021; Baker, 2022). It was not clear from these studies why gender affected disaster preparedness. A possible reason could be that these findings may reflect the culture from which the studies were conducted.

Workplace resources play an instrumental role in managing general disasters and COVID-19 effectively. Several studies describe the challenges regarding scarcity of medications and medical equipment during the COVID-19 pandemic (Armocida et al., 2020;

Hopman et al., 2020). These studies associate the lack of medical equipment with the preparedness of healthcare workers. This is supported by other studies that correlate the setting up of emergency operations centres with better preparedness for the pandemic (Richmond et al., 2021; Karnjus et al., 2021; Suwaryo, et al., 2022). Participants in several studies state that it should be mandatory for all healthcare workers to wear personal protective equipment (PPE) and hospitals should provide enough PPE for all workers (ElGeed et al., 2021; Li et al., 2021; Richmond et al., 2021). Some healthcare workers believe that using PPE would protect them from spreading COVID-19 and help to keep them and their families safe (Li et al., 2021).

The updated literature indicates an increased focus on the COVID-19 pandemic. However, there is still overwhelming support suggesting that preparedness remains low to moderate. Lack of experience in disaster response and training for disaster preparedness were common themes observed throughout all the studies. Healthcare workers have globally expressed the need for further disaster education and training. This updated review emphasised the need for extra training and education opportunities in different areas, including emergency protocols and triage, use of PPE, and workflow management. More importantly is the need to provide healthcare workers with specific education and training for common disasters in their regions. Disaster-building activities may be important to increase healthcare workers' preparation for effectively responding to and managing disasters. These activities may involve disaster simulations and actual mock drills.

2.3.4 Summary

Since the published integrative review, twenty-one studies on disaster knowledge, skills, and preparedness, and ten on disaster preparedness during COVID-19, have been added to the updated literature review (Almukhlifi et al., 2021). While some studies assessed disaster preparedness in general, others assessed preparedness for infectious diseases such as COVID-

19. This shows how this pandemic has altered the focus and direction of disaster preparedness research from immediate response to prolonged response disasters. Most healthcare workers in different studies reported moderate knowledge, skills and preparedness levels for disasters. However, some areas of concerns were common among healthcare workers. These include insufficient knowledge and understanding of hospital policies and disaster guidelines and inadequate training for chemical, biological, radiological, and nuclear events (CRBN). This finding emphasise the need for extra training and education opportunities in these areas to increase healthcare workers' preparedness for disasters. Also, this updated review underlines the need to conduct more research from all countries and from all areas of clinical healthcare (Physician, Nursing, EMS and Pharmacist) to explore the facilitators and barriers towards their disaster preparedness.

2.4 Chapter Conclusion

The aims of the integrative review and the updated review were to assess the perceived disaster preparedness of healthcare workers. Both reviews demonstrated low to moderate perceived levels of disaster preparedness. However, one additional finding in the updated literature review was the slightly improved perception of disaster preparedness among healthcare workers from developing countries. Furthermore, healthcare workers reported moderate perceptions of disaster preparedness for disasters in their specific communities. This implies that these countries may be better prepared to handle common disasters in their regions. Both the initial and updated review demonstrate that disaster training and experience enhance healthcare workers' perceived abilities to handle disasters. Additional training is a commonly requested action by healthcare workers in the literature, with needs for further training in specific areas

Chapter 3: Research Methodology

3.1 Introduction

This chapter offers a detailed description of how the study data was determined, sourced, collected, analysed, presented and stored. It further explains the rationale for adopting an explanatory sequential mixed-methods approach. The chapter is clustered into five main sections. The first provides an understanding of the study paradigm and the justification for the pragmatic approach. The second section outlines the sourcing, collection, analysis, and presentation of the quantitative data. A section describing the qualitative methods and methodology follows this, preceding a section on data storage and management. Finally, the chapter details the ethical considerations for both the qualitative and quantitative research components as well as avenues and strategies adopted to ensure the research was conducted ethically and rigorously.

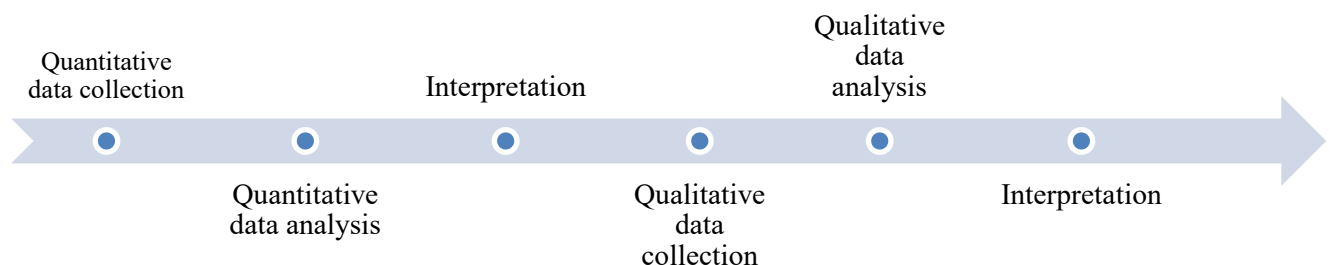
3.2 Research Paradigm and Methodology

This study uses a mixed-methods design to examine the disaster preparedness of Emergency Medical Service workers (EMS) in Saudi Arabia. This method is often aligned with the paradigm of pragmatism. Pragmatism emphasises that there is no single way of looking at the world (Tashakkori & Teddlie, 2010), and therefore, researchers need to use the best available tools to understand the world around them (Tashakkori & Teddlie, 2010). This is primarily achieved through combining research methods to comprehensively answer the research questions. Using a mixed-methods approach enables the study to deliver on not only the "what" component of our research question (quantitative component), but also the "how/why" component of the research question (qualitative component). In developing mixed-methods research, researchers can adopt 1) convergent parallel mixed-methods, 2) explanatory

sequential mixed-methods, or 3) exploratory sequential mixed-methods. These alternatives are defined by the timeline and the period within which the data sets are collected, as well as by the interaction and relationship between the quantitative and qualitative data sets (Gunasekare, 2015; Khaldi, 2017). This study used an explanatory sequential mixed-methods design, as illustrated in Figure 3 below.

In the quantitative part of the study, the survey provides an understanding of the perceived disaster knowledge, skills, and preparedness levels of EMS workers in Saudi Arabia. In the qualitative part, interviews are used to understand the needs of EMS workers and explore their perceived barriers and facilitators toward disaster preparedness. Therefore, pragmatic mixed-methods was suitable in this part to better understand the disaster preparedness of EMS workers in Saudi Arabia.

Figure 3: Explanatory Sequential Mixed-Methods Design (Creswell, 2014)



The researcher initiated the quantitative data collection phase using a cross-sectional survey design. The survey results were interpreted and used to inform the semi-structured interview questions in the qualitative arm of the study.

The aim of this study was to investigate the disaster preparedness of Emergency Medical Service workers (EMS) in Saudi Arabia.

The execution of the study was in a two-phase process, the aims of each phase are detailed below.

- Phase one: the aim was to determine the self-perceived disaster skills, knowledge, and preparation of EMS workers.
- Phase two: the aim was to understand the needs of EMS workers and to explore their perceived barriers and facilitators toward disaster management and preparedness.

3.3 Phase One: Quantitative Descriptive Study

3.3.1 Setting and Sampling

This study was conducted in Saudi Arabia (Significance of the study in Chapter One, Page 7). Saudi Arabia's hospital systems are managed under two governance structures: hospitals managed under the Ministry of Health (MOH) and hospitals managed by the Ministry of National Guard Health Affairs (NGHA). Six hospitals were selected for the study, three under each ministry. The selected hospitals are the largest hospitals in the country with many EMS workers. The MOH hospitals in this study are considered Class A with a bed capacity between 750 and 1,200 beds per hospital. The NGHA hospitals in this study have a bed capacity of 690 beds at each hospital. The hospitals in this study were selected to ensure appropriate representation of the EMS workforce in Saudi Arabia. Thus, two hospitals were selected in each of three major cities of Saudi Arabia (Riyadh, Jeddah, and Dammam). Riyadh is the capital city and is centrally located, Jeddah is in the western kingdom, and Dammam is located in the East (Figure 4). The total population of the three cities is 8,903,312 residents as of the 2016 census (General Authority for Statistics Kingdom of Saudi Arabia, 2017). There are approximately 2,000 EMS workers employed across the six hospitals.

Figure 4: Saudi Arabia



Note. Location of Saudi Arabia. Adapted from Google Maps.

A convenience sample was used to recruit potential participants who represent the study target population. The sample size was estimated using the following formula:

$$n = \frac{Z_{1-\alpha/2}^2 \mathcal{P}(1 - \rho)}{d^2}$$

Where, 'n' is the sample size, $Z_{1-\alpha/2}$ is the standard normal variate (at 5% Type 1 error and 95% CI [$p < 0.05$] it is 1.96), p is the expected proportion in the population based on previous studies, and d is the absolute error or precision. A minimum sample of 245 EMS workers was needed to produce statistically accurate results in this study according to this formula, with an expected proportion of 80% based on previous studies and a precision of 5%. Thus, the recruitment target of this study was 245 participants. However, a 20% non-completion rate was estimated among the participants; therefore, the study aimed to recruit 294 participants.

The study recruited EMS workers working for a minimum of one year at an MOH or NGHHA in Riyadh, Jeddah, and Dammam. No restrictions were placed on age, gender, or other demographic variables. This criterion was used to ensure that only relevant workers

participated in the study. The study excluded volunteer, administrative, and other healthcare workers from the study.

3.3.2 Data Collection Tool

Phase One of the study used a closed-ended questionnaire. The overall questionnaire design focused on two broad categories. The first collected the participants' demographic data such as their age, gender, level of education, experience in years, participation in disaster situations, and cities worked in, among others (Appendix 4).

The second category of the questionnaire was objective-based and developed from the DPET (Appendix 4) (Al Khalaileh et al., 2010; Labrague et al., 2018). The DPET survey uses 65 items to measure registered nurse as well as nurse practitioners' perceptions of their preparedness for disaster management. A total of 45 items are Likert-type questions with six response options ranging from strongly disagree to strongly agree (Gowing et al., 2017). The first 25 items relate to pre-disaster preparedness grouped into three categories: knowledge, disaster skills, and personal preparedness. The next 16 items relate to disaster response with items grouped into two categories: knowledge and patient management. The last six items were in relation to the recovery stage of the disaster, which is grouped into knowledge and management. Hospitals in Saudi Arabia employ the English language so the original version of the DPET has been used. Since this study targets EMS workers, the professional specialty titles "RN" (for Registered Nurse) and "Nurse Practitioner" were replaced with "EMS".

The DPET was used based on its relevance and validity for adoption. The tool was designed specifically to assess disaster preparedness. Previously, the DPET was used in studies that examined nurses' disaster preparedness (Al Khalaileh et al., 2012; Labrague et al., 2018; Brewer et al., 2020). However, this use has gradually changed over the years. The DPET has been increasingly adapted to assess disaster preparedness across many health professions, and

a rising number of studies have successfully adapted the tool to other populations of healthcare workers (Al-Ali & Abu Ibaid, 2015; King et al., 2019). As such, the DPET tool was considered appropriate to address the preparedness question raised in the study objectives (Chapter One, Page 9). Secondly, the tool has been validated as relevant and with a high accuracy rate in assessing and reporting disaster preparedness levels. The Cronbach's alpha coefficient in the original instrument in 2007 was ($\alpha = 0.90$). This high alpha value exceeds the minimum acceptable alpha value of 0.6 (Tichy et al., 2009). Moreover, it was psychometrically evaluated in the Middle East using principal component analysis (PCA) with Varimax (Cronbach's $\alpha = 0.90$) (Al Khalaileh et al., 2012).

3.3.3 Ethics Approval

Application for ethics approvals were submitted and obtained from the Human Research Ethics Committee (HREC) at the University of Newcastle (UoN), the National Guard Health Affairs (NGHA), and the Saudi Ministry of Health (MOH). These ethics approvals were obtained and granted by the three different institutions, effectively paving the way for the commencement of the research study. The approval codes were UON (H-2020-0350), MOH (20-116E), and NGHA (SP20/497/R) (Appendix 5, 6 & 7).

3.3.4 Data Collection Process

The data collection process involved creating awareness among the study's target population and distributing the relevant data collection tools. The researcher contacted the EMS supervisors at the target hospitals across the three cities, and emailed the study details, aim, and the researcher's contact information (Appendix 8). This created awareness and disseminated information about the study and its overall aim.

EMS workers were recruited to the study by receiving an email from their EMS department supervisors in each hospital. The email had the study flyer which included the study

aims, the inclusion criteria, the researcher's contact information (Appendix 8), and an information statement (Appendix 9). This approach accorded the EMS workers the time, freedom, and autonomy to decide whether to participate or not. A hyperlink to the study questionnaire URL was linked to the flyer. Interested EMS workers could access the questionnaire through the hyperlink. The participants' consent was implied by their voluntary submission of the survey. All data were collected during the COVID-19 pandemic, and online data collection ensured that precautionary safety procedures were followed (Obeid et al., 2013; Patridge & Bardyn, 2018). This will be discussed further in the ethical considerations section (Section 3.7, Page 58).

The study questionnaire was availed to the participants online through the research electronic data capture (REDCap) platform. This is an online data collection platform hosted by the Hunter Medical Research Institute (HMRI). REDCap is a safe and secure platform that guarantees the participants' data and information security (Patridge & Bardyn, 2018). The first page of the survey was the information sheet (Appendix 4). The participants were required to read through the opening information, including the aim, objectives, and participants' rights and privileges. After reading through and agreeing to the study, the participants moved onto the second survey page. This page presented the DPET questions. At the end of the survey, the participants were asked to leave their details if they would like to participate in phase two of the study, the semi-structured interviews. The data collection period lasted over two months, from February 1 to April 22, 2021. Although the minimum threshold was achieved by the fourth week of the data collection process (February 30, 2021), the researcher kept the survey portal open to accumulate as many participant responses as possible.

3.3.5 Data Analysis Process

The final stage in managing the data from the quantitative study was to undertake a statistical analysis (Wright, 2016; Kragelund et al., 2018). The data were exported from the REDCap platform to an offline file where the researcher analysed the data in Statistical Package for the Social Sciences (SPSS) version 24. SPSS utilises a single interface to perform multiple statistical analyses, including descriptive and inferential analyses. A data screening process was conducted to ensure data integrity. This was undertaken to eliminate any potential data duplications and identifiers. The REDCap platform's identifiers are flagged to ensure that they are used for data validation only but excluded in the data analysis and the presentation of the study findings (Obeid et al., 2018).

The obtained data were analysed through both descriptive and inferential statistical analyses. The participants' demographics were analysed descriptively through means, standard deviation, percentages, and frequencies. Inferential statistics were used to determine the relationship between demographics and disaster knowledge, skills, and preparedness. These included Chi-square, Independent T-test analysis, correlation, and linear regression. The findings were presented graphically through tables (Chapter Four, Page 62) (Verma, 2012; Landau, 2019). Finally, the findings were interpreted through comparing and contrasting with the existing literature on the topic. The interpretation of the findings and the emerging gaps and themes in the quantitative analysis informed the researcher's development of the qualitative study questions (Appendix 10).

3.4 Phase Two: Qualitative Descriptive Study

3.4.1 Setting and Sampling

Phase Two of the study used the same setting used in Phase One (Section 3.3.1: Setting and Sampling, Page 47). This phase used semi-structured interviews to explore the cultural factors,

facilitators, and barriers that affect disaster preparedness among EMS workers in Saudi Arabia. The findings from Phase One were used to inform Phase Two by providing direction for the interview questions (Appendix 10). The use of semi-structured interviews to collect the data was ideal for the aim and objectives of the study given the mixed-methods nature of the research (Chapter One, Page 8). This method accorded the interviewer the opportunity to pursue answers elicited from the participants regarding their experiences with disaster preparedness in Saudi Arabia. It also allowed the interviewer to probe the participants' responses, take field notes, seek clarification, and deeply explore any areas of interest (DeJonckheere & Vaughn, 2019). The approach allowed the participants to freely relate their field experiences regarding their preparation for disaster (Horton et al., 2004).

This phase aimed to recruit a purposive sample of 10-20 EMS workers. Data saturation was reached when primary recurring themes were consistently found (Francis et al., 2010; Walker, 2012), consequently, the interviews were discontinued at this point.

3.4.2 Data Collection Tool

The results from the Phase One survey were used to develop the semi-structured interview questions. Most participants reported low to moderate knowledge, skills, and preparedness for disasters in Saudi Arabia. Thus, the research questions were designed to better understand the facilitators and barriers related to the EMS workers' knowledge, skills, and preparedness for disaster. The interview questions were designed to tackle these key components and then expand on input from the participants opinions. The study used a semi-structured interview guide to conduct the interviews, and the participants were given the opportunity to share their experiences openly and freely (Appendix 10) (De Chesnay, 2015).

3.4.3 Ethics Approvals

Ethics approvals for Phase Two were obtained from the same institutions described in Phase One of this study (Section 3.3.3: Ethics Approvals, Page 50).

3.4.4 Data Collection Process

Participants who expressed their interest in Phase One to participate in the semi-structured interviews were contacted by the researcher. The researcher emailed the participants with a consent form (Appendix 11) and information statement for the semi structure interview (Appendix 12). The researcher asked the participants to read the information statement, and provided them with the opportunity to ask questions. Participants were asked to sign the consent form and email it back to the researcher if they agreed to participate, after which the researcher arranged an interview time that suited the researcher and the participant.

Before starting each interview, the researcher reminded the participants about the details of the study and the voluntary nature of their participation. The researcher adhered to the interview guide in conducting the interviews. All interviews were conducted in English through the online Zoom platform (Version: 5.7.1). Zoom provides a secure connection, and enables audio and video recording and transcription (Zoom Video Communications Inc., 2021). The COVID-19 pandemic impacted the data collection process in a significant way (Prommegger et al., 2021), disrupting the EMS workers' shift allocation, limiting their interview availability, and necessitated the transition to online interviews. Thus, most of the participants had to reschedule their interview several times. All the interviews were successfully conducted despite these challenges. Each interview lasted an average of 40-50 minutes, with the data collection process being conducted over three months, from May to August 2021.

3.4.5 Data Analysis Process

All interviews were conducted in English and audio-recorded, after which the lead researcher transcribed the interviews verbatim, thus ensuring that the meanings, views, and discussions from the interviews were neither changed nor missed during the transcription process (Polit & Beck, 2012). The participants were given the opportunity to review a copy of their interview transcripts to provide feedback; however, only one participant provided feedback on their script. The researcher also backed-up all the interviews and transcripts adhering to HREC's guidelines to avoid losing data.

This study used Braun and Clarke's (2006) six-step process to analyse the data: 1) familiarise oneself with the data through reading the transcripts; 2) generate initial codes and labels to represent essential features of the data related to the study questions; 3) search for themes from the generated codes and categories by identifying concepts and ideas that inform the semantic content of the data; 4) review and refine themes for consistency and accuracy for both levels (coded extract, entire data set); 5) determine a description and name the final themes represented in the results; and 6) conduct the qualitative data interpretation and present the final report (Chapter Five, Page 84). A key step in the analysis was to create a thematic map, which allowed the patterns to appear and the sub-themes to be grouped.

3.5 Study Rigour

A survey was used in Phase One to assess the perceived disaster knowledge, skills, and preparedness levels of EMS workers in Saudi Arabia. This required the study to demonstrate the quantitative elements of rigour, including internal and external validity, reliability, and generalisability (Bryman et al., 2008).

Internal validity refers to the accuracy of measure (the confidence in whether the study measures what it says) (Bryman et al., 2008). **External validity** refers to whether the study results are true to the population (Bryman et al., 2008). A validated DPET survey was used to ensure internal and external validity for this study. The survey has been used to assess disaster preparedness for EMS and other healthcare workers in different contexts and settings (Al-Ali & Abu Ibaid, 2015; Al Khalaileh et al., 2010; Labrague et al., 2018; King et al., 2019).

Reliability is the extent to which the findings are consistent (Bryman et al., 2008). One of the tools applicable in reliability analysis is the internal consistency index among responses. To ensure the reliability of this study, we used the Cronbach's alpha tool to examine the reliability of the findings. The analysis established a Cronbach's alpha index of 0.966. This high internal consistency index implied that the conclusions obtained were reliable for adoption as the basis for the data analysis, interpretation, and development of conclusions.

Generalisability refers to the extent to which the study findings from a sample can apply to a general population (Bryman et al., 2008). The study recruited participants from six hospitals in three major cities of Saudi Arabia (Riyadh, Jeddah, and Dammam). This ensured generalisability by producing results from a representative sample that can be applied to a broader population.

The semi-structured interview conducted in Phase Two was used to explore the participants' perceived barriers and facilitators toward disaster preparedness. The study followed Schwandt et al.'s (2007) five criteria for trustworthiness to achieve data rigour in qualitative research: 1) credibility, 2) transferability, 3) dependability, 4) confirmability, and 5) authenticity.

Credibility refers to the confidence in the truth of the data and the interpretations (Schwandt et al., 2007). This study demonstrates credibility by using a semi-structured

interview protocol to guide the questions and the interviews. The researcher undertook qualitative interview training with his supervisors prior to conducting the interviews to ensure accuracy and credibility. In addition, the researcher used the peer debriefing method through regularly receiving feedback from his supervisors on the interview questions and findings (Schwandt et al., 2007).

Transferability refers to the applicability of the findings to other populations in different contexts (Schwandt et al., 2007). The study ensured transferability by providing a detailed description of the methodology and contextual information about the study site and participants. A rich description of the study results is provided in Chapter Five to allow the readers to determine the study findings' transferability to individuals and groups beyond those included in the present study (Chapter Five, Page 84) (Schwandt et al., 2007).

Dependability refers to the stability or consistency of the interview processes used over time (Schwandt et al., 2007). **Authenticity** refers to how clearly and truthfully researchers present the participants' realities (Schwandt et al., 2007). This means not obscuring or changing what the participants said to ensure the dependability and authenticity of the study. All the interviews were conducted through the online Zoom platform. The researcher used direct quotes from the participants to support observations and interpretations, and transcripts were prepared immediately after each interview with the participants being encouraged to review and edit their interview transcripts.

Confirmability refers to the clarity of, and the ability to repeat, the methods and to present findings that reflect the participants' responses without bias (Schwandt et al., 2007). In this study, we ensured confirmability by providing a clear description of the interview process. Moreover, the researcher presented the semi-structured interview findings and interpretations in detail in Chapters Five and Six (Pages 83 and 115) (Schwandt et al., 2007).

3.6 Data Integration and Management

There are three key points in data integration in a mixed-methods study – 1) the design, 2) the methods (data collection and analysis), and 3) data interpretation and reporting (Fetters et al., 2013). At the study design stage, we achieved integration by choosing an explanatory sequential design wherein the quantitative study (Phase One) was used to inform the data collection and analysis of the qualitative study (Phase Two).

At the methods stage, integration takes place by combining the data collection and the analysis (Creswell et al., 2011). Data connecting refers to linking one type of data with the other through the sampling frame (Fetters et al., 2013). The current study used an explanatory sequential design that ensured integration by selecting participants for the qualitative phase who had previously participated in the quantitative phase.

Finally, the findings of the two phases were integrated under a concept-by-concept and theme-by-theme basis at the interpretation and reporting stages. The integrated findings are presented in Chapter Six of the thesis (Page 115).

3.7 Ethical Considerations – Phase One & Two

This study was approved and conducted following the ethical standards established by the National Health and Medical Research Council and the Australian Research Council (NHMRC, 2018). These touched on four fundamental ethical standards: *autonomy*, which allowed for the treatment of the study participants as independent people and thus respecting their right to choose to participate in the study or not and to decide for themselves; *beneficence*, to ensure that the participants were protected from any harm and to always ‘do good’ with them; *non-maleficence*, avoiding harming or hurting the participants intentionally; and *justice*, a commitment to treat all the participants equitably and fairly (Basil, 2021).

3.7.1 Autonomy and Justice

3.7.1.1 Informed consent

All EMS workers who qualified to participate in the study received an information statement as detailed previously (Sections 3.3.4 & 3.4.4: Data Collection Process, Pages 50 and 54). The information statement included the researcher's contact details, the study aims and rationale, the time needed to complete the survey, data storage, data analysis, confidentiality and privacy measures, the risks and benefits, and the voluntary nature of participation (Holloway & Galvin, 2016). The participants were provided with time to consider the information and ask any questions prior to their participation. This allowed them to return their consent form to willingly participate in the study.

3.7.1.2 Voluntary participation

The participants were invited to this study by receiving an email from their EMS department supervisors in each hospital. The email included the study flyer with a hyperlink to the questionnaire, with the participants being informed about their rights and the voluntary nature of their participation before each phase of the study. In Phase One, EMS workers expressed their willingness and consent to participate in the study by completing and submitting the survey. In Phase Two, the researcher emailed the participants a consent form. In addition, the researcher asked the participants to verbally confirm their consent prior to the commencement of the online Zoom interview. The participants had the right to withdraw from Phase Two of the study at any time without consequence.

3.7.2 Non-Maleficence, Beneficence, Confidentiality, and Anonymity

3.7.2.1 Non-maleficence

The study was developed in a manner that ensured there was no harm to any of the participants (Krefting, 1991). The interviews were conducted online, thus enhancing the participants'

security and wellbeing. In the event a participant became emotionally distressed, they were invited to stop the interview. If the participant wished to continue with the interview, the recording was recommenced. The researcher then provided the participants with the healthcare services information for counselling and support in their workplaces.

3.7.2.2 Beneficence

Although the EMS workers reaped no direct benefits from participating in the study (Krefting, 1991), the findings of the thesis may help inform and guide disaster policy-makers and hospital educators regarding the perceived knowledge, skills, and preparation for disasters in Saudi Arabia. Additionally, the knowledge obtained from the thesis can be used to improve and guide disaster preparedness and management in Saudi Arabia.

3.7.2.3 Confidentiality

Data confidentiality was assured by treating all participant information as strictly confidential and private (Krefting, 1991). No directly identifiable data or names were used in this study, and the transcriptions of the recorded interviews were de-identified. In addition, all publications and presentations related to the study do not use the participants' names or identities (Krefting, 1991).

3.7.2.4 Anonymity

The anonymity of the EMS workers was maintained through the anonymous nature of the online surveys in Phase One, and the researcher coding the interview transcripts in Phase Two (Krefting, 1991). The researcher solely transcribed the interviews and securely stored the audio recordings to ensure the participants' security. In this way, non-maleficence, beneficence, confidentiality, and anonymity were ensured for the participants in this study (Krefting, 1991).

3.7.2.5 Data storage and disposal

All surveys, audio-recorded interviews, and transcripts were stored on the University of Newcastle's secure server. Access to the study data is restricted to the researcher and his supervisors only. Once the study has been completed, all the related data and materials will be kept in the University of Newcastle's secure server system for five years. After this, all the data and the study materials will be disposed of in compliance with the university's research materials and data disposal policy and guidelines.

3.8 Conclusion

This chapter presented a detailed explanation of how the study data were collected, analysed, and presented. The rationale for an explanatory sequential mixed-methods design was explained starting with the quantitative data and leveraging its findings to inform the qualitative study. Furthermore, the chapter explains the quantitative and qualitative study designs, including their setting, sampling, data collection, and analysis. The next two chapters will present the findings of the survey and the qualitative descriptive study.

Chapter 4: Quantitative Data Findings and Analysis

4.1 Introduction

The aim of this study is to examine the disaster preparedness of Emergency Medical Service (EMS) workers in Saudi Arabia. This chapter will present the findings obtained from the Disaster Preparedness Evaluation Tool (DPET) quantitative survey. The perceived level of knowledge, skills, and preparedness of EMS workers in Saudi Arabia is examined in the descriptive and inferential statistical analysis of this survey.

4.2 Background Analysis

The DPET tool with 46 items was used to assess the perceived knowledge, skills, and preparedness of EMS workers in Saudi Arabia. The results of the survey were downloaded from REDCap (Harris et al., 2009) for offline analysis. The file was initially exported to an Excel spreadsheet, then converted to an IBM SPSS, version 24 (IBM Corp., Armonk, N.Y., USA) file for analysis.

A descriptive analysis of the findings was conducted, focusing on the respondents' demographic backgrounds as stipulated in questions 1 to 9 of the DPET survey (Appendix 4). These survey questions presented the respondents' gender, age, experience, education level, participation in disaster, working facility, area of residence, and working hours. This section of the thesis also developed a reliability analysis to examine the internal consistency levels for the offered responses.

Prior to starting the data analysis, the researcher cleaned the data to ensure that the findings would be accurate and reliable. The first step was to eliminate all the missing responses. It was necessary to only include the respondents who filled in all the questionnaire questions. Of the 358 responses gathered in the data collection process, 86 incomplete

responses were excluded, leaving 272 responses included in the analysis. In total, 24 per cent of responses were excluded (n=86). A summarised view of the respondents' demographics was developed through frequency and percentage analysis, as illustrated in the table below (Table 6).

Table 6: EMS worker participants – demographic analysis

Variable	Elements	Frequency <i>f</i>	Percentage %
Gender	Male	230	84.6%
	Female	42	15.4%
Age	18-25 years	59	21.7%
	26-35 years	173	63.6%
	36-45 years	40	14.7%
Experience in years	1 to 6 years	138	50.7%
	7 to 12 years	108	39.7%
	13 to 18 years	26	9.6%
Educational level	Diploma degree EMT	51	18.8%
	Bachelor degree EMS	197	72.4%
	Master degree EMS	16	5.9%
	Master degree Other	8	2.9%
Experience/participation in disaster situation	Yes	246	90.4%
	No	26	9.6%
Facility worked in	Government Hospital	189	69.5%
	Military Hospital	83	30.5%
Area of residence	Riyadh	125	46.0%
	Jeddah	98	36.0%
	Dammam	49	18.0%
Weekly working hours	20-34 hours/week	25	9.2%
	35-60 hours/week	247	90.8%

Most respondents were male 84.6% (n=230) and aged between 26-35 years (63.6%, n=173). Only 14.5% (n=40) of respondents were over 35 years of age. More than half of the respondents

(50.7%, n=138) had between 1 and 6 years of experience as an EMS worker, 39.7% (n=108) had 7 to 12 years, and 9.6% (n=26) had 13 to 18 years of experience. Almost three quarters of the respondents held a bachelor's degree (72.4%, n=197), with 18.8% (n=51) holding a diploma, and 8.8% (n=24) awarded a master's degree.

A majority of the respondents surveyed had participated in a disaster situation (90.4%, n=246). The participants were also asked to identify where they worked. Many worked in government hospitals (69.5%, n=189), in Riyadh City (46%, n=125), Jeddah City (36%, n=98), and Dammam City (18%, n=49). Finally, 91% of the respondents indicated they worked between 35-60 hours/week (n=247).

4.3 DEPT Tool

The DPET tool was used to determine the perceived level of disaster knowledge, skills, and preparedness of Saudi Arabian EMS workers. The questionnaire was grouped into three categories, with 13 questions focusing on disaster knowledge, 11 on disaster skills, and 21 on disaster preparedness. The aim of the analysis was to investigate whether the EMS workers had low, moderate, or high levels of disaster preparedness. The findings were analysed through a mean analysis model where the average mean for each question was evaluated. The analysis mean is based on a Likert scale of 1-6, with a mean of 1-2 representing a low disaster knowledge index, a mean of 2.1 to 4 representing a moderate disaster knowledge index, and a mean of 4.1 to 6 indicating a high disaster knowledge index.

4.3.1 Disaster Knowledge

The first category of questions focused on how EMS workers felt they had enough knowledge and were aware of the disaster management protocols and other related information required to manage a disaster effectively. A summary of the questions analysed is illustrated in Table 7 below.

Table 7: Disaster Knowledge

Item	Question	Mean	Std. Dv	Level
Q1	I have participated in emergency plan drafting and emergency planning for disaster situations in my community.	3.53	1.347	Moderate
Q2	I participate in disaster-related educational activities on regular basis (e.g. Continuing education classes, seminars, or conferences dealing with disaster preparedness)	3.79	1.235	Moderate
Q3	I am aware of classes about disaster preparedness and management that are offered (e.g. at my workplace, the university, or community)	3.74	1.203	Moderate
Q4	I find that the research literature on disaster preparedness and management is easily accessible.	3.58	1.150	Moderate
Q5	I know who to contact (chain of command) in disaster situations in my community.	3.78	1.213	Moderate
Q6	I find that the research literature on disaster preparedness is understandable.	3.59	1.187	Moderate
Q7	I know where to find relevant research or information related to disaster preparedness and management to fill in gaps in my knowledge.	3.53	1.190	Moderate
Q8	I have a list of contacts in the medical or health community in which I practice for use in case of a disaster (e.g. health department).	3.66	1.173	Moderate
Q9	I would be interested in educational classes on disaster preparedness that relate specifically to my community situation	5.43	1.121	High
Q10	I read journal articles related to disaster preparedness.	3.21	1.213	Moderate
Q11	Finding relevant information about disaster preparedness related to my community needs is an obstacle to my level of preparedness	3.64	1.157	Moderate
Q12	In case of a disaster situation I think that there is sufficient support from local officials on the local or national level.	3.66	1.213	Moderate
Q13	I participate in disaster drills or exercises at my workplace (clinic, hospital, etc.) on a regular basis.	4.24	1.274	High

A summary of the findings indicates that none of the examined areas of disaster knowledge had a low index. The respondents revealed a moderate level of knowledge in all questions except in response to the statements: *“I would be interested in education classes on disaster preparedness that relate specifically to my community situation”*, and *“I participate in disaster*

drills or exercises in my workplace (clinic, hospital, etc.) on a regular basis”, on which they showed strong interest (M=5.43, SD=1.121) and (M=4.24, SD=1.274), respectively.

4.3.2 Disaster Skills

The second set of 11 questions centered on the disaster skills possessed by EMS workers. The questions focused on examining how the EMS workers felt that their current skills were effective and sufficient for handling different types of disasters. The summary of the questions under this category is illustrated in Table 8.

Table 8: Disaster Skills

Item	Question	Mean	Std. Dev	Level
Q14	In case of a bioterrorism/biological attack I know how to execute decontamination procedures.	2.99	1.323	Low
Q15	I have an agreement with loved ones and family members on how to execute our personal/family emergency plans.	3.18	1.297	Moderate
Q16	I consider myself prepared for the management of disasters.	3.74	1.129	Moderate
Q17	I participate/have participated in creating new disaster guidelines, emergency plans, or lobbying for improvements on the local or national level.	3.28	1.232	Moderate
Q18	In case of a bioterrorism/ biological attack, I know how to use personal protective equipment.	3.22	1.417	Moderate
Q19	I believe I would be considered a key leadership figure in my community in a disaster situation.	3.52	1.273	Moderate
Q20	I am aware of what the potential risks in my community are (e.g. earthquake, floods, terror, etc).	3.75	1.229	Moderate
Q21	In a case of bioterrorism/biological attack I know how to perform isolation procedures so that I minimize the risks of community exposure	2.92	1.306	Low
Q22	I am familiar with the local emergency response system for disasters.	3.77	1.191	Moderate
Q23	I am familiar with accepted triage principles used in disaster situations.	4.06	1.218	High
Q24	I have personal/family emergency plans in place for disaster situations.	3.43	1.310	Moderate

A summary of the findings indicates that a majority of the responses were on the moderate level of disaster skills. This was with the exception of a few respondents who had low and high levels of disaster skills. The respondents reported weak skills in performing isolation during a bioterrorist/biological attack ($M=2.92$, $SD=1.306$), and knowing how to execute decontamination procedures in case of a bioterrorism/biological attack ($M=2.99$, $SD=1.323$). They reported a high skills level on the triage principle used in their workplace during a disaster ($M=4.06$, $SD=1.218$).

4.3.3 Disaster Preparedness

The third component of the survey explored disaster preparedness. The questions focused on examining how the EMS workers felt prepared to handle different types of disasters in Saudi Arabia. A summary of the 21 questions for this objective under the DPET tool is illustrated in Table 9.

Table 9: Disaster Preparedness

Item	Question	Mean	Std. Dev	Level
Q25	I feel confident managing (treating, evaluating) emotional outcomes for Acute Stress Disorder or PTSD following disaster or trauma in a multi-disciplinary way such (e.g. referrals and follow-ups), knowing what to expect in ensuing months.	3.18	1.271	Moderate
Q26	I am familiar with the main Groups (A, B, C) of biological weapons (Anthrax, Plague, Botulism, Smallpox, etc.), their signs and symptoms, and effective treatments.	2.90	1.199	Moderate
Q27	I know the limits of my knowledge, skills, and authority as an EMS to act in disaster situations, and I would know when I exceed them.	3.94	1.183	Moderate
Q28	I am familiar with the organizational logistics and roles among local, state, and federal agencies in disaster response situations.	3.64	1.207	Moderate
Q29	As an EMS, I would feel confident as a manager or coordinator of a disaster shelter.	3.92	1.232	Moderate
Q30	I am familiar with post disaster psychological interventions, e.g. behavioral therapy, support	3.49	1.187	Moderate

	groups and incident debriefing for patients who experience emotional or physical trauma.			
Q31	I would feel confident providing education on coping skills and training for patients who experience traumatic situations, so they are able to manage themselves.	3.76	1.221	Moderate
Q32	I can identify possible indicators of mass exposure evidenced by a clustering of patients with similar symptoms	3.46	1.086	Moderate
Q33	I can manage the common symptoms and reactions of disaster survivors that are affective, behavioral, cognitive, or physical in nature.	3.54	1.104	Moderate
Q34	I am able to describe my role in the response phase of a disaster in the context of my workplace, the general public, media, and personal contacts.	3.68	1.151	Moderate
Q35	I feel confident recognizing deviations in health assessments indicating potential exposure to biological agents.	3.19	1.163	Moderate
Q36	As an EMS, I would feel confident in my abilities as a direct care provider and first responder in disaster situations.	3.89	1.187	Moderate
Q37	As an EMS, I would feel reasonably confident in my abilities to be a member of a decontamination team.	3.74	1.234	Moderate
Q38	In case of a bioterrorism/biological attack, I know how to perform a focused health history and assessment, specific to the bioagents that are used.	3.03	1.245	Moderate
Q39	I feel reasonably confident I can treat patients independently, without supervision of a physician, in a disaster situation.	3.92	1.361	Moderate
Q40	I would feel confident implementing emergency plans, evacuations procedures and similar functions	3.66	1.273	Moderate
Q41	I would feel confident providing patient education on stress and abnormal functioning related to trauma.	3.81	1.231	Moderate
Q42	I am able to recognize the signs and symptoms of Acute Stress disorder and Post Traumatic Stress Syndrome (PTSD).	3.43	1.301	Moderate
Q43	I participate in peer evaluation of skills on disaster preparedness and response.	3.52	1.221	Moderate
Q44	I am familiar with how to perform a focused health assessment for PTSD.	3.35	1.226	Moderate
Q45	I am familiar with what the scope of my role as an EMS in a post-disaster situation would be.	3.88	1.192	Moderate

A summary of the findings indicates that none of the examined areas of disaster preparedness had a low index. All the responses were in the moderate preparedness level category. This indicates a moderate preparedness level among EMS workers and demonstrates the need for future improvement. The respondents showed a low response when asked about their familiarity with signs, symptoms, and effective treatments for biological weapons ($M=2.90$, $SD=1.199$). Their response to the question, “*I know the limits of my knowledge, skills, and authority as an EMS to act in disaster situations, and I would know when I exceed them*”, had the highest mean of all the questions in this category ($M=3.94$, $SD=1.183$), indicating a relatively high level of preparedness.

4.4 Inferential Analysis

A correlation analysis was undertaken to determine the self-perceived disaster skills, knowledge, and preparation of EMS workers in Saudi Arabia. This is consistent with the study aim of Phase One for this thesis. The analysis was classified into two sections, namely: (i) correlation between dependent variables, and (ii) the relationship between the dependent and independent variables (ANOVA and Independent T-test analysis). The findings are illustrated in Sections 4.5.1 and 4.5.2 below.

4.4.1 Correlation between Dependent Variables

The first section was an analysis of the relationship between the study dependent variables. The dependent variables were derived from the study questionnaire. Through the DPET, the set of 45 questions were categorised into three broad sections, knowledge (q 1-13), disaster management skills (q 14-24), and disaster preparedness (q 25-45). The analysis combined all the questions under each variable set to form a compound variable in SPSS. Through the computation of the variables, each of the respective questions under each category was combined, and the relationship between the three dependent variables was examined through a

Pearson correlation analysis. The findings are illustrated below (Table 10: Correlation Between Dependent Variables).

Table 10: Pearson Correlation between the dependent variables: Disaster Knowledge, Skills, and Preparedness

		Disaster Knowledge	Disaster Skills	Disaster Preparedness
Disaster Knowledge	Pearson Correlation	1	.766**	.764**
	Sig. (2-tailed)		.000	.000
	N	272	270	268
Disaster Skills	Pearson Correlation	.766**	1	.830**
	Sig. (2-tailed)	.000		.000
	N	270	270	266
Disaster Preparedness	Pearson Correlation	.764**	.830**	1
	Sig. (2-tailed)	.000	.000	
	N	268	266	268

** Correlation is significant at the 0.01 level (2-tailed).

Table 10 findings indicate a high correlation index across the dependent variables. This means the level and rating for one cluster of the variables (i) knowledge, (ii) skills, and (iii) preparedness for disaster directly impacted upon the other two sets. For instance, when examining the level of knowledge, the analysis indicated a high correlation with disaster skills and preparedness levels. This means that the variables had a direct positive correlation. An increase in one of the variables is marked by an increase in the other dimensions of disaster preparedness. For instance, the findings demonstrated that an increase in preparedness among the EMS workers indicated an increase in the skill levels possessed and their resulting experience in responding to the disaster. This means that the respondents with a high

preparedness index also indicated high levels of both experience and skills. Equally, those who had a low rating on their disaster skills and preparedness had an equally low index rating on their experience and success levels in handling disasters.

4.4.2 Independent and Dependent Variables Relationship

The second cluster in the relationship analysis was between the dependent variables of knowledge (q 1-13), disaster skills (q 14-24), and disaster preparedness (q 25-45), and the independent variables comprising all the EMS workers' demographic variables on age, gender, years of experience, facility worked in, city of residence, and the number of hours worked per week.

The first set of analysis was through an independent t-test analysis for the demographic variables with two levels (gender and participation in disaster) (Table 11), and a One Way ANOVA analysis for those with more than two levels (age, years of experience, education, city of residence, and hours worked) (Table 12).

Table 11: T-test for the EMS workers socio-demographic variables with two levels: gender and participation in disaster

Variable relationship to facility worked in				Levene's		t-test for Equality of Means							
				Test for									
				Equality of									
				Variances									
				F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of the Difference		
												Lower	Upper
Gender ¹	Disaster Knowledge	Equal Variances Assumed		2.876	.091	.817	270	.415	.10834	.13263	-.15279	.36947	
		Equal Variances Not Assumed			.938	65.566	.352	.10834	.11549	-.12227	.33895		
	Disaster Skills	Equal Variances Assumed		4.266	.040	1.691	268	.092	.23098	.13659	-.0395	.49990	
		Equal Variances Not Assumed			1.981	67.449	.052	.23098	.11660	-.00172	.46367		
	Disaster Preparedness	Equal Variances Assumed		4.848	.029	1.159	266	.248	.16854	.14546	-.11786	.45495	
		Equal Variances Not Assumed			1.364	68.146	.177	.16854	.12359	-.07807	.41515		
	Participation in Disaster ²	Disaster Knowledge	Equal Variances Assumed		.508	.477	-	270	.000	-.68194	.15784	-.99269	-.37119
							4.321						
		Equal Variances Not Assumed			-	28.067	.002	-.68194	.19855	-	-.27527		
						3.435				1.08861			
Disaster Skills		Equal Variances Assumed		7.736	.006	-	268	.000	-.84117	.16069	-	-.52478	
						5.235				1.15755			
		Equal Variances Not Assumed			-	27.198	.001	-.84117	.22996	-	-.36949		
						3.658				1.31284			
Disaster Preparedness		Equal Variances Assumed		2.565	.110	-	266	.000	-.83259	.17169	-	-.49455	
						4.849				1.17063			
	Equal Variances Not Assumed			-	27.787	.001	-.83259	.22529	-	-.37095			
					3.696				1.29423				

Table 12: One Way ANOVA analysis for independent EMS workers' socio-demographic variables with more than two levels

Variable relationship to Facility worked in			Findings				
			Sum of Squares	Df	Mean Square	F	Sig.
Age ³	Disaster Knowledge	Between Group	2.417	2	1.208	1.950	.144
		Within Group	166.690	269	.620		
		Total	169.106	271			
	Disaster Skills	Between Group	11.939	2	5.969	9.527	.000
		Within Group	167.290	267	.627		
		Total	179.229	269			
	Disaster Preparedness	Between Group	12.889	2	6.444	9.110	.000
		Within Group	187.468	265	.707		
		Total	200.356	267			
Experience Years ⁴	Disaster Knowledge	Between Group	4.860	2	2.430	3.980	.020
		Within Group	164.246	269	.611		
		Total	169.106	271			
	Disaster Skills	Between Group	6.094	2	3.047	4.699	.010
		Within Group	173.135	267	.648		
		Total	179.229	269			
	Disaster Preparedness	Between Group	13.346	2	6.673	9.456	.000
		Within Group	187.010	265	.706		
		Total	200.356	267			
Education Level ⁵	Disaster Knowledge	Between Group	6.743	3	2.248	3.710	.012
		Within Group	162.363	268	.606		
		Total	169.106	271			
	Disaster Skills	Between Group	12.562	3	4.187	6.683	.000
		Within Group					

³ Categorized into age periods (18-25, 26-35, 36-45, and >46 years). This was chosen because the EMS in Saudi Arabia is newly profession and involves younger workers.

⁴ Categorized into years periods (1 to 6, 7 to 12, and 13 to 18 years). This was chosen because the EMS in Saudi Arabia is newly profession and involves younger workers.

⁵ Categorized as follows (Diploma EMT, Bachelor EMS, Master EMS, and Others) because Saudi Universities only provide those qualifications for the EMS profession.

			Within Group	166.667	266	.627		
			Total	179.229	269			
			Between Group	13.343	3	4.448	6.279	.000
Disaster			Within Group	187.013	264	.708		
Preparedness			Total	200.356	267			
			Between Group	.352	2	.176	.281	.755
			Within Group	168.754	269	.627		
			Total	169.106	271			
			Between Group	1.321	2	.660	.991	.372
Disaster Skills			Within Group	177.908	267	.666		
			Total	179.229	269			
			Between Group	.480	2	.240	.318	.728
Disaster			Within Group	199.877	265	.754		
Preparedness			Total	200.256	267			
			Between Group	1.209	1	1.209	1.944	.164
			Within Group	167.887	270	.622		
			Total	169.106	271			
			Between Group	4.433	1	4.433	6.797	.010
Disaster Skills			Within Group	174.795	268	.652		
			Total	179.229	269			
			Between Group	8.741	1	8.741	12.134	.001
Disaster			Within Group	191.615	266	.720		
Preparedness			Total	200.356	267			

⁶ Categorized as (Riyadh, Jeddah, Dammam, and others). Those cities were selected because they are major cities of Saudi Arabia (Riyadh, Jeddah, and Dammam). Riyadh is the capital city and is centrally located, Jeddah is in the western kingdom, and Dammam is located in the East.

⁷ Categorized as (20-34 hours/week, 35-60 hours/week, and others) because it represents the working hours in Saudi Arabia's Labor System.

4.5 Regression Analysis

Finally, a regression analysis was performed. The regression analysis determines and demonstrates how the related variables impact the dependent study variable. The findings of the regression analysis are illustrated in Sections 4.5.1, 4.5.2, and 4.5.3.

4.5.1 Disaster Knowledge Level

The demographic variables used in the regression analysis were the facility worked in, experience in years, and the education level on the disaster knowledge level. These were used as the predictor variables. A MODEL summary analysis indicated an R square value of 0.055 and an adjusted R square value of 0.045. This means that the three variables combined had a predictor value and possible impact on the dependent variable (disaster knowledge) of 4.5%. Although a weak predictor value, the predictor impact is significant, rationalising the subsequent study analysis. Furthermore, an ANOVA analysis on the regression significance indicated a 95% confidence level with a sigma value (p) of 0.002. This means that the variables regression was significant, thus revealing the need for the development of a linear regression model. The findings on the R square and the ANOVA findings are illustrated in Table 13 & 14 below.

The final section indicated that the constant value in the regression model was at 2.887 with experience in years, education, and facility worked in having regression coefficients of (0.073, $p=0.323$), (0.272, $p=0.001$), and (0.209, $p=0.042$), respectively (Table 13). This meant that the regression between experience in years and disaster knowledge had a value above the statistical confidence level ($p<0.05$), meaning that the number of years of experience had a statistically insignificant impact on knowledge levels. The regression findings and the model are illustrated below.

Table 13: Model Summary table for disaster knowledge level regression analysis

Model Summary ^a					
Model	Variables Entered	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	Facility worked in, Education level, Experience years	.235 ^b	.055	.045	.77212

a. Dependent Variable: Disaster knowledge

b. Predictors: (Constant). Facility worked in, Education level, Experience years

Table 14: EMS workers' disaster knowledge ANOVA regression analysis

ANOVA ^a					
Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	9.333	3	3.111	5.128	.002 ^b
Residual	159.773	268	.596		
Total	169.106	271			

a. Dependent Variable: Disaster knowledge

b. Predictors: (Constant). Facility worked in, Education level, Experience years

Table 15: EMS workers' disaster knowledge coefficients regression analysis

Coefficients ^a					
Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.887	.251		11.511	.000
1 Experience years	.073	.073	.061	.990	.323
Education level	.272	.080	.206	3.390	.001
Facility worked in	.209	.102	.122	2.047	.042

a. Dependent Variable: Disaster knowledge.

4.5.2 Disaster Skills

The second examined linear regression model was on the relationship between the EMS workers' demographics and their disaster skill level. The findings included the related variables of working hours, facility worked in, age, experience in years, and the level of education. The

R square value was 0.111 with the adjusted R squared value accounting for a 0.094 standard of error of 0.7771. This meant that the variables had an estimated 9.4% predictor value on skills among the EMS workers. The findings are illustrated in the table below. Additionally, an ANOVA analysis indicated a sigma value (p) of 0.000, implying that the regression analysis was significant. The results show that a number of variables impact on disaster skills, including the number of hours worked, whether the EMS workers were civilians or military, age, education level, and years of experience. This combination of variables had a 9.4% predictor value.

Table 16: Model Summary table for disaster skills regression analysis

Model Summary ^a						
Model	Variables Entered	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	Working hours, Facility worked in, Age, Education level, Experience years ^b	.333 ^a	.111	.094		.77705

a. Dependent Variable: Disaster skills

b. Predictors: (Constant). Working hours, Facility worked in, Age, Education level, Experience years

Table 17: EMS workers' disaster skills ANOVA regression analysis

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.824	5	3.965	6.566	.000 ^b
	Residual	159.405	264	.604		
	Total	179.229	269			

a. Dependent Variable: Disaster skills

b. Predictors: (Constant). Working hours, Facility worked in, Age, Education level, Experience years

The final section was a determination of the linear regression model. The findings established a constant value of 2.686 while the other coefficients were experience years (0.133, $p=0.124$), age (0.294, $p=0.001$), education level (0.290, $p=0.001$), facility worked in (0.170, $p=0.101$), and working hours (-0.197, $p=0.258$). However, the variables of experience years, facility worked in, and hours worked had a sigma value (p) above 0.05, meaning that their regression with the disaster skills was insignificant. The variables of experience years, facility worked in, and the hours worked were found to have a minimal impact on the level of disaster skills. Hence, they were not included in the regression model. The findings and the linear regression model are illustrated below.

Table 18: EMS workers' disaster skills coefficients regression analysis

Coefficients ^a					
Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.686	.457		5.877	.000
Age	.294	.091	.217	3.226	.001
Experience years	-.133	.086	-.108	-1.545	.124
Education level	.290	.083	.213	3.486	.001
Facility worked in	.170	.103	.096	1.644	.101
Working hours	-.197	.174	-.070	-1.134	.258

a. Dependent Variable: Disaster skills

4.5.3 Disaster Preparedness

The final dimension analysed was the regression between the EMS workers' disaster preparedness and their demographic variables. The applied demographic variables were those with a significant relationship with the study dependent variables: experience in years, facility worked in, age, working experience, and the number of hours worked. The findings had a 0.193 R squared value, and a 0.177 adjusted R squared value. This means that the variables had a high and significant predictor value on disaster preparedness at 17%, meaning that adjusting

the education, age, and work experience variables among EMS workers was likely to result in at least a 17% chance of changing their disaster preparedness levels. This was in addition to an ANOVA analysis that demonstrated a sigma value (p) of 0.000. The sigma value below $P < 0.05$ meant that for the used sample base, adjusting the study variables such as the number of hours worked per day and improving the EMS workers' education levels and exposure was likely to directly affect their disaster preparedness levels and capabilities. The regression variables were significant and needed the findings to be analysed through a linear regression model.

Table 19: Model Summary table for disaster preparedness regression analysis

Model Summary ^a					
Model	Variables Entered	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	Working hours, Facility worked in, Age, Education level, Experience years ^b	.439 ^a	.193	.177	.78568

a. Dependent Variable: Disaster preparedness

b. Predictors: (Constant). Working hours, Facility worked in, Age, Education level, Experience years

Table 20: EMS workers' disaster preparedness ANOVA regression analysis

ANOVA ^a						
	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	38.627	5	7.725	12.515	.000 ^b
	Residual	161.729	262	.617		
	Total	200.356	267			

a. Dependent Variable: Disaster preparedness

b. Predictors: (Constant). Working hours, Facility worked in, Age, Education level, Experience years

The findings indicate the following: age (0.519, $p=0.00$), experience in years (-0.376, $p=0.000$), education level (0.265, $p=0.002$), facility worked in (0.185, $p=0.077$), and working hours (-0.274, $p=0.126$). From the above findings, the variables of facility worked in and

working hours had a sigma value above 0.05, and thus the regression with the dependent variable was insignificant. The findings are illustrated in the table below.

Table 21: EMS workers’ disaster preparedness coefficients regression analysis

Coefficients ^a					
Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.936	.468		6.272	.000
Age	.519	.095	.354	5.473	.000
Experience years	-.376	.088	-.287	-4.264	.000
Education level	.265	.085	.183	3.125	.002
Facility worked in	.185	.104	.099	1.775	.077
Working hours	-.274	.178	-.090	-1.535	.126

a. Dependent Variable: Disaster preparedness

4.6 Data Reliability

Reliability is the extent to which the findings are complete and accurate. One of the tools applicable in reliability analysis is the internal consistency index among responses. The Cronbach's alpha tool was adopted to examine the reliability of the findings. The analysis established a Cronbach's alpha index of 0.966. This high internal consistency index implies that the conclusions obtained were reliable for adoption as the basis for the data analysis, interpretation, and development of conclusions.

4.7 Summary

The findings demonstrate that the different EMS workers' demographic variables influenced their knowledge, skills, and preparedness for disasters. However, several inconclusive findings emerged from the analysis. First, in all the examined elements of disasters, including disaster knowledge, skills, and preparedness, none showed any relationship to gender and city of

residence. This is despite past literature demonstrating a close relationship between the variables. This forms a basis for further exploration of the variables in a qualitative study. Equally, a negative correlation was realised between disaster preparedness and experience with working hours. This creates a gap with some of the subjective variables in Saudi Arabia which need to be explored further that could result in the above findings. Other emerging gaps in the analysis requiring further exploration were how the EMS workers' skills could be improved through a variation of the applied strategies and areas of change in the current disaster management framework in Saudi Arabia.

Chapter 5: Qualitative Analysis

5.1 Introduction

This is the second chapter of the mixed-methods data analysis, and presents a detailed analysis of the qualitative data. The findings from the qualitative data inform our understandings of the perceptions of EMS workers in relation to disaster preparation, and will explore the perceived barriers towards, and facilitators of disaster preparedness.

5.2 Overview of Participants

The researcher conducted 15 interviews through the Zoom online platform (Version: 5.7.1) (Zoom Video Communications Inc., 2021). A total of 23 participants had been scheduled to take part in the study. However, due to lack of availability, only 15 interviews were completed. In terms of gender, 11 participants were male and four females. This is consistent with industry employment trends in Saudi Arabia. As stated in chapter one EMS courses were first offered in 2015 with the first graduates entering employment in 2018 (Alharthy et al., 2018). All EMS workers worked 48 hours per week. See Table 22 for the participants' demographic details.

Table 22: Demographics Table

Gender	Age	Years of experience	Education level	Type of facility
Male	30 – 35	7 – 12 years	Master's degree	Government Hospitals
Male	30 – 35	1 – 6 years	Master's degree	Government Hospitals
Male	25 – 29	7 – 12 years	Bachelor's degree	Government Hospitals
Male	25 – 29	1 – 6 years	Bachelor's degree	Military Hospitals
Female	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Male	30 – 35	1 – 6 years	Master's degree	Government Hospitals

Male	25 – 29	1 – 6 years	Bachelor's degree	Military Hospitals
Female	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Female	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Male	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Male	30 – 35	1 – 6 years	Master's degree	Military Hospitals
Male	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Male	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals
Male	30 – 35	1 – 6 years	Master's degree	Military Hospitals
Female	25 – 29	1 – 6 years	Bachelor's degree	Government Hospitals

5.3 Themes and Sub-Themes

Through using thematic analysis, as outlined by Braun and Clarke (2006), several themes were derived: (i) Social and Cultural Expectations, (ii) Impact of Workplace on Disaster Preparedness, (iii) Workers' Perceived Disaster Preparedness, and (iv) Institutional and National Disasters Framework. A code number was used from P1 to P15 in place of the participants' names to ensure their privacy. The addition of a letter to the code number indicates the sex of the participant (M: male; F: female).

5.3.1 Social and Cultural Expectations

EMS workers' operate within the specific frameworks and contexts of the country in which they work. The first theme illustrates how the cultural backdrop of Saudi Arabia impacted on the participants' ideals of what an EMS worker 'looks like'. Some participants described this impact as positive, while others believed these values negatively impacted their disaster preparedness.

Saudi Arabia has always relied on men to do everything, and women were responsible for their children. Recently, Saudi women have been equalised with men in almost everything. We have always seen women as doctors and nurses for many years, but we haven't seen them paramedics till recently. I guess it's a new experience for them and they cannot give as men in the field for now because their physical structure (P3: F, Page 1, 6-11).

This theme is underpinned by two main sub-themes: (i) access and opportunities among EMS workers, and (ii) physical ability and emotional wellness among EMS workers.

5.3.1.1 Access and opportunities among EMS workers

Several participants described the challenges related to accessibility and opportunity between male and female EMS workers. The participants described how the Saudi Arabian government provided opportunities for education, training, and development to EMS workers. However, these opportunities were highly competitive, and appeared to be biased in favour of male EMS workers.

Not many universities provide EMS certificates for a female to become a paramedic. That's why we can see the male is more educated than female at the end (P6: M. Page 1, L 36-37).

These challenges for educational opportunity also extended from their studies into the workforce.

Even before we reach to prepare for disaster management, I believe, as female paramedics, we faced challenges in studying and also in the internship (P9: F. Page 1, L 25-26).

The participant further explained how the absence of government policies and procedures exacerbated the challenges they experienced.

During our time at the university. The first problem was in the internship, what the government parties that can train us, for example, Red Crescent don't have female employees in the field and don't have a policy for female paramedics (P9: F. Page 1, L 34-36).

These disparities in educational access and opportunities for female EMS workers were also reported by male colleagues, as this issue aligns with the gender and cultural norms of Saudi Arabia.

Social norms and gendered roles in my country may have given me more advantage as males to survive than women. For example, men in my country have more access to training resources and information than females. Therefore, I believe my gender did actually influence my preparedness for disasters (P11: M. Page 1, L 9-12).

In my personal perspective, I believe that there is a huge difference between male and female paramedics especially in our country. The reason is the idea of being a female paramedic in our culture was inappropriate a long time ago. So, female paramedics in our country are considered as a new job created by the government (P2: M. Page 1, L 5-8).

It appears that female EMS workers were yet to be fully accepted and integrated into the EMS profession as equal partners with their male peers. Female EMS workers were seen as a new group of employees who were venturing into a male-dominated profession.

I think that female paramedics are marginalised. They are new to the field, and they must be empowered by giving them a like priority (P4: M. Page 2, L 29-30).

Reports of the marginalisation of female EMS workers within the workplace appeared to further increase their challenges to access education, training, and development opportunities for disaster management. Participant 9 reiterated the same view:

Men have access to different trainings and exercises, such as trauma cases and field interventions, so we struggle to keep up and enhance our skills to be in the same levels of others who has access to different kinds of trainings due to their field roles (P9: F. Page 2, L 9-11).

Access to different types of training increased male preparedness and the gap level between male and female workers. Consequently, male EMS workers dominated leadership roles.

I feel I'm well prepared for disasters since I'm the one who is responsible for organising drills, tabletop exercises, and code testing (P13: M. Page 1, L 13-14).

... as a male paramedic ... I have more access to resources that increase my knowledge and skills. I can be a part of any committee, I can work for how many hours I like, and I can work in any work environment without the fear of being subjectified, I don't think my female co-workers have that luxury (P14: M. Page 1, L 13-16).

Unlike their male counterparts, female EMS workers were expected to train within predetermined boundaries. For example, women were not expected to spend nights away from their families. Therefore, they were not able to travel for distant training opportunities. This expectation was not imposed on male EMS workers who were free to train in any environment regardless of their location and distance from home.

Female workers are not supposed to train in some environments. For example, it is not right for a female employee to train and be away from their families for a long time,

including spending nights in training camps. This is acceptable for male workers as they are free to train (P12: M. Page 2, L 23-26).

Female participants reported how society viewed them differently based on their gender. For example, Participant 3 noted that female EMS workers predominantly worked in the non-operational or tactical areas such as planning, management, and finance.

From my point of view, I see female can work in the planning and financial, but I cannot see them in the operational or tactical. Females in Saudi Arabia always have been relied on males in the physical part in every aspect of the life which is still that way until today (P3: M. Page 2, L 12-14).

The female EMS workers further described how restrictions to these positions left them concerned about losing their practical skills. This was not an issue for male EMS workers who had opportunities to improve their skills through field duties.

I work administrative roles only in the disaster unit. I never did any fieldwork. I start to lose my skills which is something I don't need to happen. Unlike male workers who can work in the field (P8: F. Page 2, L 31-33).

5.3.1.2 Physical ability and emotional wellness among EMS workers

Families in Saudi Arabia rely on men to do work outside the home, while women take on other responsibilities inside the home, such as childcare and housework. These roles can decrease a woman's physical capacity, preventing them from serving equally to their peers. The job of EMS workers is very physical and requires a significant amount of manual labour, such as lifting patients and moving equipment.

In EMS, female are not able to do the heavy lifting of patient and equipment, in fact they are hindering male work especially in Saudi Arabia (they are not physically fit) (P1: M. Page 1, L 9-10).

A similar response from another male participant agreed that male EMS workers were inherently better positioned and prepared to handle disaster situations than their female peers.

I believe men are better than women in handling disaster. Men can do many things like helping victims in disasters. They can use their physical strength to lift things from the people they fall on. The women do not have the physical strength to help (P13: M. Page 2, L 7-9).

EMS workers carry heavy equipment. This is not an impossible task for a female EMS worker, but according to participants, it is more difficult, on average, than it is for male EMS workers. The prevailing male perception in the responses appeared to suggest that EMS workers needed to be physically prepared and ready all the time:

I believe that it is really important to be physically fit in, especially in the EMS work, you know, because you will be handling patients and moving patients. And, you know, it needs powerful physical fitness (P8: M. Page 1, 35-37).

A female participant shared the same opinion that it is a very physical job, but that they do not believe it to be beyond their capacities.

Females have different capacities and capabilities. So, I'm able to hold the stretcher, transfer the patient with my male peers. But some female colleagues said no, this is not my work. I will not do it. I'm not able to do it. So maybe there are things that need more time to prepare as a woman to face all these issues (P15: F. Page 2, L 27-30).

Another participant concurred and stated that a different area requires EMS workers to have physical capabilities to provide effective treatment.

It is important to be physically fit not only to do the heavy work. Also, to have the ability to provide CPR. I confess that, yeah, I did CPR for a person, and I collapsed. So, it is very important to be you know to have a fitness for that (P8: F. Page 2, L 1-3).

A similar response from another participant stated that physical wellbeing was not the only difference in responding to disasters between male and female workers, but that there is a difference in their emotions too.

The physical differences between me and my male partner weren't the only challenge to respond to disasters. I think we are emotionally different. I think it's the nature of the female to express their emotions more than males, especially with bad circumstances (P8: F. Page 2, L 6-9).

Participants argued that female EMS workers appeared to have more emotional responses to traumatic disaster situations. This led to male participants stating that females were less equipped to face and handle disaster situations.

I remember when we had a call to respond to a mass causality incident. Me and my female partner responded to those accidents, and there were more than 11 patients. Once we arrived, we saw bodies on the street. It was a difficult moment, but we had to be strong and save those patients. I asked my female partners to explore the scene, and I will take care of the bystanders. She was panicking and could not talk to me. I understand that it was a really difficult call, but she had to prepare herself always for the worse (P13: M. Page 2, L 9-14).

Another female worker reiterated a similar opinion and stated that sometimes they faced challenges in providing care for patients. Patients and relatives did not always accept female workers to treat them. This included inappropriate language and lack of trust.

However, patients do not accept my care in some cases because I am a woman. They need male EMS workers to take care of them. Sometimes they engaged with us with bad language, and they are not happy to see us working in the field (P9: F. Page 1, L 22-25).

Despite the differences between male and female EMS workers in relation to physical and emotional wellness, Participant Four believed that women were equally capable in this job as men. They excelled in their jobs and were every bit as capable as their male peers.

Okay. To be honest, I don't think that my gender plays any role as a paramedic and in my preparedness level. Even my female co-workers. They are professional in their work and not inferior to males in the work (P4: M. Page 2, L 22-24).

This theme highlights the barriers, and facilitators of disaster preparedness between male and female EMS workers. Most participants reported that cultural and social expectations informed their preparedness through differences in access and opportunities and their physical and emotional wellness based on their gender, whereas some participants believed their gender did not reflect how they prepared for disaster.

5.3.2 Impact of workplace on disaster preparedness

EMS workers play a significant role in hospitals' disaster responses in Saudi Arabia. An external factor that impacted on disaster preparedness was workplace resources and support. EMS workers faced many challenges, including long shifts and exhaustion, which impacted on

their preparedness. This theme is underpinned by two main sub-themes: (i) Workplace resources and support, and (ii) Impact of long shifts and exhaustion.

5.3.2.1 Workplace resources and support

Hospitals in Saudi Arabia operate differently from one place to another. This appears to play an increasingly vital role in influencing their workers' preparedness levels. Various resources are necessary to support the workers to increase their disaster preparation. Some participants felt that their workplace had effectively prepared them for disaster.

I feel prepared because in my workplace, they run a disaster drill on a regular basis. Also, there are inter-department educational activities run all the year, once a month. These activities increased our preparedness for disaster (P9: F. Page 3, L 27-29).

Participants stated that sustained support from the workplace is essential to achieving good preparedness levels, but for the most part, training and education resources are not uniform across hospitals in Saudi Arabia. Thus, other participants were not confident about their disaster preparedness levels.

I'm still experiencing some difficulty when it comes to disaster preparedness because I have no idea if we have a preparedness unit in the hospitals or not. I have been working for almost two years and haven't been in any kind of drill or exercise. I have attended only one disaster lecture, and I think they were doing it for the records because I did not get much from it. You are asking me if I am prepared, so the answer is no or maybe not as I was expected (P3: M. Page 1, L 15-20).

The lack of disaster preparedness training within my hospitals is an obstacle. Thus, I don't feel well prepared to respond to a major disaster (P11: M. Page 1, L 22-23).

Unfortunately, I feel I am not well prepared for disasters. I never participated in any drills or lectures at my workplace. I don't know why they didn't do that. We've been asking them to do because it's very important things to do. As you know, disaster, it's not expected. It's happened any time and you will not know the amount of damage that disaster could impact, especially your city or your hospital (P6: M. Page 8, L 25-29).

These concerns became barriers for EMS workers in relation to increasing their preparedness levels in the workplace. Most participants highlighted the same solution to overcoming these barriers.

For a better response to any disaster situations, we need to improve our skills in disaster management. The first effective method to increase our skills is to conduct disaster drills frequently. This method helps us participate in training on new equipment, new plan, and new policies and procedures on how to manage any disaster situation in the future. The second effective method is participating in educational courses. This method will automatically improve our knowledge of disaster preparedness. The third methods are more flexibility in work schedule, to attend courses and seminars. By doing this, I believe our skills and knowledge will get improved. Unfortunately, these methods that I told you about are not available at my work, and that's why we are one step back from improvement (P2: M. Page 2, L 14-23).

I think if my workplace conducts more courses or lectures on disasters will increase our knowledge, they can make it mandatory. All the workers have to attend because we all have to know about disasters, and if there are any workers who don't have the knowledge, they will not be ready to respond to disasters. Also, make these courses available to all workers (P9: F. Page 5, L 31-36).

The Minister of Health or hospitals should conduct a lecture to provide EMS with the knowledge, skills, and how they can be prepared when disaster strikes. This is the most important thing that they need to do to teach workers what they need or what they got to do when disaster strikes (P6: M. Page 6, L 7-10).

Participants highlighted the importance of these learning activities for their preparedness levels and expected their hospitals to conduct them regularly

The workplace should provide courses and exercises every quarter to increase the workers' preparedness (P13: M. Page 2, L 5-6).

Hospitals should do departmental drills monthly to check each department preparedness level, and this will help us to find out the gap and build up our emergency operation plan (P15: F. Page 2, L 12-14).

Training and education are important, however some participants claimed it can still be difficult to be motivated and engaged when it comes to learning. Some participants reported that hospitals can provide incentives to stimulate their motivation to attend courses. For example, providing continuing medical education hours (CME) for participants.

If hospitals really want workers to have better knowledge, they should reward the participants so they can encourage others to join them. When I say rewards, I didn't mean something big. Something like continuing medical education hours on those lectures that will help the staff to renew their licenses or to get a promotion (P3: M. Page 2, L 13-16).

I think provide free courses, reward hours for workers who attend any course. Because after working 12 hours a day, I will not come in my free days to attend any course or drills. But if there are rewards, it will push me to attend. Also, hospitals should provide

free courses. ... We have subject matter experts inside each hospital who can prepare and provide courses to the hospital's workers (P5: F. Page 7, L 14-19).

The participants argued that workplace incentives would be a positive way to show appreciation and encourage workers to attend workplace courses and training. EMS workers stated that they derived many benefits from attending these activities which could not be self-taught:

Self-learning is good to keep me updated in the area and better than having no refresher, but preparation at the workplace is much better. I cannot involve in a discussion nor do drills in self-learning. What's good about workplace preparation is that it helps to test my knowledge and my team as well, engrave what we learn in memory, and test our skills and sharpen them (P1: M. Page 2, L 14-18).

Attending workplace training helped to increase the knowledge of the team, in turn boosting preparedness. Participants reported that training in the workplace increased their knowledge through discussion with expert EMS workers.

The good thing about preparedness at the workplace is when your boss allows you to explore and share workers' experiences in this field. In my work, my boss attended a disaster fellowship at Boston University. Sharing his experience during a lot of disasters also during Corona help us to have an idea of what the world is doing, and then you will have a chance to explore for more details by yourself (P5: F. Page 4, L 26-30).

Talking to experts in so many different fields at my hospitals help to widen my gaze about disaster management, and they will push, motivate, and encourage me to learn more to become a master at what I do (P1: M. Page 2, L 18-21).

5.3.2.2 Impact of long shifts and exhaustion

Saudi EMS workers regularly worked 12-hour shifts, and an average of 48 hours per week. However, most EMS workers reported that they often exceeded these hours to cover shift requirements.

Right now, I'm working with the Ministry of Health in the emergency medical services departments. Basically, I'm working 48 hours per week plus extra shifts different from time to time. But since we lack employees in our department, we have to cover this gap by working an extra time (P6: M. Page 3, L 37-40).

As an EMS, I work long hours and long shifts, sometimes 12 hours sometimes more than one day. The long hours' shift makes it difficult for me to focus and do other things (P1: M. Page 1, L 18-19).

Participants reported that working as an EMS required them to work long hours with an irregular workload, often requiring them to work around the clock in rotating shifts.

EMS workers here in Saudi work 12 hours shift. They have to work a 3-day shift, and after the off, they have to do a 3-night shift, and that is exhausting (P3: M. Page 1, L 30-31).

These various shift allocations, including day and night shifts and rotating schedules, interfered with the consistency of the participants' sleep quality and natural circadian rhythms.

One of my biggest issues with shifts is getting enough sleep. In order for me to sleep, I have to sleep at the same time every night. Not resting well affects my mood as well as my body (P1: M. Page 1, L 21-23).

A similar response from another participant stated that his daily practice exhausted him physically and emotionally, which left no space for preparedness.

Working for a long shift exhaust me physically and mentally, which leave no space to be better prepared. The shift consumed my energy and put my mood in bad shape (P1: M. Page 1, L 27-28).

EMS workers' performance toward the end of their shifts was also impacted by shift length. Participants explained how their performance deteriorated towards the end of long shifts due to exhaustion.

If I respond to an emergency at the last hours of my working shift, it will not be the same as if it happens at the first of the shifts. I will be exhausted and tired. I will hope that I will make the right decisions. I remember once when we responded to the case; it was not a disaster but was something near to disaster point. Our shifts started from 7 am to 7 pm. So, I was working the nights, and I was the team leader; at 5 am, hospitals called for red codes in the building, and we had to start evacuating the department. It was a nightmare. Hopefully, everything went well, and everything came back to normal. I believe my response would be different if it were at the first hours of the shift. I will be much more ready, can take, grasp and endures hard works. I will be more patient, relaxing, and able to think of my choices much more than if it's happened in the last hour definitely (P9: F. Page 4, L 38-40 & Page 5, L 1-8).

Other participants reiterated the same point and stated that long shifts and exhaustion did not allow them to increase their preparedness during their shifts.

Working for a long shift exhausted me and left me with no time to increase my preparedness for disaster during my shifts. Then after my shifts, there are other

responsibilities that I should focus on like family, health and so on (P1: M. Page 1, L 20-21).

If I get one day off, I will fall asleep because I'm very exhausted. As I told you, I'm a family guy, and I have to take care of my family. Especially if I get one day or two days off. I don't have time to register for a course or a lecture (P6: M. Page 4, L 32-34).

I only attended one course in my off shifts during all my working years, I tried harder to attend more courses, but I could not. After working for 12-hour shifts four days, you will not have the energy to do anything during your off. Also, I like to spend more time with my family, my friend, relax, and look for my health (P9: F. Page 5, L 15-18).

Long shifts and competing personal/family commitments exhausted EMS workers physically and mentally. This left many participants feeling under-prepared and dissatisfied with their level of preparedness.

Well, as a person that works 12-hour shifts, I feel like my work hours, kind of hindering me from strengthening my skills and my preparedness level (P4: M. Page 3, L 17-18).

In the current work environment where work is heavy, there is no chance to improve skills and acquire new knowledge for disaster preparedness. I am not satisfied with my preparedness level (P1: M. Page 1, L 23-24).

Regarding the relationship between my work hours and my preparedness level, I think my 12-hour shifts badly impacts my ability to gain skills and increase my knowledge in disaster management. With a work schedule that is not settled, I feel that every plan I make to increase my knowledge and skills gets interrupted by work or other obligations. With more work hours, the occupational stressors increase, which makes disaster preparedness is not a priority (P14: M. Page 1, L 20-25).

These cumulative adverse health consequences impacted participants' physical and mental readiness to respond to disasters. Another participant highlighted the importance of personal readiness, which also reflected on their levels of preparedness.

You can't treat patients when you are exhausted. You have to be strong yourself to be prepared for any event, any disaster, any catastrophe that will happen. There is a saying that we learned during our EMS. That states personal safety first. You can't save others if you don't think yourself. So, you have to be prepared mentally and physically, even the personal health, to treat those who need your help because if you are exhausted, you will not be even in the mood to treat others. So, it does even affect the psychological state of the person (P8: F. Page 3, L 24-30).

Therefore, most participants reported the importance of recruiting new workers to release more time for other workers, which they could invest in increasing their preparedness.

If we want to have better preparedness in the paramedic field, we will need to recruit more staff so we can have free time (P3: M. Page 2, L 7-8).

Hopefully, our hospital will reduce these amounts of time by recruiting more workers. Then we can take education classes or training to improve our skills and knowledge (P6: M. Page 4, L 34-36).

The above examples reported the impact of the workplace as an external factor on workers' preparedness. Participants suggested providing more courses and training in their workplace to increase their knowledge and skills. Furthermore, EMS workers suggested that the recruitment of additional workers to decrease workload pressures would give EMS workers more time to invest in their preparedness.

5.3.3 Workers' Perceived Disaster Preparedness

EMS workers stated they need proper preparedness to handle emerging disasters. The participants believed that different factors influenced their preparedness levels for disaster response. These included their previous disaster response experience, education, and training level. Most participants felt prepared, but reported that they needed to participate in more training and education activities to increase their preparedness.

Different factors influence our disaster preparation, like disaster experience, education, and skills level. I feel ok, but I think the number of skills and knowledge I have are not enough and I need more training and courses in this particular area to increase my preparedness (P12: M. Page 1, L 23-26).

5.3.3.1 Work experience

EMS workers act as the frontline healthcare responders in disaster response. The study participants stated that the more working years they had as an EMS, the higher the possibility they had experience responding to a disaster. Most participants reported that working as an EMS positively contributed to their knowledge and skill levels related to disaster preparedness.

The more I practice my job, the more I feel prepared and confident. I believe my experience contributed positively to my knowledge, skills, and how prepared I feel. Working in endless emergency scenarios daily developed my abilities to solve problems, communicate more effectively, and act correctly in most cases (P10: M. Page 1, L 27-30).

Working in the prehospital setting have significantly enhanced my ability to prepare, respond and recover from disasters. Since my day-to-day job is to respond to emergency calls which most of the time entails more than one patient injured at the

same incident. Therefore, my knowledge and skills related to disaster preparedness increased (P11: M. Page 1, L 18-22).

Participants reported that working as first responders and responding to daily incidents contributed positively to their skills, which made them feel very prepared; for example, responding to a truck explosion as mentioned below:

Several factors contributed to my disaster preparedness skills and knowledge. One of these is the experience I gained from responding to the truck explosion incident (P10: M. Page 2, L 6-8).

Another participant concurred, stating that responding to daily incidents increased their preparedness levels either by learning from the experience itself or engaging with leaders in the field.

..// I worked as a full-time paramedic // .. and there was a massive volume of cases, including mass causality incidents. So, I believe the exposure to such incidents allowed me to elevate my skills as well as my knowledge either by learning from the experience itself or exposing to leaders in the field, who have better experience compared to me when it comes to disaster preparedness and management (P12: M. Page 1, L 17-23).

Other participants stated that they hadn't responded to any disasters during their working life. This made them feel unprepared.

For me, I worked now more than three years. Still, I feel I'm not prepared because I haven't responded to any disasters through my working years. This is why I need real experience in disasters to increase my preparedness and know how to respond to crises (P14: M. Page 4, L 20-22).

Another participant further explained that limited exposure to disasters decreased their sense of preparation. He reported this was because his main role was to transfer patients.

My role during the shifts is to transfer patients, whether it is internal or external transfer. I haven't fully practiced my job, this is because the EMS provision is new at my hospital, and my manager thinks we only can help with patients transferring. I am sure my experience unprepared me for disaster response, and I want to fully practice my job and engage with more and more disaster situations to increase my preparedness (P13: M. Page 5, L 13-18).

5.3.3.2 Education among EMS workers

The aim of disaster education is to enrich EMS workers with the knowledge and skills to increase their preparedness for disaster response. One of the participants believed it was their responsibility to learn and hold on to the knowledge to increase their disaster preparation. Most participants felt they were not prepared enough, and needed to increase their knowledge to be ready to respond to a disaster.

When it comes to disaster preparedness, I don't feel like I'm good enough to handle or to deal with cases like disasters in our city. I think it is my responsibility to learn more and more to improve my knowledge (P6: M. Page 5, L 19-21).

Participants reported different methods to increase their disaster knowledge, with some preferring to increase their knowledge through self-learning.

The best way to increase my knowledge is through self-learning. We work in rotating shifts which make it harder to attend all face-to-face classes, so I preferred to educate myself through to self-learning (P14: M. Page 4, L 5-7).

Participants preferred self-initiated because it allowed them greater flexibility to increase their disaster preparedness. One of the participants reiterated a similar opinion and stated that self-learning through reading published papers and watching lectures positively impacted his preparedness level.

I like to increase my knowledge through self-learning, whether reading published papers or disaster books. It helped me to increase my disaster knowledge and reflected positively on my preparedness level (P12: M. Page 2, L 1-3).

This participant gave an example where he transferred what he reads into action. He believed that using the smart triage tag during his response to a mass casualty incident increased his response level.

I remember I read an article that discussed the implication of using the smart triage tag during mass casualty incidents. It was my first time knowing about the existence of this type of tag. I discussed it with my supervisor, and he was supportive to change the triage tag we used with the smart tag. The smart triage tag comes with a great advantage like preventing re-triaging, and it has a system to track all the patients. These two advantages minimised our response time and increased our response to mass casualty' (P12: M. Page 2, L 6-11).

While some participants preferred reading articles and books, others acquired their knowledge through learning from online courses and YouTube. They found these sources to be more convenient for their learning needs.

My learning comes from getting to know how others dealt with disasters from online courses whether it is regular course in website, YouTube video or audio record (P1: M. Page 2, L 6-8).

In addition to that there are some organisations offer free online courses like UN and Coursera, the good thing about these courses is that it is self-paced so you can take the courses when you are free stop when you are busy and get back to where you left in your next free time (P1: M. Page 2, L 8-11).

Other participants stated that one of the most important sources for disaster knowledge acquisition was attending conferences and workshops. They stated that conferences were excellent spaces and moments for the dissemination of new scientific knowledge, as well as for interaction and development of social networks among disaster experts.

The third methods are attending conferences and workshop in a global scale. These methods also will increase our knowledge by learning what other country have done during disasters that happened to them and what strategy they used when disaster strike (P2: M. Page 2, L 21-23).

I believe following and engaging in the conferences that related to disaster is another effective and useful way to increase my preparedness. Also, it allows me to engage with other expert in the disaster field (P12: M. Page 2, L 6-7).

Despite the importance of these learning acquisition methods on personal preparedness, several participants argued it was difficult to be motivated to initiate learning in this area when they had gained little prior disaster knowledge during their bachelor's degree.

Even though taking courses, workshops, reading books and articles helps increase disaster preparedness, sometimes it is hard to educate yourself on a topic you don't know about it. I think if I had a disaster educational class back in my bachelor curriculum, things would be different. My educational background will help me during my self-learning activities (P13: M. Page 7, L 16-19).

In addition, another participant reported that the gaps in his education made it difficult to prepare him when he needed to be prepared for responding to a disaster and providing assistance.

I didn't take any subject related to disaster management during my undergraduate study. So, this was a very big obstacle. Once we work in the scene, you know, we are not aware of disaster, we are not able to handle any disasters. The only thing that we are doing is getting orders from doctors or our supervisor when it comes to disaster management. We don't know how to deal. We don't know where to go or how to perform. This is a very big issue (P6: M. Page 6, L 28-33).

A recurring convergent opinion among the participants highlighted the importance of integrating disaster-related content into the undergraduate EMS curriculum. This would raise awareness and expose students to appropriate skills and knowledge to be competent practitioners when facing disasters.

I have one more thing to add that would assist my knowledge and skills to improve when it comes to disaster management which is I believe university should include a course like disaster management in their curriculum, once they added this course to their curriculum, the EMS will be graduated with more awareness and more preparation about disaster management (P6: M. Page 6, L 18-22).

I also believe all universities in my home country need to consider adding such a course as disaster medicine and management in the curriculum to the EMS provider would make a change in the future as well (P2: M. Page 2, L 9-11).

5.3.3.3 Training among EMS workers

EMS workers believe they needed to participate in a range of training exercises to increase their preparedness for disaster response. Some participants confirmed that their low levels of awareness of the likelihood of disaster types in their city decreased their understanding of training needs for disaster response.

I haven't responded to any disaster, and I don't know the skills required for disaster response. I have to increase my awareness about disasters and explore the likelihood of risk around me to know what training required to respond to these disaster (P14: M. Page 6, L 15-17).

Other participants reported that most of their knowledge and skills about disasters came from education classes. They argued that education was important, but coupling it with hands-on practical experience during training would give them confidence with their disaster roles and responsibilities.

Nothing will be learned through classes except the theoretical part. It is good to have knowledge and skills about disasters, but the most important is to have hands-on experience through training to respond effectively during disasters (P15: F. Page 2, L 20-21).

It is important for EMS workers to have hands-on experience to be able to function better in a disaster situation. Participants reported that all EMS workers should receive proper training in disaster management.

I believe that all EMS workers should participate in training exercises that suits their needs to increase their skills and knowledge for disaster (P11: M. Page 2, L 11-12).

Constant training is a vital part of disaster preparedness. Some participants credited their effective disaster response to their training and preparedness exercises.

Real-time incidents and training constantly are the most effective ways that I believe helped me to recognise my preparedness level and improved me more in dealing with emergencies and disasters (P13: M. Page 1, L 25-27).

Participants reported that training was the only way to develop skills, the more one did something, the better they got at doing it. Participants identified field triage, infection control, basic and advanced life support as important training requirement for preparing EMS workers for disaster response.

As one of my mentors said, continuous practice will strengthen your disaster skills. I believe that participating in BLS, ACLS, field triaging, and infection control training exercises will increase my disaster skills and knowledge to respond to disasters (P1: M. Page 2, L 27-29).

Other participants reported that participating in tabletop exercises was a highly effective training method that helped them increase their disaster skills and knowledge.

The second effective method is participating in a tabletop exercise. This method will automatically improve our skills and knowledge because it is a facilitated scenario in a clean environment based on a discussion that tests protective measures of a potential risks (P2: M. Page 2, L 18-20).

Additionally, all the participants agreed that drills were essential experiences to prepare EMS workers to sufficiently respond to disaster situations.

I think more participation in drills exercises will increase my skills and knowledge. Seeing the disaster situation firsthand gives me a good feel of how my skills will play out. So yeah, I think I test my skills and knowledge at those exercises (P4: M. Page 7, L 11-13).

I think that my skills will be much improved if I participated in more disaster drills and exercises (P14: M. Page 2, L 13-14).

Drills provided participants with the chance to understand the procedures of the hospital disaster plan and to practise essential skills during the exercise sessions. Other participants suggested that training could be improved by involving all other healthcare disciplines and agencies.

During disasters, all health-related and unrelated workers will respond as one team. It is important that we train together to improve our cooperation and communication skills. We will have a chance to understand each other scope of practice during the exercises (P13: M. Page 5, L 20-22).

While full-scale exercises may be an effective training tool, the participants reported that these exercises were difficult to organise and required significant resources and time.

Differences between our shifts time and training needs were the two most barriers preventing us from full scale training at our hospitals (P11: M. Page 4, L 10-11).

For these reasons, the participants suggested that virtual simulation be offered as a viable alternative option to practice exercises with multiple agencies. They considered this approach to be ideal for initial exposure to disaster management.

In the era of technology, I think shifting the regular exercises to simulation based. It will save us more time than we used to organise. Also, it allows us to practice for different disaster scenarios at a lower cost (P14: M. Page 5, L 5-7).

This theme highlighted the importance of perceived preparedness on workers' response levels. Participants reported that having a better response to disaster preparedness is associated positively with more years of practicing as an EMS. The participants also stated that it was essential to couple their knowledge with skills to increase their preparation.

5.3.4 Institutional and National Disaster Framework

The participants believed that a successful emergency response required each team member to know exactly what to do and when to do it at the right time. They believed their job would remain, but would entail different roles and responsibilities. For instance, their roles and responsibilities could be working as first responders at the scene, working in the emergency department, functioning as a back-up worker in the intensive care unit (ICU), or reporting for duty at the different health departments.

It is essential to have a clear policy and procedure for disaster response, and all workers know where to find it, understand it, and know how to follow it because it will improve our preparedness for disaster. During disaster response, we may practice the same daily practice, or we may practice a new role we don't use to do it. We may work at the field, emergency department, intensive care unit, or backup at a different healthcare facility (P7: M. Page 12, L 6-11).

This theme is underpinned by two main sub-themes: (i) workplace policy and procedures, and (ii) Saudi Arabian disaster regulation.

5.3.4.1 Workplace policies and procedures

Most participants reported that their workplaces did not have clear disaster policies and procedures for EMS workers, with participants reporting they needed to approach their supervisors for procedural instruction and reassurance.

Unfortunately, in my day-to-day work we do not have a clear disaster protocol. This does not mean there is no protocol at all, but it means people who works in the field do not know about these protocols. The field management officers may know or have copies of the protocol but not the paramedics and the EMTs (P10: M. Page 9, L 3-6).

This lack of clarity often led to EMS workers seeking direction from their supervisor in regard to how to respond during larger-scale critical incidents.

Actually, there is no clear policy and procedures in the paramedic department. You always have to ask the supervisors or the old employees how work goes in such case[s] which always causes a delay in the response or even makes you make some mistakes (P3: M. Page 9, L 8-10).

The participants believed it was important for all EMS workers to know where to find the disaster response plan and to be familiar with its contents before an emergency arose.

All the EMS workers have to be familiar with the disaster policy and procedure. We have to know where to find these plans, what does it include and how to apply them during the response (P6: M. Page 10, L 1-4).

Other participants reported that their hospital had a written plan for disasters. However, these plans were difficult to apply during a disaster.

I think disaster policy and procedures are good to some extent but when it comes to applying that in real world there comes the challenges (P1: M. Page 9, L 17-18).

This participant further explained the reasons that hindered the implementation of the policies and procedures.

Implementing what is written is the toughest part for many reasons, like people in charge of carrying them out are not trained enough in that specific subject matter (lack of qualified personnel and subject matter expert). Also, people who are in charge of these have a lot of responsibilities which does not leave enough attention to disaster management (P1: M. Page 9, L 19-22).

As a result, the participants felt there was a lack of understanding of disaster policies and procedures.

Yes, we do have a policy and procedure. I don't know them. Like I didn't see them or have read the regulations. But I think that the disaster preparedness unit has some official regulations and policies, but they didn't explain them to us (P3: M. Page 9, L 34-36).

The participants reported that failing to explain the disaster policies and procedures to them on orientation day was the main reason for their lack of preparedness.

When I joined, I don't remember that someone told me, "This is the policy that you need to follow", or "This is what we are following"' (P5: F. Page 8, L 35-36).

The main reason for our misunderstanding of the disaster policy and procedure at our hospitals is that they didn't explain it to us at orientation. So, we don't know if our hospital has a policy or not (P12: M. Page 9, L 20-22).

Participants suggested that their workplace could improve their disaster policies and procedures by having a clear policy and acquainting workers with specific regulations when they were first hired.

If we want to promote disaster response, we will first have to write a clear policies and procedures [document] that will facilitate the EMS [workers] day by day work and included the disaster regulations. Second, make sure that the staff understand [the] policies when they [are] first hired in the department (P3: M. Page 9, L 12-15).

Other participants suggested that it may be helpful to outline a plan and tasks for assigned roles in a card system or small notebook for frequent incidents such as motor vehicle crashes including necessary contact information, and to have it updated regularly.

Our hospital responds to frequent emergencies like motor crash accidents, and I imagine the easiest way to remember our roles and the hospital's important contact information is to highlight in a small card or notebook. This will help to standardise our response and decrease the mistakes (P6: M. Page 10, L 12-15).

5.3.4.2 Saudi Arabian disaster regulation

Three years ago, Saudi Arabia established the National Health Emergency Operations Centre (NHEOC). This centre sets out all disaster roles and regulations for hospitals in Saudi Arabia, and also serves as an official link between hospitals and other government departments.

Saudi Arabia established an official centre three years ago to set all the disaster policies and regulations. All hospitals are supposed to follow the [centre's] policies during disaster response, you know we have a different hospital, and it is hard if we don't follow the same plan during disaster response (P8: F. Page 13, L 27-30).

Most EMS workers lacked awareness of the centre's roles and tasks.

I heard from the news that they established a new centre specialised for disasters, but I haven't heard anything more about this centre. We don't know if they created a national response plan or not (P11: M. Page 9, L 27-29).

Participants reported that their lack of awareness of the centre's roles and responsibilities resulted from limited access to publicly available data, and that the government was not transparent with its policies and procedures. This negatively affected their preparedness for disaster response.

I heard about the new national centre from my peers, and I tried to know more about it, so I google[d] it but couldn't find anything helpful more than the news post about the centre. I asked my supervisors if they had more information, but they didn't know anything else. To be honest, I was expecting that to happen because most of the public policies and procedures are hard to access, even for us, the healthcare workers who should have a clear understanding of their plans to respond well to disasters (P14: M. Page 11, L 10-15).

As a result, most of the participants reported disparities in the disaster response between the Ministry of Health, military hospitals, and the Red Crescent authority.

There is a huge difference between the EMS worker in the Ministry of Health, the military hospitals and the EMS worker in the Red Crescent when it comes to disaster management. I mean the rule and responsibility when disaster strike[s]. There is no specific policy and procedures for both sides to follow under any disaster situation (P2: M. Page 9, L1-4).

Participants suggested that the NHEOC should create a standard response plan to reduce response variation and to standardise practices across hospitals. This would also make healthcare workers aware of these plans and make them more accessible.

The National Health Emergency Operations Centre should take deliberate actions to enhance disaster response by setting a national response plan for all healthcare facilities. They also should put intertwining efforts to educate all healthcare workers about these plans to guide desired outcomes (P10: M. Page 9, L 11-14).

This theme highlighted the importance of having clear disaster policies and procedures that fit the Saudi Arabian framework. Participants reported low levels of awareness of disaster policies and procedures in their workplace, which they believed decreased their preparedness for disasters. Participants believed they would increase their preparedness if disaster policies were presented during their orientation and were made constantly accessible.

5.4 Summary

Chapter Five of the thesis has focused on the emerging themes deduced from the qualitative analysis for this study. Using Braun and Clarke (2006), the analysis focused on four major themes: (i) Social and Cultural Expectations, (ii) Impact of Workplace on Disaster Preparedness, (iii) Workers' Perceived Disasters Preparedness, and (iv) Institutional and National Disasters Framework.

The chapter has demonstrated and focused on the unique findings and context of Saudi Arabian EMS workers. Some of the emerging findings focus on barriers to disaster preparedness, including the unique impact of Saudi Arabian culture, the lack of equal access to training opportunities, a lack of a standardised national policy, and the lack of clear and available institutional and national disaster frameworks.

Chapter 6: Discussion

6.1 Introduction

This chapter discusses the findings from Phases One and Two of the study to explore the perceived barriers to, and facilitators of, disaster management and preparedness among EMS workers in Saudi Arabia. The findings are unique in the Saudi Arabian context and can potentially inform future decision-making regarding EMS workers preparedness for disaster.

6.2 Key findings

This chapter presents the barriers to, and facilitators of, EMS workers' disaster preparedness in Saudi Arabia. The findings demonstrated a range of factors organised into the following themes: (i) *A Developing Profession with a Young Workforce*, (ii) *Access and Opportunities in the Workplace*, (iii) *Gender Differences*, and (iv) *Roles in the Workplace*.

6.2.1 A Developing Profession with a Young Workforce

Workforce demographics is a core factor affecting a profession's effectiveness, professional knowledge, and disaster awareness. A national survey of EMS workers in Saudi Arabia identified that the EMS profession predominantly comprises younger workers under 35 years old (Alshammari et al., 2019). This was reflected in our study with 85% of respondents meeting this category (85%, n=232). Universities in Saudi Arabia began to teach EMS Bachelor's Degrees after 2007 (Alshammari et al., 2017). More than half of the participants in this study were aged 26-35 years (n=138) and had 1-6 years of experience, while 39.7% had 7-12 years of experience (n=108). Therefore, many participants were quite new to the profession. Subsequently, the participants reported having limited exposure to disasters and believed that this lack of exposure decreased their disaster preparedness.

Younger participants employed in the profession for less than six years reported that their lack of experience decreased their preparedness for disaster management. EMS workers with a longer employment history reported that their skill and knowledge levels increased with years of experience. Thus, the year of experience as an EMS worker was positively related to their perceived skill level for disasters. The study also found that EMS workers gained better access to educational opportunities with advancing age and experience, such as exposure to materials, literature, seminars, and workshops. Therefore, it appears that access to these opportunities may be related to the relationship between advancing age and perceived skill level. Albanese and Paturas (2018) and Al Khalaileh et al. (2012) supported these findings noting that with advancing age, EMS workers had additional opportunities to engage in training and practise exercises. Thus, improving their skills for handling disasters as they climbed the career ladder and providing them with increased access to drills, information, and knowledge (Albanese & Paturas, 2018; Al Khalaileh et al., 2012; Paton & Jackson, 2002).

Female EMS workers were integrated into the field in 2018. This is consistent with the population of this study where a quarter of the participants were female (15.4%, n=42) (Alharthy et al., 2018). Female participants reported additional barriers to disaster preparedness such as their poor levels of acceptance and integration into the EMS profession. They described their treatment as a new group of workers who were venturing into a male-dominated field. The female workers reported additional barriers that impacted their preparedness for disasters. These barriers will be discussed later in this chapter.

6.2.2 Access and Opportunities in the Workplace

Equal access and opportunity in the workplace play a key part in preparing EMS workers for disasters. Participants reported that access and opportunities to partake in the education and training offered in their workplace decreased their disaster preparedness. This was because

activities such as attending seminars and drills were either very limited or reserved for those with higher career progression such as profession leaders. The lack of education and training opportunities was consistent with other studies that reported this as a core challenge to enhancing EMS workers' preparedness globally (Blessman et al., 2007; Hsu et al., 2013; Mulyasari et al., 2013).

Other studies found that increasing workers' access to education and training opportunities was critical to enhancing their disaster preparedness levels (Almukhlifi et al., 2021; Carli et al., 2017). EMS workers who had access to lectures, drills, and training opportunities had enhanced knowledge and skills and responded better to disaster situations (Bentley & Levine, 2016; Carli et al., 2017). Xu and Zeng (2016) study demonstrated a strong link between education and disaster preparedness. The findings revealed that the level of education and training was directly linked to disaster preparedness, and that the more EMS workers were educated and trained, the higher were their preparedness levels. For example, EMS workers were able to refer to more advanced and extensive literature written by authors with higher levels of education, such as a Master's or PhD degree (Almukhlifi et al., 2021; Hammad et al., 2012). This allowed them to access peer-reviewed information to improve their levels of knowledge (Xu & Zeng, 2016). Other studies identified seminars, drills, and tabletop exercises as appropriate learning and training opportunities to increase worker preparedness (Hsu et al., 2013; Mulyasari et al., 2013; O'Sullivan et al., 2008). However, Hammad et al. (2012) stated that there is no agreement regarding what is the most appropriate content, mode, or method of delivery, and that disaster education is limited in terms of frequency, relevance, and availability.

Male EMS workers were favoured for competitive training and education opportunities. Female participants reported a limited ability to attend courses and training compared to their

male peers. This was because female EMS workers were expected to train within predetermined cultural limits. Some training opportunities were available locally. However, they were routinely held at night due to the limited availability of training locations. This means that female EMS workers were unable to attend, especially for training focused on gaining or assessing practical skills and expertise. Male EMS workers did not share these cultural limitations and had the freedom to spend nights away from home to attend the training sessions⁸. This restricted the ability of women to attend training sessions and limited their preparedness to respond to disasters. These cultural expectations contributed to the variance in preparedness, and aligned with the findings that male EMS workers consistently reported better preparedness levels than their female peers. Several international studies have identified that female workers have reported lower preparedness levels for disaster than their male peers (Al-Ali & Abu Ibaid, 2015; O'Sullivan et al., 2008). The researchers reported insufficiencies in education and training programmes, where female workers had less access to these opportunities than male workers (Al-Ali & Abu Ibaid, 2015; O'Sullivan et al., 2008).

Lack of access to, and understanding of, workplace policies and procedures also lowered the preparedness of EMS workers for disasters. This was described by some participants who reported they did not know the policies and procedures of their workplace. Current practice requires junior EMS workers to approach supervisors for procedural instruction and reassurance during disasters. The existing policies of workers' organisations influenced the knowledge and skills acquired. For instance, some Disaster Preparedness Evaluation Tool questions on knowledge referred to the presence of disaster management policies, understanding of related frameworks, and awareness of the chain of command in a disaster. The participants considered the presence of policy guidelines and frameworks to be

⁸ Different government bodies provide training sessions for EMS workers, including the Ministry of Health and the National Guard Health Affairs. They provide morning and night sessions, however, most of the training is held at night due to location availability and work shift pressure.

critical in promoting their disaster knowledge and skills. Al-Hunaishi et al. (2019) found that knowledge can best be determined by the extent to which EMS workers are aware of existing regulations, guidelines, and policies. Setyawati et al. (2020) and Taskiran and Baykal (2019) claimed that EMS workers who had sufficient knowledge and understanding of their workplace disaster policies and guidelines reported better preparedness. For example, they showed better understanding of what was expected of them during disaster response. Unclear policies and procedures restrict the ability and opportunities of EMS workers to develop disaster knowledge and skills (Catlett et al., 2011; Henderson & Pandey, 2013). Öztekin et al. (2016) found that lectures followed by mock drills were a useful method for increasing EMS workers' understandings of their roles in a disaster. The findings revealed that this combination provided participants not only with the chance to understand the procedures of their workplace disaster plans, but also the chance to practise essential skills during the exercise sessions (Öztekin et al., 2016).

The participants also raised concerns about training and workplace policies. Both are neither evidence-based nor standardised in Saudi Arabia. Furthermore, the participants claimed that there is no uniform training curriculum and policies in Saudi Arabia. They reported that hospitals have developed unique, hospital-specific EMS worker preparedness training curricula and policies in response to training and policy gaps. Consequently, these curricula and policies vary between hospitals. Each hospital formulates its own preparedness policies in line with its other existing policy guidelines, the available resources, and the priority and rank given to its EMS workers. These unique hospital training resources and policies are a barrier to EMS workers' disaster preparedness. This was likely due to the lack of a comprehensive national policy on EMS workers' disaster preparedness. The difference in hospital policies meant that some workers could be proactive while others were not so enabled. Additionally, the lack of a standardised training curriculum did not provide assurance that learned skills and preparedness

areas are nationally equivalent to meet the requirements and expectations of EMS skills and preparedness levels. Disaster preparedness for EMS workers changes periodically and thus requires a standardised training system that can evolve with the profession's needs across the country (Hammad et al., 2012; Almukhlifi et al., 2021). A work-based, competency-based training curriculum for EMS workers is a necessary first step to ensure the uniformity of practice and policies in the workplace (Hammad et al., 2012; Almukhlifi et al., 2021). Governments should allocate financial resources to establish and operate these programmes in hospitals (Djalali et al., 2014; Hammad et al., 2012). Djalali et al. (2014) pointed out that using standardised guidelines may help hospitals reach a 'consistent' level of disaster preparedness. Nations with clear and concise policies reported higher rates of EMS worker disaster preparedness, including the UK and Australia who have demonstrated consistency in management policies for EMS workers (Dzigbede et al., 2020; Jaeger et al., 2007; Strang, 2014).

6.2.3 Gender Differences

Gender was identified as another factor that influenced the division of work and worker preparedness. A significant barrier to EMS workers' preparedness in the Saudi Arabian context is the existing Arabic Muslim culture, which is largely collective and patriarchal (Hamam et al., 2015; ALobaid et al., 2021). Arabic culture has strong social and cultural expectations of the differing roles of males and females in society which favour men over women⁹.

Cultural expectations led the participants to describe how society was less receptive to female workers caring for patients outside of the hospital setting, and being alone with male EMS workers. Female participants reported that patients and bystanders used inappropriate language when engaging with them. Other patients lacked trust and refused their care. A semi-

⁹ While societal norms are an important concept, they are not the primary focus of this study

structured interview study conducted with female Australian paramedics reported similar attitudes experienced by female EMS workers (McFarlane et al., 2021). However, the authors argued that this barrier was not enough to prevent female workers from excelling in their job as equal partners to their male peers (McFarlane et al., 2021). Many participants believed that society considers the EMS profession in Saudi Arabia to be a male career. This cultural belief reinforces the negative societal perception of female EMS workers that lowers their morale and subsequently reduces their overall disaster preparedness. These circumstances led the female participants to perceive that they were less effective at their job. Consequently, they felt less competent over time. This finding is consistent with previous studies that describe the Saudi Arabian industry as inherently male-dominated (Hamam et al., 2015; ALobaid et al., 2021). The authors demonstrate that apart from the nursing profession, societal awareness of female EMS workers remains very low (Alkabba et al., 2012; Alsaleem et al., 2018).

The EMS workers reflect the larger society of which they are a part. The expectations on female EMS workers are not only social, but also professional. The study found that cultural expectations led male EMS workers to believe that female workers were less prepared for disasters. Thus, female EMS workers faced a bias in the available training opportunities mentioned in this chapter (Page 116) and the allocation of responsibilities. One factor that could be a cause of the disparities between male and female preparedness is the nature of the job. The role of the EMS is physical and involves a significant amount of manual labour such as lifting patients and moving equipment. Another factor is that female workers may have more family demands in Saudi Arabia, for example childcare. An additional challenge is that the shift patterns make it more difficult for female workers to find childcare support while working. The findings are consistent with Crane et al. (2010) and Al-Ali and Abu Ibaid (2015) who found that male workers demonstrated higher levels of knowledge, skills, and preparedness than their female counterparts. The researchers emphasised the need for equitable preparedness

opportunities among workers to increase the unity of response to disasters. However, Staats et al. (2021) found that some patients preferred female EMS workers responding to certain conditions or situations, especially those involving children or pregnant women. The supporting literature in Saudi Arabia reported that female patients showed strong agreement to accept treatment from female EMS workers, especially in life-threatening situations in which the presence of male EMS workers would be inappropriate (Alharthy et al., 2018).

6.2.4 Roles in the Workplace

Having a workforce equipped with the knowledge, skills, and capabilities is a core element in responding to disasters effectively. This requires EMS workers to be prepared and to understand their responsibilities during disasters. There are clinical and administrative responsibilities in the EMS role. EMS workers' clinical responsibilities include providing rapid response to medical emergencies in and out of the hospital. They treat patients with critical and non-critical injuries, often while in transit, and transport patients to hospitals. Moreover, EMS workers have administrative responsibilities such as handling dispatch duties, transferring patients, and working in logistics roles (AlShammari et al., 2017). While EMS workers are trained and capable of providing both clinical and administrative responsibilities, some hospitals recruit EMS workers only to fulfil administrative responsibilities that prevent them from practising their full scope of practice. Currently, female workers predominantly fill these administrative roles.

Social norms have influenced how the delegation of work occurs within the profession, leading to disadvantages or challenges that females face in practising what is considered a clinical responsibility. Female participants reported that they were only allocated, and exposed to, tasks considered administrative in terms of roles and responsibilities. The responsibilities assigned to female workers were in support, such as operational and logistics roles, rather than

being trained for working in the field. This resulted in a bias in training and skills along gender lines, with male EMS workers having both greater training and experience than their female peers, leading to greater preparedness of male EMS workers.

The study findings revealed a relationship between disaster preparedness and female EMS workers' experience. Female participants reported a lack of experience due to limited duties and responsibilities in their workplaces. Consequently, female EMS workers knowledge, skills and preparedness became limited and were viewed as less important which prevented them from practicing their clinical skills effectively, and negatively affecting their disaster preparedness. Female participants believed that they are culturally viewed as weaker, less well prepared, and therefore, ill-equipped to manage a disaster situation. The literature reveals that the lack of practising clinical responsibilities for EMS workers directly impacted their disaster preparedness (AlObaid et al., 2021; AlShammari et al., 2017). Other studies have asserted the need to expose EMS workers to clinical and administrative responsibilities (Cavanagh et al., 2020; Pedersen et al., 2016). The authors revealed that EMS workers who were allocated clinical responsibility had better preparedness scores in the long run. This was unlike EMS workers, who were allocated only responsibilities that were considered administrative responsibilities in most countries' healthcare systems (Cavanagh et al., 2020; Pedersen et al., 2016). Cavanagh et al. (2020) and Oostlander et al's (2020) studies reported that although responsibilities were often challenging for female EMS workers in the initial stages, exposure to disaster situations improved their knowledge and skills, which in turn increased their preparedness levels.

Not only did these roles vary by gender, but they were also determined by location. Participants were concerned about their hospitals' low understanding of their roles as the Saudi Arabia EMS is a relatively new profession. The participants working in the Ministry of Health

reported that hospitals only allocated them to undertake what were considered administrative responsibilities due to an unclear understanding of the EMS scope of practice. Their role was limited to only transferring patients and handling dispatch duties. Thus, they believed they had lower preparedness levels than their peers in other hospitals. The findings indicated that their hospitals impacted their preparedness level. The regression values in this study for facilities worked in were 0.209 for EMS disaster knowledge and 0.185 for disaster preparedness. EMS workers working in military hospitals had better opportunities to practise clinical and administrative responsibilities; thus, they had higher disaster knowledge and preparedness levels than their peers working in civilian hospital settings. The findings aligned with Tzeng et al. (2016) and Al Thobaity et al.'s (2015) studies which demonstrated that participants working in military hospitals possessed more knowledge, skills, and preparedness for disaster than those who worked in civilian hospitals. They concluded that this was because military workers were exposed to more clinical cases and responsibilities in their workplace. The studies showed that military workers also participated in drafting disaster plans in their workplaces, and that they had a better understanding of disasters. The more EMS workers practiced their roles, the greater was their preparedness to respond (Al Thobaity et al., 2015; King et al., 2019; Tzeng et al., 2016).

Other participants also reported staff shortages as a barrier to increasing their preparedness for disasters. They reported that they were sometimes required to work more hours to fill staff shortages (more than 48 hours per week). They also reported the relatively low number of EMS workers in the workplace meant they worked extremely long hours and after finishing one shift, they often had little time to prepare for the next shift. The study findings reported a negative correlation between hours worked and preparedness. Participants reported that working extensive shifts reduced their concentration and increased the risk of workplace mistakes. The supporting literature shows that EMS workers had minimal time to

regain their energy and expand and grow their skills through training, leading to a prolonged risk of low preparedness (Patterson et al., 2012; Patterson et al., 2018). This means that high fatigue often leads to a low satisfaction index (Barger et al., 2018; Patterson et al., 2012). The thesis findings contrast with the existing literature that indicates a positive relationship between EMS workers' working hours and their disaster preparedness (Blau et al., 2012; Fernandez et al., 2011; Al-Otaibi, 2018). However, it also shows that this positive relationship is based on an optimal number of weekly working hours (Al Khalaileh et al., 2012; Brewer et al., 2020). According to Al-Otaibi, (2018) and Blau et al's (2012) studies, it is evident that when EMS workers are over-worked beyond the average and optimal working hours (40 hours per week), they are prone to a decline in preparedness due to high levels of fatigue. EMS workers under fatigue conditions have slower responses and are less creative and flexible, thus lowering their response times and preparedness levels (Al-Otaibi, 2018; Blau et al., 2012). Other studies demonstrated that considering the challenges and limitations linked to EMS workers' exhaustion, there is a great need to reduce fatigue and increase opportunities for improving EMS workers' knowledge, skills, and preparedness for disasters (Al-Wathinani et al., 2021; Alyami et al., 2020).

6.3 Conclusion

This chapter discusses the significant findings of this study, identifying moderate levels of knowledge, skills, and preparedness among EMS workers in Saudi Arabia. EMS workers reported interest in increasing their preparedness for disasters. However, they reported a number of barriers to increasing their preparedness levels, such as EMS being a developing profession, accessibility and opportunities in the workplace, and gender differences and roles in the workplace. The next chapter will present recommendations and implications for future research for EMS workers in Saudi Arabia.

Chapter 7: Conclusion: Recommendations and Future Directions

7.1 Introduction

This final chapter of the thesis presents a number of practical recommendations for developing the disaster preparedness of Saudi Arabian EMS workers and identifying future directions for research.

7.2 Recommendations

Ten practical recommendations for improving disaster preparedness among Saudi Arabian EMS workers are proposed from this work.

1. Educational and training opportunities need to be equitable, standardised, and inclusive for EMS workers in Saudi Arabia.

The qualitative result reported that EMS workers strongly identified the need for education, training, and development opportunities to be equitable, standardised, and inclusive. The availability of drills and training predominantly occurs outside of normal working hours. This negatively impacts the capacity of female EMS workers to attend due to curfew rules (or the inability to travel after dark without their husbands) (Chapter Five, Page 85). One suggestion for solving such inequity in education and training opportunities is to acknowledge the educational needs of both male and female EMS workers. Education and training programs need to be accessible to all EMS workers, and should be scheduled at a time that facilitates the involvement of both males and females. Courses should be offered at different times for men and women and include segregated classes to ensure the privacy of female EMS workers. Educational activities can be targeted to address areas of lower preparedness among EMS

workers. For example, chemical, biological, radiological, nuclear and explosives (CBRNE) training, and further isolation skills. Providing equitable education and training opportunities increases disaster preparedness across the entire workforce of EMS workers.

2. EMS workers must have a board of registration and complete compulsory CPD requirements.

The interview participants believe they cannot improve their disaster preparedness unless they engage in regular real cases, simulations, and drills. A continuing professional development (CPD) program provides EMS workers with clear guidelines on the amount and nature of training that EMS workers should attend every year. Participants believed that drills and workshops improved their knowledge, skills, and leadership qualities that could not be gained through other exercises. Compulsory CPD will allow workers to maintain updated preparedness skills to match the changing complexity of disaster response needs. CPD elevates workers' motivation, engagement, productivity, and increases overall performance. The continuing learning program promotes a vision for an effective and skilful EMS workforce in Saudi Arabia. Currently an organisation does not exist that oversees CPD for EMS workers in Saudi Arabia. This organisation would have the ability to standardise and set the required amount of CPD per year.

3. A secondment program should be created to provide exchange experiences for government and military EMS workers.

The findings of the quantitative and qualitative study together found that EMS workers from military hospitals had better knowledge, skills, and preparedness for disasters due to a structured education and training program. Thus, military EMS workers had greater opportunities to enhance their disaster preparedness. A secondment program would enable EMS workers from government hospitals to temporarily work in a military hospital to increase

their preparedness. EMS workers would receive exposure to different disaster scenarios, protocols, and immersion with these different cultures. Consideration also needs to be taken to ensure equal opportunities for the participation of female EMS workers in these initiatives. Changing the practice environment will benefit government EMS workers working in a military hospital. Consequently, this could improve coherence between the two organisations and improve the national response plan to disasters in Saudi Arabia.

4. Mentorship should be considered a key component of EMS workers in Saudi Arabia.

The findings of the quantitative and qualitative study together found that a majority of the workforce that constitute EMS workers in Saudi Arabia are young people with less experience in disaster preparedness than their senior managers. This is not surprising as EMS is a relatively new profession and an evolving field in Saudi Arabia. Senior EMS workers should be empowered to mentor and support the development of youth EMS workers in the workplace environment. Mentoring can help young workers' engagement and facilitate effective knowledge sharing. Mentoring also helps senior workers support younger colleagues and provide them with a sense of belonging and responsibility for their roles. Supporting relationships between mentees and mentors that last for an amount of time (for example, one year) are central to the success of the profession, increasing mentees' ability to utilise and absorb the knowledge and grow their ability to become mentors. A culture that values mentoring will increase the development of excellence in the Saudi Arabian EMS profession.

5. Postgraduate programs need to be developed to support Saudi Arabia's disaster response.

The findings of the quantitative and qualitative study together found that the EMS workers' clinical and academic opportunities are limited to furthering their education (Chapter Five, Page 100). Therefore, the author recommend providing advanced clinical and academic opportunities to enhancing Saudi Arabian EMS workers' disaster preparedness. Currently, The

Saudi Arabian literature reports that universities in the country only offer diplomas and bachelor's degrees (AlShammari et al., 2017). Establishing a Saudi-based postgraduate program will enable the profession to enhance knowledge and skills through expanded learning opportunities for EMS workers. Creating opportunities for EMS workers to pursue further studies will allow the profession to meet international standards of education delivery and disaster preparedness. Importantly, it is necessary to provide clinical and academic opportunities with a part-time option, as this will allow EMS workers to gain more experience and broaden their knowledge without giving up their existing jobs.

6. Target recruitment of female EMS workers in Saudi Arabia.

The quantitative and qualitative study findings found that most of the workforce is male workers. Recruiting female EMS workers would be prudent to overcome the deficit in the current workforce. The findings from this thesis suggest adjusting and changing the recruitment policies for EMS workers to promote diversity and inclusion within the EMS workforce. In line with cultural norms, a general societal perception from participants is that male EMS workers are more effective and better equipped than their female peers. This leads to recruiting more male than female EMS workers (Alharthy et al., 2018). Expanding the existing workforce would prevent burnout and fatigue. Also, more female EMS workers are needed, especially in conservative cultures such as Saudi Arabia. Female EMS workers are preferred in certain situations including those involving children or pregnancy. EMS workers in Saudi Arabia work in a team of three (AlShammari et al., 2017). Including one female in the team increases their opportunity to gain experience and to meet the chances of culturally competent and safe care.

7. Establishment of standardised full-time working hours for EMS workers.

The participants in the quantitative and qualitative study reported working more than 48 hours per week. Participants believed that working long hours contributed to fatigue and sleepiness

(Chapter Five, Page 96). The study findings advise limiting the weekly working hours and following international work standards (40 hours per week) (AlShammari et al., 2017; Algerian et al., 2018). Reducing working hours may help EMS workers to mitigate the psychological and psychosocial burden of fatigue, while the establishment of standards may allow them to invest more time in increasing their disaster preparedness.

8. Standardised staff rotation policy to empower EMS workers with all systems.

It is recommended that a workplace staff rotation policy is developed that alternates EMS workers between administrative and clinical roles to provide equal work distribution across the workforce. The qualitative findings reported that Male EMS workers are regularly offered clinical roles while female EMS workers are primarily allocated administrative roles (Chapter Five, Page 85). This decreases female EMS workers' clinical experience and lowers their preparedness levels. Role rotation would help EMS workers acquire multiple capabilities and extend their disaster skills and knowledge. This will increase institutional preparedness by improving EMS workers' awareness of all roles and responsibilities. In addition, it will allow female EMS workers to increase their preparedness levels to the same level as their male peers.

9. The Saudi Association of Emergency Medical Services (SAEMS) should be provided with appropriate governance powers to regulate the profession.

The Saudi Association of Emergency Medical Services (SAEMS) undertakes tasks such as forming scientific committees, encouraging research, holding conferences and symposia, and providing public knowledge and awareness. However, the interview results show that the association does not have any role in the governance of policies for the EMS profession or practitioners. Since EMS is a new profession in Saudi Arabia, very few policies and regulations exist to support the development of the profession. SAEMS is a pre-existing body that could be adapted to establish and standardise policies and procedures for the EMS profession. This

may assist in developing the emerging EMS field and ensure uniformity and consistency in operational procedures. A dedicated website for EMS policies and procedures may support EMS workers' practice and preparedness in their day-to-day work. Involving EMS workers in the generation of governance policies is useful to promote stronger awareness of how and when the policies might apply. For example, SAEMS might invite EMS workers annually to gain their feedback to assist with updating the EMS profession's policies, regulations, and registrations.

10. *Collaboration between SAEMS with international disaster institutions.*

Another aspect proposed from the quantitative and qualitative study advocate for SAEMS to collaborate with professional international disaster institutions; for example, the World Association for Disaster and Emergency Medicine (WADEM), the World Health Organization (WHO), and the Centre for Research on the Epidemiology of Disasters (CRED). The SAEMS's ability to debate, scrutinise, and share their experience is essential for developing the EMS profession in Saudi Arabia. Building international collaborations is vital for achieving sustainable development through sharing views, ideas, and experience.

7.3 Directions for Future Research

Several new questions have emerged from the results of this study that relate to the advancement of disaster preparedness for EMS workers in Saudi Arabia. These questions provide an indication of directions for future research in this area.

These include:

- Assessing the Saudi Arabian workplaces equitable, standardised, and inclusive education and training opportunities.
- An exploration of best practices to promote effective CPD programs in Saudi Arabia.

- Examine the impact of a secondment program for EMS workers between military and government hospitals on their knowledge, skills, and preparedness for disasters.
- An evaluation of mentorship program roles and responsibilities to develop a successful and sustainable EMS workforce in Saudi Arabia.
- Evaluating the ability of postgraduate programs to deliver the EMS workers' needs and concerns related to disasters in Saudi Arabia.
- Exploring the challenges, barriers, and enablers to recruiting more females to the Saudi Arabian EMS workforce.
- An evaluation of the relationship between long working hours and fatigue and sleepiness among EMS workers in Saudi Arabia.
- Exploring the influence of staff rotation policies on EMS skills and knowledge and identifying the factors that influence the development of job rotation strategies.
- Examine the relationship between standardised response procedures for all EMS workers in Saudi Arabia and their quality of care.
- Examine the SAEMS capability to develop the EMS profession through international collaboration.
- Investigating the experiences and challenges that female EMS workers encounter in Saudi Arabia's workplaces.

7.4 Strengths and Limitations

The study had several strengths. First, the study was able to obtain the perceptions of EMS workers' disaster knowledge, skills, and preparedness from a geographically and demographically representative sample of the EMS workforce in Saudi Arabia. The explanatory sequential mixed-methods approach facilitated the analysis of the perceived knowledge, skills, and preparedness of EMS workers. Additionally, this approach allowed for

the identification of facilitators, barriers, and cultural impacts on the disaster preparedness of EMS workers' in Saudi Arabia. Secondly, this study used the validated Disaster Preparedness Evaluation Tool (DPET) to explore EMS workers' preparedness. This increases the credibility of the data by precisely representing what it measures (knowledge, skills, and preparedness). Additionally, this will assist comparison of the data from this research with other international studies in the same field.

This study also had several limitations. The study focused on the three largest cities in Saudi Arabia. Thus, the study was only designed to capture the knowledge, skills, and preparedness of EMS workers in three largest cities. Rural communities in Saudi Arabia with limited government resources (e.g., workforce and equipment) have a different emergency response system. This means rural communities require different disaster preparation that may not correlate with the findings of this study. Secondly, the DPET survey did not assess perceived levels of knowledge, skills, and preparedness for a specific type of disaster. This generalised nature of this survey tool could lead to the under reporting of self-perceived knowledge, skills, and preparedness for specific disasters. Consequently, this study did not explore if there were differences in preparation for different types of disasters. The main disaster in Saudi Arabia is flooding, therefore, future research should focus on this area of preparedness. Finally, this study was conducted at a time of great change for the EMS profession as it is a developing field in Saudi Arabia. This period of development has been compounded by global events such as the COVID-19 pandemic that has impacted the field and shifted the focus in disaster management from incident response to prolonged response. In future, the gender roles of EMS workers, and the cultural nuances of care provision (e.g., a female giving care to a male or vice versa) would need to be more deeply explored for its impact on preparedness.

7.5 Conclusion

This explanatory mixed-methods study explored the disaster preparedness of EMS workers in Saudi Arabia. EMS workers reported an overall moderate level of knowledge, skills, and preparedness for disasters. The preparedness of EMS workers was strongly influenced by their attainment of postgraduate education, working in military facilities, more years of experience and working more hours. These findings align with other global findings in similar studies. However, the thesis reported unique aspects of the disaster response system in Saudi Arabia. These included gender roles, a developing profession with a younger workforce, and the differing military and government disaster response systems. These aspects require further exploration to increase the preparedness of the Saudi Arabian EMS workers for disasters.

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Appendix 1: Table 3: Evidence Table

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
1.	Fung et al. 2008	Hong-Kong	Explores Hong Kong nurses' disaster preparedness	Cross Sectional. Data collected in 2008	Disaster Preparedness Questionnaire (DPQ)	Descriptive statistics	164 Nurses	<ul style="list-style-type: none"> Almost all 97% of respondents acknowledged that they were inadequately prepared, 84.8% believed that there was a protocol in their workplace for dealing with disasters, but only 61% had read it.
2.	O'Sullivan et al. 2008	Canada	Assess perceptions of preparedness for disasters and access to support mechanisms, particularly for nurses in emergency and critical care units	Cross Sectional. Data collected in 2008	Self-designed, closed-ended questionnaire using Canadian Community Health Survey and the APEX study (Corneil et al)	MANOVA, Pearson's correlation coefficients	1,543 Critical Care Unit Nurses	<ul style="list-style-type: none"> Respondents had higher ratings of preparedness for responding to infectious diseases and natural hazards than other disasters, women perceived that they were less prepared for all scenarios than men did. Full-time nurses perceived better preparedness than part-time employed nurses.
3.	Duong 2009	Australia	Examines South Australian emergency nurses' knowledge and understandings of	Mixed Methods. Data	Self-designed, open- and closed-ended	Descriptive statistics + thematic analysis	152 Emergency	<ul style="list-style-type: none"> Majority (87%) of participants knew where their disaster plan is located but 42% have not read it. Some of them (37%) had been involved in a disaster in their professional or personal life.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
			disaster response in the healthcare setting	collected in 2009			Registered Nurses	
4.	Jacobson et al. 2010	USA	Assess the self-reported terrorism preparedness and training needs of a nursing workforce	Cross Sectional. Data collected in 2009-2010	Self-designed	Multivariate logistic regression	941 Nurses	<ul style="list-style-type: none"> More than half the participants indicated that they had not participated in bioterrorism preparedness and response training. A majority of respondents (58%) were not confident in their ability to diagnose or treat a bioterrorism case.
5.	Fernandez et al. 2001	USA	Assess EMS professionals' perceptions of preparedness and determine whether the amount of training individuals received was correlated with their perceptions of preparedness	Cross Sectional. Date of data collection not mentioned	Self-designed, closed-ended	Multivariate logistic regression, Wald chi-square, Hoshmer-Lemeshow goodness of fit test, Spearman's rank correlation coefficient	21,438 Paramedics	<ul style="list-style-type: none"> At least 35% of individuals reported receiving 1-4 hours of individual level training in each topic area, majority of participants (55.1%) had participated in multi-agency disaster drills. At least 38% agreed to feeling adequately prepared for each disaster scenario.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
6.	Hammad et al. 2011	Australia	Explores South Australian (SA) emergency nurses' knowledge and preparedness for disaster response in the acute setting	Cross Sectional. Data collected in 2011	Self-designed, open- and closed-ended	Descriptive statistics + thematic analysis	194 Nurses	<ul style="list-style-type: none"> Majority of the nurses (85%) failed the knowledge test with a score of less than 50%. Nurses displayed confusion regarding their likely role in a disaster. Hospital education sessions were the most common form of disaster training, with 69% to 70% of nurses having been involved in any disaster response.
7.	Putra et al. 2011	Indonesia	Evaluate the perceived ability to practice regarding disaster management among public health nurses	Cross Sectional. Data collected in 2010-2011	The Public Health Nurses' Perceived Ability to Practice Regarding Disaster Management Questionnaire (PHNPP-DMQ) with a Cronbach's alpha of 0.92	Descriptive statistics	252 Public Health Nurses	<ul style="list-style-type: none"> The total score of participants' perceived ability to practice regarding disaster management was at a moderate level. The highest mean score was at recovery phase, followed by response phase, and preparedness phase.
8.	Al Khalaileh et al. 2012	Jordan	Assesses Jordanian RNs' perceptions of their knowledge, skills, and	Cross Sectional. Data	DPET	Student's t-tests, One-way ANOVA	474 Nurses	<ul style="list-style-type: none"> Respondents considered themselves weakly prepared for participating in emergency plan drafting and planning for disaster situations. Only 42% of respondents were aware that their workplace had established a disaster plan, while 58% were not familiar with that workplace plan.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
			preparedness for disaster management	collected in 2011				<ul style="list-style-type: none"> Of those who were aware of disaster plans in their workplace, 80% were not confident about execution of the plan in their workplace. RNs considered themselves weakly prepared in health assessments related to biological or chemical agents, organisational logistics and roles, and addressing of biological weapons.
9.	Baack & Alfred 2013	USA	Analysis of rural nurses' perceived readiness to manage disaster situations	Cross Sectional. Data collected in 2013	Disaster Preparedness Questionnaire	Multiple logistic regression	620 Nurses	<ul style="list-style-type: none"> Nurses presented a somewhat low overall perceived competence to their familiarity with disasters, and nurses did not feel competent to effectively respond in a disaster situation. Participation in a major disaster, past experience in a post-disaster shelter, and SR were significant predictors, with the greatest contribution coming from the SR (motivation) scale.
10.	Lim et al., 2013	Singapore	Investigates the factors affecting the perceptions of healthcare workers towards individual and institutional preparedness for a disaster	Cross Sectional. Data collected in 2013	Self-designed, closed-ended questionnaire	Chi-square tests, Fisher's exact test, Logistic regression	1,700 Healthcare Workers	<ul style="list-style-type: none"> 36.4% of the participants were ready to be part of a disaster response team. Respondents were more likely to be ready to respond to disaster if they had been involved in a previous disaster incident response and if their supervisor, colleagues, and institution is prepared. 80.7% wanted to participate in future training.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
11.	Whetzel et al. 2013	USA	Assess nurses' perceptions of their role in a disaster and their perceived susceptibility to a disaster	Cross Sectional. Data collected in 2013	Self-designed	Frequency distribution	177 Nurses	<ul style="list-style-type: none"> 48% of nurses had inadequate knowledge, 42% had moderately adequate knowledge, and 10% had adequate knowledge of disaster preparedness. 91% of the nurses acknowledged they were inadequately prepared for disasters. Disaster training was considered important by 73% of the nurses.
12.	Al-Ali & Abu Ibaid 2015	Jordan	Assesses healthcare providers' perceptions of their knowledge, skills, and preparedness for disaster management	Cross Sectional. Data collected in 2015	DPET	Mann-Whitney U-test, Kruskal-Wallis test	207 Healthcare Workers	<ul style="list-style-type: none"> The disaster knowledge sub-scale results indicated that most of the participants perceived themselves as having a moderate knowledge of disaster management. The majority of participants perceived themselves as having moderate to weak skills in disaster management. There were significant differences between males and females in their perceptions of preparedness for disaster management.
13.	AlThobaity et al. 2015	Saudi Arabia	Explored nurses' knowledge and sources of knowledge and skills as they relate to disaster	Cross Sectional. Data collected in 2014	A quantitative, non-experimental, descriptive research design DPET	Independent sample t-tests	396 Nurses	<ul style="list-style-type: none"> Nurses in Saudi Arabia are moderately prepared for disaster. 71% had acquired their knowledge and skills from drills. Only 26% indicated that their knowledge and skills came from being involved in actual disasters.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
			management in Saudi Arabia					
14.	Hodge et al. 2015	USA	Evaluate nurses' self-perceptions of emergency preparedness relating to topics of disaster response at a rural hospital in southeast Ohio	Cross Sectional. Data collected in 2014-2015	EPIQ/Nurses Assessment of Readiness, NAR	Multiple logistic regression	307 Nurses	<ul style="list-style-type: none"> Emergency preparedness depended on age; registered nurses reported more familiarity of emergency preparedness
15.	Labrague et al. 2015	Philippines	Examines the perceived level of disaster preparedness in Philippine nurses	Cross Sectional. Data collected in 2014-2015	Disaster Preparedness Questionnaire (Fung et al. 2008), modified and validated with content validity index of 0.90 and	Descriptive statistics	170 Nurses	<ul style="list-style-type: none"> More than half of the nurses (57.7%) were not aware of an existing protocol for disaster management in their workplace. Most (80%) nurses were not fully prepared for a disaster. With regards to learning needs, most (64.71%) cited specific practice drills and scenarios as the preferred learning method.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
					Cronbach's alpha of 0.81			
16.	Usher et al. 2015	Bangladesh, Bhutan, Cambodia, China, Laos, Nepal, Solomon Islands	Assess the perceptions of Asia-Pacific RNs regarding their knowledge, skills, and preparedness for disaster management	Cross Sectional. Data collected in 2015	DPET	Generalised multiple linear regression analysis	757 Nurses	<ul style="list-style-type: none"> • Very few respondents (19%) attended disaster training course and had previous experience in disaster response. • All participants indicated moderate to high interest in education classes on disaster preparedness, but those from Bhutan and Solomon Islands had low awareness of classes offered. • Nurses from Bangladesh and Laos were weakly prepared to treat patients individually without supervision in a disaster situation. • Sex had no effect on skills, knowledge, and preparedness scores, while age had effect on skills.
17.	Ahayalimudin & Osman 2016	Malaysia	Determines knowledge, attitude, and practice of emergency nurse and community health nurse towards disaster management	Cross Sectional. Data collected in 2016	Self-designed, validated with Cronbach's alpha of knowledge above 0.7 and for attitude 0.66	Kolmogorov-Smirnov for normality testing, Chi-square and Fisher's exact test for inferential analysis	468 Emergency and Community Health Nurses	<ul style="list-style-type: none"> • More than 80% of participants knew the definition of disaster and disaster management. • More than 93% agreed that it is important to read and understand their institutions' disaster management plan. • More than half felt that assisting disaster victims is not their responsibility. • More than half knew the location of their disaster plan.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
18.	Berhanu et al. 2016	Ethiopia	Assessing the perceived knowledge, experience, and training needs of health professionals regarding disasters, their prevention and management in Jimma Zone, Southwest Ethiopia	Cross Sectional. Data collected in 2016	Self-designed, open- and closed-ended	MANOVA, Pearson's correlation coefficients	377 Nursing and other Allied Health Workers	<ul style="list-style-type: none"> Majority (85.1%) tried to define disaster by various perspectives, while 9.7% did not know about the concept of disaster at all. Respondents perceived to have adequate 29.4%, moderate 32.4%, and poor 38.2% knowledge about early warning indicators, preparedness, and response to common disasters.
19.	Oztekin et al. 2016	Japan	Explore nurses' perceptions regarding their knowledge, skills, and preparedness for disasters and how they acquired their knowledge about disaster preparation	Cross Sectional. Data collected in 2015-2016	DPET	Student's t-tests, One-way ANOVA	902 Nurses	<ul style="list-style-type: none"> No significant differences in perceptions of their preparedness according to their experience, but did between skills and evaluation, respectively. Workplace (public vs private hospitals) showed no significant difference in knowledge, but did in skills and evaluation. Age showed significant differences in knowledge, skills, and evaluation while education showed none; years of experience showed significant differences between knowledge and skills, but none between evaluations.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
20.	Tzeng et al. 2016	Taiwan	Analyses the perceived readiness of hospital nurses for a disaster response, and the factors influencing their report for work outside the hospital environment	Cross Sectional. Data collected in 2016	Self-designed, validated adapted from EPIQ, DPET, and Readiness Estimate and Deplorability Index (REDI; Reineck et.al. 2001) with Cronbach's alpha of 0.96	Generalised linear model, Pearson's chi-square test, Wald chi-square test	311 Nurses	<ul style="list-style-type: none"> Participants mean item scores indicate a low level of self-reported preparedness for disaster response. Personal preparedness was significantly associated with military nurse experience, disaster training.
21.	Khan et al. 2017	Pakistan	Explore the disaster preparedness knowledge of nurses at two tertiary care hospitals in Lahore and to assess nurses' education and training needs in preparation for disasters	Cross Sectional. Data collected in 2017	Validated, self-designed tool	Independent t-tests, ANOVA	200 Head Nurses, Bedside Nurses, Nursing Supervisors	<ul style="list-style-type: none"> 48% of nurses had inadequate knowledge, 42% had moderately adequate knowledge, and 10% had adequate knowledge of disaster preparedness. 91% of nurses acknowledged they were inadequately prepared for disasters. Disaster training was considered important by 73% of the nurses.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
22.	Nofal et al. 2018	Saudi Arabia	Assess the knowledge, practices, and attitudes regarding disaster and emergency preparedness among Emergency Department (ED) staff	Cross Sectional. Data collected in 2017-2018	Self-designed + EPIQ	Student's t-test, chi-square test	194 Physicians, Nurses	<ul style="list-style-type: none"> Knowledge score of participants was greater with more years of experience (greater than 5) and the difference was statistically significant. All participants (100%) believed it was necessary to have a disaster plan and conduct drills in the hospital, while 98.4% believed that training was necessary for all health workers.
23.	Rizqillah & Suna 2018	Indonesia	Assess disaster preparedness among Indonesian emergency nurses and examine factors that affected disaster preparedness in this group	Cross Sectional. Data collected in 2017	Preparedness section from the DPET tool	Independent t-test, correlation test, one-way ANOVA, regression analysis	120 Emergency Nurses	<ul style="list-style-type: none"> Participants had a moderate level of preparedness, 56.7% had prior experience responding to a disaster, 63.3% had prior training or education of disaster management. A strong positive correlation was found between years working and the DPET score.
24.	Shahzad et al. 2018	Pakistan	Assess the attitudes and previous experience of emergency physicians towards disaster management	Cross Sectional. Data collected in 2017	Self-designed, validated	Kruskal-Wallis test	63 Physicians	<ul style="list-style-type: none"> The attitude of doctors towards disaster preparedness was positive with most agreeing to the presence of organisational logistics and institutional plans. Self-assessment of disaster preparedness was positive, most thought that they were prepared to handle national, local, and biological disasters. Experience is low, as 73% of the physicians had never participated in any mass casualty drill.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
			preparedness from three tertiary care hospitals in Peshawar, Pakistan					
25.	King et al. 2019	USA	Assesses self-reported perceptions of disaster preparedness in a convenience sample of military healthcare personnel preparing to deploy on a shipboard global health engagement mission	Cross Sectional. Data collected in 2019	Modified DPET	Backward stepwise regression analysis	135 Military Healthcare Workers	<ul style="list-style-type: none"> • Very few (19.6%) participants had experienced a real disaster, and 70.4% of participants were aware of a disaster plan in their workplace. • 62% of participants reported that disaster drills were conducted regularly in their workplace, and 65.9% found them to be helpful. • Nearly half (47%) had participated in disaster preparedness continuing education courses, 51.9% had participated in bioterrorism training, and 55.6% reported training at facility-based disaster drills.
26.	Brewer et al. 2020	Australia	Determine the self-reported disaster preparedness of RRENs through perceptions of knowledge, skills, and	Cross Sectional. Data collected in 2020	Modified DPET	Student's t-test and One-way ANOVA	32 Regional and Rural Emergency Nurses	<ul style="list-style-type: none"> • Self-reported disaster knowledge and management skills were moderate • The areas in which respondents felt unprepared was in relation to performing a focused health assessment for Post-Traumatic Stress Disorder (PTSD).

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key finding
			preparation for managing disasters					
27.	Goniewicz & Goniewicz 2020	Poland	Explore the competencies of healthcare workers, in addition to assessing the preparedness of hospitals for mass-casualty incidents	Cross Sectional. Data collected in 2020	Self-designed, open- and closed-ended	Spearman's coefficient, Chi-square test, Student's t-test, Mann-Whitney's test	134 Doctors, Nurses, and Paramedics	<ul style="list-style-type: none"> Majority of the participants (74.6%) had not taken part in any disaster or mass casualty incident, more than half (54.5%) of the participants reported a lack of organisation with drills regarding disaster management in their workplace, with a majority (91.8%) reporting that these drills were organised once every 3 years. Respondents who had previously taken part in disaster as a healthcare worker evaluated their preparedness better than those who had never taken part in disaster management.

Appendix 2: Table 4: Key Findings of the Studies Assessing Knowledge, Skills and Preparedness for Disaster

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
1.	Al-Wathinani et.al. (2021)	Saudi Arabia	Explore the emergency preparedness of healthcare workers during floods	Cross-sectional	Self-designed, closed-ended	Independent sample t-test Chi-squared test	227 Healthcare Workers	<ul style="list-style-type: none"> Almost all participants (99.6%) had low to moderate perceived knowledge levels for emergency response during floods. Majority (80%) of the participants were willing to report to work following a flood. Most (73.2%) had positive perceptions regarding their hospital preparedness for flood emergencies. Most (90%) reported the need for more training and guidelines related to disaster management during floods.
2.	Al-Ziftawi et al. (2021)	Qatar	Explore the knowledge, attitudes, readiness to practice, and disaster preparedness among	Cross-sectional	Self-designed, closed-ended, validated with Cronbach's alpha of 0.909 for all 49 items (knowledge K, attitude A, readiness to practice rP)	Shapiro-Wilk test for normalcy Independent student's t-test differences in gender and KArP scores	187 Students	<ul style="list-style-type: none"> Overall, students displayed moderate KArP scores. There was no difference in mean KArP scores between genders ($p>0.05$). Qatari students displayed better total KArP scores than non-Qatari students. Significant moderate correlations were found between KArP ($p<0.0001$). Knowledge and attitude were significant predictors for students' readiness to practice ($p<0.0001$).

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			university students			<p>One-way ANOVA to compare students' major and rP</p> <p>Post-hoc analysis using Tukey's test</p> <p>Pearson's correlation to establish strength of relationship between K, A and rP</p> <p>Linear regression to predict rP from K and A</p>		
3.	Brinjee et al. (2021)	Saudi Arabia	Identify the disaster nursing training and education needs for nurses	Cross-sectional	Self-designed, closed-ended	One-way ANOVA	231 Nurses	<ul style="list-style-type: none"> Incident management systems (IMS), disaster triage, and disaster drills were three factors that were extracted from the data after redundant items were excluded. Nurses with less than three years of experience had limited knowledge in these three factors and needed to learn more in order to have effective disaster management skills.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
4.	Emaliyawati et al. (2021)	Indonesia	Determine the factors associated with nurses' preparedness in coastal areas	Cross-sectional	Emergency Preparedness Information Questionnaire (EPIQ)	Chi-squared test Binary logistic regression	142 Community Health Nurses	<ul style="list-style-type: none"> Among the participants, 52.24% had a high level of preparedness. Bivariate logistic regression showed that the factors that had significant correlation with preparedness were work history, disaster training, knowledge sources, disaster volunteering, and disaster management experience.
5.	Goniewicz et al. (2021)	Poland	Identify the factors affecting disaster competence of nurses	Cross-sectional	Self-designed, closed-ended	Logistic regression analysis	468 Nurses	<ul style="list-style-type: none"> Nurses showed moderate level of disaster preparedness (2.32 ± 0.80, median=2, range=1-5). Work experience, workplace preparedness, and triage training were shown to have significant correlation with disaster competence as shown by logistic regression analysis.
6.	Hasan et al. (2021)	Bangladesh	Examine knowledge (K), skills (S), and disaster preparedness (P) of nurses	Cross-sectional	Disaster Preparedness Evaluation Tool (DPET)	Independent student's t-test and One-Way ANOVA to evaluate significant differences in means of participant characteristics and KSP	410 Nurses	<ul style="list-style-type: none"> Participants had moderate levels of disaster management knowledge ($M=2.99 \pm 0.66$). Participants had moderate levels of disaster management skills (2.44 to 3.85). Participants had moderate levels of disaster preparedness ($M=3.57 \pm 0.54$). Significant positive correlations were found between nurses' disaster knowledge and skills. Moderate positive correlation was also found between nurses' disaster skills and preparedness.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			and factors affecting KSP			<p>Pearson correlation coefficient for inter-relationships between KSP</p> <p>Multiple linear regression analysis for identifying predictors of KSP</p>		<ul style="list-style-type: none"> • KSP scores were significantly associated with disaster response experience and training on disaster management. • KSP scores were significantly influenced by participants' non-nursing academic degree. • K and P scores were significantly influenced by type of hospital. • S scores were significantly influenced by nursing experience.
7.	Khilji et al. (2021)	Pakistan	Evaluate preparedness and response of nurses towards terrorism-related events	Cross-sectional/qualitative	Semi-structured interviews using phenomenology approach	Thematic content analysis	15 Nurses	<ul style="list-style-type: none"> • None of the participants had any prior disaster management training. • 5 themes emerged – i) experience, information source, and call-up mechanism for terrorism-related disaster event, ii) response towards the terrorism event, iii) preparedness for terrorism-related disaster, iv) barriers towards terrorism-related disaster management, v) suggestions and recommendations. • All nurses have experienced, responded to, and managed terrorism-related disaster. • They were professionally and psychologically prepared in dealing with terrorism-related disaster. • All participants highlighted space and workforce limitations. • Barriers to terrorism-related disaster management included lack of disaster curricula, absence of protocol, recurrence of

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
								disaster, and hostile attitude of victims' attendants during emergency.
8.	McCourt et al. (2021)	Australia	Determine the factors that influence disaster preparedness behaviours and disaster preparedness of pharmacists	Cross-sectional	Self-designed, closed-ended	Exploratory factor analysis to create new variables for analysis Multiple linear regression analysis	123 Pharmacists	<ul style="list-style-type: none"> Participants had low-moderate level of preparedness. The final model of disaster preparedness indicated that 86% of variation in preparedness was explained by disaster experience, perceived knowledge and skills, colleague preparedness, perceived self-efficacy, previous preparedness behaviours, perceived potential disaster severity, and trust of external information sources.
9.	Murphy et al. (2021)	Sweden	Assess self-perceived disaster preparedness of emergency department registered nurses (ED RN)	Cross-sectional	Modified EPIQ using the Delphi technique and pilot study – validated using Cronbach's alpha = 0.989	Mann-Whitney u-Test Kruskal-Wallis to assess differences between groups and means Spearman's tau-b correlation	140 ED Registered Nurses	<ul style="list-style-type: none"> Participants showed a moderate level of total disaster competency (M=2.34). Clinical experience, higher education, being an instructor, prior major incident experience, and formal disaster medicine education were all correlated with total disaster competency. These factors were also significantly correlated with RN's perception of their overall disaster preparedness.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
10.	Nofal et al. (2021)	Saudi Arabia	Assess knowledge and preparedness of emergency first responders towards bioterrorism events	Cross-sectional	Self-designed, closed-ended	Chi-squared test for categorical variables Kolmogorov-Smirnov test Kruskal-Wallis test Mann-Whitney test	1,030 Participants ; 351 Physicians, 516 Nurses, 131 Paramedics/EMS, 32 Poison Control/Clinical Laboratory Personnel	<ul style="list-style-type: none"> • Mean knowledge score of participants was very low in basic concepts of bioterrorism and clinical presentations of agents used in bioterrorism. • Most participants (79.4%) did not have prior training in bioterrorism preparedness. • Many participants (68.7%) showed willingness to assist during a bioterrorism event.
11.	Schumacher et al. (2021)	Multi-national study spanning 27 European	Evaluate the emergency and disaster preparedness of European pharmacists	Cross-sectional	Self-designed, closed-ended questionnaire based on International Pharmaceutical Federation (FIP)	Fischer's exact test	306 Pharmacists	<ul style="list-style-type: none"> • Majority (65%) of the respondents had never participated in emergency drills. • Half the respondents had experienced at least one major disaster or emergency in the last 5 years. • Most European hospital pharmacists were not fully compliant with the FIP guidelines.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
		n countries			guidelines for pharmacy 2016			
12.	Setyawan et al. (2021)	Indonesia	Determine the correlation of fire knowledge and disaster response and preparedness among hospital nurses	Cross-sectional	Self-designed, closed-ended	Bivariate analysis – Sommer's D correlation test	71 Nurses	<ul style="list-style-type: none"> Majority of the respondents displayed good knowledge about fire related disasters (77.5%). Majority of the respondents responded with "ready" on the disaster response and preparedness scales (73.2%). There is a positive correlation between fire knowledge and disaster response and preparedness among nurses.
13.	Shah et al. (2021)	Pakistan	Evaluate preparedness of medical responders to nuclear and radiological disasters in public hospitals of major cities	Mixed methods	Self-designed, closed-ended and open-ended questionnaire Semi-structured interviews	Descriptive analysis Thematic content analysis	554 Doctors, Nurses and Medical Assistants	<ul style="list-style-type: none"> Majority of respondents (86%) had never taken a course in nuclear emergency management. Most (67%) participants knew the symptoms of acute radiation syndrome. Majority (87%) were aware of the requirement and importance of patient decontamination after a nuclear/radiological disaster. Most (80%) of them were willing to treat patients after a nuclear incident. Only about half (56%) were aware of the disaster response teams in the country/province.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
								<ul style="list-style-type: none"> Less than half (49%) were aware of the role and tasks of the National Disaster Management Authority in Pakistan.
14.	Skryabina et al. (2021)	United Kingdom	Evaluate experiences and perceptions of healthcare staff regarding mass casualty terrorist incident response	Convergent mixed methods	Self-designed, closed-ended and open-ended questionnaire Semi-structured interviews	Summative content analysis Thematic content analysis	86 Healthcare Workers (HCW) in Survey 56 HCWs in interviews	<ul style="list-style-type: none"> Factors that enabled efficient response included dedication of the NHS staff, staff availability, teamwork, and presence of a functional major incident plan. Communication between ambulance services and hospitals, difficulties with patient identification and tracking, and managing the return to 'normal' work patterns post-event were recognised as challenges. The most commonly mentioned clinical issue was the lack of immediately available clinical protocol to deal with blast injuries.
15.	Sulistiyadi et al. (2021)	Not specified	Analyse the relationship between knowledge, skills, attitudes, and training with mass casualty incident (MCI)	Cross-sectional	Modified DPET	Partial Least Square Structural Equation Model (PLS-SEM)	108 Paramedics	<ul style="list-style-type: none"> There is a positive significant relationship of knowledge, skills, attitudes, and training with MCI preparedness. The factor that has the most influence on MCI preparedness is "skill". Knowledge, skills, attitudes, training, and MCI preparedness of paramedics in this study were found to be in the "high" category.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			preparedness of paramedics					
16.	Tilahun et al. (2021)	Ethiopia	Determine knowledge, attitudes, and level of familiarity of ED nurses with respect to disasters	Cross-sectional	Modified EPIQ	Bivariate regression logistic	102 ED Nurses	<ul style="list-style-type: none"> Majority of the participants (51%) had low knowledge. Factors associated with disaster preparedness among nurses included age, sex, marital status, training, simulation exercises, participation in developing a disaster plan, and prior disaster experience.
17.	Younus et al. (2021)	Bangladesh	Assess disaster preparedness of nurses as well as identify factors affecting nurses' disaster management	Convergent mixed methods	DPET (Bengali version) Focus group discussions (FGD) Key informant interviews (KII)	Independent t-tests One-way ANOVA Thematic content analysis	405 Nurses	<ul style="list-style-type: none"> Less than half (42%) of nurses had prior disaster response experience. Disaster preparedness of nurses was found to be moderate. A lack of knowledge, skills, and education on disaster management was identified. Nursing academic qualifications, hospitals (public/private), and nurses' working areas (cyclone-prone, flood-prone, and earthquake-prone areas) were significant predictors of the nurses' disaster response and recovery preparedness.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
18.	Zhao et al. (2021)	USA	Assess the emergency response activities, training, disaster preparedness, willingness to respond, and knowledge of Memorandum of Understanding (MOU) and pharmacy's emergency preparedness plans among pharmacists	Cross-sectional	Self-designed, closed-ended	Independent t-test Chi-squared test Fischer's exact test	255 Pharmacists	<ul style="list-style-type: none"> Majority of the pharmacists (80%) have never volunteered in any emergency. Most pharmacists (64%) have never attended any emergency training program. Many pharmacists (60%) were willing to assist in the distribution of medicines and vaccinations. Majority (60%) were not aware of what an MOU is.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
19.	Baker (2022)	Saudi Arabia	Evaluate the self-perceived disaster preparedness competence and familiarity of nurses at professional and personal level	Cross-sectional	EPIQ	T-tests One-way ANOVA Post-hoc using Tukey's HSD test	350 Nurses	<ul style="list-style-type: none"> Perceived disaster preparedness among nurses was low. Familiarity with disaster preparedness was significantly associated with age. Disaster preparedness was significantly associated with gender and nationality; males were better prepared than females and Saudi nurses were better prepared than non-Saudi nurses. Total mean scores of disaster preparedness were also differed significantly according to type of hospital and nursing education.
20.	Balut et al. (2022)	USA	Assess the desire of healthcare workers for disaster training, and factors that influence the need for such training	Cross-sectional	Veteran Affairs Preparedness Survey	Multi-variate logistic regression analysis	4,026 Veteran Affairs (VA) Employees, including all categories of health workers	<ul style="list-style-type: none"> Majority of the respondents wanted additional training – 61% for natural, 63% for pandemic, and 68% for human-made disasters. VA supervisors and clinicians were more likely to report the need for extra disaster training. Those who perceived their role to be more important during disaster response indicated a greater need for disaster training.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
21.	Chegini et al. (2022)	Iran	Assess disaster preparedness and core competencies of ED nurses	Cross-sectional	Nurses Perceptions of Disaster Core Competencies Scale (NPDCC)	Pearson's correlation coefficient Independent t-test One-way ANOVA Post-hoc Tukey test Multiple regression analysis	271 Nurses	<ul style="list-style-type: none"> Nurses had a moderate to high self-perceived disaster preparedness score. There was a positive significant relationship between the nurses' perceptions of disaster preparedness and average score of core disaster competencies. Nurses who had experience in the disaster stage and those with prior disaster response experience perceived better disaster preparedness than those without experience. Nurses with higher educational qualifications had better skills.

Appendix 3: Table 5: Key Findings of the Studies Related to COVID-19 Disaster

Preparedness

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
1	ElGeed et al. (2021)	Qatar	Assess the current practices, response preparedness, and professional development needs with regard to COVID-19 among community pharmacists	Cross-sectional	Self-designed, closed-ended	Mann-Whitney U test Kruskal-Wallis test	311 Community Pharmacists	<ul style="list-style-type: none"> Majority of the pharmacists (75%) practiced hygiene and social distancing measures. Pharmacists involved in patient assessment, education or raising awareness of COVID-19, and application of evidence-based protocol only ranged from 32% to 73%. Majority (77%) of pharmacists either “strongly agreed” or “agreed” that they have all the necessary COVID-19 related emergency response preparedness and training. Almost all of them (86% to 97%) indicated the need for professional development related to COVID-19.
2	Iddrisu et al. (2021)	Ghana	Assess the self-perceived preparedness of nurses against	Qualitative	Semi-structured interviews	Thematic content analysis	29 Nurses	<ul style="list-style-type: none"> Content analysis yielded two themes – i) health facilities’ preparedness of nurses against COVID-19, and ii) Nurses’ individual preparedness against COVID-19. Nurses have received training on infection control and prevention, and case management through demonstrations and simulations.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			COVID-19 pandemic					<ul style="list-style-type: none"> Experienced nurses volunteered on the frontline to manage active cases.
3	Karnjus et al. (2021)	Slovenia	Assess the core disaster-response competencies of nurses against COVID-19	Cross-sectional	Disaster Nursing Core Competency Scale (DNCCS)	Kolmogorov-Smirnov test for normalcy Mann-Whitney U test Kruskal-Wallis Test Pearson's chi-squared test	118 Registered Nurses	<ul style="list-style-type: none"> RNs perceive the core competencies of disaster nursing to be important to their preparedness for disaster situations.
4	Li et al. (2021)	Australia	Assess knowledge, preparedness, and experiences of healthcare workers in managing COVID-19	Cross-sectional	Self-designed, closed-ended and open-ended	Descriptive statistics Conventional content analysis	159 ED Nurses, 110 Emergency Physicians (EP) and 161 Paramedics	<ul style="list-style-type: none"> Majority of each group of health workers (67.3% to 78%) indicated that their knowledge of COVID-19 was "good" to "very good". The most frequently accessed source of COVID-19 information was from state Department of Health websites. Most of the respondents in each group (77.6%-86.4%) received COVID-19 specific training and education, including personal protective equipment (PPE) usage. Common concerns raised included disease transmission to family, public complacency, and PPE availability.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
5	Moheimani et al. (2021)	Iran	Evaluate hospitals' operational readiness levels in disaster management emphasizing the admission, care, and treatment of COVID-19 patients	Cross-sectional	Self-designed, closed-ended	Rough set theory	3 experts (doctors in high administrative posts) evaluated 25 hospitals	<ul style="list-style-type: none"> Hospitals in Tehran need to have adequate medical equipment and medicine supplies to avoid frustration in providing the needed support and service for COVID-19 patients. In order for hospitals to achieve functional preparedness, sufficient medical equipment and medicine are a critical necessity.
6	Richmond et al. (2021)	Canada	Assess the prevalence and effectiveness of disaster preparedness activities among Emergency Management (EM) professionals	Cross-sectional	Self-designed, closed-ended	Kruskal-Wallis H test Chi-squared tests Kendall-Tau correlations	150 EM Professionals	<ul style="list-style-type: none"> EM reported that reviewing infectious disease (pandemic) plans and protocols was the most widespread activity (82%), while simulation-based exercises was the least (26%). Organisational incident management response to COVID-19 was led by a sole 'incident commander' 61% of the time, while 39% of 'incident commands' were led by multiple individuals. Of all those assigned to lead IM, only 68% received training in that role. Overall, the prevalence of disaster preparedness activities in healthcare

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			regarding COVID-19					organisations was positively associated with leaders who received training in incident response and having a dedicated EM resource.
7	Farghaly et al. (2022)	Saudi Arabia	Assess and compare the disaster management preparedness of nurses and physicians during COVID-19	Cross-sectional	Disaster Preparedness Evaluation Tool (DPET)	Chi-squared tests	608 Nurses 228 Physicians	<ul style="list-style-type: none"> Participants had more knowledge regarding the disaster preparedness stage than mitigation and recovery stages. Participants also reported a need for advanced disaster training areas.
8	Alrajhi et al. (2022)	Saudi Arabia	Assess the knowledge and awareness of COVID-19 pandemic preparedness and response measures	Cross-sectional	Self-designed, closed-ended	Kolmogorov-Smirnov test for normalcy testing Chi-squared test T-test One-way ANOVA	260 Healthcare Workers (HCW)	<ul style="list-style-type: none"> Majority of the participants (72.91%) showed a moderate level of knowledge of this disease. Most participants (76.10%) were highly knowledgeable about dealing with suspected, probable, and confirmed cases. A vast majority (82.47%) of the participants were highly knowledgeable about precautionary measures. HCWs' workplace and education levels were significantly related to the nature of the disease domain.

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			by healthcare workers					<ul style="list-style-type: none"> The HCWs' job descriptions were significantly related to the transmission of the disease domain.
9	Hong et al. (2022)	Korea	Assess the disaster competencies of public health nurses in the context of emerging infectious diseases, and identify their influencing factors based on Deci and Ryan's self-determination theory	Cross-sectional	DPET (Korean version)	T-tests One-way ANOVA Pearson's correlation coefficient Stepwise regression analysis	242 Public Health Nurses	<ul style="list-style-type: none"> The significant factors influencing disaster competencies included "willingness to respond to a disaster," "preventive behaviour," "experience of receiving education on emerging infectious diseases response," "public health centre experience," "job satisfaction," and "education". "Willingness to respond to a disaster" was the strongest factor affecting disaster competencies. Based on these results, it is concluded that interventions to improve disaster competencies and psychological wellbeing of public health nurses are needed.
10	Suwayo et al. (2022)	Indonesia	Determine the relationship between knowledge and	Cross-sectional	EPIQ	Pearson's correlation coefficient	66 Nurses	<ul style="list-style-type: none"> The nurses demonstrated moderate knowledge and moderate level of readiness to respond. There was a positive significant relationship between knowledge and nurse readiness in disaster preparedness ($p = 0.000$).

N	Author/Year	Country	Aim	Design	Method/instrument	Method of analysis	Sample	Key findings
			nurse readiness in disaster preparedness					<ul style="list-style-type: none"> Massive and continuous education process will improve nurses' preparedness in dealing with the COVID-19 disaster.

Appendix 4: Disaster Preparedness Evaluation Tool (DPET)

Code # _____

PREPAREDNESS OF EMS WORKERS FOR DISASTERS

Definition of a disaster: An extraordinary event that is man-made or natural, that challenges a system to deliver speedy response and exceeds the system's normal response capability, with infrastructure disruption (Bond & Beaton, 2005). Disaster has three stages: preparedness stage, mitigation and response stage, and evaluation stage. This questionnaire is designed to assess all three areas.

Please tell a little about yourself by filling in the appropriate boxes below:

1- What is your gender?

☐ Male

☐ Female

2- What is your age?

☐ 18-25 years old

☐ 26-35 years old

☐ 36-45 years old

☐ 46-55 years old

3- How many years of experience do you have as an EMS?

☐ 1 to 6 years.

☐ 7 to 12 years.

☐ 13 to 18 years.

☐ 19 to 24 years.

4- What is your highest completed level of education?

☐ Diploma degree, EMT

☐ Bachelor degree, EMS

☐ Master degree, EMS

☐ Master degree, Other

5- Over your EMS career, have you ever participated in a real disaster situation?

☐ (if yes, please answer # 6)

☐ No (skip to # 7)

If yes, briefly describe:

6- How qualified did you feel in this disaster situation to respond? What did the experience teach you?

7- In which type of facility are you primarily employed?

- ☐ Governmental Hospital ☐ Military Hospital
- ☐ Other

8- Where do you live?

- ☐ Riyadh ☐ Jeddah
- ☐ Dammam ☐ Other

9- How many hours per week do you usually work as an EMS?

- ☐ 20 to 34 h/week. ☐ 35 to 60 h/week.

The following items pertain to how you view your professional and personal level of preparedness for disasters. Rate the items from strongly disagree to strongly agree.

1 Strongly Disagree 2 Disagree 3 Somewhat Disagree 4 Somewhat Agree 5 Agree 6 Strongly Agree

10. I participate in disaster drills or exercises at my workplace (clinic, hospital, etc.) on a regular basis.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I have participated in emergency plan drafting and emergency planning for disaster situations in my community.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I know who to contact (chain of command) in disaster situations in my community.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I participate in disaster-related educational activities on regular basis (e.g. Continuing education classes, seminars, or conferences dealing with disaster preparedness)	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I read journal articles related to disaster preparedness.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. I am aware of classes about disaster preparedness and management that are offered (e.g. at my workplace, the university, or community)	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I would be interested in educational classes on disaster preparedness that relate specifically to my community situation	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. I find that the research literature on disaster preparedness and management is easily accessible.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I find that the research literature on disaster preparedness is understandable.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I consider myself prepared for the management of disasters.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Finding relevant information about disaster preparedness related to my community needs is an obstacle to my level of preparedness	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. I know where to find relevant research or information related to disaster preparedness and management to fill in gaps in my knowledge.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. I have a list of contacts in the medical or health community in which I practice for use in case of a disaster (e.g. health department).	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. In case of a disaster situation I think that there is sufficient support from local officials on the local or national level.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. I participate/have participated in creating new disaster guidelines, emergency plans, or lobbying for improvements on the local or national level.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. I would be considered a key leadership figure in my community in a disaster situation.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. I am aware of what the potential risks in my community are (e.g. earthquake, floods, terror, etc).	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. I know the limits of my knowledge, skills, and authority as an EMS to act in disaster situations, and I would know when I exceed them.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. In case of a bioterrorism/ biological attack, I know how to use personal protective equipment.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. In case of a bioterrorism/biological attack I know how to execute decontamination procedures.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. In a case of bioterrorism/biological attack I know how to perform isolation procedures so that I minimize the risks of community exposure.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. I am familiar with the local emergency response system for disasters.	1	2	3	4	5	6
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

32. I am familiar with accepted triage principles used in disaster situations.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
33. I have personal/family emergency plans in place for disaster situations.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
34. I have an agreement with loved ones and family members on how to execute our personal/family emergency plans.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
35. I can identify possible indicators of mass exposure evidenced by a clustering of patients with similar symptoms	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
36. I can manage the common symptoms and reactions of disaster survivors that are affective, behavioral, cognitive, or physical in nature.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
37. I am familiar with post disaster psychological interventions, e.g. behavioral therapy, support groups and incident debriefing for patients who experience emotional or physical trauma.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
38. I am able to describe my role in the response phase of a disaster in the context of my workplace, the general public, media, and personal contacts.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
39. I am familiar with the main Groups (A, B, C) of biological weapons (Anthrax, Plague, Botulism, Smallpox, etc.), their signs and symptoms, and effective treatments.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
40. I feel confident recognizing deviations in health assessments indicating potential exposure to biological agents.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
41. As an EMS, I would feel confident in my abilities as a direct care provider and first responder in disaster situations.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
42. As an EMS, I would feel confident as a manager or coordinator of a disaster shelter.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
43. As an EMS, I would feel reasonably confident in my abilities to be a member of a decontamination team.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
44. In case of a bioterrorism/biological attack, I know how to perform a focused health history and assessment, specific to the bioagents that are used.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
45. I feel reasonably confident I can treat patients independently, without supervision of a physician, in a disaster situation.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
46. I am familiar with the organizational logistics and roles among local and national agencies in disaster response situations.	1 2 3 4 5 6

	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
47. I would feel confident implementing emergency plans, evacuations procedures and similar functions	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
48. I would feel confident providing patient education on stress and abnormal functioning related to trauma.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
49. I would feel confident providing education on coping skills and training for patients who experience traumatic situations so they are able to manage themselves.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
50. I am able to recognize the signs and symptoms of Acute Stress disorder and Post Traumatic Stress Syndrome (PTSD).	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
51. I am familiar with what the scope of my role as an EMS in a post-disaster situation would be.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
52. I participate in peer evaluation of skills on disaster preparedness and response.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
53. I am familiar with how to perform a focused health assessment for PTSD.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
54. I feel confident managing (treating, evaluating) emotional outcomes for Acute Stress Disorder or PTSD following disaster or trauma in a multi-disciplinary way such (e.g. referrals and follow-ups), knowing what to expect in ensuing months.	1 2 3 4 5 6 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Note: In the left Boxes please put \checkmark or X to indicate the understandability of each item.

55. Please describe one thing that would make you personally better prepared for the management of disasters.

56. Please describe what priority you would give to education on disaster preparedness and management if it were to be included in a national curriculum.

57. How do you perceive your current ability to respond in a variety of disaster situations?

58. Mark all the following that apply:

- ☐ I was educated about disasters in an undergraduate EMS program.
- ☐ I was educated about disasters in a graduate EMS program.
- ☐ I have been trained in facility drills as an EMS.
- ☐ I have participated/participate in disaster related continuing education courses.
- ☐ I have participated in a real disaster. (Describe the type of disaster: _____)
- ☐ Other, _____ please _____ describe:

59. Were you formally prepared about what to do in bioterrorism disaster situations?

- ☐ Yes ☐ No

60. Are you aware of whether your workplace has an established emergency (disaster) plan?

- ☐ Yes ☐ No ☐ Not sure

61. Do you feel confident that the emergency (disaster) plan in your workplace would be well executed in case of a disaster?

- ☐ Yes ☐ No ☐ Not sure

62. I am aware of the level of preparedness of the health care systems in my community.

- ☐ Yes ☐ No ☐ Not sure

63. I would like more education about disasters in these areas (mark the ones that apply):

- ☐ My role (my scope of practice, skills) as an EMS in a disaster situation.
- ☐ What potential risks exist in my community in case of a disaster.
- ☐ Biological and Chemical agents and ways to identify their signs and symptoms.
- ☐ Biological and Chemical agents and their differential diagnosis and treatments.
- ☐ Resources in my community such as agencies for referral, health departments, emergency contacts, the chain of command, and community shelters.

- ☐ Recovery state: acute stress disorder, posttraumatic stress disorder, and crisis intervention (focused assessment, debriefing strategies, and behavioral, cognitive, or medication therapy).

- ☐ I feel well prepared for a disaster?

64. Do you have regular disaster or emergency drills in your workplace?

- ☐ Yes ☐ No

65. If so, do you feel like they are effective or helpful?

- ☐ Yes ☐ No

THANK YOU FOR YOUR PARTICIPATION IN THIS STUDY.

☐ If you are happy to have a follow-up interview, please tick this box and write your contact information (*optional*)

Name:

Email:

OR

Phone Number:

Appendix 5: Ethics Approvals from University of Newcastle, Australia

HUMAN RESEARCH ETHICS COMMITTEE



Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	Professor Alison Hutton
Cc Co-investigators / Research Students:	Mr Yasir Almukhlifi Doctor Gary Crowfoot
Re Protocol:	Disaster preparedness among Emergency Medical Services workers in Saudi Arabia
Date:	15-Jan-2021
Reference No:	H-2020-0350

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.

We are pleased to advise that the decision on your submission is **Approved** effective **15-Jan-2021**.

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-2020-0350**.

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**

1. It is the responsibility of the person **first named on this Approval Advice** to report adverse events.
2. 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.
3. 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.
4. 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.
5. 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 procedures; and
 - action taken in response to the event.
6. 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 (ie 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.

Human Research Ethics Committee

For communications and enquiries:

Human Research Ethics Administration

Research & Innovation Services

Research Integrity Unit

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>

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
		.	

HUMAN RESEARCH ETHICS COMMITTEE



Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	Professor Alison Hutton
Cc Co-investigators / Research Students:	Mr Yasir Almkhlifi Doctor Gary Crowfoot
Re Protocol:	Disaster preparedness among Emergency Medical Services workers in Saudi Arabia
Date:	26-Mar-2021
Reference No:	H-2020-0350

Thank you for your **Response to Conditional Approval** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to a variation to the **above** protocol.

Variation to:

1. Introduce Phase Two of the research (semi-structured interview) for ~25 participants.

- Phase Two Information Statement (v2, dated 24.3.21)
- Phase Two Consent Form (v2, dated 24.3.21)
- Interview Script (version submitted 25.3.21)

Your submission was considered under **Expedited** review by the Ethics Administrator.

We are pleased to advise that the decision on your submission is **Approved** effective **26-Mar-2021**.

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.


Human Research Ethics Committee

For communications and enquiries:

Human Research Ethics Administration

Research & Innovation Services
Research Integrity Unit
The University of Newcastle
Callaghan NSW 2308
T +61 2 492 17894
Human-Ethics@newcastle.edu.au

Appendix 6: Ethics Approvals from Ministry of Health (MOH), Saudi Arabia

Kingdom of Saudi Arabia Ministry of Health Central IRB GDRS		المملكة العربية السعودية وزارة الصحة اللجنة المركزية لأخلاقيات البحوث الإدارة العامة للبحوث والدراسات
اللجنة المركزية لأخلاقيات البحوث بوزارة الصحة Central Institutional Review Board		
National Registration Number with NCBE-KACST, KSA: (H-01-R-009)		
<u>Approval Letter</u>		
Date: 24/06/2020 Central IRB log No: 20 – 116E Category of Approval: Exempt Affiliation: King Saud Bin Abdulaziz U. for Health Sciences		
Dear Yasir M. Almukhlifi		
The Central IRB-MoH pleased to inform you that your study mentioned below has been reviewed and was approved according to ICH-GCP. Approval was given for <u>one year</u> from the date of this letter.		
Protocol Title	Disaster Preparedness Among Emergency Medical Services Workers in Saudi Arabia	
Documents Reviewed	Study proposal, CV, Request for exempt status, PI statement, signed consent form, signed Data Sharing Agreement, study questionnaire, Ethics certificate	
Approval Conditions:		
<ul style="list-style-type: none">• Abide by the rules and regulations of the Government of Saudi Arabia, NCBE, Central IRB and the IHC-GCP guidelines.• To conduct research as per the approved documents.• Research participant confidentiality should be protected at all times.• All researchers are required to have current and valid certificate on Protecting Human Research Participants (NIH or NCBE certificate).• Amendment to the approved documents, the Principal Investigator is required to advise the Central IRB for its approval before implementation.• You are required to submit a Progress Report every <u>6 month</u>.• If PI is unable to complete his research within the validation period, he will be required an extension letter from the Central IRB one month before the expiry of the approval.• Document Retention: all study documents should be kept by the Principal Investigator for a period of <u>5 years</u> from study completion.		
e-mail: GDRS-IRB@moh.gov.sa		



- This letter gives you an ethical clearance to implement your study according to the approved documents and you still need to obtain administrative approval from the site/s where the study will be conducted.
- **At the end of the study**, please submit Final Report including the results or copy of the manuscript intended for publication to MOH data base: e-review.marifah.gov.sa

We thank you for submitting your study for review by the Central IRB-MoH and wish you all the best with this study.

If you have any further questions, feel free to contact me.

Sincerely Yours,

Dr. Hisham M. Aziz - M.D
Consultant
Central IRB-MOH Chairman-KSA
Phone: + 966 11 2125555 Ext. 4337
e-Mail: haziz@moh.gov.sa





اللجنة المركزية لأخلاقيات البحوث بوزارة الصحة

Central Institutional Review Board

National Registration Number with NCBE-KACST, KSA: (H-01-R-009)

Amended Approval Letter

Date: 05/07/2021

Central IRB log No: 20 – 116E

Affiliation: King Saud Bin Abdulaziz U. for Health Sciences

Dear Yasir M. Almukhlifi, PI

We have received, reviewed and approved the amendment request regarding to the study titled *“Disaster Preparedness among Emergency Medical Services Workers in Saudi Arabia”* as per details below:

- Renewal the IRB approval for 6 months to be expired at 24/12/2021, for completing the interviews, data collection and analysis.
- Publication by any means not allowed except after getting an approval letter from GDRS, and Central IRB.
- At the end of the study, you must submit final report to GDRS and IRB including the results.

If you have any further questions, feel free to contact me.

Sincerely Yours,

Dr. Hisham M. Aziz - M.D
Co-Chairman-KSA
Central IRB-MOH



e-mail: GDRS-IRB@moh.gov.sa

Appendix 7: Ethics Approvals from National Guard Health Affairs (NGHA), Saudi Arabia

Kingdom of Saudi Arabia
Ministry of National Guard - Health Affairs

المملكة العربية السعودية
وزارة الحرس الوطني - الشؤون الصحية

King Abdullah International Medical Research Center (KAIMRC)

IRB NCBE Registration No.: H-01-R-005

IRB Office

Memo Ref.No. IRBC/2310/20 E-CTS Ref. No. RYD-20-419812-157533

Study Number: SP20/497/R
Study Title: Disaster Preparedness Among Emergency Medical Services Worker in Saudi Arabia
Study Sponsor: Non grant
IRB Approval Date: 20 December 2020
IRB Review Type: ☒ Expedited Review ☐ Full Board
Study site(s): Central Region

Dear Dr. Abdullah Alabdali
Assistant Professor, CAMS, KSAU-HS
Ministry of National Guard - Health Affairs

Sub-investigator/s: Yasir Almukhlifi

After reviewing your submitted research proposal/protocol and related documents, the IRB has **APPROVED** the submission. The approval includes the following related documents:

Document/Title	Version	Date
Research Proposal	01	20 December 2020
Data Collection Form	01	20 December 2020

The approval of the research study is valid for **one year** from the above approval to expiration date.

Terms of Approval:

- Annual Reports:** An Annual report must be submitted for approval to avoid termination/suspension of your research.
- Financial reports:** If your study is funded project, details financial report should be submitted with the scientific report.
- Final Report:** After completion of the study, a final report must be forwarded to the IRB.
- Retention of original data:** The PI is responsible for the storage and retention of original data pertaining to the project for a minimum of five years.
- Reporting of adverse events or unanticipated problems:** The PI is responsible to report any serious or unexpected adverse events or unanticipated problems, which could involve any risk to participants or others, or any event or incidents that may have impact on the research or participants.
- Biological samples:** No biological samples to be shipped out of the Kingdom of Saudi Arabia without prior IRB approval.
- Participant incentives:** No financial compensation or gifts to be given to participants without prior IRB approval.
- Storage of biological samples:** All biological samples collected for the purpose of this research must be stored in the KAIMRC related repository.
- You will need to resubmit the proposal to the IRB for review and re-approval before implementing any changes to the approved proposal.
- It is possible that the IRB may decide that the proposed new changes may exclude the proposal from being accepted for exempt review.
- It is your responsibility to safely store the data collected.
- Please note that phone based surveys are not permitted.
- If your approved proposal requires access to Bestcare, please write to the IRB informing them of the name of the designated data collector and exactly define the period requested for collecting data. Do not start the data collection until an approval memo is issued from the IRB giving permission to that collector to start accessing Bestcare for the duration of the project and after signing a confidentiality agreement.

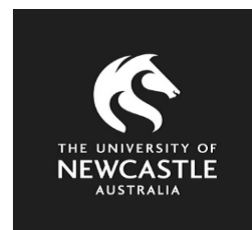
Prof. Abdullah Al Sayyari
Chairman, Institutional Review Board (IRB)
Ministry of National Guard - Health Affairs

08 JAN 2021

AS/AQ/AL

Appendix 8: Recruitment Study Flyer

Chief Investigator/ Alison Hutton (Principal supervisor)
Co-investigator/ Dr Gary Crowfoot (Co-supervisor)
Student Researcher/ Yasir Almukhlifi (PhD student)
School of Nursing, Faculty of health and medicine. University of Newcastle
University Dr, Callaghan NSW 2308
0249215000
Yasir.Almukhlifi@uon.edu.au



ARE YOU PREPARED FOR DISASTER?

Volunteers Needed for Research Study

Details:

A PhD student at the University of Newcastle NSW Australia, Yasir Almukhlifi, is conducting a research study which aims to examine the perception of knowledge, skills and preparation for disaster preparedness. Almukhlifi invites you to participate in a research study that aims to understand the needs of Emergency Medical Services (EMS) workers and explore their perceived barriers and facilitators toward disaster management and preparedness.

Who can Participate?

- ☐ Currently working at Ministry of Health or National Guard hospital.
- ☐ Working as EMS.
- ☐ EMS of at least one year of experience level, age or gender.
- ☐ Currently working in Riyadh, Jeddah, Dammam.

How can I participate?

If you think you are eligible and willing to participate, please fill out an online survey that will last 30 minutes. More information about the study and access to the survey is available at [@https://redcap.hmri.org.au/surveys/?s=7D8Y9YEK8A](https://redcap.hmri.org.au/surveys/?s=7D8Y9YEK8A). Please read the Participant Information Statement before you access the online survey.

Further information?

If you would like any further information please contact the student researcher- Mr. Yasir Almukhlifi on (+966507060957) or Yasir.Almukhlifi@uon.edu.au

Welcome

RESEARCH
STUDY

www.newcastle.edu.au

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2020-03; Ministry of Health in Saudi Arabia Log No: 20-116E, and National Guard Hospitals Affairs SP20/497/ R.

Appendix 9: Phase One Participant Information Statement

Participant Information Statement (Phase 1, survey)

The Research Team

Student Researcher/ Mr. Yasir Almukhlifi, PhD candidate,
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: +966507060957 (SA), +61452105079 (AU)
Yasir.almukhlifi@uon.edu.au



Chief Investigator / Professor Alison Hutton, Principal Supervisor
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: +6249215264
Alison.Hutton@newcastle.edu.au

Co-investigator/ Dr Gary Crowfoot, Co supervisor
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: +61240421619
Gary.crowfoot@newcastle.edu.au

Information Statement for the Research Project:

Disaster Preparedness Among Emergency Medical Services (EMS) Workers in Saudi Arabia

Version [2]; dated 30 /12 / 2020

Dear Potential Participant,

You are invited to participate in the research project “**Disaster Preparedness Among Emergency Medical Services (EMS) Workers in Saudi Arabia**”. This research project is being conducted as part of the requirements for a Doctor of Philosophy which is being undertaken by Yasir Almukhlifi and supervised by Professor Alison Hutton, and Dr Gary Crowfoot from the School of Nursing and Midwifery at the University of Newcastle (UON), Australia.

Why is the research being done?

Since disaster strikes without warning, all health care providers, especially Emergency Medical Service workers, must be prepared for disaster procedures. This project aims to examine EMS workers’ perceptions regarding their current knowledge, skills, and preparations toward disasters management. This study will use a modified version of the Disaster Preparedness Evaluation Tool (DPET)¹ survey; a validated survey designed to explore the knowledge, skills, and preparation of EMS for disaster management.

Who can participate in the research?

¹ Tichy et al., 2009

We are seeking Emergency Medical Services (EMS) workers who are currently working at Saudi Arabian Ministry of Health or National Guard Hospitals, EMS worker for a period of at least one-year experience, and of any age or gender, who currently living in the Riyadh, Jeddah, Dammam regions to participate in this research project, and can speak and understand English.

What choice do you have?

Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you in any way and will not place you in any risks or affect your relationship with the EMS, doctors, managers, and other health workers in your workplace. If you do decide to participate, you may withdraw from the study up to submitting your completed survey without giving a reason and without negative consequences. Please note that due to the anonymous nature of this survey, you will not be able to withdraw your response after you have submitted your survey.

What would you be asked to do and how much time will it take?

If you agree to participate, you will be asked to complete an online survey questionnaire. The survey questionnaire is not an examination or test. Due to the anonymous nature of the survey, the responses you provide will not be identifiable. It is anticipated that this survey will take up to 30 minutes of your time to complete. Your survey submission will be considered as your informed and voluntary consent to participate in this study. The survey will be available once ethical approval is received and will remain open for up to three months.

What are the risks and benefits of participating?

Your participation may help to inform and guide disaster policy makers and educators at the hospitals regarding the perceived knowledge, skills, and preparation for disaster management in Saudi Arabia. Additionally, the potential knowledge gained from this study could be used to guide and improve the disaster preparedness and management in Saudi Arabia.

There are no anticipated risks associated with participating in this research project. However, if you find any of the questions upsetting you can stop your participation at any time. You can also access the healthcare services provided freely at your workplace for counselling and support. If you work at MOH at health support@moh.gov.sa, or if you work at NGHA at health.direct@ngha.med.sa

How will your privacy be protected?

Please be assured that all your information you provide in this study will be treated as strictly private and confidential. Names or any direct identifiable data will not be used in this research. Due to the anonymous nature of the online survey the response you provide will not be identifiable, the online survey will be conducted using REDCap which is an electronic data capture tool hosted at the Hunter Medical Research Institute (HMRI) in Newcastle. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources ([click here for privacy policy/](#)). Publications and presentations related to this research project will not use the participants identity in any way. During data collection, all completed documents and materials, such as survey questionnaire will be stored on the UON's own cloud secure storage system. Access to any data in this research project will be restricted to

the researcher and research supervisors named above. Data will be retained securely for a minimum period of 5 years from completion of the research, then data will be destroyed in accordance with the University's Research Data and Materials Management Guideline (see <https://policies.newcastle.edu.au/document/view-current.php?id=72>).

How will the information collected be used?

The collected data in this research project will be presented in a formal PhD thesis to be submitted for assessment for the degree. It may also be presented in academic publications, journals or conferences. Individual participants will not be identifiable in any reports arising from the project. Non-identifiable data may also be shared with other parties to encourage scientific scrutiny, and to contribute to further research and public knowledge. If you would like to receive a summary of the results before they are published, do not hesitate to contact the researcher or the research supervisors named above.

What do you need to do to participate?

Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, please contact the researcher Yasir Almukhlifi. Contact details can be found at the top of this Information Statement. If you would like to participate, please complete the online survey questionnaire, answering all the questions to the best of your ability.

The researcher may be interested in contacting you for follow up interview (yet to be determined), the aim of this interview is to understand the needs of EMS workers and to explore the perceived barriers and facilitators toward disaster management and preparedness among EMS workers. If you are happy to be contacted, please click the link provided after completing the survey which will take you a secure site to provide your details.

Further information

If you would like further information about this study, please contact the researcher Yasir Almukhlifi at Yasir.Almukhlifi@uon.edu.au or by phone SA (+966507060957) AU (+61452105079).

Thank you for considering this invitation.

Yours Sincerely,

Chief Investigator: Professor Alison Hutton

Student Researcher: Yasir Almukhlifi

Complaints about this research

For any complaints from the participants about the project on site, an independent local contact is provided; if you working at MoH, please contact Dr. Hisham Mohamed Aziz, Research and Studies Affairs at the Ministry of Health, Saudi Arabia, If you have any complaints about the research project please contact him at the telephone: (+966114735038), email: haziz@moh.gov.sa OR if you are working at NGHHA please contact Dr. Abdullah Alharbi, Acting Chairman of the Department of Emergency Medical Services at the NGHHA. If you have any complaints about the research project please contact him at telephone (+966118010811), email; alharbi.abdullah@ngha.med.sa.

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2020-0350, Ministry of Health in Saudi Arabia Log No: 20-116E, and National Guard Hospitals Affairs SP20/497/R.

Please tick this box if you have read and understood the information prior to commencing the survey.

Appendix 10: Interview Guide Question

Phase Two Semi-Structure Interview

Qualitative Study Questions

Interview Guide

Time: _____ Date: _____

Location: _____

Pre-interview script

- ☐ Introduce myself to the participant.
- ☐ Thank the participant for his/her agreement to be interviewed.
- ☐ Explain my research study and its purposes in lay terms. Check that the person has seen the participant information sheet regarding the study.
- ☐ Ask if they have any questions relating to the study.

** Please make sure that your phone is silent to prevent any interruption during the interview.*

Also, I will audio-video record the interview for analysis purposes.

I would like to talk to you about your work practice and how you believe these influence your preparedness;

1. Can you explain how your gender relates to your personal preparedness, particularly your knowledge, skills and how prepared you feel?
2. Reflect on the hours you work as an EMS – how does the number of hours you work impact your preparedness, particularly your knowledge, skills, and how prepared you feel.
3. Can you tell me about factors that assist you to increase your knowledge and preparedness for disaster management? and why?
4. Can you please talk about things that you believe will increase your skills for disaster management? and why?
5. How can the current regulations and policies in the Saudi Arabia disaster management framework be enhanced to promote disaster response efficiency?

Appendix 11: Participant Consent Form

Participant Consent Form

The Research Team

Student Researcher/ Mr. Yasir Almkhlifi, PhD candidate,
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: +966507060957 (SA), +61452105079 (AU)
Yasir.almukhlifi@uon.edu.au

Chief Investigator / Professor Alison Hutton, Principal Supervisor
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: (02) 4921 5264
Alison.Hutton@newcastle.edu.au

Co-investigator/ Dr Gary Crowfoot, Co supervisor
School of Nursing & Midwifery
The University of Newcastle
University Drive
Callaghan, NSW 2290
Ph: +61240421619
Gary.crowfoot@newcastle.edu.au



Interview Consent Form for the Research Project:

Disaster Preparedness Among Emergency Medical Services Worker in Saudi Arabia

Document Version [2]; dated 24/03 /2021

I agree to participate in the above research project and give my consent freely.

I understand that the project will be conducted as described in the Information Statement (Phase 2), a copy of which I have read and retained.

I understand I can withdraw from the project at any time, no more than two months from conducted my interview, and I do not have to give any reason for withdrawing.

I consent to participate in a Zoom interview for 40-50 minutes and having it audio-video taping.

I understand that my personal information and my workplace will remain confidential to the researchers except as required by law.

I would like to review my interview transcript and understand that I have up to two weeks to review and return any desired edits.

I have had the opportunity to have questions answered to my satisfaction.

Print Name: _____

Signature: _____ **Date:** _____

Appendix 12: Phase Two Information Statement

Participant Information Statement (Phase 2, interview)

The Research Team

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Information Statement for the Research Project: Disaster Preparedness Among Emergency Medical Services Worker in Saudi Arabia

Version [2]; dated 24/ 03/ 2021

Dear Potential Participant,

You are invited to participate in the research project "Disaster Preparedness Among Emergency Medical Services (EMS) Workers in Saudi Arabia". This research project is being conducted as part of the Doctor of Philosophy's requirements undertaken by Yasir Almukhlifi and supervised by Professor Alison Hutton, and Dr Gary Crowfoot from the School of Nursing and Midwifery at the University of Newcastle (UON), Australia. You have been sent this Information Statement and consent form because you have completed the Online Survey questionnaire Disaster Preparedness Evaluation Tool (DPET[®]) (Tichy et al., 2009) in Phase one of this research project and agreed to participate in Phase two, an online Interview through Zoom.

Why is the research being done?

Since disaster strikes without warning, all health care providers, especially Emergency Medical Service workers, must be prepared for disaster procedures. This project aims to examine EMS workers' perceptions regarding their current knowledge, skills, and preparations for disasters management. This study consists of two phases; phase one consist of a survey. Phase two consist of a semi-structured interview through Zoom. This interview aims to understand the needs of EMS workers; and to explore the perceived barriers and facilitators toward disaster management and preparedness in Saudi Arabia.

Who can participate in the research?

We seek participants who have completed phase one of this research project and are willing to participate in phase two semi-structured interviews. If you are Emergency Medical Services (EMS) currently working at Saudi Arabian Ministry of Health or National Guard Hospitals, with at least one year of experience, any age or gender, currently living in the Riyadh, Jeddah, Dammam regions, you are eligible to participate in this research project. If you can speak and understand English, and have completed phase one survey, you are eligible to participate in phase two of this research.

What choice do you have?

Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you in any way and will not place you at any risks or affect your relationship with the EMS, doctors, managers, and other health workers in your workplace. If you do decide to participate, you may withdraw from the study no more than two months after your interview conducted, without giving a reason and without any negative consequences.

What would you be asked to do and how much time will it take?

If you agreed to participate, you will be invited to do an online semi-structured Zoom interview with the researcher Yasir Almukhlifi, and it will be conducted in English. The researcher will conduct the interview at a time that is convenient for you. Before conducting the interview, the researcher will introduce the purpose of phase two to you and check whether or not you have any questions about this part of the study. The anonymity of your information will be maintained, and you have the right to withdraw from the interview at any time without any consequences.

During the interview, you will be asked to talk about things that help you prepare for disaster management. The interview will be audio-video taped and transcribed by the research team for analysis. If you wish to receive a copy of your interview transcripts to provide any comments or changes required, please tick the checkbox in the consent form. You have to provide your feedback no more than two weeks from your interview.

It is estimated that the interview will last for 40-50 minutes. You have the right to withdraw from the interview, and your data will be removed from the study. Your data will be erased from the taping file, and your transcript will be returned to you.

What are the risks and benefits of participating?

Your participation may help to inform and guide disaster policy makers and educators at the hospitals regarding the perceived knowledge, skills, and preparation for disaster management in Saudi Arabia. Additionally, the potential knowledge gained from this study could be used to guide and improve the disaster preparedness and management in Saudi Arabia.

During the interview, you may become emotionally distressed when sharing your experience or concerns. If you feel that during the interview, please feel free to inform the researcher to stop both the interview and the taping to check whether or not you wish to complete the interview. If this happens, You can also access the healthcare services provided freely at your workplace for counselling and support. If you work at MOH at health.support@moh.gov.sa, or if you work at NGHHA at health.direct@ngha.mcd.sa

How will your privacy be protected?

Please be assured that all your information you provide will be treated as strictly private and confidential. Names or any direct identifiable data will not be used in this research. Interview audio-video taping transcriptions will be de-identified. Publications and presentations related to this research project will not use the participants identity in any way. During data collection, all completed documents and materials, such as audio-video taping, and interview consent form will be stored on the UON's own cloud secure storage system. Access to any data in this research project will be restricted to the researcher and research supervisors named above. Data will be retained securely for a minimum period of 5 years from completion of the research, then data will be destroyed in accordance with the University's Research Data and Materials Management Guideline (see <https://policies.newcastle.edu.au/document/view-current.php?id=72>).

How will the information collected be used?

The collected data in this research project will be presented in a formal PhD thesis to be submitted for assessment for the degree. It may also be presented in academic publications, journals or conferences. Individual participants will not be identifiable in any reports arising from the project. Non-identifiable data may be also be shared with other parties to encourage scientific scrutiny, and to contribute to further research and public knowledge. If you would like to receive a summary of the results before they are published, do not hesitate to contact the researcher or the research supervisors named above.

What do you need to do to participate?

Please read this Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, please contact the researcher Yasir Almukhlifi Contact details can be found at the top of this Information Statement.

If you would like to participate, please sign the consent form that you have received with this Information Statement and email it back to the researcher. The researcher Yasir Almukhlifi will contact you once he received your completed consent form. After that, the researcher will then contact you to arrange the interview at your convenient time. The researcher will send you a confirmation of your interview appointment.

Further information

If you would like further information about this research project, please contact the researcher Yasir Almukhlifi at Yasir.Almukhlifi@uon.edu.au or by phone SA (+966507060957) AU (+61452105079).

Thank you for considering this invitation.

Yours Sincerely,

Chief Investigator: Professor Alison Hutton

Student Researcher: Yasir Almukhlifi

Complaints about this research

This project has been approved by the University's Human Research Ethics Committee, Approval No. H-2020-0350, Ministry of Health in Saudi Arabia Log No: 20-116E, and National Guard Hospitals Affairs SP20/497/R.

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to Research and Studies Affairs at the Ministry of Health, Saudi Arabia, telephone: (+966114735038), email: research@moh.gov.sa OR to the Institutional Review Board at the ministry of National Guard, Saudi Arabia, telephone (+9668011111), email: irb@ngha.med.sa. OR to the Human Research Ethics Officer, Research & Innovation Services, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 4921 6333, email Human-Ethics@newcastle.edu.au.