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Predictors of Sexually Transmitted Infection in Australian Women: Evidence from the Australian Longitudinal Study on Women's Health

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ABSTRACT

This longitudinal study examined characteristics of women diagnosed with sexually transmitted infections (STI) for the first time in their later 20s and early 30s. Participants were 6,840 women (born 1973-1978) from the Australian Longitudinal Study on Women's Health. Women aged 18-23 years were surveyed in 1996 (S1), 2000 (S2), 2003 (S3), and 2006 (S4). There were 269 women reporting an STI for the first time at S3 or S4. Using two multivariable logistic regression analyses (examining 18 predictor variables), these 269 women were compared 1) with 306 women who reported an STI at S2 and 2) with 5,214 women who never reported an STI across the four surveys. Women who reported an STI for the first time at S3 or S4 were less likely to have been pregnant or had a recent Pap smear compared to women reporting an STI at S2. Women reporting a first STI at S3 or S4 were less likely to have been pregnant or had a recent Pap smear compared to women reporting an STI at S2. Women were more likely to report an STI for the first time at S3 or S4 compared to women not reporting an STI at any survey if they were younger, unpartnered, had a higher number of sexual partners, had never been pregnant, were recently divorced or separated, and reported poorer access to Women's Health or Family Planning Centres at S2. These findings demonstrate the value of longitudinal studies of sexual health over the life course beyond adolescence.

Keywords:

sexually transmitted infections, life course epidemiology, sexual health, women, Australia

INTRODUCTION

Sexually transmitted infections (STI) remain a considerable public health problem (Piper, 2008). As well as the general burden of disease, there are implications for fertility, and issues relating to relationship difficulties and physical and mental well-being. Risk factors for STI are well established and prevention efforts focus on changing individual sexual risk behaviors such as multiple sexual partners and condom non-use, particularly with casual partners (Piper, 2008). The likelihood of acquiring a STI is influenced by both gender and age. A longitudinal cohort study of New Zealanders examined sexual behavior and STI at ages 21, 26, and 32 years. The period before age 21 was found to be a time of heightened risk of STI for women but there was low risk among women aged 26-32 years after adjusting for sexual risk behavior (Paul, van Roode, Herbison, & Dickson, 2009). This analysis focused on the effects of gender and age. Little is known about factors that predict the diagnosis of STI among women as they age beyond adolescence. This study used longitudinal, national population data from the Australian Longitudinal Study on Women's Health (ALSWH) to examine the characteristics of women diagnosed with STI for the first time in their later 20s and early 30s.

Life Course Perspectives

A life course perspective suggests that events early in life can have an impact on health later in life (Elder, 1985; Kuh & Hardy, 2002). Thus, sexual experiences during adolescence and young adulthood may affect later patterns of sexual behavior. The age and type of partner at first sex have been found to be related to later sexual behavior, suggesting that early sexual experiences have some influence on later behavior (Ford & Chamratrithirong, 2009).

Life courses are no longer neatly divided by conventional markers of childhood, adulthood, and old age but rather are now viewed as more individualized and dependent on choices of individuals (Marshall, 2011). Furthermore "there are few roles or dimensions of identity that are more burdened with life-cycle stage specifications or more troubled by the transformations accompanying life-cycle stage changes than the sexual" (Simon & Gagnon, 1986) (p112). Dramatic recent changes in patterns of sexual behavior reflect profound changes in the ordering of family careers. Cultural and epidemiologic distinctions based on age or stage of life (such as "adolescent" and "adult") are not always useful approaches to issues of STI prevention and control. Rather, patterns of behavior or "sexual scripts" may determine risk behavior. These may be vaguely defined and change over time (Simon & Gagnon, 1986). There has been more focus over the last decade on the sexual experiences of older adults. This is partly due to the availability of drugs to treat erectile dysfunction and an acknowledgement that increasing longevity also extends "sexually active life" (Lindau & Gavrilova, 2010). Understanding sexual activity as people grow older is important for anticipating the need for public health resources and services, including prevention and treatment of sexually transmitted diseases or risky sexual behavior (Lindau & Gavrilova, 2010). Much more needs to be known about patterns of sexual activity and risk of STI beyond adolescence. This study focused on women who acquired an STI for the first time in their 20s and early 30s.

Longitudinal Studies of STI among Adolescents

Most longitudinal studies focus on adolescents. An analysis of data from the National Longitudinal Study of Adolescent Health in the U.S. examined factors at Wave I (when participants were in Grades 7-12) associated with the results of STI tests at Wave III six years later. Female adolescents with a higher grade point average and those who perceived that their parents were more strongly disapproving of their having sex during adolescence were less likely to have an STI six years later. Other factors, such as feelings of connection to family or school, importance of religion, school attended, and pledges of virginity during adolescence, did not predict STI status six years later.

Sexual abuse in childhood has been identified as a risk factor for STI in clinic populations (Buffardi, Thomas, Holmes, & Manhart, 2008) and population cohort studies (Fergusson, Horwood, & Lynskey, 1997). Fergusson et al. followed a birth cohort of 520 New Zealand born women from birth to age 18 and showed that child sexual abuse was associated with early onset of sexual activity which led to heightened risks of other adverse outcomes, including teenage pregnancy, multiple sexual partners, unprotected intercourse, STI, and sexual assault after the age of 16.

Cross-sectional Studies of STI among Older Women

There are few longitudinal studies examining STI among adult women. Studies of STI among adult women beyond adolescence are limited to cross-sectional analyses and cover wide age ranges thus potentially obscuring important life stage differences. The Australian Study of Health and Relationships, a national Australian population survey, found that 17% of women aged 16-59 had ever been diagnosed with STI (Smith, Rissel, Richters, Grulich, & De Visser, 2003). Predictors of ever having being diagnosed with an STI included older age, speaking English at home, bisexual identity, post-secondary education, managerial/professional occupation, history of being paid for sex, and injecting drug use. In the UK, the National Survey of Sexual Attitudes and Lifestyles found 13% of women had ever been diagnosed with an STI (Johnson et al., 2001) and that being unmarried, of younger age, partner concurrency or having more than one partner in the last year were associated with STI (and chlamydia infection in particular) (Fenton et al., 2001). In previous studies of the 1973-1978 cohort of women from the Australian Longitudinal Study on Women's Health (aged from 18-23 years to 22-27 years) risk

factors for ever having been diagnosed with an STI included a higher number of lifetime male sexual partners and longer use of the oral contraceptive pill (Khan, Hussain, & Schofield, 2005; Schofield, Minichiello, Mishra, Plummer, & Savage, 2000), illicit drug use, higher stress (Khan, et al., 2005), non-single status, higher alcohol use, and having been pregnant (Schofield, et al., 2000).

Bateson, Weisberg, McCaffery, and Luscombe (2012) surveyed 1,788 Australian women using an internet dating service and found that, while women aged 40 or over were more likely to discuss STI with a new partner, they were less likely to refuse sex without a condom compared to younger women Across the sample 29.1% reported a lifetime history of STI. These crosssectional studies did not address predictors of STI diagnosis using longitudinal data and therefore there is a gap in knowledge about patterns of acquiring STI among women over the life course.

Study Aims

This article presents a unique longitudinal perspective on sexual health across young adulthood beyond adolescence. It examined whether the longitudinal patterns confirm or challenge findings from cross-sectional studies with older women. This study examined whether sociodemographic characteristics, health service access, health behavior, physical and mental health, and sexual/relationship factors predicted later diagnosis of STI. Specifically, the paper examines whether these characteristics (measured at Survey 2 when women were aged 22-27 years) predict which women reported the diagnosis or treatment of STI for the first time three or six years later (at Survey 3 or Survey 4 when they were aged 25-30 or 28-33 years).

METHOD

Participants

This analysis focused on the cohort of women born in 1973-1978 who had participated in four waves of data collection ("surveys") over 11 years. The women were aged 18-23 years at Survey 1 (S1, 1996, N = 14,247) and were resurveyed three times: when they were aged 22-27 at Survey 2 (S2, 2000, N = 9,688), aged 25-30 at Survey 3 (S3, 2003, N = 9,081) and aged 28-33 at Survey 4 (S4, 2006, N = 9,145). There were 6,840 women (74.8% of S4 participants) who responded to all four surveys and 6,306 of these women provided data about STI diagnosis at all surveys. The women who did not participate in ALSWH after S2 were less likely to be married, had lower education, and more pregnancy events than women who continued to participate in the study after S2 (p < .0001). STI diagnoses at S2 were compared between those who continued with the study and those who did not. S2 participants who did not continue to participate in S3/S4 reported having genital warts (HPV) more than four years ago (1.5%) less often than participants who stayed with the study (2.2%, p = .02). There were no other significant differences in STI diagnoses at S2 between those who continued with the study and those who did not.

Overall, the women in ALSWH were generally representative of the Australian population. A number of minority groups with special needs were under-represented in the original sample and/or lost to attrition over time, including Aboriginal/Torres Strait Islander women, migrants who do not speak, read, or write English well, women with disabilities, and those living in institutions (Lee et al., 2005). Women who responded to all of the four surveys were more educated, less likely to be stressed about money, less likely to be smokers, and less likely to have children than women who responded to only some surveys. While attrition was found to be non-random and was also related to poorer health, no serious bias in statistical estimates and determinants of change were found as the result of attrition of participants from S1 to S4 (Powers & Loxton, 2010).

Procedure

The ALSWH is a broad-ranging longitudinal national population survey that examines reproductive, physiological, and social factors relating to women's health. Participants responded to mailed surveys. In 1996 Australian women from three age cohorts (born 1921-1926, 1946-1951, 1973-1978) were selected from the Medicare database, which contains names and addresses of all Australian citizens and permanent residents. Random sampling of the population was undertaken with intentional over-sampling of women from rural and remote areas. The methodology for the ALSWH has been described elsewhere and the study has ethical clearance from ethics committees at the Universities of Queensland and Newcastle (Brown et al., 1998; Lee, et al., 2005). Further information about the study, including the questionnaires, is available from the website at <u>www.alswh.org.au</u>. Further information about the data used in this paper including all analyses and group comparisons are available from the corresponding author.

Measures

STI diagnoses

At S1, participants were asked whether they had "ever been told by a doctor that they had any sexually transmissible disease (STD)" and were given the fixed response categories of "yes," "no," and "don't want to answer" for four infections: Chlamydia, genital herpes, genital warts (HPV), and other STD. At S2 participants were asked whether they had ever been told by a doctor that they had Chlamydia, genital herpes, genital warts (HPV) with the fixed response categories of "yes, in the last 4 years", and "yes, more than 4 years ago." This question differed from S1 in that the words "sexually transmitted disease" were not specifically included in the question stem. At both S3 and S4, participants were asked "In the last 3 years, have you been diagnosed or treated for: A Sexually Transmitted Infection (e.g., chlamydia, genital herpes)?" with the response option of "yes, in the last 3 years" or leaving the question blank. This was asked as part of a broader question about diagnoses and treatments of general health conditions. *Explanatory variables*.

Eighteen explanatory variables associated with STI in other studies and measured by ALSWH at S2 (participants aged 22-27 years) were explored.

Sociodemographic variables. Sociodemographic variables included age at participation in the survey, marital status (the category "partnered" included those who were married or cohabiting and the category "unpartnered" included those who were never married, divorced, separated or widowed), employment status (working full-time, part-time, or not in the labor force), and highest level of education (finished high-school/Year 12, trade/diploma qualification, university degree).

Sexual and relationship variables. A number of sexual and relationship variables were measured. Lifetime history of child sexual abuse was measured by the answer to a question at S4 (when the women were aged 28-32 years): "As a child, did you experience sexual abuse (e.g., forced to engage in unwanted sexual practices such as unwanted touching, exposure or penetration)?" Response options were: "yes" or "no." Current condom use was measured by agreement to either of two statements in a list of contraception options: "I use condoms for contraception" or "I use condoms (or other barrier methods) for prevention of infection." Women were asked to indicate their lifetime number of male sexual partners by writing the number in response to the question "How many sexual partners have you had?" with separate boxes to indicate male and female partners. The definition of a sexual partner was determined by the participants answering the question. For this analysis, responses were categorized as "0," "1," "2-5" or "6 or more." Women were asked to indicate whether they were currently pregnant or had been pregnant in the past (coded "yes" or "no"). Unwanted sexual activity in the past 12 months was measured by a question which asked women to indicate whether they had been "Forced to take part in unwanted sexual activity" in the last 12 months as part of a scale of life events (coded "yes" or "no"). Age at first sex was measured by women writing the number in response to the question: "What age were you when you had your first sexual intercourse?" Women were asked to indicate whether they had been divorced or separated in the last 12 months (coded "yes" or "no"). Women who had never married were categorised as not having been divorced or separated.

Health behaviour variables. Women were asked a series of questions about alcohol use and smoking status and their responses categorized following Australian national guidelines: alcohol "non drinker," "low/rare drinker" or "risky/high drinker" (National Health and Medical Research Council, 2001); and "current smoker," "ex-smoker," "non-smoker" (Australian Institute of Health and Welfare, 2000).

Physical and mental health measures. Physical and mental health measures included the mental health component score (MCS) and physical health component score (PCS) of the SF-36 Health Status Form (Ware, Snow, Kosinski, & Gandek, 1993).

Health service access variables. Three health service access variables were measured: access to a Women's Health Centre or a Family Planning Centre, ease of seeing the GP (general practitioner or family doctor) of their choice, and having had a Pap test within the last two years. Women were asked: "Thinking about your health care, how would you rate the following now?": access to a Women's Health Centre or a Family Planning Centre, ease of seeing the GP of your choice. Women indicated their response on a Likert scale as "Excellent," "Very good," "Good," "Fair" or "Poor." There was also an option for "Don't know." Women were asked: "When did you last have a Pap test?" An explanation was provided: "A Pap test (for cervical cancer) is a routine test carried out by a doctor or nurse during an internal (vaginal) examination." Women responded according to the response categories: "I have never had a Pap test," "Less than 2 years ago," "2-5 years ago," "More than 5 years ago," or "Not sure." For the purpose of this analysis, responses were coded "Yes" if they responded "Less than 2 years ago."

Data Analysis

Exploratory analysis

An exploratory analysis was conducted to examine the proportion of women who reported an STI at each survey and the timing of the first reported STI. To take account of the oversampling of rural and remote women, all data were weighted to reflect the probability of being sampled in the initial survey. Frequency data were presented as the weighted percentage of the total weighted number of participants. Of the entire sample of 6,840 women, 214 (3.1%) reported an STI at S1 but did not re-report the STI at S2. As the purpose of this article was to examine the timing of first reporting an STI, these 214 women were classified as first reporting an STI at S1 and were not included in further analyses.

The exploratory analysis used data from 6,306 women who answered all four surveys and who also completed the STI questions. Four women who reported STI for the first time at S3 but did not complete S4 were included in the analysis as they met the criteria for inclusion having been diagnosed with STI for the first time at S3.

Multivariable analyses

Two multivariable logistic regression analyses were conducted. For both analyses, a parsimonious model was obtained by backwards selection of variables at p < .05. To account for the over-sampling of women in rural and remote areas, the analyses were weighted to reflect the probability of being sampled in the initial survey. All analyses were conducted using SAS software, Version 9.1.3 SP4 (SAS Institute Inc., Cary, NC).

The first analysis examined the role of the explanatory variables as measured at S2 (when they were aged 22-27 years) in predicting whether women reported STI for the first time at S2 (when they were aged 22-27 years) compared to whether they reported STI for the first time at S3 or S4 (when they were aged 25-30 or 28-33 years). The purpose of this analysis was to show how the group of women acquiring STI at a later age were different to those acquiring STI at a younger age and to provide a cross-sectional analysis as a comparison for the second longitudinal analysis. The outcome for this analysis was reporting STI for the first time at S2 (age 22-27 years). The first analysis included 575 women who either first reported STI at S2 (n = 306) or first reported STI at S3 or S4 (n = 269).

The second analysis examined the role of the explanatory variables as measured at S2 (when they were aged 22-27 years) in predicting whether women reported STI for the first time at S4 or S4 (when they were aged 25-30 or 28-33 years) compared to whether they did not report STI at any survey. The outcome for this analysis was reporting STI for the first time at S3 or S4 (age 25-30 or 28-33 years). The second analysis included 5,483 women who either never reported STI at any survey (n = 5,214) or first reported STI at S3 or S4 (n = 269). Women who reported STI at S1 or S2, but not at S3 or S4 were excluded from the second analysis.

RESULTS

Exploratory Analysis

Of the 6,306 women who completed all four surveys and had complete STI histories, 1,092 (17.3%) reported that they had been diagnosed with STI at least once. Among these women, many reported STI more than once across four surveys. At S1, there were 521 (8.3%) who reported that they had ever been diagnosed with STI. At S2, there were 393 (6.2%) who had been diagnosed with STI since S1. At S3, there were 254 (4.0%) and at S4 there were 229 (3.6%) who had been diagnosed with STI in the previous three years. At S1 and S2 when individual infections could be identified, genital warts (HPV) was the most commonly diagnosed STI reported. Of the 1,092 women who had ever been diagnosed with STI, almost half (47.7%) first reported this at S1. A further 28% first reported STI at S2, with a smaller proportion first reporting STI at S3 (11.9%, 134 women) and S4 (12.4%, 135 women).

Women's Characteristics Associated with Reporting STI Diagnosis at Survey 3 or Survey 4

Table 1 shows the unadjusted associations. Compared to women who first reported STI at S3 or S4, women reporting STI for the first time at S2 were more likely to have six or more lifetime male sexual partners at S2, more likely to have been pregnant by S2, to have a younger age of first sex, to report better access to Women's Health or Family Planning Centres at S2, and to have been more likely to have had a recent Pap test at S2. Compared to women who had not reported an STI, women reporting STI for the first time at S3 or S4 were younger than 25 at S2, unpartnered, were not using condoms, had more lifetime male sexual partners, had no previous pregnancy, and had been divorced or separated in the previous 12 months. They were also more likely to have used alcohol at risky levels, had lower mental health scores (indicating poorer mental health), and had poorer access to a Women's Health or Family Planning Centre.

After adjustment for all characteristics, the factors independently associated with reporting an STI for the first time at S3 or S4 were identified using two multivariable logistic regression analyses (Table 2). Compared to women who first reported STI at S2, women reporting STI for the first time at S3 or S4 were more likely to report no pregnancy by S2 (OR = 1.70, 95% CI 1.11-2.61) and less likely to have reported having a recent Pap test at S2 (OR = $\frac{1}{2}$ 0.18, 95% CI 0.11-0.29). This shows that, when this analysis was adjusted for all other variables, there was no longer an association with marital status, lifetime number of partners, age at first sex or access to Women's Health and Family Planning Centres. Compared to women who had not reported an STI, women who reported STI for the first time at S3 or S4 were more likely at S2 to be younger than 25 (OR = 1.58, 95% CI 1.19-2.10), to be unpartnered (OR = 2.13, 95% CI 1.57-2.91), to report a higher number of male sexual partners (2-5: OR = 2.04, 95% CI 1.37-3.05; 6 or more: OR = 3.47, 95% CI 2.31-5.23), to have never been pregnant (OR = 1.77, 95% CI 1.22-2.58), to have been divorced or separated in the previous 12 months (OR = 2.93, 95% CI 1.61-5.31) and to have reported poorer access to Women's Health or Family Planning Centres (OR = 1.65, 95%CI 1.25-2.18). This shows that, when this analysis was adjusted for all other variables, there was no longer an association with current condom use, smoking, alcohol consumption, or poor mental health.

DISCUSSION

This longitudinal analysis of predictors of new STI diagnoses among young adult women confirmed the findings of longitudinal studies among adolescents and cross-sectional research among adult women. This new study validated the preceding literature that emerged from major national cross-sectional studies such as the UK NATSAL (Johnson, et al., 2001) and the Australian Study of Health and Relationships (Grulich, De Visser, Smith, Rissel, & Richters, 2003). These confirmatory longitudinal findings were highly significant for research because they strengthened our confidence in the validity of the previous cross-sectional findings. There were no major associations in the earlier studies that were not replicated here. The value of the longitudinal findings was further emphasized by the differences in the important variables shown by our first cross-sectional analysis and our second longitudinal analysis. The cross-sectional analysis examining predictor variables measured at S2 was less useful in predicting diagnosis of STI at S2 than was the longitudinal analysis at predicting new acquisition of STI six years later.

This study confirmed the value of a life course perspective of sexual health across the lifespan and demonstrated that the conventional markers of life stages were not necessarily helpful (Marshall, 2011). Rather, specific sexual behaviors that place people at risk of sexually transmissible infections may continue past adolescence into adulthood via risky sexual scripts (Simon & Gagnon, 1986). While a focus on adolescent sexual education is justified, it should not be allowed to obscure the needs of adults who may also lack knowledge and skills relating to safe sexual practices.

The analysis showed that partner and relationship factors for women aged 22-27 were important predictors of STI diagnosis up to six years later. These longitudinal results were similar to earlier cross-sectional results showing that number of previous male sexual partners was associated with women's later diagnosis with STI (Khan, et al., 2005; Schofield, et al., 2000). Being recently divorced or separated at age 22-27 predicted later STI and this finding was consistent with previous findings that women leaving long-term relationships were at risk for STI though they were not a recognized target group for education or research aimed at prevention (Rich, 2001; Sherman, Harvey, & Noell, 2005). Women who had been pregnant were less likely to experience a later STI diagnosis contrary to earlier cross-sectional findings with this cohort when they were aged 18-23 years when pregnancy was associated with experiencing STI (Schofield, et al., 2000). It is likely that at 18-23 years of age having experienced a pregnancy was indicative of an earlier age at first intercourse and riskier sexual behavior. As women moved out of their teens and became more sexually experienced, previous pregnancy was more likely to indicate proactive family formation (Herbert, Lucke, & Dobson, 2009), probably within a stable relationship in the context of less risky sexual behavior. This conclusion was also supported by our finding that women who reported STI for the first time at S3 or S4 were less likely to have had a pregnancy event at S2 compared to women who first reported STI at S2. Women who first reported STI at S3 or S4 were also less likely to have had a recent Pap test at S2 compared to women who first reported STI at S3 or S4 were also less likely to have had a recent Pap test at S2 compared to women who first reported STI at S3 or S4.

Past research has shown associations between STI status and child sexual abuse. The lack of a significant finding in the current study may be due to a lack of statistical power to detect an association with STI diagnosis. Child sexual abuse may have the strongest impact on sexual behavior at younger ages and the impact may be weaker once women reach their 20s, gather more life experiences, and are more sexually experienced. If child sexual abuse resulted in reluctance to engage in sexual behavior or delayed relationship formation this may have led to a decrease in risk of STI.

Fergusson et al. (1997) found that child sexual abuse was associated with adverse events because of its association with early onset of sexual activity. Thus, child sexual abuse may not be shown to have an impact on later acquisition of an STI because of its association with other factors related to sexual risk. It may be that child sexual abuse is related to women's likelihood of divorce or separation in their mid-20s or reduced ability to negotiate safe sexual practices with new partners after the break-up of a relationship and thus contributes to the likelihood of STI diagnosis. The lack of an association with experience of child sexual abuse would be worth further research attention. Similarly the role of current or previous intimate partner abuse should be examined.

The findings suggested that reporting good access to Women's Health or Family Planning Centres may have played a role in protecting women against being diagnosed with new STI later on. Women in this study were asked to rate their access themselves so their responses would have been influenced by their awareness of available services as well as their need for such services. Women who did not need to access services because they were not sexually active or had access to alternative services may not have rated their access as good. Furthermore good access to a GP of choice was not an important factor in future reporting of an STI. It is difficult to interpret these findings because of the subjective nature of the measure used. Further examination of more objective measures of access to health services (such as distance between the woman's home and the nearest service) in protecting against STI among Australian women may be warranted particularly in relation to planning services for rural areas (Mirza, Kovacs, & Kinfu, 2001; Mirza, Kovacs, & McDonald, 1998). This study showed that despite adjusting for a range of factors, including area of residence, perceived quality of access to Women's Health or Family Planning Centres was protective for later STI diagnosis.

Our finding that a relationship break-up for women in their 20s predicted later STI further highlights the need to provide resources and education to women and men renegotiating sexual relationships at all ages and stages of life. It would be useful to further explore the relationship between diagnosis of STI and divorce and/or separation throughout the lifespan. The median age of divorce for women in Australia in 2007 was 41.3 years with an average time to divorce of 12.5 years (Australian Bureau of Statistics, 2007). The role of relationship break-ups in sexual health among women in their 40s and 50s and beyond would be worth further study.

The findings of this study should be interpreted in light of the limitations of a large, longitudinal survey. Women who were more educated, more affluent, in better health, and have fewer children were more likely to continue to participate in the study and this may influence the generalizability of the findings. Analyses of attrition in the 1973-1978 cohort have shown that there was no serious bias in statistical estimates (Powers & Loxton, 2010). For example, we have shown in this study that while the women who did not participate in surveys after S2 were less likely to be married, had lower education, and were more likely to have been pregnant by S2, there were no significant differences in STI diagnosis at S2 between those who remained in the study and those who did not. The only difference was a pattern for fewer women who did not continue after S2 to report genital warts (HPV) more than four years before the survey compared with the women who continued in the study. The outcome variables in this study focused on whether a woman had ever been diagnosed with any STI (rather than specific infections) in order to reduce any potential bias from attrition. It is important to note that this paper showed that genital warts (HPV) was the most common infection at S1 and S2 but it is likely that the epidemiology of genital warts and other HPV related disease will change in the future as young women are vaccinated.

The study was designed to examine broad changes in health over time rather than detailed clinical information and the results need to be interpreted in this context. The questions relating to STI were general and required women to give self-reported answers. They also changed subtly

over the four surveys in terms of their format, the options provided, and their placement within the survey as a whole. At S1, women were asked whether they had been told by a doctor they had any STI and were given the options of Chlamydia, genital herpes, genital warts (HPV), and any other STI. At S2, they were asked specifically whether a doctor had told them they had Chlamydia, genital herpes and genital warts (HPV) and were not given an "other" option. At S3 and S4, they were asked whether they had "been diagnosed or treated for a Sexually Transmitted Infection (e.g., chlamydia, genital herpes)." These differing formats may have changed the way that women answered the questions and in particular, the lack of an "other" option at S2 may have missed some STI. The decision to remove the "other" option was taken on the basis of the pattern of answers to S1 and it is likely that most STI were recorded.

A more important limitation of this study was that data were based on self-reported diagnoses. It was not possible to confirm diagnoses or other health indicators from health care provider records. Therefore, in order to report an STI at a particular survey, women must have known they had been diagnosed or treated for STI and they must also have been prepared to report STI. Asymptomatic infections may have been unreported or reported much later than they were diagnosed. Access to sexual health clinics and potential bias due to improved clinical methods for STI diagnosis could not be identified in the study. In the U.S., there is evidence that good access to sexual and reproductive health services among young women is becoming increasingly associated with an advantaged socioeconomic background (Potter, Trussell, & Moreau, 2009). Further research is warranted to examine whether this is also the case in Australia.

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Table 1

Characteristics of women at age 22-27 years who reported their first STI diagnosis at S3 or S4 (age 25-30 or 28-33 years) (referent)

compared to a) those who reported their first STI diagnosis at S2 (age 22-27 years), and b) compared to those who never reported STI

| | | First STI repo | orted at S2 | First STI r | r S4 | | |
|-----------------------|---------------------|-----------------|----------------|----------------------------|-----------------|----------------|--|
| | | (age 22-27 | years) | (age 25-30 or 28-33 years) | | | |
| | | Yes (a) | p ² | Yes (referent) | No (b) | p ² | |
| Characteristics at S2 | | n = 306 | | n = 269, | n = 5,214, | | |
| (at age 22-27 years) | | $n, (\%_w)^{1}$ | | $n, (\%_w)^{1}$ | $n, (\%_w)^{1}$ | | |
| Age | Less than 25 | 194 (63.1) | | 180 (67.9) | 2968 (56.8) | | |
| | 25 or older | 112 (36.9) | | 89 (32.1) | 2246 (43.2) | .0003 | |
| Marital status | Partnered | 111 (34.2) | | 71 (25.2) | 2495 (45.3) | | |
| | Unpartnered | 193 (65.8) | .02 | 195 (74.8) | 2701 (54.7) | <.0001 | |
| Employment | Full-time | 193 (61.6) | | 174 (66.1) | 3150 (61.8) | | |
| | Part-time | 79 (26.7) | | 63 (22.4) | 1293 (24.5) | | |
| | Not in labour force | 34 (11.7) | | 32 (11.6) | 765 (13.7) | | |

diagnosis

| Highest level of education | University | 148 (53.5) | | 123 (49.9) | 2182 (47.8) | |
|-------------------------------|------------------|------------|-------|------------|-------------|--------|
| | Trade/diploma | 64 (20.8) | | 61 (22.9) | 1233 (23.5) | |
| | Year 12 or below | 82 (25.7) | | 78 (27.2) | 1636 (28.8) | |
| History of child sexual abuse | Yes | 60 (19.2) | | 40 (13.6) | 849 (15.7) | |
| | No | 244 (80.8) | | 224 (86.5) | 4327 (84.3) | |
| Current condom use | Yes | 121 (39.6) | | 98 (37.6) | 1404 (28.2) | |
| | No | 183 (60.4) | | 169 (62.4) | 3747 (71.8) | .0009 |
| Number of lifetime male | 0 | 1 (0.5) | | 7 (2.8) | 459 (10.3) | |
| sexual partners | 1 | 21 (7.0) | | 31 (13.2) | 1296 (27.7) | |
| | 2-5 | 105 (35.5) | | 97 (41.4) | 1823 (38.5) | |
| | 6 or more | 158 (57.0) | .0006 | 106 (42.6) | 1118 (23.4) | <.0001 |
| Ever been pregnant | Yes | 83 (25.8) | | 49 (16.3) | 1307 (23.3) | |
| | No | 220 (74.2) | .005 | 219 (83.7) | 3787 (76.7) | .007 |
| Unwanted sexual activity, | Yes | 7 (2.8) | | 5 (1.6) | 63 (1.3) | |
| last twelve months | No | 296 (97.2) | | 264 (98.4) | 5115 (98.7) | |
| Age at first sex | Mean (SD) | 17.4 (1.9) | .0002 | 18.0 (2.4) | 18.3 (2.7) | |

| Divorce or separation, | Yes | 14 (5.1) | | 16 (5.2) | 98 (2.0) | |
|-----------------------------|-----------------|-------------|--------|-------------|-------------|--------|
| previous twelve months | No | 289 (94.9) | | 253 (94.8) | 5080 (98.0) | .0003 |
| Alcohol consumption | Non drinker | 16 (4.8) | | 13 (4.6) | 481 (8.9) | |
| | Low/rarely | 274 (90.5) | | 239 (90.5) | 4547 (88.2) | |
| | Risky/high risk | 15 (4.7) | | 15 (4.8) | 153 (2.8) | .009 |
| Smoking status | Never | 158 (50.4) | | 135 (52.6) | 3259 (63.7) | |
| | Ex-smoker | 56 (18.1) | | 35 (12.3) | 713 (13.3) | |
| | Current smoker | 90 (31.5) | | 96 (35.1) | 1204 (23.0) | <.0001 |
| Mental health score | Mean (SD) | 42.1 (12.4) | | 42.3 (11.9) | 44.3 (11.1) | .006 |
| Physical health score | Mean (SD) | 53.3 (7.7) | | 53.6 (7.4) | 53.0 (7.6) | |
| Access to Women's Health | Excellent/good | 137 (46.5) | | 96 (33.0) | 2185 (42.5) | |
| or Family Planning Centres | Fair/poor | 166 (53.5) | .0008 | 171 (67.0) | 2973 (57.5) | .002 |
| Ease of seeing GP of choice | Excellent/good | 200 (66.4) | | 168 (62.1) | 3388 (66.5) | |
| | Fair/poor | 102 (33.6) | | 100 (37.9) | 1766 (33.5) | |
| Pap test in last two years | Yes | 280 (91.5) | | 179 (65.3) | 3420 (64.6) | |
| | No | 25 (8.5) | <.0001 | 89 (34.8) | 1759 (35.4) | |

⁻¹ Unweighted frequency (n), weighted percentage (%_w) or mean. Missing data not included.

 $^{2} p < .05$ was considered significant.

Table 2

Most significant characteristics of women at S2 (age 22-27 years) who reported their first STI diagnosis at S3 or S4 (age 25-30 or 28-

33 years) compared to a) those who reported their first STI diagnosis at S2 (age 22-27 years), and b) compared to those who never

reported STI diagnosis

| | | (a) First STI reported at | | (b) First STI reported at | | | | | |
|--------------------------------|--------------|---------------------------|------------------------------|---------------------------|--------------------------|--------------|----------------|--|--|
| | | 25-30 or 28-33 years | | | age 25-30 or 28-33 years | | | | |
| | | (vs rep | (vs reported at 22-27 years) | | | (vs No STI) | | | |
| Characteristics at S2 (at age | | Adj OR ¹ | (95% CI) | p ² | Adj OR ¹ | (95% CI) | p ² | | |
| 22-27 years) | | | | | | | | | |
| Age | Less than 25 | | | | 1.58 | (1.19, 2.10) | .002 | | |
| | 25 or older | | | | 1.00 | | | | |
| Marital status | Partnered | | | | 1.00 | | | | |
| | Unpartnered | | | | 2.13 | (1.57, 2.91) | <.0001 | | |
| Lifetime male sexual partners | 0 | | | | 0.30 | (0.13, 0.70) | | | |
| | 1 | | | | 1.00 | | | | |

| | 2-5 | | | | 2.04 | (1.37, 3.05) | |
|-----------------------------|----------------|------|--------------|--------|------|--------------|--------|
| | 6 or more | | | | 3.47 | (2.31, 5.23) | <.0001 |
| Ever been pregnant | Yes | 1.00 | | | 1.00 | | |
| | No | 1.70 | (1.11, 2.61) | .02 | 1.77 | (1.22, 2.58) | .003 |
| Divorce or separation, | Yes | | | | 2.93 | (1.61, 5.31) | .0004 |
| Previous twelve months | No | | | | 1.00 | | |
| Access to Women's Health or | Good or better | | | | 1.00 | | |
| Family Planning Centres | Fair or worse | | | | 1.65 | (1.25, 2.18) | .0004 |
| Pap test in last two years | Yes | 0.18 | (0.11, 0.29) | <.0001 | | | |
| | No | 1.00 | | | | | |

¹Parsimonious multivariable logistic regression model. Due to oversampling of women in rural and remote areas odds ratios were

weighted to reflect the probability of being sampled in the initial survey.

 $^{2} p < .05$ was considered significant.