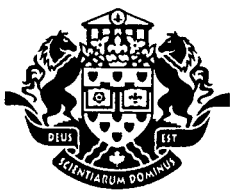

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SEXUALLY TRANSMITTED DISEASES AND THEIR SOCIO-DEMOGRAPHIC AND BEHAVIOURAL CORRELATES IN CANADA: NATIONAL POPULATION HEALTH SURVEY 1996-97

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Sexually Transmitted Diseases and Their Socio-Demographic and Behavioural Correlates in Canada: National Population Health Survey 1996-97

by

Christine Navarro

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ABSTRACT

This research examines the two-year period prevalences and gender-specific correlates for self-reported gonorrhea, chlamydia, genital herpes, and genital warts among 43,192 sexually experienced Canadians aged 15 to 59 years in the 1996-97 National Population Health Survey. Reporting multiple partners in the past year was consistently related to higher prevalences of STD. Regular alcohol consumption was a potential indicator of a higher risk lifestyle that places men and women at increased risk for chlamydia and genital herpes. Canadian-born respondents were significantly more likely to report STD, which may be a result of respondent error. Gender, age, and age at first intercourse were also important correlates, acting as both direct risk factors influencing susceptibility and as markers of higher risk sexual activity. Although the survey relies on self-reports of STD experience, in combination with clinic-based studies and surveillance it can be a useful tool for targeting prevention strategies for the general population.

1.0 INTRODUCTION

1.1 Significance of the Problem

Chlamydia, gonorrhea, genital herpes, and genital warts are of considerable public health importance worldwide for several reasons. Most importantly, the burden of illness in terms of morbidity and economic costs of all four sexually transmitted diseases (STDs) is substantial worldwide (Goeree & Gully, 1993; Siegal, 1999). Repeated bacterial infections of gonorrhea and chlamydia are common, whereas the STDs caused by herpes simplex virus (HSV) and human papillomavirus (HPV, which causes genital warts) are incurable (LCDC Expert Working Group, 1998). The large proportion of asymptomatic and sub-clinical infections contributes greatly to their spread (Koutsky et al., 1990; Rowley & Berkley, 1998). The sequelae of these four infections are significant, from pelvic inflammatory disease and infertility in females to spontaneous abortion of the fetus and neonatal infections (Brown et al., 1997; Schachter & Alexander, 1998; Hook, 1999). Sexually transmitted infections, particularly HSV type 2, may also be associated with an increased risk of infection with human immunodeficiency virus (HIV) (Holmberg et al., 1988; Hook et al., 1992; Wasserheit, 1992). The natural history of each STD, including the causative agent, incubation period, symptoms and sequelae, transmission, diagnosis, treatment, and estimated costs is provided in Appendix A.

1.2 Literature Review: Occurrence of STDs in Canada

STDs are a significant problem in Canada, although there are some very important gaps in our knowledge of the occurrence of these diseases that need to be filled, particularly for the viral infections (Health Canada, 1997a). Data on the occurrence of STDs can be obtained from three major sources: surveillance reports, clinic-based studies, and population-based surveys. The bacterial STDs are nationally reportable in North America and most European countries (Aral, 1999a). In comparison, data on the viral STDs is limited. Cases of genital herpes and genital

warts seen at genitourinary medicine (GUM) clinics and detected in laboratories are reportable in the U.K. (Hughes & Catchpole, 1998), and in the U.S., first consultations at physician's offices for these STDs are recorded in the National Disease and Therapeutic Index (NDTI) (National Center for Health Statistics, 1999). In Canada, the only national estimates available for HSV infections are those derived from laboratory specimen testing, and neither HPV infection nor genital warts are covered under any systematic surveillance system (Health Canada, 1999). Clinic-based studies provide point prevalence estimates for self-selected sub-populations through the use of diagnostic testing, whereas population-based surveys usually rely solely on self-reported STD history. A summary of the Canadian and American population-based surveys discussed in this paper is found in Appendix B.

1.2.1 Chlamydia

Chlamydia has become the most commonly reported bacterial STD in Canada, accounting for approximately 84% of all reported STD cases (Squires et al., 1997). Since it became nationally reportable in 1991, the overall annual incidence of reported chlamydial infections among men and women combined decreased steadily from 171.7 per 100,000 in 1991 to 111.2 per 100,000 in 1997. In 1997, this was equivalent to 8,848 cases among males and 24,816 cases among females (Health Canada, 1999).

In clinic-based populations, the prevalence of chlamydia among women ranges from 4.4% at a university clinic (Noble et al., 1988); 4.6% to 11.4% at abortion clinics (Levallois et al., 1987; Miller & Gillett, 1990); 4.9% in a rural hospital setting (Langille & Shoveller, 1993); 7.0% at a family planning clinic (Sellors et al., 1992); 7.1% to 10.2% at general practitioners' offices (Masse et al., 1991); 12.4% of *C. trachomatis* laboratory tests requested by general practitioners (Orr et al., 1994); 14.8% at an adolescent gynaecology unit (Hughes et al., 1989); 27.1% of women at a Halifax STD clinic (Pereira et al., 1990); to 54.7% self-reported lifetime

history among Edmonton STD clinic attenders (Romanowski et al., 1997). There were few similar studies in men: the prevalence varies from 8.7% of C. trachomatis laboratory tests requested by general practitioners (Orr et al., 1994); to 12.0% in a rural hospital setting (Langille, 1993); 13.2% at general practitioners' offices (Masse et al., 1991); and 45.0% self-reported lifetime history among STD clinic attenders (Romanowski et al., 1997).

Data on the self-reported history of chlamydia is available from only one Canadian population-based survey: according to the 1998 Canadian Contraception Survey (CCS), 48% of married women and 50% of unmarried women reported a past diagnosis of chlamydia (Boroditsky et al., 1999). Although not necessarily generalisable to the Canadian population, this figure may be compared to the lifetime prevalence of chlamydia in U.S. surveys. In the 1992 U.S. National Health and Social Life Survey (NHSLS), self-reported chlamydia among men and women respondents aged 18 to 59 years was much lower at only 3.2% (Laumann et al., 1994). In the 1991 National Surveys of Men (NSM) and Women (NSW), 1.2% of male respondents aged 20 to 39 years and 7.0% of female respondents aged 20 to 37 years reported having had chlamydia in their lifetime (Tanfer et al., 1995). The self-reported lifetime occurrence of chlamydia was slightly lower for females in the 1995 National Survey of Family Growth (NSFG), where 5% of women aged 15 to 44 years reported this disease (Miller et al., 1999).

1.2.2 Gonorrhea

Gonorrhea has been a nationally notifiable disease in Canada since 1940. There has been a steady reduction in the annual incidence rates of gonococcal infections in males and females over the past two decades, from 216.6 per 100,000 in 1980 to 14.7 per 100,000 in 1997. The number of reported gonorrhea cases is much lower than chlamydia, with only 2,651 cases reported in males and 1,780 in females in 1997 (Health Canada, 1999). This dramatic decline in reported incidence has been attributed to improved treatment facilities, screening programs for

women, enhanced partner notification of cases, increased condom use, and the continued availability of effective single-dose antibiotic therapy (Fox et al., 1998; Health Canada, 1997; van der Heyden et al., 2000).

The point prevalence estimates of gonorrhea among women in clinic-based studies range from a low of 0.9% at multiple general practitioners offices and an abortion clinic (Levallois et al., 1987; Vincelette et al., 1991); 1.1% at an adolescent gynaecology unit (Hughes et al., 1989); 20.2% self-reported lifetime history among Edmonton STD clinic attenders (Romanowski et al., 1997); to as high as 32.8% of 247 women attending a Halifax STD clinic (Pereira et al., 1990). Among men, the self-reported lifetime history among STD clinic attenders was 35.2% (Romanowski et al., 1997).

The lifetime prevalence of gonorrhea reported in the 1998 CCS was lower than chlamydia (16% of married and 9% of unmarried women) (Boroditsky et al., 1999). In the U.S., lower lifetime histories of gonorrhea were also reported in the 1992 NHSLS (6.6%), 1991 NSM (6.2%), 1991 NSW (4.4%), and the 1995 NSFG (2%) (Laumann et al., 1994; Miller et al., 1999; Tanfer et al., 1995).

1.2.3 Genital Herpes

Genital herpes appears to be increasing worldwide, but no country has taken steps to implement control strategies or comprehensive surveillance programs (Health Canada, 1997). HSV-2 is the most common cause of genital herpes, but the proportion of cases caused by HSV-1 is increasing in a number of countries (Rodgers & O'Mahony, 1995; Ross et al., 1993; Vyse et al., 2000; Wilson et al., 1994). In Canada, the total number of samples testing positive for HSV-2 at the National Laboratory for Viral and Zoonotic Diseases has increased from 4,055 in 1990 to 7,925 in 1997 (Health Canada, 1999). Steben and Sacks (1997) have estimated that as many as 2% of young sexually active Canadians may acquire genital herpes annually.

Few primary studies have determined the prevalence of HSV in Canadian populations. In a randomly drawn sample of 566 females and 391 males living in metro Toronto in 1978-80, the prevalence of HSV-2 antibodies was found to be 17.5% and 12.8% respectively (Stavraky et al., 1983). Among 247 women attending an STD clinic in Halifax in 1983-85, Periera et al. (1990) found that 6.5% had HSV. The self-reported lifetime history of genital herpes among STD clinic attenders was higher at 19.0% of women and 14.2% of men (Romanowski et al., 1997).

In the 1998 CCS, 18% of married women and 10% of unmarried women reported ever having had any type of herpes (Boroditsky et al., 1999). This is much higher than reported in the 1991 NSM (0.9%) and NSW (2.7%), the 1992 NHSLS (2.1%) and the 1988 NSFG (1.8%). (Anderson et al., 1994; Laumann et al., 1994; Tanfer et al., 1995). The U.S. National Health and Nutrition Examination Surveys (NHANES) have also included testing for HSV-2 seropositivity. There was a significant increase in HSV-2 seroprevalence in men and women combined from 16.4% (95% CI: 14.2-18.6) in the 1976-80 NHANES to 21.9% in the 1989-94 NHANES (or 45 million infected Americans) (Johnson et al., 1989; Fleming et al., 1997). One disadvantage of these serosurveys is that they ignore the contribution of sexually acquired HSV-1 to the epidemic of genital herpes by as much as 15% (Lafferty et al., 2000).

1.2.4 Genital Warts

Genital HPV infection is very common and has also increased in developed countries since the 1950s (Koutsky, 1997). However, the frequency of occurrence of genital warts or HPV infection in Canada is not known (Health Canada, 1999). Koutsky (1997) estimated that the prevalence of external genital warts among the sexually active population in the U.S. was approximately 1%, and it is thought that this prevalence is probably similar among sexually active Canadians (Lytwyn & Sellors, 1997). As well, only two Canadian clinic-based studies have looked at the prevalence of genital warts in either men or women: Sellors et al. (2000)

found that among 909 women between 15 and 49 years seen for cervical cytological screening by 32 family physicians in Ontario, 1.1% had visible genital warts. The self-reported lifetime history of genital herpes among STD clinic attenders was much higher at 33.9% of women and 33.5% of men (Romanowski et al., 1997).

The 1998 CCS reported very high lifetime prevalences of disease, with 30% of married women and 28% of unmarried have ever had genital warts (Boroditsky et al., 1999). This figure was again much lower among respondents of the 1992 NHSLS (4.7%), 1991 NSM (2.5%) and NSW (5.0%), and 1988 NSFG (3.6%) (Anderson et al., 1994; Laumann et al., 1994; Tanfer et al., 1995).

1.3 Direct Determinants of STDs

Yorke, Hethcote and Nold (1978) were the first to hypothesise that the prevalence of gonorrhea is a dynamic equilibrium that responds rapidly to changes in social and sexual behaviours, medical treatment, and control programmes. In the late 1980s, Anderson and May developed a mathematical model to describe this equilibrium in relation to HIV, and that could be applied to other STDs (Anderson & May, 1988; May & Anderson, 1987). According to this model, the reproductive rate (R_o), or the mean number of new infections generated by an infected person over the lifetime of his or her infection, is determined by three factors and is stated as

$$R_o = \beta c D$$

where R_o = reproductive rate
β = probability of transmission from an infected to uninfected person
c = rate of sex partner change
D = average duration of infectivity.

The prevalence of infection rises when R_o is greater than one and declines when it is less than one (Brunham, 1991). Changes in one component of the equilibrium will be compensated for by other components. The values for these parameters will differ for each pathogen because each is distinct in its transmissibility, symptomaticity, chronicity, and susceptibility to treatment

(Brunham & Plummer, 1990). This model suggests points of intervention useful for designing prevention and control strategies (St. Louis & Holmes, 1999).

A risk factor may be defined as "an attribute or exposure that is associated with an increased probability of a specified outcome, such as the occurrence of a disease. Not necessarily a causal factor" (Last et al., 1995). Most of the traditional risk factors for STDs tend to address the direct determinants. The probability of transmission (β) depends upon the infectiousness of the pathogen, the infectivity of the infected individual, the susceptibility of the host, the frequency and type of sexual act, and use of barrier contraceptives (Anderson, 1999). The rate of sex partner change (c) depends upon the average number of sexual partnerships formed per unit time by infected individuals, heterogeneity in rates of sexual partner change, and patterns of sexual contact (Billy et al., 1993; Seidman et al., 1992). The average duration of infectivity (D) depends upon the pathogen as well as the quality, accessibility, and use of health services (Rowley, 1998).

1.4 Social and Behavioural Correlates of STDs

There are additional social structural factors not captured in this model that can act as markers or indicators of certain sexual and health care behaviours (Aral, 1999a). For example, marital status can affect sex partner recruitment patterns (Dolcini et al., 1993; Finer et al., 1999). Level of education and socio-economic status (SES) can influence the direct determinants through their impact on a person's knowledge of protective behaviours or access to and use of health services (Toomey et al., 1993). Racial or ethnic origin can often act together with SES to influence health care seeking behaviours and sexual behaviours including partner choices and use of contraception (Catania et al., 1991; Laumann et al., 1994; Upchurch et al., 1998). High-risk sexual behaviour has also been related to cigarette smoking and drug and alcohol use, as part of a convergence of risk-taking behaviour stemming from negative influences in a person's social

environment such as peer behaviour and family instability (Biglan et al., 1990; Shafer et al., 1993). In addition to being a risk marker for other sexual behaviours, alcohol and drugs may act as "risk modifiers" since they can potentially impair a person's ability to make decisions or to implement protective behaviours like condom use (Aral, 1999a; Shafer et al., 1993).

Other variables can function as both risk factors and risk markers. For instance, the efficiency of transmission of sexually transmitted infections is usually greater from males to females (Lycke, 1980; Mertz et al., 1992; Platt et al., 1983), while changes in cervical ectopy, vaginal flora, and mucus production in adolescent females make them more susceptible to some pathogens (Bolan et al., 1999). Gender and age are also important indicators of sexual behaviours such as patterns of partner recruitment or use of contraceptives and health care (Aral, 1999a). A person's age at first intercourse will influence his or her susceptibility to infection and cumulative risk of exposure, and it can also be a marker for other high-risk sexual behaviours such as multiple partnerships and the recruitment of casual partners (Evans et al., 1997; Greenberg et al., 1992; Joffe et al., 1992; Kost & Forrest, 1992). Identifying and understanding both the direct and indirect risk factors for the STDs are important for designing prevention and control strategies.

1.5 Literature Review: Risk Factors for STDs

The majority of knowledge on the correlates of the specific STDs comes from clinic-based studies, although few of these have been set in Canada. A summary of the primary studies reviewed and their major findings are given in Appendix C. Surveillance reports can also provide valuable information on high-risk groups in terms of gender, age, and geographic location. In addition, four population-based surveys, the 1988 NSFG, the NHANES II and III, and the AIDS in Multi-Ethnic Neighbourhoods (AMEN) study, have examined the relationship between specific STDs and socio-demographic and behavioural characteristics.

1.5.1 Chlamydia

Canadian surveillance reports have shown that gender is an important risk factor for chlamydia, with a stable female-to-male case ratio of about 3.1 (Squires et al., 1997b). This is probably a reflection of screening of asymptomatic females and low testing among males. Annual reported rates are also consistently highest among women aged 15 to 24 years and men aged 20 to 24 years (Health Canada, 1999). This age distribution has also been found in many clinic-based studies: 29 of 37 studies in females and six of nine studies in males demonstrated a significant relationship between young age and chlamydial infection in multivariate analysis (Tables 2 and 3 in Appendix C). This age differential may be related to marital status. Indeed, eight studies in females and three in males have shown a increased prevalence of chlamydia among unmarried subjects, with three of these studies demonstrating a significant association in multivariate analysis.

High incidence rates of chlamydia are also reported in the Yukon and Northwest Territories, which may be attributed to high levels of infection in Aboriginal communities (Health Canada, 1999). However, only about half of the 24 clinic or laboratory-based studies in females and two of six studies in males indicated a significantly higher risk of chlamydial infection in non-White groups, including Blacks, Hispanics, and Aboriginals, compared with Whites in multivariate analysis. SES does not appear to be strongly correlated to chlamdyial infection for neither men nor women. In a number of studies, there was no association between chlamydia and a variety of measures, including current employment status (Hart, 1992, 1993a & 1993b); income (Jolly et al., 1995; Ramstedt et al., 1992; Stergachis et al., 1993); education level (Addiss et al., 1987; Jonsson et al., 1995; Karam et al., 1986; Phillips et al., 1989; Sellors et al., 1992; Stergachis et al., 1993); level of parents' education (McCormack et al., 1985); use of Medicaid insurance (Neu et al., 1998; Phillips et al., 1989); occupation (Jonsson et al., 1995;

Sellors et al., 1992); working class status (Ellen et al., 1995); and poverty level status (Anderson et al., 1994; Ellen et al., 1995).

Oral contraceptive pills (OCP) use has often been regarded as an important risk factor for chlamydial infection because it induces ectopy, making more cervical epithelial cells susceptible to infection. Alternatively, ectopy induced by OCP may make sampling more efficient and thus improve detection of *C. trachomatis* by culture (Cottingham & Hunter, 1992; Munk et al., 1999; Oh et al., 1989). Women who use OCP to prevent pregnancy may also be less likely to use condoms or other barrier contraceptives to protect themselves against STD (Boroditsky et al., 1999). Sixteen studies found the prevalence of genital chlamydial infection is higher among OCP users compared with non-users in simple analysis, but only two of these found a significant relationship after controlling for other risk factors such as age and number of partners (Mosure et al., 1996; Oh et al., 1989). In contrast, Mosure et al. (1997) found that OCP users had a 20% decreased risk of being infected with chlamydia compared with females who did not use any method of contraception. Harrison et al. (1985) suggest that cervical ectopy is a better predictor of chlamydial infection.

Age at first sexual intercourse was found to be significantly associated with genital chlamydia in simple analysis in five of ten studies, although it did not remain significant after controlling for other risk factors. Jonsson et al.'s (1995) population-based study was unique in that it found that young women who reported first intercourse between 12 and 15 years were more than twice as likely to be seropositive for *C. trachomatis* antibodies than women having first intercourse at 18 years or older. Number of partners in the past year may be a more important risk factor to consider. Of fifteen primary studies examining this relationship among women, seven found a significant association in multivariate analysis. Among men, only two studies examined this risk factor. Karam (1986) found that among 85 asymptomatic men visiting a U.S. emergency room, subjects with five or more partners in the past year were significantly

more likely to have chlamydia than men with less than four partners, whereas among men recruited from a variety of Montreal provider sites, Vincelette et al. (1993) did not find any difference in the prevalence of infection between those with one partner in the past year and men with multiple partners. Only a few studies have examined the relationship between chlamydia and casual partnerships. In a study of 5,785 asymptomatic young women seeking contraceptive advice in Sweden, Ramstedt et al. (1992) found that shorter duration of a patient's present relation was significantly associated with chlamydial infection after adjusting for age group, contraceptive use, and previous genital infection. Among patients at a Baltimore STD clinic, while there was no significant relationship between type of partner and chlamydia for women, men with a casual partner were significantly less likely to be diagnosed with chlamydia after adjusting for age, number of partners in the past month, and other types of partners (adjusted OR=0.19, 95% CI: 0.05-0.77) (Hook, 1992).

Consistent use of barrier contraceptives was not shown significantly reduce of the risk chlamydia in seven studies in women and one study in men (Jonsson et al, 1995; van Duynhoven, 1997; Oakeshott, 1998; Burstein, 1998; Winter, 1990; Vuylsteke, 1999), although Han et al. (1997) found that reporting unprotected sex in the past three months was associated with almost twice the risk of having chlamydia compared with consistent condom use among women attending New York family planning clinics. As well, using a condom at the last sexual encounter was significantly associated with a decreased risk of chlamydial infection in a study of adolescent males (Marazzo et al., 1997). The lack of a consistent protective effect of condoms may be attributed to the timing of events; for example, if individuals have become infected prior to condom use and started to use condoms after symptoms appeared. As well, social desirability bias may cause individuals to over-report their condom use (Catania et al., 1990).

1.5.2 Gonorrhea

Canadian males have had consistently higher reported rates of gonococcal infections than females, although the male-to-female ratio has decreased from 1.57 in 1981 to 1.34 in 1995 (Squires & Doherty, 1997a). Approximately 50% of the cases reported in 1997 were in people aged 15 to 24 years (Health Canada, 1999). Similarly, 14 of 18 studies among females and five of 11 studies in males found younger age to be a significant risk factor after adjusting for other covariates (Tables 5 and 6 in Appendix C). Again, this age differential may be related to marital status, as three primary studies found it to be an independent risk factor for women, with adjusted odds ratios for unmarried women ranging from 3.4 to 5.0 (Hillis et al., 1995a; Mertz et al., 1997; Stergachis et al., 1993). However, Hart (1992 & 1993) and Periera (1990) found no significant relationship among women or men. Only Anderson et al. (1994) found that never married women in the 1988 NSFG were significantly less likely to report a lifetime history of gonorrhea than women who had been married, although this is probably due to the younger age of unmarried women.

Unlike chlamydia, gonorrhea has been consistently shown to be concentrated in "core groups", which are subgroups of the population having high rates of transmission of an STD, and are usually lower SES, minority communities (Brunham, 1991). The highest rates of reported gonorrhea in Canada occur in regions with high concentrations of Aboriginal populations (Health Canada, 1997a). A similar race differential between has also been demonstrated in a number of primary studies. All 14 studies examining this risk factor found a higher prevalence of gonococcal infection in non-White groups compared with Whites, and the majority of these studies demonstrated a significant association for males and females in multivariate analysis. Likewise, the majority of studies reviewed found gonorrhea to be associated with varying measures of SES. Use of Medicaid insurance (Phillips et al., 1988), being an industrial worker, student or housewife (Bjekic et al., 1997), and being classified as

150% below the poverty threshold (Anderson et al., 1994) were associated with increased risk of gonorrhea in women. Scoring greater than zero on the Jarman deprivation scale (Low et al., 1997), residing in an area classified as socio-economically deprived (Lacey et al., 1997), and belonging to a working class neighbourhood (Ellen et al., 1995) were significant risk factors for both sexes. Current unemployment was not associated with gonorrhea for either gender in three Australian studies (Hart, 1992, 1993a & 1993b). A number of additional ecological studies have demonstrated that contiguous neighbourhoods or census tracts in urban areas with the lowest SES ratings have the highest burden of gonorrhea (Blanchard et al., 1998; Ellen et al., 1997; Hamers et al., 1995; Rice et al., 1991; Rothenberg, 1983; Rothenberg et al., 1988; Zimmerman et al., 1990). In terms of educational level, Phillips et al. (1988) and Bjekic et al. (1997) found a significant increase in risk for women with high school education or less in simple analysis, and Bjekic also found lower educational levels associated with gonorrhea in men in multivariate analysis.

In terms of behavioural characteristics, the prevalence of gonorrhea was not greater among OCP users compared to non-users in six clinic-based studies. Early age at sexual debut was found to be a significant risk factor for self-reported lifetime history of gonorrhea after controlling for other factors including age, marital status, race, and number of lifetime partners in the 1988 NSFG (Anderson et al., 1994). Phillips et al. (1988) also found a four-fold increase in chlamydial infection among women reporting age at sexual debut at 16 years or younger. Only one study examined this risk factor among men: Bjekic et al. (1997) found that although men who reported first intercourse at ages 15 to 19 years had a higher prevalence of gonorrhea than men reporting first intercourse at younger or older ages, there was no significant relationship after adjusting for covariates. Having more than two partners in the past year was found to increase the risk of being diagnosed with gonorrhea by 2.2- to 3.5-fold for women in multivariate analysis of two European studies (Bjekic et al., 1997; Evans et al., 1993), although this

association was not significant in two North American studies (Aral et al., 1991; Vincelette et al., 1991). Aral et al. (1991) found that males reporting three to six partners in the past year were 1.3 times more likely to be diagnosed with gonorrhea in the last year (95% CI: 1.0-1.7), but having more than six partners did not significantly increase risk of infection (OR = 1.2, 95% CI: 0.9-1.6). These results were inconsistent with two other studies, which showed no significant relationship between number of partners in the past year and gonorrhea for males (Bjekic et al., 1997; Vincelette et al., 1991). Among men, Upchurch et al. (1990) and Bjekic et al. (1997) observed that reporting sex with a casual partner in the past month increased the risk of having gonorrhea by almost three times in multivariate analysis, and Van Duynhoven et al. (1997) found that males whose last sexual encounter was with a casual partner were twice as likely to have gonorrhea than those males whose last sexual encounter was with a steady partner after adjusting for other variables. Among women, however, three studies failed to demonstrate a significant association between casual partnerships and gonorrhea. Hook et al. (1992) suggest that males may be more likely to acquire gonorrhea from new or casual partnerships, and they consequently transmit infection to their regular, more-often-monogamous female sexual partners. Indeed, they found that females with a regular partner in the past month had an adjusted odds ratio of 3.85 (95% CI: 1.27-11.73) for gonorrhea when compared with females without a regular partner. Like chlamydia, there was no consistent protective effect for condom use: while three studies found that men and women condom users were two to three times less likely to be infected with gonorrhea (Burstein et al., 1998; Upchurch et al., 1990; van Duynhoven et al., 1997), seven studies in females and two studies in males did not detect a significant relationship.

1.5.3 Genital Herpes

Females are consistently at greater risk for genital herpes. For instance, in the U.K., the female-to-male case ratio ranges between 1.55 for all blood samples at public health laboratories

(Vyse et al., 2000); 2.0 to 3.0 in attenders at GUM clinics (Cowan et al., 1994; Simms et al., 1998); to 8.9 among blood donors (Cowan et al., 1994). Similarly, in the NHANES III, women were about 45% more likely than men to be infected with HSV-2 (Fleming et al., 1997), and in the AMEN survey, women were 1.7 times more likely to be infected with HSV-2 than men (95% CI: 1.4-2.0) even after adjusting for age, ethnicity, and education level (Siegel et al., 1992).

In contrast to the bacterial STDs, genital herpes has been shown to be more common among older study subjects (Tables 8 and 9 in Appendix C). In the 1988-94 NHANES III, there was an increase in the proportion of HSV-2 infection from the earliest ages, peaking through the late twenties, remaining stable through the early forties, followed by a decline in the middle ages (Fleming et al., 1997). This trend was also seen for self-reported lifetime genital herpes among men and women respondents of the 1992 NHSLS (Laumann et al., 1994). Seven other primary studies found that age over 25 to 30 years was significantly associated with genital herpes for both males and females in multivariate analyses. This age-related increase is due to a combination of the chronicity of the disease, the cumulative exposure to potential sources of infection though the accumulation of lifetime partners, and an increasing number of years of sexual activity. Likewise, levels of HSV-2 were highest among older previously married NHANES II and III respondents and lowest among the never married, although this risk factor did not remain significantly related to seropositivity after adjusting for age, race, and gender (Fleming et al., 1997; Johnson et al., 1989).

Genital herpes is also appears to be more prevalent in communities with "core group" characteristics. In nine studies examining this risk factor, non-Whites were more likely to have genital herpes than Whites, even after adjusting for SES and levels of sexual activity. The relationships between measures of SES and genital herpes were somewhat less consistent among the primary studies reviewed than for gonorrhea. In the NHANES II (Johnson et al., 1989), individuals with a lower income were significantly more likely to test positive for HSV-2 than

higher income groups in simple analysis, and in the NHANES III (Fleming et al., 1997) this relationship persisted in multivariate analysis. A similar relationship between HSV-2 and lower income was reported by Breining (1990) among women at family planning clinics, although three studies found that being of "blue collar origin", level of parent's income (Gibson et al., 1990) or family income (Siegel et al., 1992) were not associated with HSV-2 infection. Employment status was not associated with HSV-2 infection for neither males nor females in Hart's Australian study (1993), although Gibson et al. (1990) found that students who were employed were more likely to be infected with HSV-2, which might be due in part to the fact that these working students were often older and came from more economically disadvantaged backgrounds than students who did not have to work while in university. Lower educational achievement was associated with HSV-2 seropositivity in studies among STD clinic attenders (Bassett et al., 1994), patients at a family medicine clinic (Oliver et al., 1995), and in the 1988-89 AMEN survey (Siegel et al., 1992).

Although the relationship between substance use and STD has not been explored in many primary studies, Siegal et al. (1992) found that in the AMEN survey, alcohol used at least weekly was associated with the presence of HSV-2 antibody in both men and women, as was sexual activity under the influence of drugs or alcohol, but these relationships did not remain significant after adjusting for age, race, number of sexual partners, and education level. As well, no association between HSV-2 infection and any alcohol use was found in a study of 1,103 women patients of an STD clinic in Georgia (Austin et al., 1999). One population-based study and one primary care clinic-based study did not find a significant association between current smoking status and HSV-2 infection in women (Becker et al., 1996; Kjaer et al., 1990).

There was no association between genital herpes and duration of OCP use in three studies (Becker et al., 1996; Evans et al , 1993; Kjaer et al., 1990). Only Hart (1993) found that genital herpes was associated with use of oral contraceptives among a group of 6,125 women

attending an STD clinic (adjusted OR = 2.0, $p<0.001$). Three studies found that early age at first intercourse was associated with more than a two-fold increase in HSV-2 infection after adjusting for other socio-demographic and behavioural variables (Fleming, 1997; Kjaer, 1990; Siegal, 1992). There were no studies that looked at the association between genital herpes and number of partners in the past year. Number of lifetime partners may instead be a more relevant risk factor for this chronic viral infection, as this risk factor was significantly associated with HSV-2 infection for males and females in multivariate analyses in ten studies (Austin et al., 1999; Bassett et al., 1994; Becker et al., 1996; Cowan et al., 1994; Evans et al., 1993; Fleming et al., 1997; Kjaer et al., 1990; Rosenthal et al., 1997; Siegel et al., 1992; van de Laar et al., 1998). Very few studies have considered the relationship between type of partner and HSV-2 infection. Van de Laar et al. (1998) did not find that reporting last sexual contact with a casual partner was significantly associated with HSV-2 seropositivity for a sample of males and females combined. Lastly, several studies consistently found no significant relationship between genital herpes and any measure of condom use for neither men nor women (Austin et al., 1999; Becker et al., 1996; Cowan et al., 1994; Evans, 1993; Fleming et al., 1997; Gibson et al., 1990; van de Laar et al., 1998).

1.5.4 Genital Warts

The gender differential for genital warts is not as great as for the other STDs. For example, data collected in 1989-90 from a number of provider sites in an urban area of Sweden, showed that the overall female-to-male ratio was 1.3 (Persson et al., 1996). At GUM clinics in England, where genital warts is the most common STD diagnosed, the female-to-male ratio was 1.20 in 1996 and 1.0 in 1997 (Simms et al., 1998). In contrast, according to the U.S. NDTI data, the occurrence of genital warts from 1976 to 1992 was more common among males than females (Franco, 1996).

Although genital warts are also caused by a viral infection which cannot be eradicated by medication, it does not have the same inverted U-shaped age distribution as genital herpes. Instead, the majority of studies reviewed found that younger age in males and females was significantly associated with an increased risk of genital warts (Tables 10 and 11 in Appendix C). Unlike HSV, infections with HPV can be transient, or at least transiently detectable, and are often spontaneously cleared by the immune system (Ferenczy, 1997; LCDC Expert Working Group, 1998; Schiffman & Burk, 1997). The decrease among older people, in addition to lower levels of sexual activity, may also be a result of acquired strain-specific immunity HPV (Galloway, 1999). A number of studies found an increased risk for unmarried women and men in multivariate analysis (Habel et al., 1998; Hart, 1993; van den Eeden et al., 1998; Wen et al., 1999), although two studies reported no significant relationship among women (Evans et al., 1993; Munk et al., 1997).

Like chlamydia, genital warts appears to occur in a more diffuse population. None of four studies examining the association between genital warts and racial or ethnic group demonstrated a significant increase in risk of this STD for non-White groups. Likewise, for neither men nor women, there was no significant association with current employment status (Hart, 1993; Wen et al., 1999); occupation type (Ross, 1996; Wen et al., 1999); annual family income (Daling et al., 1986); welfare receipt (Wen et al., 1999); or education level (Daling et al., 1986; Habel et al., 1998; Munk et al., 1997; van den Eeden et al., 1998). Habel et al.'s study (1998) was unique in that it found that compared with females who reported an annual household income under $15,000, females reporting a household income of greater than $45,000 per year were at significantly increased risk of being diagnosed with genital warts (OR = 6.8, 95% CI 1.3-34.2).

In terms of substance use, smoking status was not significantly associated with HPV 6/11 infection or diagnosis of genital warts in two population-based case-control studies in women in

Sweden (Kjaer et al., 1990) and the U.S. (Habel et al., 1998) and one in American men (van den Eeden et al., 1998). However, three additional case-control studies in women (two population-based, one clinic-based) and one STD clinic-based case-control study of men did find that smoking was significantly related to genital warts in women, even after adjusting for number of sexual partners (Brisson et al., 1988; Daling et al., 1986; Munk et al., 1997; Wen et al., 1999). Daling et al. (1986) suggest that nicotine may have a toxic effect on the epithelium, which could facilitate the entry of HPV, while Wen et al. (1999) postulated that the development of warts in smokers may reflect a local cigarette-induced immune modulation.

A few studies found that OCP use was associated with increased risk of genital warts in multivariate analysis. For instance, in a case-control study of women at a U.K. GUM clinic, they found that after adjusting for other covariates, women with genital warts were significantly more likely to have genital warts than current OCP users (OR=1.7, 95% CI: 1.3-3.2), with an estimated attributable risk of 41% (Ross, 1996). Hart (1993) also found that OCP users were 1.4 times more likely to be diagnosed with genital warts than non-users in multivariate analysis. Ross et al. (1996) proposed that elevated estrogen levels from OCP use reduce or inhibit cellular immunity to HPV infection. Daling et al. (1986) found that although ever use of OCP compared to never use was not associated with increased risk of self-reported history of genital warts, OCP users of 5 or more years had a relative risk of 9.8, suggesting that duration of exposure may be an important factor. However, Munk et al. (1997) did not find any significant association between any OCP use or duration of use and genital warts. There was no significant association between the age at sexual debut and presence of genital warts or infection with HPV 6/11 among men or women in five clinic-based studies (Brisson, 1988; Evans, 1993; Habel, 1998; Kjaer, 1990; Munk et al., 1997; Wen, 1999), although van den Eeden et al. (1998) found that among men recruited from a health maintenance organization, individuals who reported first intercourse at age 20 years or older were at significantly greater risk of having a new case of genital warts compared

with those whose age at debut was 18 or 19 years (adjusted OR = 2.6, 95% CI: 1.2-5.6). Number of partners in the past year was not significantly associated with genital warts in the single study examining this relationship (Evans et al., 1993). In contrast, the number of partners over the past five years (Habel et al., 1998; van den Eeden et al., 1998) or during one's lifetime (Brisson et al., 1988; Daling et al, 1986; Habel et al., 1998; van den Eeden et al., 1998; Wen et al., 1999) appears to be a more relevant risk factor. Lastly, inconsistent condom use was significantly associated with a two- to three-fold increase in risk of genital warts among men and women in two case-control studies (van den Eeden et al., 1998; Wen et al., 1999), although Munk (1997) and Habel (1998) did not observe such a protective effect among women.

1.6 Summary

To summarise, the importance of direct and indirect risk factors differ for the four STDs. Although they all share the same mode of transmission, the STDs are found in different, though not mutually exclusive, subsets of the population and the impact of the various sexual behaviours on the occurrence of STD is not equal. Identifying and understanding the specific characteristics and risk behaviours of populations at greater risk for acquiring an STD is required to target public health strategies (Health Canada, 1997a). In addition, the majority of knowledge in this area has been limited to surveillance reports and clinic-based studies. While data collected by national surveillance systems provide valuable information on the occurrence of the bacterial STDs, only minimal demographic information and no data on sexual behaviour are collected for reported cases, and there may be under-reporting for higher socio-economic levels (Health Canada, 1997b). Clinic-based studies are useful for examining specific populations, but because they use self-selected study subjects, they may not be representative of the general population (Rowley & Berkey, 1998; van Duynhoven, 1997). As well, few of these studies are set in Canada. Population-based surveys are an important data source because they often contain in-

depth socio-demographic and behavioural information. One disadvantage is that surveys have the potential for participation bias and respondent error, particularly with regard to STD experience, which requires that cases be first diagnosed and then reported accurately in the survey setting. However, surveys supply estimates of the prevalence and patterns of behaviours that affect the distribution and spread of STDs in the general population that cannot be obtained elsewhere (Health Canada, 1997a; Ku et al., 1997). Only a handful of American population-based surveys have attempted to address the relationship between STD and socio-demographic and behavioural risk factors in the general population, while in Canada, the National Population Health Survey provides a unique opportunity to explore these issues among the general population.

1.7 Goals and Objectives

The goal of this study is to improve STD knowledge in Canada using data from the 1996-97 National Population Health Survey. This will be accomplished through two objectives: first, to determine the period prevalences of gonorrhea, chlamydia, genital herpes, and genital warts in the general Canadian population and second, to examine the socio-demographic and behavioural correlates of these STDs.

2.0 METHODS

2.1 Description of the Database

The complete methodology of the National Population Health Survey (NPHS) has been described elsewhere (Statistics Canada, 1997), but its main features will be described here. One of its objectives was to collect data on the economic, social, demographic, occupational, and environmental correlates of health and to provide data for analytical studies that would assist in understanding the determinants of health. The survey programme collects information on a panel of individuals at two-year intervals, and comprises three parts: the survey of households, the survey of institutions, and the survey of the North. The target population of the household survey includes household residents in all provinces, with the principal exclusion of long-term residents of institutions and populations on Indian Reserves, Canadian Forces Bases, and some remote areas of Quebec and Ontario. The research in this paper is based on data from the second cycle of the NPHS, which was conducted in 1996-97.

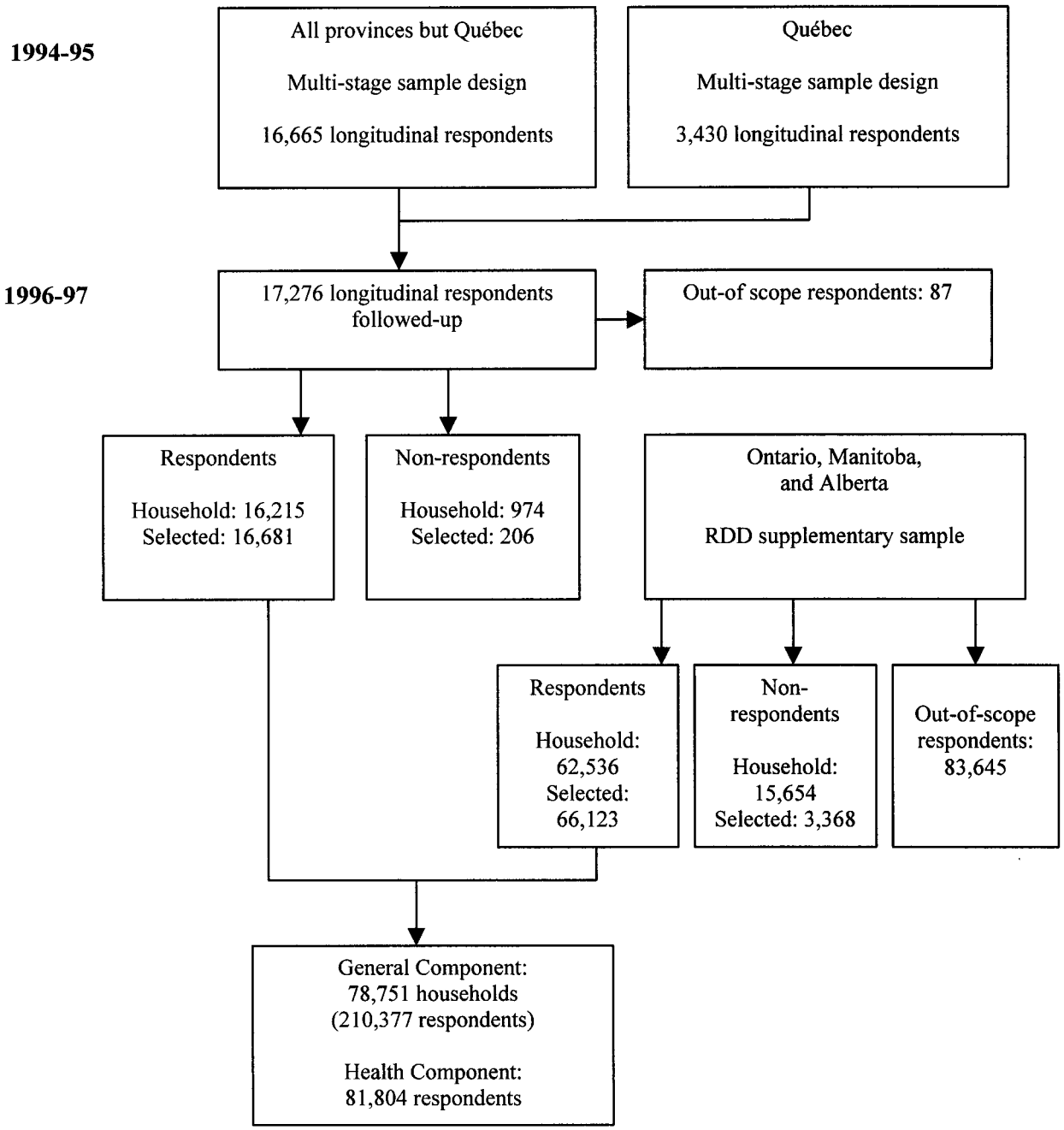
2.1.1 Sample Selection

Longitudinal sample

A schematic of the sample design is shown in Figure 1. For the household component of the NPHS, the sample design was a stratified two-stage design. For the first cycle in 1994-95, each province required a minimum of 1,200 households included in the survey. The sample size was initially distributed proportionally to the population size within each province, although four provinces (Ontario, Manitoba, New Brunswick, and British Columbia) chose to increase their allotted sample size through the buy-in of additional units.

In all provinces except Québec, the sampling for the 1994-95 NPHS was based on a multi-stage stratified sample design of the Labour Force Survey (LFS). In the first stage of sampling, each province was divided into three types of areas (major urban centres, urban towns, and rural areas) from which geographic and/or socio-economic strata were formed. Strata were

Figure 2.1: Schematic of the 1996-97 National Population Health Survey (NPHS) Sample Design



grouped to yield an appropriate sample size for the NPHS, and within each grouped stratum, six clusters (primary sampling units, or PSUs, which were usually Census Enumeration Areas) were selected with probability proportional to size (PPS) sampling. In the second stage, dwellings were systematically selected from dwelling lists of each cluster.

In Québec, the NPHS sample was selected using a multi-stage design based on the *Enquête de sociale de santé* (ESS). The province was divided geographically by crossing 15 health areas with four urban density classes (Montréal Census Metropolitan Area, regional capitals, small urban agglomerations, and the rural sector). In each area, clusters were stratified by socio-economic characteristics and selected using PPS sampling. Within each cluster, dwellings were enumerated and selected, ensuring that the four household types identified (one-member households, households with children, other households with youths, and other) were represented proportionally to the population.

Finally, one household member was randomly selected to be the respondent of the Health component, and these 20,095 selected respondents comprised the longitudinal sample. The General component included information on all household members living with the longitudinal respondent at the time of the interview for cross-sectional purposes only. Eighty-six percent of longitudinal respondents were interviewed again in the second cycle. The sample sizes for the longitudinal sample of the second cycle are shown in Table 2.1.

Table 2.1: Longitudinal sample size by current province for the 1996-97 NPHS (Statistics Canada, 1997).

Province	General Component	Health Component
Newfoundland	3,017	1,082
Prince Edward Island	2,752	1,037
Nova Scotia	2,775	1,085
New Brunswick	2,888	1,125
Québec	7,838	3,000
Ontario	10,899	4,307
Manitoba	3,045	1,205
Saskatchewan	2,785	1,168
Alberta	4,164	1,544
British Columbia	4,276	1,723
TOTAL	44,439	17,276

Information on all household members currently living with the longitudinal respondent was again collected for the General component of the second cycle, and the longitudinal respondents answered questions for the Health component. The major limitation of using this longitudinal sample was that it may no longer be representative of the target population. For example, since no new respondents were selected to account for attrition from the first cycle, people who immigrated to Canada in the preceding two years are not represented in the longitudinal sample. Also, of the longitudinal respondents who were followed into the second cycle, 87 individuals were no longer part of the target population, having died or moved to an institution, an Indian Reserve, a military base, or out of Canada.

Cross-sectional sample

Ontario, Manitoba and Alberta had supplementary buy-in samples for cross-sectional purposes in the second cycle. The supplementary sample sizes were allocated according to health areas determined by the provincial ministries of health. All of these interviews were done by telephone, using the Statistics Canada Random Digit Dialing (RDD) System. In this system, telephone exchanges (the first three digits of the telephone number) were used as stratification units and strata were composed of groups of exchanges that covered the same health areas. As with the longitudinal sample, a General component interview was administered to all members of the household and one member of the household was selected for the in-depth Health component. The number of in-scope households from the buy-in samples is shown in Table 2.2.

Table 2.2: Random Digit Dialing (RDD) supplemental sample sizes by province (Statistics Canada, 1997).

Province	Number of In-Scope Households
Ontario	48,770
Manitoba	12,952
Alberta	16,459
TOTAL	78,181

There are some limitations to using RDD sampling. First, although telephone coverage is very high in Canada at 97%, non-coverage is higher for rented houses, single person households, low income households, and those with unemployed persons, and is slightly higher outside major urban areas (Trewin & Lee, 1988). RDD interviews also usually cannot access very high risk populations such as injection drug users, street youth, and prostitutes (Brewer et al., 2000; Gribble et al., 1999; Mishra et al., 1993). In addition, unit non-response tends to be more problematic for telephone interviews because of unanswered phones, difficulties finding respondents at home, and the increased use of call screening (Turner, 1999).

2.1.2 Questionnaire Design and Data Collection

Survey content was selected according to a list of criteria, among which included that the survey should focus on behaviours or conditions that are amenable to prevention, treatment, or intervention and that the content should seek to increase the understanding of health and its determinants, especially in areas which have not been adequately studied. The General component contained general socio-demographic and health information on current members of the household while the Health component contained more in-depth information on a wide range of topics including health status, use of health services, and risk factors.

A number of questions of the sexual health section of the 1996-97 NPHS originated from the Health Promotion Survey (HPS). These questions were developed for the 1990 HPS after extensive consultation with government and non-government officials and the entire instrument was pre-tested in 300 English and 300 French interviews (Stephens et al., 1993). These questions along with a small number of new questions regarding attitudes towards condom use and STD history were then incorporated into the Supplement Survey of the 1994-95 NPHS and the Health component of the 1996-97 NPHS (Statistics Canada, 1995 & 1997). The entire instrument for the 1996-97 cycle was discussed in focus groups and field-tested twice using both the in-person and

RDD methods of data collection. The questions for the sexual health section are included in Appendix D.

The data were collected by trained interviewers using computer-assisted interviewing (CAI), which allows for on-line editing and response validation. The total interview took approximately one hour. Collection for the longitudinal sample occurred in June, August, and November 1996 and February 1997, while collection for the RDD samples was carried out monthly. Proxy responses were not permitted for the sexual health section.

2.1.3 Response Rates

Unit non-response in the NPHS was minimized using a number of approaches (Statistics Canada et al., 1997). When the household could not be reached, numerous call attempts or visits were made at various times of day and contact information provided in previous interviews was used to trace longitudinal respondents. In cases where an individual in the longitudinal sample refused to participate, a letter was sent from the Regional Office, which stressed the importance of the survey and the household's co-operation. The letter was followed-up by another call or visit from one or more interviewers. All non-response cases were also followed-up in subsequent data collection periods, with an additional collection held in June 1997 for a final attempt to reach households. Sampled units that failed to respond were not replaced by other units, and reasons for non-response were not included in the survey file. The response rates are shown in Table 2.3.

Table 2.3: 1996-97 NPHS response rates (Statistics Canada, 1997).

Level	Longitudinal	RDD	Overall
Household (General component)	94.3%	80.0%	82.6%
Selected members (Health component): excluding RDD-Child	98.7%	94.8%	95.6%
Selected members: RDD-Child only	–	98.2%	98.2%

2.1.4 Original Sample Weighting

The principle behind estimation in a probability sample such as the NPHS is that each person in the sample represents several other persons who are not in the sample, and is thus assigned a weight accordingly. In single-stage sampling, the sample weight is defined as the inverse of the individual's inclusion probability, which is the probability he or she will be included in the sample, whereas in multi-stage sampling, the inclusion probability is the product of the PSU-level inclusion probability from the first stage of sampling and the conditional inclusion probability from the second stage (Korn & Graubard, 1999). Sample weights are required to derive meaningful estimates from the survey.

The starting point for the weights for the longitudinal sample in 1996-97 were the final weights derived for the 1994-95 survey with certain multiplicative adjustments (Statistics Canada, 1997). The derivation of the sample weights for the 1994-95 NPHS were tied to weighting procedures used in the ESS in Québec and the LFS in all other provinces. In the LFS, the basic weight was a product of the "cluster weight" (the inverse of the probability that the cluster would be selected) and the "dwelling weight" (the inverse of the probability that the dwelling would be selected). In creating the sample weight for the NPHS, the LFS basic weight was first adjusted to account for the difference in the number of clusters used by the LFS and that required by the NPHS. The second change adjusted for the growth of clusters between Census enumeration and when the cluster was listed for survey purposes. The next adjustment accounted for those dwellings originally listed as single households but which actually comprised two or more private dwellings. Fourth, they adjusted for sample stabilization and for the rejective rule, a method used in sample selection to prevent the under-sampling of large households. Lastly, they adjusted for household non-response, which includes refusal, special circumstance, language barrier, no one at home, temporarily absent, or computer problem. This step also accounted for the removal of the 1994-95 cross-sectional buy-in units from that were not re-interviewed in the second cycle. Further weight adjustments were made for the selected members to give the set of weights

associated with the Health component. They adjusted for the probability that the member would be selected from the household for the Health component. They also made two adjustments to account for the integration of child respondents who were part of the 1994-95 National Longitudinal Survey of Children and Youth and to account for discrepancies in the inclusion of 12-year olds in the Adult sample over the data collection period.

Similar to the NPHS sample weights based on the LFS, the sample weights for respondents in Québec were based on adjustments made to basic weights determined by the ESS. The ESS basic weight was a product of the ESS cluster weight and the ESS dwelling weight. However, since the NPHS involves only a subset of the ESS sample, the NPHS basic dwelling weight was a product of the ESS cluster weight, the ESS dwelling weight, the inverse of the probability of retaining an ESS cluster for the NPHS, and the inverse of the probability of retaining an ESS dwelling for the NPHS. Further adjustments were made to these basic weights in calculating the sample weights for the NPHS, including adjusting for the existence of multiple dwellings where only one dwelling was listed, cluster growth, and household non-response. As well, the same adjustments were made to the basic weights for selected members as for the Health component in other provinces.

For the 1996-97 NPHS, a number of adjustments were made to these 1994-95 sample weights for the longitudinal household respondents of the General component. First, the weights were adjusted for household non-response, which, in addition to the reasons mentioned above, also includes cases in which the selected member followed up from 1994-95 was deceased, institutionalized, had moved to a territory or out of the country by the second cycle. NPHS methodologists also adjusted for household member non-response, inter-provincial migrations, and changes in the longitudinal respondent's household. As well, the weights were post-stratified, which is an adjustment of the sample weights of the responding units so that the totals over various demographic categories match known population (i.e. Census) totals of province-age-sex categories. This adjustment is usually upwards, to account for sampling frame under-coverage

and is also intended to decrease the variability of the estimators (Korn & Graubard, 1999). They also added a "noise" factor to the weights in order to maintain confidentiality. For selected members who answered questions of the Health component, a second set of weights was created. Also based on the sample weight from the 1994-95 NPHS, they adjusted for household and selected member non-response, inter-provincial migrations, and post-stratification.

For provinces with RDD supplemental samples, the sample weight was based on the probability of selecting that telephone number using stratified simple random sampling without replacement. A number of further adjustments were made to the basic RDD weight. The first of these accounted for the low proportion of residential numbers within certain strata in Manitoba. The sampling method also required they adjust for respondents with telephone numbers that were duplications of those in the longitudinal sample, households without telephones, and multiple telephone lines within a dwelling. As well, they adjusted for collective dwellings containing ten or more unrelated persons, which are in-scope for the longitudinal survey but out-of-scope for the RDD survey. Similar to the longitudinal sample, the RDD weights were adjusted for household and household member non-response. Next the longitudinal sample weights and the RDD weights were integrated to produce a set of composite weights. Finally, the composite weights were post-stratified using strata based on health area, age, and sex. For the selected respondent, the RDD weights for the Health component were adjusted for the probability of that person being selected within the household, collective dwellings, and selected member non-response. Again, these RDD weights were integrated with the set of weights calculated for longitudinal respondents of the Health component and adjusted for post-stratification.

Lastly, the HPS weight was created for those questions integrated into the 1996-97 NPHS from the Health Promotion Survey. A separate weight is required for use with these questions because these items were not asked of the Alberta RDD sample. In this case, the longitudinal respondent weight was post-stratified to province/age/sex totals in the same manner as non-RDD provinces. Four sexual behaviour measures (number of partners in the past 12 months,

relationships lasting less than 12 months, condom use in relationships lasting less than 12 months, and condom use at last intercourse) and history of injection drug use required the use of the HPS weights in this analysis.

2.2 Data Considerations

2.2.1 Sample Size Issues

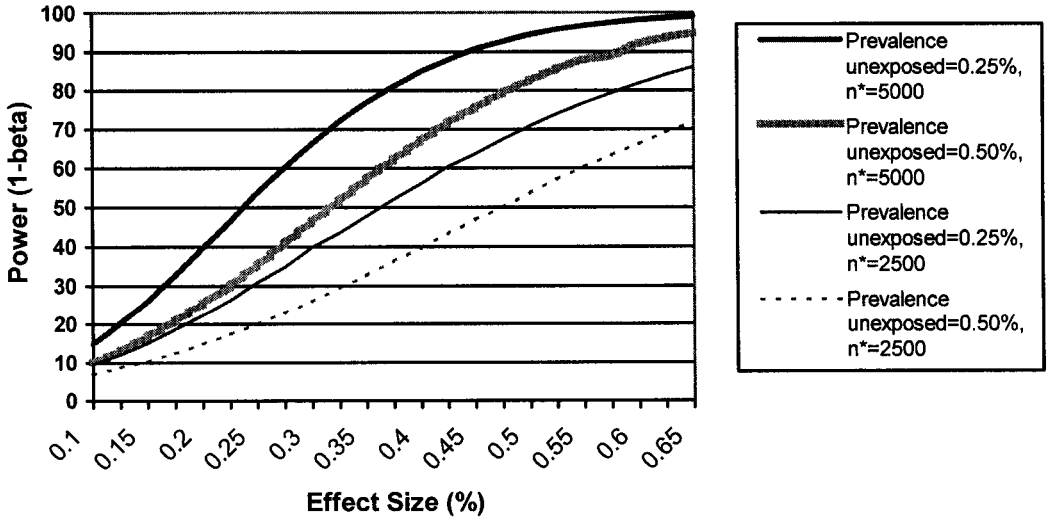
Statistical power is the probability that the test correctly rejects the null hypothesis over repetitions of the study ($1-\beta$). Type-II errors can result when the observations are too few, the magnitude of the effect is small, or the errors around the estimates are large (Aday, 1996; Rothman & Greenland, 1998a). The power of a test to correctly reject the null hypothesis stating that there is no significant difference between the proportions can be estimated using the following formula:

$$Z_{\beta}=[(p_1-p_2)\cdot\sqrt{(n^*)}]/[\sqrt{(p_1q_1+p_2q_2)}]-Z_{1-\alpha/2}$$

where Z_{β} is the normal deviate corresponding to power, $Z_{1-\alpha/2}$ is the normal deviate corresponding to significance level ($\alpha=0.05$), p_1 is the prevalence of STD in the exposed group, p_2 is the prevalence of STD in the unexposed group, and the effect size is the difference between two population parameters (i.e., p_1-p_2) or the departure of a population parameter from a constant (Cohen, 1988). Assuming equal groups, n* is the effective sample size in each group (Elwood, 2000), where the effective sample size is the sample size divided by the design effect (Aday, 1996; Skinner, 1989). The design effect is the ratio of the sampling variance for an estimator calculated under the complex sample design to the variance that would have been obtained if a simple random sample had been used (Skinner, 1989). Therefore, using the representative design effect of 4.32 for 1996-97 NPHS respondents of the Health component, the total effective sample size, N*, is approximately 10,000 (43,192/4.32).

Figure 2.2 illustrates the change in power over a range of effect sizes for this sample. In this example, if the prevalence of a particular STD in the unexposed group is 0.25% (n*=5000), the effect size must be approximately 0.375% (giving a prevalence of 0.625% in the exposed group, for a prevalence ratio of 2.5) in order to detect a significant difference with a power of 80%, at an α-level of 5%. In comparison, when the prevalence of the STD is 0.50% in the unexposed group, an effect size of approximately 0.50% (which corresponds to a prevalence of 1.0% in the exposed group and a prevalence ratio of 2.0) will be detected with a power of 80%. Therefore, the power to detect smaller relative differences between proportions is greater when the prevalence of the STD is greater. Power is further decreased when the sample size is reduced, for example if the sample is stratified by sex, which reduces the size of each subgroup within each stratum to n*=2,500. In this scenario, an effect size of 0.50% (for a prevalence of 0.25% in the unexposed group, 0.75% in the exposed group, and a prevalence ratio of 3.0) is required to reject the test hypothesis with a power of only 70%, compared to an effect size of 0.65% (for a

Figure 2.2: Power Analysis for Detecting Significant Difference Between Proportions of Two Groups for Sexually Experienced 1996-97 NPHS Respondents aged 15-59 years, alpha=5%.



prevalence of 0.50% in the unexposed group, 1.15% in the exposed group, and a prevalence ratio of 2.3). The small number of positive counts may also result in high variability of estimates, as reflected by large coefficients of variation and imprecise confidence intervals.

Therefore, when the number of self-reported cases is small, inferences can only be made where there is adequate power to detect significant differences between groups. While combining men and women in analyses would increase sample size, the effect of gender on STD is strong due to differences between men and women in sexual and health care seeking behaviours, susceptibility to disease, and development of symptoms (Bolan et al., 1999). Similarly, combining outcomes would have also increased power, but as shown in the literature review, there are vast differences in the risk factors for the STDs.

Another concern related to sample size is an increase in the variability of the estimates, which is reflected by large coefficients of variation for these variables. According to the Statistics Canada release guidelines, estimates, more specifically of proportions and number of cases, with CVs between 0.0% and 16.5% are allowed unrestricted release, those with CVs between 16.6% and 33.3% are considered to be marginal and require a warning of high sampling variability, and estimates with CVs greater than 33.3% are recommended not to be released (Statistics Canada, 1997). A minority of the estimates from this analysis had high CVs, and as a result, while the point estimates are displayed to illustrate the general trend of the data, the confidence intervals for such estimates have not been presented in the Results section.

Lastly, the small number of positive counts may affect the accuracy of the confidence intervals. Confidence intervals are important because they show the precision of an estimate. In a non-survey setting, exact confidence intervals based on the binomial distribution are used when the number of positive counts is small because they provide a more conservative coverage. However, binomial intervals are not applicable when using complex survey data (Korn & Graubard, 1999). Recently, Korn and Graubard (1998) argued that variance estimators computed

using linearization or replication methods such as the bootstrap method are not appropriate for small numbers of positive counts because they assume an approximately normal distribution. Consequently, in a small number of instances in this study, the self-reported STD prevalences for sub-groups will have confidence intervals which overlap slightly, whereas odds ratios derived from simple analysis show significant differences between sub-groups. As well, some confidence intervals had lower limits below zero. However, this is the only method available for calculating confidence intervals using this database, but more research needs to be done to determine the most appropriate way to calculate confidence intervals in this situation.

To summarise, the small number of positive counts is a limitation of this research because of its potentially adverse effects on the power of the analyses, the variability of the estimates and the accuracy of the confidence intervals. As will be discussed in later sections of this paper, the use of approaches which enhance respondents' privacy and confidentiality can improve the accuracy of self-reported STD, increasing the number of cases and thus mitigating these issues.

2.2.2 Estimation of Population Parameters and Variance

Using data from complex surveys can be problematic because the clustering, stratification, and the unequal probabilities of selection affect the calculation of point estimates and variance (Brogan, 1988; Statistics Canada, 1997). Estimates from surveys can be calculated in a number of different ways. To illustrate, Table 2.4 compares the odds ratios for self-reported genital herpes (males and females combined) according to three potential risk factors using unweighted and weighted procedures.

Table 2.4: Odds ratios (95% confidence interval) of self-reported genital herpes for men and women combined in the 1996-97 NPHS by risk factor and analytic weight.

Risk Factor	Unweighted	Original Sample Weight	Relative Weight	Relative Weight/ Design Factor	Bootstrap Weight
Age group					
15-24	0.82 (0.50-1.34)	0.55 (0.54-0.57)	0.55 (0.32-0.97)	0.55 (0.25-1.24)	0.55 (0.25-1.21)
25-34	1.63 (1.21-2.21)	2.78 (2.74-2.81)	2.78 (2.12-3.64)	2.78 (1.88-4.11)	2.78 (1.46-5.29)
35-59	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Living with a partner					
Yes	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
No	1.56 (1.17-2.08)	1.47 (1.45-1.49)	1.47 (1.13-1.91)	1.47 (1.01-2.15)	1.47 (0.76-2.86)
Country of origin					
Canada	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Other	0.69 (0.42-1.12)	0.54 (0.53-0.55)	0.54 (0.35-0.84)	0.54 (0.28-1.03)	0.54 (0.24-1.23)

The unweighted point estimates are biased because the model is being fitted to a distribution of observations that is specific to the sample rather than to the population (Korn & Graubard, 1995). The extent of this bias is related to the high variability of the original sample weight (Brogan, 1998), which ranges from 3 to 16,724 in this sample. The odds ratio estimate is badly biased for age group in particular because the weights are influenced by post-stratification to province/age/sex population totals. In comparison, the parameters estimated using the original sample weights are approximately unbiased, but the confidence intervals are underestimated. Another approach is the rescaling of weights so that the average weight is one (i.e. divide each sample unit's weight by the average of the original weights), which downweights the number of cases to the actual sample size while maintaining the relative distribution of subgroups within the population (Aday, 1996). While the confidence intervals obtained using the relative weights are more conservative than with the original weights, this method still does not take into account the stratification and clustering of the sample's design (Brogan, 1998; Statistics Canada, 1997). The third approach accounts for intra-cluster correlation by dividing the relative weights by the square root of the representative design effect (the design factor) (Aday, 1996; Skinner, 1989). However, this representative design effect was determined by taking the 75th percentile of the design effects for a range of characteristics (Yeo et al., 1999), and it is not clear that this average design effect is appropriate for estimating confidence intervals for the sub-population of interest. Approximate

95% confidence intervals may also be calculated using the coefficients of variation (CV), which are derived using the variance formula for simple random sampling (CV = standard deviation/θ x 100%) and also incorporate the design effect, although this method cannot be applied to complex analyses including logistic regressions (Statistics Canada, 1997).

To summarise, an unweighted analysis of sample survey data generally will yield biased point estimates of population parameters, underestimates of the standard error for point estimates, confidence intervals which are too narrow, and tests of significance which are too likely to reject the null hypothesis (Brogan, 1998; Korn & Graubard, 1995; Skinner, 1989). Weighted estimates using either the original sample weight or the re-scaled weight have unbiased point estimates, but the standard errors tend to be underestimated. The design effects or coefficients of variation can be used to calculate only approximate standard errors and confidence intervals, whereas the bootstrap method is the preferred approach because takes into account the complex design and provides exact variances and the most conservative confidence intervals.

2.2.3 Potential Sources of Non-Sampling Error

The robustness of population estimates from surveys also depends on the level of non-sampling error (Johnson & Copas, 1997). Participation bias can be an important source of non-sampling error if respondents differ systematically from non-respondents demographically and with regards to sexual behaviours (Groves & Lyberg, 1988; Johnson et al., 1997). Unit non-response can occur when the interviewer is unable to contact a household selected by sampling procedures (non-contact) or when the chosen respondent is unable or unwilling to do the survey (Groves & Lyberg, 1988; Lehtonen et al., 1995). Most individuals refuse to participate at the stage of initial contact because they see the survey as inconvenient or invasive, and many refuse before they know about the sexual component (Catania et al., 1992 & 1995; Catania, 1999; Laumann et al., 1994). However, participation bias can be a problem for sexual behaviour research in particular because of the general tendency to avoid discussing sex and the potential

stigma attached to AIDS and other STDs (Turner, 1999). This bias can stem from a respondent's health status, perception of risk for STDs and AIDS, past experiences with surveys, motivation to participate, and feelings of social responsibility (Catania et al., 1990a & 1999; Groves et al., 1992). As well, a number of studies have found that respondents of sexuality surveys tend to have different socio-demographic characteristics, more liberal attitudes towards sexuality, and greater sexual experience than those individuals who refuse to participate (Catania et al., 1986; Morokoff et al., 1986; Strassberg et al., 1995; Wiederman et al., 1999). In addition, previous work has also shown that non-contacts who are not easily found at home have less conservative attitudes towards sexuality and greater sexual experience than immediate refusers (Turner, 1999). Similar differences have been observed between complete survey responders and individuals who refuse to respond to questions about their sexual behaviour within the context of a larger general health survey (partial non-responders). For example, in an on-going national Australian study, survey participants who completed the supplementary anonymous mail questionnaire on sexual behaviour and attitudes had higher levels of education, attended church less often, had less conservative sexual attitudes and voting preferences, and were more likely to smoke cigarettes and drink alcohol more often than those who refused (Dunne et al., 1997). A non-response analysis of the U.S. 1990 National Alcohol Survey also found socio-demographic differences: survey participants who refused to answer the supplemental self-administered questionnaire on sexual behaviour were more likely to be non-White, less well educated, widowed, and older than the total sample (Leigh et al., 1993).

Reporting bias is the "selective revealing or suppression of information about past medical history" (Last et al., 1995), resulting in either item non-response or mis-reporting. This usually produces a net negative bias for estimates of the prevalence of high-risk behaviours (Catania et al., 1990a). In self-presentation bias, respondents tend to alter their responses to what they perceive as socially desirable (Catania et al., 1995; Gribble et al., 1999; Saltzman et al., 1987; Turner et al., 1997). The characteristics of the respondent, especially age and gender, can

play a role in determining the level of this bias. Race, religion, sexual orientation, and social class may also be important, but these have not been systematically evaluated (Catania et al., 1990a & 1999). In addition, certain stigmatized sexual behaviours, such as male-male sexual contact or anal sex, may be more susceptible to mis-reporting (Catania, 1999; Ford & Norris, 1991). Recall bias can also affect the validity of sexual behaviour measures, even for highly motivated and uninhibited respondents. Recall ability may vary across sexual behaviours, and can depend on pattern complexity and the length of the recall period (Catania et al., 1990a). Similarly, valid responses depend on the respondent's ability to correctly understand the question and know the answer. For instance, in the National AIDS Behavioural Survey II, men were more likely to report difficulty understanding terms like "vaginal intercourse" and "anal intercourse", as were minority respondents and those individuals with less than 12 years of education (Binson & Catania, 1998). The use of vernacular terms may increase understanding of questions, but these can be very specialized for certain populations and may also change over time (Catania et al., 1990a & 1990b; Ford & Norris, 1991).

Despite these potential limitations, NPHS methodologists have incorporated a number of strategies to reduce respondent error. With the strategies to reduce unit non-response discussed earlier, the response rate of the 1996-97 NPHS is considerably higher than seen in a number of other U.S. and Canadian population-based surveys, as shown in Appendix C. The use of telephone interviewing with 95% of NPHS respondents may reduce the effect of social desirability bias because of increased anonymity and limited interaction with the interviewer compared to face-to-face interviews (Catania et al., 1990a; Johnson & Copas, 1997; Wiederman et al., 1994). As well, questions in the sexual behaviour section are placed in a context of altruism and confidentiality ("I would like to ask you a few personal questions about sexual behaviour because of its importance to personal health and social problems. You can be assured that anything you tell me will remain confidential."). This method has previously been shown to

increase reporting of stigmatised behaviours and decrease reporting of normative behaviours (Clark et al., 1997; Wiederman et al., 1994). To improve recall in the NPHS, the sexual health section only includes incidence items (e.g. have you had this STD in the past two years), which are more easily recalled than frequency items (e.g. frequency of intercourse), and the period of recall is relatively long for most measures, which is appropriate for use with the general population (Johnson AM et al., 1989; Kauth et al., 1991; McFarlane & St. Lawrence, 1999; Saltzman et al., 1987). Lastly, the use of pre-testing, focus groups, and consultation with expert panels would help to ensure that respondents would be able to understand the questions in the survey (Catania et al., 1995).

2.3 Data Management

2.3.1 Study Population

This analysis is based on data from the Health component of the 1996-97 NPHS. Questions regarding sexual behaviour and STD history were limited to those respondents interviewed in the Health component that gave an affirmative answer to the question: "Have you ever had sexual intercourse?" This question was asked only of selected respondents aged 15 to 59 years and was not done by proxy. The unweighted response rate for this question was 87.5% for the 53,530 individuals in this age range. The number of individuals giving an affirmative response was 43,192, which represents a total of 15,466,761 sexually experienced Canadians aged 15 to 59 years.

2.3.2 Definition of STD Cases

The outcomes of interest were self-reported history of chlamydia, gonorrhea, genital warts, and genital herpes. An individual was considered a case if an affirmative response was given to the question: "Do you currently have, or in the past two years, have you had the

following STD?" Response rates were high for these outcomes, with only six to seven respondents of the sample not disclosing their history of gonorrhea, genital herpes, and genital warts, and 68 respondents refusing to disclose their history of chlamydia.

2.3.3 Selection of Variables

Socio-demographic and behavioural variables were selected for the present analysis based on a review of the literature and availability of questions in the NPHS. All variables selected were tested for their association with each STD. A list of these variables and their definitions are shown in Table 2.5.

Table 2.5: Socio-demographic and behavioural correlates selected for analysis from the 1996-97 NPHS.

Socio-Demographic Variables		
Variable	**Definition**	**Notes**
Gender	Male Female	
Age (years)	15-24 25-34 35-59	
Race	White Non-White	
Country of origin	Canada Other	
Marital status	Married Single Formerly married	• Single includes common-law, living with a partner, never married. • Formerly married includes widowed, separated, divorced.
Living arrangement	Living with partner Not living with partner	• Living with partner includes living with spouse or partner. • Not living with partner includes all other type of living arrangements.
Highest level of education	High school or less Post-secondary	• High school or less ranges from no schooling to high school graduation. • Post-secondary includes at least some of any type of post-secondary education, including college, trade school, or university.
Currently in school	Yes No	• Includes school, college, or university.
Regular employment in the past 12 months	Yes No	• Non-regular employment includes those not currently working but had a job and those who did not work during past 12 months.
Income adequacy	Low Middle High	• NPHS derived variable based on annual household income and household size[1]. • High level of item non-response (~12%).
Current pregnancy	Yes No	• Not asked of female respondents aged 50 to 59 years.

[1] Derivation of income adequacy categories.

Income Adequacy	Annual Household Income	Household Size
Low income	<$10,000	1-4
	<$15,000	≥5
	$10,000-$14,999	1 or 2
	$10,000-$19,999	3 or 4
	$15,000-$29,999	≥5
Middle income	$15,000-$29,999	1 or 2
	$20,000-$39,999	3 or 4
	$30,000-$59,999	≥5
High income	$30,000-$59,999	1 or 2
	$40,000-$79,999	3 or 4
	$60,000-$79,999	≥5
	≥$60,000	1 or 2
	≥$80,000	≥3

Table 2.5 (continued)

Substance Use Variables		
Variable	**Definition**	**Notes**
Current smoking status	Smoker Non-smoker	• Smoker includes daily, occasional (former daily), and always occasional. • Non-smoker includes former daily, former occasional, and never smoker. • Literature review does not suggest a dose-response gradient according to (never→former→current) for any STD.
Type of drinker	Regular Occasional Non-drinker	• NPHS derived variable. • Regular drinking defined as one or more alcoholic drinks per month. • Occasional drinking is defined as less than one alcoholic drink per months. • Non-drinking defined as no alcoholic drinks in past 12 month or abstinent (never drank).
Ever injected non-prescription drugs	Yes No	• Not asked of respondents under age 18 years or Alberta RDD respondents.
Sexual Behaviour Variables		
Variable	**Definition**	**Notes**
Use of birth control pills in last three months	Yes No	• Not asked of female respondents aged 50 to 59 years.
Age at first sexual intercourse (years)	≤15 >15	• Derived from continuous response variable (Question SSH-Q2). • High level of item non-response (~8%).
Sexual intercourse in the past 12 months	Yes No	
Number of partners in the past 12 months	≤1 >1	• Respondents with 2, 3, and 4 or more sexual partners were grouped into a single category of ">1". • Not asked of Alberta RDD respondents.
Relationship lasting less than 12 months	Yes No	• Derived from Questions SSH-Q3 to Q6. • Not asked of Alberta RDD respondents.
Condom use at last intercourse	Yes No	• Only asked of respondents not in Alberta RDD sample who reported more than two partners in the past 12 months or who were unmarried and had a single relationship lasting less than 12 months (n=4,240)
Condom use in relationships lasting less than 12 months	Always Not always	• "Not always" combined respondents who answered "usually", "occasionally" or "never" to this question. • Only asked of respondents who were not in the Alberta RDD sample who were unmarried and reported multiple partnerships, any of which lasting less than 12 months.

2.3.4 Missing Data

In the database: Although the CAI application did not allow an interviewer to enter invalid responses, inconsistent or contradictory responses between questions resulted in a warning message. In these instances, edits were performed at Statistics Canada after data collection.

Inconsistencies were corrected by setting one or both of the variables in question to "not stated", and no imputation was performed in any case. If respondents were not asked the question, the response was coded as "not applicable."

In the analysis: Individuals were excluded from an analysis if they answered "don't know", refused to provide an answer, or had a response coded as "not stated" or "not applicable". Respondents with missing data for any variables in a model were also excluded from that multivariate analysis using listwise deletion. Lastly, any analysis involving HPS questions which were not asked of Alberta RDD respondents (coded as "not applicable") required the use of the alternative HPS weights (for both original and bootstrap weighting methods).

2.3.5 Variance Estimation Using the Bootstrap Method

Although the original sample weights provide unbiased estimators of population parameters, the variance estimated using some statistical programs provide variances that are not correct because they do not account for certain features of the survey design such as clustering and stratification (Brogan, 1998). The bootstrap method is an approach that can correctly account for the multi-stage sampling design in calculating the variance of estimators. This method is a type of replication method that involves calculating a parameter estimator repeatedly from different subsets of data, and calculating the variance among these estimates. While there are a number of approaches for the bootstrap technique, the general principal is that the simulation process creating these subsets of data should mirror as closely as possible the process that gave rise to the observed data (Carpenter & Bithell, 2000). For the NPHS, Yeo and colleagues (1999) used a modification of Rao, Wu, and Yue's (1992) bootstrap method for stratified multistage designs. In general, this approach assumes that there are L design strata, where stratum h has N_h total clusters and $n_h \geq 2$ sampled clusters. A number of independent artificial data sets of the same size and structure as the original data set are then generated by repeatedly re-sampling the PSUs with replacement in the observed data. Therefore, for a stratified multistage sampling design,

each artificial data set is generated by independently re-sampling PSUs with replacement in each stratum.

An unbiased population parameter was estimated using the design weights with its various adjustments, and its variance was estimated by using the bootstrap weights calculated by Statistics Canada. This bootstrap weight was obtained by randomly resampling m_h of the n_h clusters in stratum h with replacement. But since only a small number of clusters were sampled from each stratum in the original design, which may introduce a bias due to small sample size, the resampling of $m_h = n_h - 1$ clusters was used as an acceptable strategy to eliminate this bias (Korn & Graubard, 1999). Therefore, a new bootstrap weight, w^*_{hik}, for each record in that stratum was calculated using the following formula:

$$w^*_{hik} = n_h/(n_h-1)m_{hi} \cdot w_{hik}$$

where w_{hik} is the original design weight and m^*_{hi} is the number of times the $(hi)^{th}$ cluster is selected. The number of replications (B) should ideally be large (i.e. from 400 to 800) in order to yield variance estimators that are less variable; here, the number of replications was 500. In other words, this weighting procedure was repeated 500 times, and thus the bootstrap weight file contains 500 bootstrap weights for each record of the NPHS. The bootstrap weights were then recalibrated to population totals for province/age/sex in post-stratification.

However, because in calculating these weights they began with the respondent file rather than the sample file, this method did not include all weighting steps as outlined in the preceding section. In order to account for non-respondents (as well as non-respondent clusters) as the original sample weighting had, they applied a bootstrap sub-sampling weight adjustment factor. If p_h clusters were missing in stratum h, a sample of $n_h - p_h - 1$ clusters was taken from the remaining $n_h - p_h$ clusters with responding households. Therefore, the weight expansion factor was calculated as $(n_h - p_h)/(n_h - p_h - 1)$. Yeo et al. (1999) suggests that ignoring non-response adjustments in the bootstrap algorithm does not have a large impact on the variance estimation; nevertheless, they plan to incorporate these adjustments for the next cycle of the NPHS.

Therefore, in order to correctly calculate variance for a given estimate one first calculates the point estimate B times, using the weights from each of the bootstrap replicates. Next, the variance among these 500 estimates is then calculated using the following formula:

$$\hat{var}_{BS}(\theta) = (1/B) \sum_{b}^{B} (\hat{\theta}_b^* - \hat{\theta}^*)^2 \qquad \text{where parameter estimate } \hat{\theta} = (1/B) \sum_{b}^{B} \hat{\theta}_b^*$$

Although the variance is based on the bootstrap weights, the point estimates presented in the results are based on the original sample weights.

2.4 Statistical Analysis

All analyses were performed using the bootstrap weighting method. First, a simple analysis comparing selected characteristics of complete responders and partial and item non-responders was performed to investigate the potential bias from non-response.

Second, in order to fulfil the first objective, the self-reported period prevalence of each STD was calculated for men and women separately, using an appropriate denominator, the sexually active population aged 15 to 59 years (Aral et al., 1988; Laumann et al., 1994). Period prevalence is defined as the proportion of cases that exist within a population during a specified period of time. This measure can be utilised if it is difficult to determine when a disease can be considered present, and therefore combines both point prevalence and incidence in a single parameter (Hennekens & Buring, 1987). This is particularly relevant for STDs because a large proportion of cases are asymptomatic (Appendix A). This measure should be distinguished from cumulative incidence, which is defined as the proportion of a group of people who experience the *first onset* of a health-related event during a specified time interval (Last, 1995), and therefore, those individuals who are identified as infected at the beginning of the time period are excluded from both the numerator (new cases during the time period) and the denominator (population at risk). However, the question ("Do you currently have, or in the past two years, have you had the following STD?") is ambiguous and there have been no studies addressing how respondents may

have interpreted the question. I cannot determine if individuals interpreted the question to include active cases diagnosed prior to the two-year period (prevalent cases) and those that were diagnosed during that time period (incident cases). Since the question could have been interpreted either way, I believe that period prevalence is the more appropriate measure because it does account for both meanings.

The second objective was to determine the socio-demographic and behavioural correlates of these STDs. All analyses were STD-specific and stratified by sex. First, the period prevalences of the various STDs was calculated according to the various risk factors of interest. Second, crude odds ratios (ORs) with their 95% confidence intervals were calculated in simple logistic regression (bivariate) analyses to compare grouped study factors, with p-values derived from the Wald chi-square statistic. Third, sex-specific multiple logistic regression analyses were performed for each STD where statistical power was adequate. In the multivariate analysis, risk factors that were significantly associated with the STD at the $p<0.05$ level in bivariate analysis were entered into the model simultaneously. Variables which remained significant in the full model were retained in a parsimonious model. Potential effect modification was tested by including interaction terms created among main effects of the minimum model, as well as interaction terms between main effects and age group. Potential confounders were also added to the model and were retained if they resulted in a 10% or greater change in the odds ratios of other main effects.

Analysis was performed using SAS version 6.12 (SAS Institute Inc., Cary, NC, USA). Although the bootstrap weights were not disseminated with the public-use microdata files due to confidentiality concerns, they were available by remote access through Statistics Canada. The basic program for calculating estimates and 95% confidence intervals was originally written by NPHS methodologists at Statistics Canada. The necessary modifications were then made to the program and tested using dummy master files, which contain fake data and a sub-sample of the original records with bootstrap weights. A technical officer at Statistics Canada ran the modified

programs using the Master File and reviewed the output for confidentiality concerns before returning the results.

3.0 RESULTS

3.1 Description of the Sample

3.1.1 Socio-Demographic and Behavioural Characteristics

Among the complete responders, the study population included 20,557 males (49.7%) and 22,635 females (50.3%) between the ages of 15 and 59 years old who reported ever having had sexual intercourse (Table 3.1). The age distribution of men and women was similar, with about 15% of the sample aged 15 to 24 years, 25% aged 25 to 34 years, and almost 60% aged 35 to 59 years. The majority of men and women were currently married, and about 60% of respondents were living with a partner or spouse at the time of the interview. Less than 10% of the sample reported being a member of a non-white racial group, and 16% of both men and women were born in a country other than Canada. Approximately 64% of respondents reported completion of at least some post-secondary school, and 11.1% of males and 13.5% of females were in school, college, or university at the time of the interview. The majority of men (88.2%) and of women (66.3%) was regularly employed in the twelve months preceding the interview. Only a small proportion of men (11.9%) and women (15.0%) was found to be lowest income adequacy group, although non-response for annual income was high at about 12% of men and women. About one-third of the sample was current daily or occasional smokers at the time of the interview. Seventy-four percent of men and 52.2% of women reported drinking alcohol regularly, at least once a month, 13.3% of males and 27.5% of females reported drinking alcohol less than once and month, and the balance of the sample was comprised of former drinkers or abstainers. Less than 1% of males and females had ever injected non-prescription drugs such as cocaine, steroids, or heroin, although this information was collected only for respondents over the age of 18 years who were not in the Alberta RDD sample.

Table 3.1: Weighted distribution of socio-demographic and behavioural characteristics of respondents aged 15 to 59 years who have had sexual intercourse, 1996-97 National Population Health Survey (NPHS).

Characteristic	Men		Women	
	Sample Size	%	Sample Size	%
TOTAL	20,557	100.0	22,635	100.0
Age (years)				
15-24	2,795	15.5	3,283	15.7
25-34	5,728	25.1	6,681	26.3
35-59	12,034	59.4	12,671	58.0
Marital status				
Married	12,566	55.2	14,119	56.6
Single	6,051	37.9	5,243	31.9
Widow/Div/Separated	1,915	6.9	3,238	11.4
Living with partner				
Yes	11,828	59.4	13,521	61.0
No	8,728	40.6	9,109	39.0
Race/Ethnicity				
White	18,673	90.3	20,462	91.4
Other	1,405	9.7	1,529	8.6
Country of origin				
Canada	17,735	85.3	19,594	83.6
Other	2,792	16.7	3,102	16.4
Income Level				
Lower	1,865	11.9	3,224	15.0
Middle	4,247	25.2	5,128	28.6
Upper	11,067	62.8	10,632	56.4
Regularly employed in the past 12 months				
Yes	17,184	88.2	15,359	66.3
No	3,283	17.8	7,191	33.7
Educational level				
High school or less	7,607	35.7	8,103	36.2
Post-secondary	12,825	64.3	14,439	63.8
Currently in school				
Yes	1,965	11.1	2,589	13.5
No	18,585	88.9	20,042	86.5
Current smoking status				
Smoker	7,655	36.5	7,445	31.4
Non-smoker	12,895	63.5	15,180	68.6
Type of drinker				
Regular	15,204	74.4	11,864	52.2
Occasional	2,783	13.3	6,499	27.5
Former/abstainer	2,515	12.3	4,224	20.2
Ever injected non-prescription drugs[1]				
Yes	185	0.82	101	0.5
No	16,318	99.2	18,200	99.5

[1] Not applicable to respondents <18 years and in Alberta RDD sample (N=54,321).

Table 3.1 (continued)*

Characteristic	Men		Women	
	Sample Size	%	Sample Size	%
Currently pregnant[2]				
Yes	N/A		717	3.3
No			17,959	96.6
Took birth control pills in last 3 months[2]				
Yes	N/A		3,906	19.5
No			14,787	80.5
Age at first intercourse (years)				
≤ 15	4,048	21.5	2,871	14.8
> 15	14,758	78.5	18,053	85.2
Sexual intercourse in past 12 months				
Yes	18,371	92.6	19,275	88.9
No	1,805	7.4	2,828	11.1
Number of partners in past 12 months[3]				
≤1	15,178	89.2	17,731	94.0
≥2	1,655	10.8	968	6.0
Relationship lasting less than 12 months [3]				
Yes	2,287	14.3	1476	9.13
No	14,531	85.7	17,213	90.9

[2] Not applicable to women aged 50 to 59 years (N=18,696).
[3] Not applicable to respondents in Alberta RDD sample (N=18,874).

Of females aged 15 to 49 years, 3.3% were pregnant at the time of the interview and 19.5% reported taking oral contraceptives in the three months preceding the interview. Almost 22% of men and 14.8% of women were 15 years or younger at sexual debut, although non-response was also high for this question at approximately 8%. A small proportion of males (7.41%) and females (11.1%) reported that they had not had sexual intercourse in the 12 months preceding the interview. The majority of respondents reported having one or no partners in the 12 months preceding the interview, while 10.8% of men and 6.03% of women reported two or more partners in that time period. Lastly, a minority of men (14.3%) and women (9.13%) reported having recent relationships lasting less than 12 months. However, data on these last two variables were not collected for respondents in the Alberta RDD sample.

3.1.2 Comparison to the General Population

While weights in the NPHS are adjusted to provincial or health area totals of age and sex (Statistics Canada, 1997), the sample's representativeness in terms of other demographic variables such as ethnic origin, marital status, and social class can be assessed using available census data (Wellings et al., 1990). Table 3.2 provides a comparison of the population totals estimated from the entire sample of the 1996-97 NPHS Health component and the 1996 Canadian Census totals.

Table 3.2: Comparison of 1996 Census totals to populations estimates derived from the 1996-97 National Population Health Survey (NPHS) Health Component.

Characteristic	**1996 Census Total** (Statistics Canada, 2000)	**Population Estimate from 1996-97 NPHS Health Component** (Statistics Canada, 1997)
Total population	28,528,125	29,671,912
Visible minority (Non-White)	3,197,480	3,079,856
Country of birth other than Canada	4,971,070	4,819,482
Marital status		
Single	12,536,661[1]	11,643,804
Married/common-law/separated	14,444,072	14,557,682
Widowed	1,456,664	1,319,421
Divorced	1,234,515	1,090,261
University degree	3,000,695	3,460,926
Low income[2]	5,514,190	3,934,341

Notes: [1] Source: Canadian Socio-Economic Information and Management Database, 1996.
[2] Low income cut-offs in the Census are based on family size, level of urbanization, and family expenditure on basic necessities. The 1996 Census total relates to 1995 income. The NPHS measure of income adequacy is based on household income in the past 12 months and the size of the household. The NPHS estimate in this table includes the lowest and lower middle income quintiles.

The population totals for number of visible minorities and number of people of immigrant status are slightly lower in the survey sample. As well, the NPHS sample represents a higher number of people with university degrees and a lower number of unmarried people and people in lower income categories than the Census, although it should be noted that the measures of low income are different for the two sources. These discrepancies are important because individuals who are minorities, unmarried, or low socio-economic status tend to be at greater risk of acquiring STD (Aral, 1999a). These groups may not be accurately represented in the NPHS if

these individuals have been systematically excluded from the sampling frame or if they are more likely to be unit non-respondents.

3.1.3 Comparison of Self-Reported Sexual Behaviours to Other Canadian Population-Based Surveys

Although the sample used in this analysis is a subset of the Health component sample, there are no aggregrate totals like census data that are restricted only to the sexually experienced population with which to draw comparisons. Instead, one can compare the estimates of sexual behaviours from the NPHS to those obtained from other Canadian population-based surveys.

In the 1996-97 NPHS, 21.5% of males and 14.8% of females who have ever had sexual intercourse reported age at sexual debut at 15 years or younger. These estimates are slightly lower than those found in the 1990 HPS, where among all respondents, including those who have never had intercourse, 36% of males and 18% of females reported first intercourse at 16 years or younger (Willamson, 1993). Similar relationships with other socio-demographic characteristics were found in the NPHS and HPS samples: younger, never married, and less educated respondents were more likely to report early age at first intercourse (Table 2 in Appendix E). However, income adequacy was not related to age at sexual debut in the HPS sample, while in the NPHS sample, lower income respondents were significantly more likely to report early age at sexual debut.

About 10.8% of men and 6.0% of women reported having two or more sexual partners in the 12 months preceding in the survey in the 1996-97 NPHS. These estimates are quite comparable to those found in a number of Canadian surveys, including the 1990 Ontario Health Survey (OHS) (10% of men and women aged 16 to 44); the 1990 HPS (12% of males and 6% of females aged 15 and older); the 1994 Canadian Health Monitor (CHM) (13% of males and 4% of females aged 20 years and older who have ever had intercourse); the 1994-95 NPHS (12% of

males and 7% of females aged 20 to 44 years); the 1996 Québec General Population Survey (16% of males and 8% of females aged 15 to 64 years); and the 1997 CHM (8% of males and 5% of females aged 20 years and older who have ever had sexual intercourse) (Houston, 1998; Willamson, 1993).

In terms of contraceptive practices, almost 20% of women aged 15 to 49 in the NPHS sample have used OCP in the past three months, which is lower than found in the 1998 CCS, in which 28% of women aged 15 to 44 reported currently using this form of birth control (Boroditsky et al., 1999). About 54% of both males and females in the NPHS sample reported always using condoms in relationships lasting less than 12 months. Compared to the 1994-95 NPHS supplement, the proportion reporting always use of condoms in short-term relationships in the past year was greater among men (70.9% for men aged 15 to 19; 50% for men aged 20 to 44 years) but lower among women (37.0% for women aged 15 to 19; 49.4% for women aged 20 to 44 years) (Houston et al., 1998). Our sample also had somewhat lower levels of condom use than reported in the 1994 CHM, where of respondents who had more than one partner in the past year, 59.0% of males and 69.7% of females always used condoms with casual partners.

Some of the variations in these findings are likely to be a result of differences in the surveys' sample design, target population, mode of data collection, and operationalisation of measures. However, the relative consistency of these sexual behaviours speaks to the robustness of the findings in the NPHS by illustrating that NPHS respondents appear to be no more or less likely to be subject to reporting errors than respondents of other Canadian population-based surveys which explore sexual behaviour.

3.1.4 Non-Response Analysis

In the NPHS, respondents had the opportunity to refuse to participate in the survey or to refuse to answer any question of the survey. Since the socio-demographic or behavioural characteristics of unit non-responders were not included in the survey file, it was not possible to compare them to survey participants. However, within the survey, participants who were between the ages of 15 to 59 years were asked the question: "Have you ever had sexual intercourse?" If a respondent answered affirmatively, the interviewer preceded with the rest of the questions on sexual behaviour and STD history, whereas for respondents who answered no, "don't know", or refused to answer the question, the section on sexual health was skipped entirely. There were 357 men and women who answered "don't know" and 5,464 eligible survey participants who refused to answer this question, for a weighted level of non-response of 8.0% (95% CI: 7.6-8.4). A comparison of a number of selected socio-demographic and behavioural characteristics between complete and partial non-responders is shown in Table 9 of Appendix E. Partial non-responders were significantly more likely to be of immigrant status and have a high school education or less than responders. Complete responders were significantly more likely to be aged 15 to 24 years, single, non-White race, current smoker, regular drinkers, and have low income adequacy compared with partial non- responders.

Different questions regarding sexual behaviour and STD history had different levels of item non-response, and the characteristics of those who did not answer differ according to each question as well. *Age at first intercourse* had the highest non-response rate of all the sexual behaviour questions: 3,459 respondents (8.2%, 95% CI: 7.6-8.9) who reported ever having had sexual intercourse did not disclose this information. As shown in Table 11 of Appendix E, non-responders were significantly more likely to be female, aged 15 to 24 years, single, living with a partner, Canadian, White, current smokers, or regular drinker, and have post secondary education and low income adequacy than item responders. *Sexual intercourse in the past 12 months* also

had a relatively high level of non-response, as 911 eligible respondents (2.0%, 95% CI: 1.7-2.3) did not answer this question. As shown in Table 11 of Appendix E, compared to responders, item non-responders were significantly more likely to be immigrants, non-White, and smokers, but less likely to be aged 15 to 24 years, regular drinkers, or single. For *number of partners in the past 12 months*, 175 eligible respondents (0.6%, 95% CI: 0.4-0.8) answered "don't know" or refused to answer the question. Non-responders were significantly more likely to be male, single, not living with a spouse, and regular drinkers, and to have at least some post-secondary education than responders (Table 12 of Appendix E).

Among the STDs, chlamydia had the highest level of non-response. For self-reported chlamydia history, 60 men and women (0.2%, 95% CI: 0.1-0.4) refused to answer this question. As illustrated in Table 13 of Appendix E, because the number of non-responders was low, the confidence intervals were imprecise and there were no significant differences between responders and non-responders, with the exception that non-responders were significantly less likely to be regular drinkers than item responders. In comparison, the other STD questions had much better levels of response, with only six to seven non-responders for each item regarding history of gonorrhea, genital herpes, and genital warts.

3.2 Period Prevalences of STDs

The proportion of 1996-97 NPHS respondents who reported having had an STD in the two years preceding interview was low for all outcomes of interest, although women reported all four STDs more often than men. The period prevalences and population estimates of the STDs are shown in Table 3.3. Genital chlamydia was the most commonly reported STD among sexually experienced men and women in the sample, with weighted period prevalences that were similar for the two genders, at about 0.50%. The population estimates for the number of people in the target population who have had chlamydia in the past two years were also similar for men and

women, at about 40,000 Canadians aged 15 to 59 years. While genital herpes was the second most commonly reported STD for men and women in the sample, it had the highest weighted period prevalence and population estimate among women, and the third highest among men. Genital warts ranked third for women, with a period prevalence and population estimate about twice that for men. Gonorrhea was the least commonly reported STD for both men and women, and also had the lowest ranked period prevalences and population estimates, with about 25,000 men and women in Canada estimated to have had the disease in the two years preceding the survey.

Table 3.3: Period prevalence and population estimates of self-reported sexually transmitted diseases (STDs) in the two years preceding interview for sexually experienced Canadians in the general population aged 15-59 years old, 1996-97 NPHS.

Sexually Transmitted Disease	Number of Cases	Period Prevalence		Population Estimate	95% CI
		%	95% CI		
Chlamydia					
Males	97	0.50	0.33 - 0.66	38,134	25,649 - 50,620
Females	144	0.52	0.37 - 0.67	40,493	28,831 - 52,155
Gonorrhea					
Males	32	0.16	0.06 - 0.26	12,155	4,657 - 19,653
Females	39	0.17	0.07 - 0.28	13,278	5,288 - 21,267
Genital Herpes					
Males	70	0.23	0.14 - 0.33	17,851	10,444 - 25,258
Females	119	0.81	0.51 - 1.12	63,151	39,495 - 86,807
Genital Warts					
Males	65	0.24	0.10 - 0.38	18,403	8,007 - 28,799
Females	96	0.51	0.28 - 0.74	39,500	21,430 - 57,569

One way to evaluate the completeness of reporting is to compare the survey estimates against some other independent aggregate estimate for the same population, such as surveillance totals (Fowler, 1995). Figure 3.1 compares the estimated population totals of chlamydia from the NPHS to the number of cases reported to surveillance in 1995 and 1996. Among men, the population totals for NPHS respondents aged 25 to 34 years and 35 to 59 years are significantly greater than the cases reported to surveillance; this is also true for women aged 35 to 59 years. In contrast, the population total for female respondents aged 15 to 24 years is significantly less than the number of cases reported to surveillance for this age group. For gonorrhea, NPHS population totals are greater than surveillance reports among the older age groups, although these differences

are only significant for women (Figure 3.2). Among respondents aged 15 to 24 years, there is only a large discrepancy among the males: although there were 2,227 cases in young men reported to surveillance in 1995-96, there were no self-reported cases in this group in the NPHS. These discrepancies may be attributed to under-reporting of STD experience by respondents in the survey setting, under-reporting of diagnosed cases to surveillance systems, and under-representation of certain high risk groups in the survey. These issues will be further addressed in the Discussion.

Figure 3.1: Comparison of self-reported cases of chlamydia (weighted NPHS population totals) and 1995-96 surveillance reports

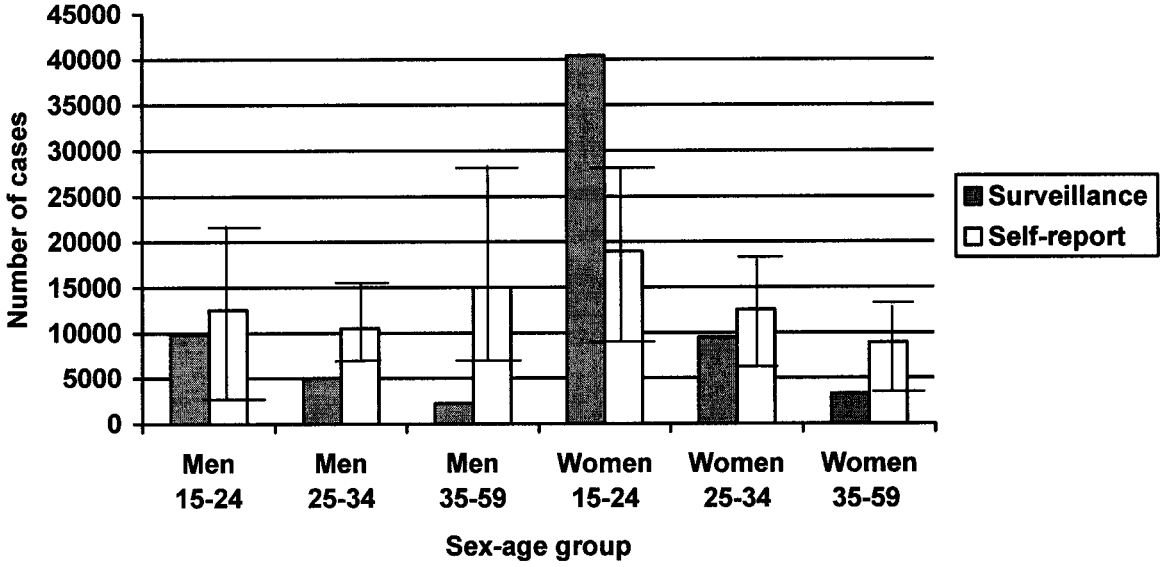
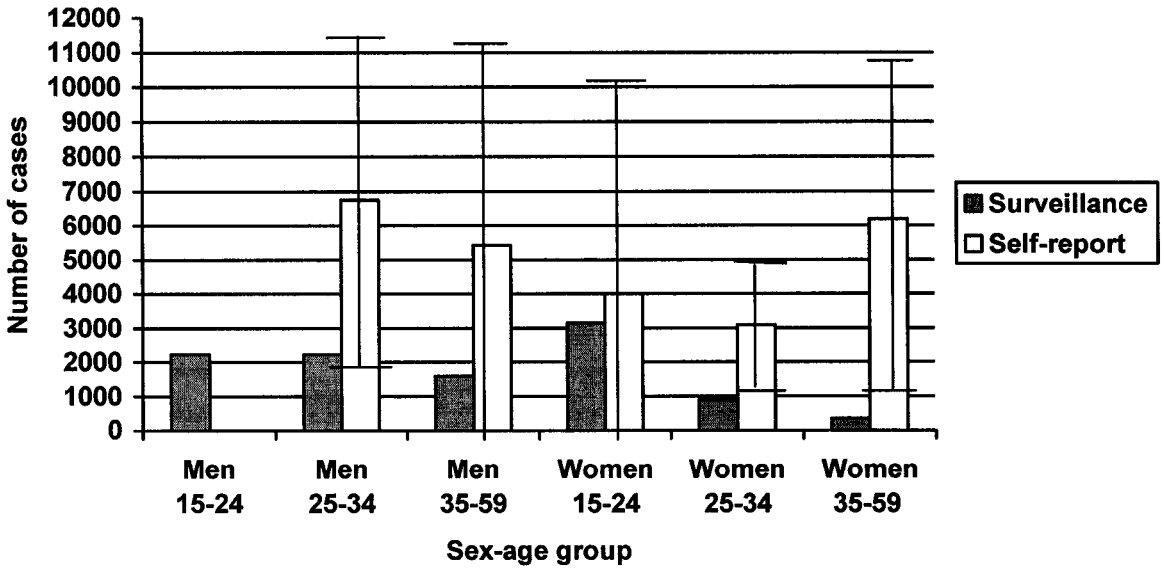


Figure 3.2: Comparison of self-reported cases of gonorrhea (weighted NPHS population totals) and 1995-96 surveillance reports



3.3 Risk Factors for the STDs

Tables 3.4 through 3.7 illustrate the weighted period prevalences of chlamydia, gonorrhea, genital herpes, and genital warts according to a number of socio-demographic characteristics, substance use and sexual behaviours, stratified by gender. Tables displaying STD-specific bivariate and multivariate analyses follow. However, due to the small number of cases of genital herpes and genital warts for men and gonorrhea for both men and women, there was inadequate power to detect significant differences according to the potential risk factors in bivariate analysis. Due to a small number of cases of some STDs, where statistical power was inadequate, we did not go further in analysis.

Table 3.4: Period prevalence of self-reported genital chlamydia according to socio-demographic and behavioural risk factors, 1996-97 NPHS.

Risk factor	Men				Women			
	Sample Size	Cases	%	95% CI*	Sample Size	Cases	%	95% CI*
TOTAL	20,146	97	0.51	0.34, 0.67	22,064	144	0.53	0.38, 0.69
Age (years)								
15-24	2,766	24	1.07	0.35, 1.79	3,243	63	1.58	0.81, 2.34
25-34	5,650	36	0.55	0.29, 0.82	6,549	47	0.62	0.34, 0.91
35-59	11,730	37	0.34	0.14, 0.54	12,272	34	0.21	0.09, 0.32
Marital status								
Married/Partner	12,290	42	0.34	0.16, 0.52	13,756	49	0.22	0.09, 0.34
Single	5,957	47	0.67	0.36, 0.99	5,147	73	1.03	0.63, 1.42
Widow/Div/Separated	1,876	8	0.93	0.00, 2.11	3,126	22	0.72	0.26, 1.18
Living with partner								
Yes	11,568	37	0.33	0.17, 0.50	13,177	46	0.25	0.13, 0.36
No	8,577	60	0.76	0.42, 1.11	8,883	98	0.98	0.63, 1.33
Race/Ethnicity								
White	18,673	88	0.50	0.33, 0.68	20,462	126	0.51	0.35, 0.66
Other	1,405	9	0.56	0.14, 0.99	1,529	18	0.87	0.12, 1.61
Country of origin								
Canada	17,447	89	0.52	0.33, 0.70	19,180	134	0.61	0.42, 0.79
Other	2,699	8	0.47	0.00, 0.97	2,884	10	0.16	0.05, 0.28
Income Level								
Lower	1,837	18	1.24	0.35, 2.13	3,163	37	0.76	0.41, 1.10
Middle	4,176	25	0.49	0.17, 0.82	5,030	32	0.52	0.17, 0.86
Upper	10,889	40	0.43	0.21, 0.66	10,428	54	0.52	0.28, 0.76
Regularly employed in the past 12 months								
Yes	16,857	72	0.46	0.27, 0.64	15,011	87	0.43	0.30, 0.55
No	3,205	25	0.75	0.29, 1.21	6,981	57	0.75	0.36, 1.14
Educational level								
High school or less	7,450	35	0.40	0.14, 0.65	7,874	47	0.41	0.21, 0.60
Post-secondary	12,584	62	0.57	0.35, 0.80	14,106	97	0.61	0.39, 0.83
Currently in school								
Yes	1,944	14	0.72	0.13, 1.30	2,541	29	0.89	0.35, 1.44
No	18,196	83	0.49	0.31, 0.66	19,520	115	0.48	0.32, 0.64

* 95% confidence intervals with lower limits estimated below zero are truncated at zero.

Table 3.4 (continued)

Risk factor	Men				Women			
	Sample Size	Cases	%	95% CI*	Sample Size	Cases	%	95% CI*
Current smoking status								
Smoker	7,549	48	0.35	0.20, 0.51	7,304	65	0.94	0.53, 1.36
Non-smoker	12,593	49	0.60	0.34, 0.85	14,756	79	0.35	0.22, 0.47
Type of drinker								
Regular	14,595	78	0.62	0.40, 0.83	11,635	90	0.75	0.47, 1.03
Occasional	2,713	10	0.24	0.05, 0.43	6,352	32	0.29	0.18, 0.41
Former/abstainer	2,433	9	0.14	0.03, 0.25	4,039	22	0.30	0.11, 0.48
Ever injected non-prescription drugs								
Yes	184	5	3.01	0.00, 7.82	100	0	0.00	---
No	16,002	59	0.43	0.26, 0.60	17,755	103	0.53	0.35, 0.70
Currently pregnant								
Yes	N/A				708	6	1.29	0.00, 3.12
No					17,558	133	0.58	0.41, 0.75
Took birth control pills in last 3 months								
Yes	N/A				3,853	54	1.22	0.55, 1.90
No					14,433	86	0.46	0.30, 0.61
Age at first intercourse (years)								
≤ 15	4,042	25	0.60	0.17, 1.04	2,864	49	1.50	0.71, 2.28
> 15	14,722	65	0.49	0.29, 0.68	17,976	93	0.40	0.27, 0.53
Sexual intercourse in past 12 months								
Yes	18,344	92	0.52	0.34, 0.69	19,241	129	0.56	0.39, 0.74
No	1,802	5	0.45	0.00, 1.23	2,823	15	0.33	0.04, 0.61
Relationship lasting less than 12 months								
Yes	2,287	22	1.06	0.24, 1.88	1,442	30	2.44	0.96, 3.91
No	14,531	47	0.55	0.13, 0.97	17,113	79	0.56	0.28, 0.85
Number of partners in past 12 months								
≤1	15,165	47	0.30	0.16, 0.44	17,709	82	0.34	0.22, 0.47
≥2	1,653	22	1.77	0.55, 2.98	964	27	3.42	1.32, 5.52

* 95% confidence intervals with lower limits estimated below zero are truncated at zero. Ellipses indicate estimates with coefficients of variation greater than 100%.

Table 3.5: Period prevalence of self-reported gonorrhea according to socio-demographic and behavioural risk factors, 1996-97 NPHS.

Risk factor	Men				Women			
	Number	Cases	%	95% CI*	Number	Cases	%	95% CI*
TOTAL	20,143	32	0.16	0.06, 0.26	22,060	39	0.17	0.07, 0.28
Age (years)								
15-24	2,766	0	0.00	0.00, 0.00	3,242	6	0.33	0.00, 0.88
25-34	5,649	15	0.36	0.11, 0.61	6,547	15	0.15	0.06, 0.25
35-59	11,728	18	0.12	0.00, 0.26	12,271	18	0.14	0.04, 0.25
Marital status								
Married/Partner	12,290	22	0.14	0.05, 0.22	13,754	21	0.13	0.03, 0.23
Single	5,955	8	0.12	0.00, 0.23	5,145	10	0.22	0.00, 0.49
Widow/Div/Separated	1,875	2	0.56	0.00, 1.61	3,126	8	0.26	0.00, 0.51
Living with partner								
Yes	11,568	20	0.14	0.06, 0.22	13,175	15	0.10	0.01, 0.18
No	8,574	12	0.20	0.00, 0.42	8,881	24	0.30	0.06, 0.55
Race								
White	18,671	31	0.18	0.07, 0.29	20,458	35	0.17	0.06, 0.28
Other	1,404	1	0.01	0.00, 0.02	1,529	4	0.26	0.00, 0.62
Country of origin								
Canada	17,445	27	0.13	0.05, 0.20	19,176	35	0.19	0.07, 0.32
Other	2,698	5	0.35	0.00, 0.82	2,884	4	0.09	0.00, 0.20
Income Level								
Lower	1,836	4	0.08	0.00, 0.17	3,161	12	0.34	0.08, 0.61
Middle	4,175	8	0.15	0.00, 0.32	5,029	5	0.07	0.01, 0.14
Upper	10,888	17	0.19	0.03, 0.36	10,429	17	0.20	0.01, 0.40
Regularly employed in the past 12 months								
Yes	16,855	26	0.19	0.06, 0.31	15,011	22	0.13	0.04, 0.21
No	3,204	6	0.06	0.00, 0.12	6,977	16	0.28	0.00, 0.55
Educational level								
High school or less	7,448	11	0.07	0.02, 0.13	7,871	13	0.15	0.00, 0.30
Post-secondary	12,583	21	0.21	0.06, 0.37	14,105	25	0.19	0.04, 0.34
Currently in school								
Yes	1,944	3	0.06	0.00, 0.15	2,540	3	0.35	0.00, 0.99
No	18,193	29	0.18	0.06, 0.29	19,517	35	0.15	0.07, 0.23

* 95% confidence intervals with lower limits estimated below zero are truncated at zero.

Table 3.5 (continued)

Risk factor	Men				Women			
	Sample Size	Cases	%	95% CI*	Sample Size	Cases	%	95% CI*
Current smoking status								
Smoker	7,547	13	0.09	0.03, 0.15	7,301	18	0.22	0.04, 0.41
Non-smoker	12,592	19	0.20	0.05, 0.36	14,755	21	0.16	0.02, 0.29
Type of drinker								
Regular	14,594	24	0.19	0.06, 0.32	11,634	17	0.20	0.02, 0.39
Occasional	2,713	3	0.08	0.00, 0.16	6,351	13	0.11	0.04, 0.18
Former/abstainer	2,431	5	0.09	0.00, 0.18	4,037	9	0.20	0.02, 0.38
Ever injected non-prescription drugs								
Yes	184	1	0.52	0.00, 1.56	100	0	0.00	--
No	15,975	24	0.14	0.05, 0.24	17,721	34	0.18	0.07, 0.29
Currently pregnant								
Yes	N/A				708	1	0.17	0.00, 0.50
No					17,555	35	0.17	0.05, 0.29
Took birth control pills in last 3 months								
Yes	N/A				3,851	6	0.06	0.00, 0.12
No					14,432	30	0.20	0.06, 0.34
Age at first intercourse (years)								
≤ 15	4,042	13	0.26	0.03, 0.50	2,862	5	0.08	0.00, 0.17
> 15	14,720	17	0.14	0.02, 0.27	17,976	31	0.20	0.07, 0.33
Sexual intercourse in past 12 months								
Yes	18,342	32	0.18	0.07, 0.29	19,237	31	0.16	0.05, 0.28
No	1,801	0	0.00	0.00, 0.00	2,823	8	0.28	0.00, 0.56
Relationship lasting less than 12 months								
Yes	14,519	3	0.32	0.00, 0.87	17,192	2	0.57	0.00, 1.53
No	2,284	22	0.14	0.00, 0.33	1,472	32	0.20	0.06, 0.34
Number of partners in past 12 months								
≤1	15,162	22	0.11	0.04, 0.18	17,707	32	0.17	0.05, 0.28
≥2	1,653	3	0.43	0.00, 1.15	964	2	0.30	0.00, 0.74

* 95% confidence intervals with lower limits estimated below zero are truncated at zero. Ellipses indicate coefficients of variation greater than 100%.

Table 3.6: Period prevalence of self-reported genital herpes according to socio-demographic and behavioural risk factors, 1996-97 NPHS.

Risk factor	Men				Women			
	Number	Cases	%	95% CI*	Number	Cases	%	95% CI*
TOTAL	20,142	70	0.24	0.14, 0.34	22,057	119	0.83	0.52, 1.15
Age (years)								
15-24	2,765	1	0.02	0.00, 0.05	3,242	18	0.41	0.16, 0.66
25-34	5,649	30	0.45	0.23, 0.67	6,546	47	1.66	0.71, 2.62
35-59	11,728	39	0.21	0.07, 0.35	12,269	54	0.58	0.29, 0.86
Marital status								
Married/Partner	12,289	37	0.23	0.08, 0.39	13,752	61	0.59	0.27, 0.92
Single	5,955	25	0.24	0.12, 0.35	5,145	37	0.99	0.37, 1.60
Widow/Div/Separated	1,875	8	0.19	0.01, 0.37	3,125	21	1.41	0.06, 2.77
Living with partner/spouse								
Yes	11,567	33	0.23	0.08, 0.38	13,173	57	0.67	0.8, 1.07
No	8,574	37	0.25	0.14, 0.36	8,880	62	1.10	0.55, 1.65
Race/Ethnicity								
White	18,671	67	0.24	0.14, 0.34	20,455	109	0.86	0.53, 1.20
Other	1,404	3	0.25	0.00, 0.67	1,529	9	0.61	0.00, 1.31
Country of origin								
Canada	17,444	62	0.21	0.11, 0.31	19,173	109	0.95	0.58, 1.32
Other	2,698	8	0.37	0.05, 0.70	2,884	10	0.26	0.00, 0.53
Income Level								
Lower	1,836	7	0.13	0.00, 0.27	3,159	22	1.18	0.10, 2.26
Middle	4,175	11	0.19	0.01, 0.36	5,029	19	0.39	0.13, 0.64
Upper	10,888	48	0.29	0.13, 0.44	10,428	60	1.00	0.48, 1.53
Regularly employed in the past 12 months								
Yes	16,853	58	0.24	0.13, 0.34	15,010	83	0.68	0.41, 0.96
No	3,205	12	0.25	0.00, 0.49	6,975	36	1.15	0.39, 1.90
Educational level								
High school or less	7,448	20	0.15	0.07, 0.23	7,869	37	0.89	0.23, 1.55
Post-secondary	12,582	50	0.29	0.14, 0.43	14,104	82	0.81	0.46, 1.16
Currently in school								
Yes	1,944	6	0.16	0.00, 0.33	2,541	13	1.11	0.02, 2.20
No	18,192	64	0.25	0.14, 0.36	19,513	106	0.80	0.46, 1.13

* 95% confidence intervals with lower limits estimated below zero are truncated at zero.

Table 3.6 (continued)

Risk factor	Men				Women			
	Number	Cases	%	95% CI*	Number	Cases	%	95% CI*
Current smoker								
Yes	7,547	26	0.21	0.10, 0.31	7,300	38	0.87	0.28, 1.47
No	12,591	44	0.26	0.11, 0.40	14,753	81	0.82	0.45, 1.20
Type of drinker								
Regular	14,954	55	0.27	0.14, 0.40	11,633	74	1.23	0.66, 1.80
Occasional	2,712	7	0.17	0.02, 0.32	6,350	26	0.45	0.16, 0.73
Former/abstainer	2,431	8	0.14	0.01, 0.26	4,030	19	0.35	0.11, 0.60
OCP use in past 3 months								
Yes	N/A				3,852	27	1.32	0.26, 2.38
No					14,429	85	0.91	0.51, 1.30
Unknown					3,776	7	0.09	0.01, 0.17
Currently pregnant								
Yes	N/A				708	3	0.39	0.00, 1.03
No					17,553	108	1.01	0.61, 1.40
Ever injected non-prescription drugs								
Yes	184	3	1.91	0.00, 4.68	100	1	0.18	0.00, 0.54
No	15,975	50	0.25	0.13, 0.38	17718	89	0.83	0.52, 1.14
Age at first intercourse (years)								
≤15	4,042	17	0.25	0.08, 0.42	2,862	29	2.24	0.64, 3.84
>15	14,721	48	0.25	0.12, 0.38	17,973	85	0.63	0.36, 0.91
Sexual intercourse in past 12 months								
Yes	18,340	64	0.24	0.14, 0.35	19,235	107	0.90	0.55, 1.25
No	1,802	6	0.21	0.00, 0.46	2,822	12	0.34	0.05, 0.62
Relationship lasting less than 12 months								
Yes	2,284	14	0.55	0.08, 1.01	1,472	13	1.96	0.00, 1.53
No	14,519	42	0.33	0.04, 0.61	17,192	79	0.20	0.06, 0.34
Number of partners in past 12 months								
≤1	15,163	45	0.26	0.12, 0.40	17,703	82	0.71	0.42, 1.01
≥2	1,653	11	0.60	0.00, 0.19	964	10	2.50	0.16, 4.85

* 95% confidence intervals with lower limits estimated below zero are truncated at zero.

Table 3.7: Period prevalence of self-reported genital warts according to socio-demographic and behavioural risk factors, 1996-97 NPHS.

Risk factor	Men				Women			
	Number	Cases	%	95% CI*	Number	Cases	%	95% CI*
TOTAL	20,144	65	0.24	0.11, 0.38	22,060	96	0.52	0.28, 0.76
Age (years)								
15-24	2,766	12	0.23	0.06, 0.39	3,242	28	0.98	0.03, 1.93
25-34	5,649	26	0.59	0.06, 1.13	6,548	41	0.64	0.24, 1.04
35-59	11,729	27	0.10	0.05, 0.16	12,270	27	0.34	0.10, 0.58
Marital status								
Married/Partner	12,290	28	0.24	0.00, 0.47	13,754	40	0.33	0.11, 0.56
Single	5,956	31	0.24	0.14, 0.35	5,146	42	0.89	0.31, 1.48
Widow/Div/Separated	1,875	5	0.19	0.00, 0.42	3,125	14	0.30	0.04, 0.56
Living arrangement								
Living with partner	11,568	26	0.24	0.01, 0.46	13,175	35	0.40	0.15, 0.66
Not living with partner	8,575	39	0.26	0.16, 0.36	8,881	61	0.72	0.28, 1.15
Race/Ethnicity								
White	18,672	61	0.25	0.10, 0.41	20,458	88	0.53	0.28, 0.79
Other	1,404	4	0.20	0.00, 0.42	1,529	6	0.38	0.00, 0.80
Country of origin								
Canada	17,446	59	0.27	0.11, 0.44	19,176	86	0.59	0.31, 0.87
Other	2,698	6	0.12	0.00, 0.25	2,884	10	0.19	0.05, 0.34
Regularly employed in the past 12 months								
Yes	16,855	47	0.22	0.06, 0.38	15,010	52	0.44	0.15, 0.73
No	3,205	18	0.36	0.16, 0.57	6,978	44	0.69	0.28, 1.11
Educational level								
High school or less	7,449	18	0.18	0.09, 0.27	7,871	29	0.61	0.08, 1.13
Post-secondary	12,583	47	0.28	0.07, 0.50	14,105	67	0.48	0.27, 0.69
Income Level								
Lower	1,837	11	0.32	0.08, 0.56	3,161	27	0.74	0.26, 1.23
Middle	4,175	18	0.26	0.07, 0.45	5,029	18	0.88	0.12, 1.63
Upper	10,888	29	0.24	0.01, 0.47	10,428	42	0.37	0.12, 0.61
Currently in school								
Yes	1,944	10	0.25	0.07, 0.43	2,541	21	1.19	0.04, 2.34
No	18,194	55	0.25	0.09, 0.40	19,516	75	0.42	0.22, 0.62

* 95% confidence intervals with lower limits estimated below zero are truncated at zero.

Table 3.7 (continued)

Risk factor	Men				Women			
	Number	Cases	%	95% CI*	Number	Cases	%	95% CI*
Current smoking status								
Smoker	7,548	33	0.27	0.15, 0.38	7,302	44	0.73	0.29, 1.16
Non-smoker	12,592	32	0.24	0.03, 0.44	14,754	52	0.43	0.15, 0.72
Type of drinker								
Regular	14,595	53	0.29	0.10, 0.48	11,634	58	0.63	0.23, 1.03
Occasional	2,713	4	0.07	0.00, 0.15	6,351	24	0.51	0.19, 0.82
Former/abstainer	2,431	8	0.18	0.04, 0.31	4,037	14	0.28	0.07, 0.49
Currently pregnant								
Yes	N/A				708	2	0.37	0.00, 1.00
No					17,556	89	0.59	0.29, 0.88
Took birth control pills in last 3 months								
Yes	N/A				3,852	40	1.46	0.36, 2.56
No					14,432	52	0.37	0.16, 0.58
Ever injected non-prescription drugs								
Yes	184	3	1.34	0.00, 2.96	100	0	0.00	---
No	15,976	45	0.20	0.07, 0.33	17,721	74	0.46	0.27, 0.66
Age at first intercourse (years)								
≤ 15	4,042	18	0.21	0.09, 0.32	2,863	25	1.19	0.27, 2.10
> 15	14,721	44	0.27	0.08, 0.46	17,975	70	0.44	0.20, 0.69
Sexual intercourse in past 12 months								
Yes	18,342	62	0.26	0.11, 0.41	19,238	83	0.53	0.27, 0.80
No	1,802	3	0.07	0.00, 0.15	2,822	13	0.46	0.11, 0.80
Relationship lasting less than 12 months								
Yes	2,284	13	0.34	0.13, 0.56	1,472	18	1.14	0.44, 1.84
No	14,519	36	0.16	0.05, 0.26	17,192	60	0.61	0.08, 1.13
Number of partners in past 12 months								
≤1	15,163	38	0.19	0.05, 0.33	17,706	61	0.46	0.22, 0.70
≥2	1,653	11	0.36	0.09, 0.63	964	17	1.66	0.64, 2.67

* 95% confidence intervals with lower limits estimated below zero are truncated at zero. Ellipses indicate coefficients of variation greater than 100%.

3.3.1 Chlamydia

Bivariate analysis. As shown in Table 3.8, younger age was significantly associated with self-reported chlamydia for both genders, although the effect of age was much stronger among women than men. Men and women who were not living with a partner or spouse were significantly more likely to report chlamydia as well. Never and formerly married respondents were also more likely to have a history of this STD, although this association was only significant among women. Women who were born in a country other than Canada were significantly less likely to report a history of chlamydia than Canadian-born respondents, but there was no difference according to country of origin among men. Self-reported chlamydia was not found to be associated with respondents' working status over the last 12 months, highest level of education, or current student status. However, among men, those with low income adequacy were significantly more likely to report chlamydia compared to those with high income adequacy, while this measure of socio-economic status (SES) was not associated with the disease among women. For both genders, the regular consumption of alcohol was significantly associated with self-reported disease, while being a current smoker was only a significant risk factor among women. Women who reported use of oral contraceptive pills (OCP) in the three months preceding the interview were almost three times more likely to report the disease than women who were not OCP users. Age at first intercourse of 15 years or younger was also related to a history of chlamydia among women. Lastly, respondents who reported relationships lasting less than 12 months or two or more partners in the preceding year were significantly more likely to report chlamydia in the preceding two years; however, these associations seemed to be stronger among women for both risk behaviours.

Table 3.8: Bivariate analysis for self-reported chlamydia, 1996-97 NPHS, using bootstrap weights.

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Gender	1.00	Reference	1.05	0.66 – 1.68
Age (years)				
15-24	3.17	1.13 – 8.91	7.80	3.49 – 17.40
25-34	1.63	0.73 – 3.65	3.05	1.43 – 6.50
35-59	1.00	Reference	1.00	Reference
Marital status				
Married/Partner	1.00	Reference	1.00	Reference
Single	1.98	0.93 – 4.24	4.81	2.32 – 9.97
Widow/Div/Separated	2.74	0.29 – 25.77	3.34	1.32 – 8.47
Living with partner				
Yes	1.00	Reference	1.00	Reference
No	2.30	1.12 – 4.76	3.96	2.15 – 7.40
Race/Ethnicity				
White	1.00	Reference	1.00	Reference
Other	1.12	0.46 – 2.75	1.71	0.56 – 5.24
Country of origin				
Canada	1.00	Reference	1.00	Reference
Other	0.91	0.22 – 3.72	0.26	0.11 – 0.65
Income Level				
Low	2.89	1.07 – 7.79	1.47	0.74 – 2.92
Middle	1.14	0.45 – 2.89	1.00	0.40 – 2.47
Upper	1.00	Reference	1.00	Reference
Regularly employed in past 12 months				
Yes	1.00	Reference	1.00	Reference
No	1.64	0.73 – 3.70	1.77	0.92 - 3.42
Educational level				
High school or less	1.00	Reference	1.00	Reference
Post-secondary	1.45	0.63 – 3.32	1.87	0.87 – 3.98
Currently in school				
Yes	1.49	0.50 – 4.43	1.87	0.87 – 3.98
No	1.00	Reference	1.00	Reference
Current smoking status				
Smoker	0.59	0.31 – 1.14	2.73	1.50 – 4.99
Non-smoker	1.00	Reference	1.00	Reference
Type of drinker				
Regular	4.54	1.66 – 12.39	2.54	1.15 – 5.61
Occasional	1.75	0.45 – 6.86	0.99	0.45 – 2.16
Former/abstainer	1.00	Reference	1.00	Reference
Ever injected non-prescription drugs				
Yes	3.71	---	N/A	
No	1.00	Reference		
Currently pregnant				
Yes	N/A		2.24	0.25 – 20.10
No			1.00	Reference
Took birth control pills in last 3 months				
Yes	N/A		2.70	1.35 – 5.43
No			1.00	Reference

*Ellipses indicate coefficients of variation greater than 100%.

Table 3.8 (continued)

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Age at first intercourse (years)				
≤ 15	1.24	0.49 – 3.13	3.81	1.92 – 7.56
> 15	1.00	Reference	1.00	Reference
Sexual intercourse in past 12 months				
Yes	1.16	---	1.76	0.61 – 5.06
No	1.00	Reference	1.00	Reference
Relationship lasting less than 12 months				
Yes	3.03	1.11 – 8.27	7.29	3.33 – 15.95
No	1.00	Reference	1.00	Reference
Number of partners in past 12 months				
≤ 1	1.00	Reference	1.00	Reference
≥2	6.07	2.36 – 15.60	10.27	4.65 – 22.67

*Ellipses indicate coefficients of variation greater than 100%.

Multivariate analysis. Among men, only two risk factors remained significantly associated with chlamydia in multivariate logistic regression (Table 3.9). Regular drinkers were five times more likely to report a history of chlamydia compared to non-drinkers, while occasional drinkers had no increased risk of reporting chlamydia in the past two years. Having two or more sexual partners in the 12 months preceding the interview remained strongly related to self-reported chlamydia. Although age did not remain significantly associated with the outcome, it was an important confounder for number of partners, reducing the adjusted odds ratio from 5.46 (95% CI: 2.11-14.13) to 4.53 (95% CI: 1.56-13.14) when age group was included in the model. There were no significant interaction terms in the model.

Table 3.9: Summary of multiple logistic regression analysis on factors associated with self-reported chlamydia, 1996-97 NPHS, men aged 15 to 59 (N=16,477).

Risk Factor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age 15 to 24 years	1.85	0.55 – 6.27	0.322
Age 25 to 34 years	1.21	0.46 – 3.22	0.701
Regular drinker	5.00	1.12 – 22.31	0.035
Occasional drinker	2.46	0.42 – 14.41	0.317
Two or more partners in the past 12 months	4.53	1.56 – 13.14	0.006

Among women, young age remained significantly associated with self-reported chlamydia (Table 3.10). However, the effect of age was confounded by age at sexual debut.

When age at first intercourse was included in the model, the adjusted odds ratio for women aged 15 to 24 years compared to those aged 35 to 59 years decreased from 4.04 (95% CI: 1.57-10.42) to 3.20 (95% CI: 1.24-8.22), while the risk for women aged 25 to 34 years was no longer significantly related to the outcome. Likewise, age at sexual debut decreased the effect of multiple partners, reducing its odds ratio from 6.0 (95% CI: 2.75-12.98) to 5.33 (95% CI: 2.37-12.01). Country of birth was also retained in the model, with women who were not born in Canada significantly less likely to report chlamydia than Canadian-born respondents.

Table 3.10: Summary of multiple logistic regression analysis on factors associated with self-reported chlamydia, 1996-97 NPHS, women aged 15 to 59 (N=17,174).

Risk Factor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age 15-24 years	3.20	1.24 – 8.22	0.016
Age 25-34 years	2.47	0.91 – 6.69	0.074
Country of origin other than Canada	0.22	0.07 – 0.62	0.005
Age at first intercourse ≤15 years	2.12	0.98 – 4.60	0.057
Two or more partners in the past 12 months	5.33	2.37 – 12.01	<0.001

3.3.2 Gonorrhea

Bivariate analysis. As shown in Table 3.11, because there was only a small number of cases (32 in men, 39 in women), the majority of the estimates had very high variability and there was not enough statistical power to test for differences between exposure groups. Nevertheless, there are some interesting trends to note. While there were no cases of gonorrhea reported among men aged 15 to 24 years, men who were aged 25 to 34 years tended to be more likely to report this STD than men aged 35 to 59 years. Among women, the highest period prevalences were found among those in the youngest age group. Like chlamydia, respondents who did not live with a partner or spouse at the time of the interview were more likely to report the disease, as were never and formerly married women and formerly married men.

Table 3.11: Bivariate analysis for self-reported gonorrhea, 1996-97 NPHS, using bootstrap weights.

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Gender	1.00	Reference	1.09	0.43 – 2.75
Age (years)				
15-24	0.00	---	2.36	0.01– 452.5
25-34	2.91	0.73 – 11.65	1.12	0.38 – 3.35
35-59	1.00	Reference	1.00	Reference
Marital status				
Married/Partner	1.00	Reference	1.00	Reference
Single	0.84	0.22 – 3.16	1.65	0.26 – 10.52
Widow/Div/Separated	4.12	---	1.98	0.43 – 9.06
Living with partner				
Yes	1.00	Reference	1.00	Reference
No	1.48	0.35 – 6.24	3.16	0.76 – 13.22
Country of origin				
Canada	1.00	Reference	1.00	Reference
Other	2.78	---	0.47	---
Race/Ethnicity				
White	1.00	Reference	1.00	Reference
Other	0.04	---	1.51	---
Income Level				
Lower	0.40	---	1.68	0.34 – 8.34
Middle	0.80	0.17 – 3.75	0.36	---
Upper	1.00	Reference	1.00	Reference
Regularly employed in past 12 months				
Yes	1.00	Reference	1.00	Reference
No	0.33	0.03 – 4.04	2.20	0.49 – 9.83
Educational level				
High school or less	1.00	Reference	1.00	Reference
Post-secondary	2.82	0.95 – 8.51	1.24	0.26 – 5.92
Currently in school				
Yes	0.35	---	2.34	---
No	1.00	Reference	1.00	Reference
Current smoking status				
Smoker	0.45	0.14 – 1.42	1.42	0.32 – 6.28
Non-smoker	1.00	Reference	1.00	Reference
Type of drinker				
Regular	2.23	---	1.00	0.20 – 5.14
Occasional	0.88	---	0.57	0.15 – 2.19
Former/abstainer	1.00	Reference	1.00	Reference
Ever injected non-prescription drugs				
Yes	7.17	---	N/A	
No	1.00	Reference		
Currently pregnant				
Yes	N/A		0.98	---
No			1.00	Reference
Took birth control pills in last 3 months				
Yes	N/A		0.29	---
No			1.00	Reference

*Ellipses indicate coefficients of variation greater than 100%.

Table 3.11 (continued)

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Age at first intercourse (years)				
≤ 15	1.85	0.46 – 7.43	0.41	0.003 – 59.4
> 15	1.00	Reference	1.00	Reference
Sexual intercourse in past 12 months				
Yes	N/A	"Yes" for all	0.55	0.13 – 2.34
No		respondents	1.00	Reference
Relationship lasting less than 12 months				
Yes	2.84	---	4.20	---
No	1.00	Reference	1.00	Reference
Number of partners in past 12 months				
≤1	1.00	Reference	1.00	Reference
≥2	3.91	---	1.78	---

*Ellipses indicate coefficients of variation greater than 100%.

Men who were White or born in a foreign country were somewhat more likely to report gonorrhea, while among women, respondents who were non-White or Canadian born were more likely to report this disease. There was also no clear pattern according to socio-economic status: while men and women respondents with higher levels of education were more likely to report gonorrhea, women who were not regularly employed in the preceding year or had low income adequacy reported the STD more frequently than their regularly employed, more affluent counterparts, while among men the reverse was true. Relationships lasting less than 12 months and having two or more partners in the past year were also related to increased reporting of the disease for both men and women, whereas early age at sexual debut was related to self-reported STD history among men but later sexual debut was related to gonorrhea for women. However, none of these relationships were significant in bivariate analysis, and no multivariate analyses were performed due to low statistical power.

3.3.3 Genital herpes

Bivariate analysis. Table 3.12 shows the crude odds ratios for the risk factors for genital herpes among men and women. Since only 70 cases of genital herpes reported among men, there was not enough statistical power to detect significant differences for any variables studied. However, genital herpes was reported more frequently among men who were aged 25 to 34 years,

foreign-born, had completed some post-secondary education, regular drinkers, had ever injected non-prescription drugs, had relationships lasting less than 12 months, and multiple partners in the year preceding the survey. In addition, men with low and middle income adequacy tended to report a history of genital herpes less frequently than men with high income adequacy.

Women were significantly more likely to report genital herpes than men, with a period prevalence of self-reported disease more than three times for women (0.83%) than men (0.23%), with a crude odds ratio of 3.53 (95% CI: 2.01-6.20). Bivariate analysis among women alone did show some significant differences between groups. Women who were aged 15 to 24 years were significantly less likely to report having had genital herpes in the two years preceding the survey than women aged 35 to 59 years, while respondents aged 25 to 34 years were almost three times more likely to report the disease than those in the oldest age group. Women who were born in a country other than Canada were less likely to report genital herpes, although this only approached significance (p=0.058). Like men, women of the lower income groups were also less likely to report genital herpes than their higher income counterparts, but this difference was not statistically significant. Regular drinkers were significantly more likely to have a history of genital herpes compared to non-drinkers, while for occasional drinkers this increase is only slight. Having a relationship lasting less than 12 months was related to an almost three-fold increase in the risk of reporting this STD, but this difference was not statistically significant (p=0.085). Lastly, women who reported first intercourse at 15 years or younger or who had two or more partners in the preceding year were about 3.6 times more likely to have a history of genital herpes, although only age at sexual debut was a statistically significant risk factor.

Table 3.12: Bivariate analysis for self-reported genital herpes, 1996-97 NPHS, using bootstrap weights.

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Gender	1.00	Reference	3.53	2.01 – 6.20
Age (years)				
15-24	0.08	---	0.71	0.31 – 1.67
25-34	2.19	0.89 – 5.37	2.93	1.32 – 6.48
35-59	1.00	Reference	1.00	Reference
Marital status				
Married/Partner	1.00	Reference	1.00	Reference
Single	1.00	0.41 – 2.43	1.65	0.70 – 3.90
Widow/Div/Separated	0.80	0.19 – 3.35	2.41	0.59 – 9.88
Living arrangement				
Living with partner	1.00	Reference	1.00	Reference
Not living with partner	1.10	0.47 – 2.59	1.65	0.71 – 3.80
Race/Ethnicity				
White	1.00	Reference	1.00	Reference
Other	1.05	---	0.70	0.16 – 3.00
Country of origin				
Canada	1.00	Reference	1.00	Reference
Other	1.73	0.57 – 5.27	0.27	0.07 – 1.05
Income Level				
Low to middle	0.35	0.10 – 1.25	0.53	0.16 – 1.81
Upper middle	0.42	0.13 – 1.36	0.74	0.23 – 2.45
Upper	1.00	Reference	1.00	Reference
Regularly employed				
Yes	1.00	Reference	1.00	Reference
No	1.02	0.29 – 3.60	1.68	0.72 – 3.90
Educational level				
High school or less	1.00	Reference	1.00	Reference
Post-secondary	1.91	0.91 – 4.01	0.91	0.35 – 2.39
Currently in school				
Yes	0.65	0.02 – 19.87	1.40	0.36 – 5.51
No	1.00	Reference	1.00	Reference
Current smoking status				
Smoker	0.81	0.36 – 1.81	1.06	0.43 – 2.66
Non-smoker	1.00	Reference	1.00	Reference
Type of drinker				
Regular	1.98	0.57 – 6.99	3.57	1.41 – 9.00
Occasional	1.23	0.26 – 5.77	1.29	0.45 – 3.72
Former/abstainer	1.00	Reference	1.00	Reference
Ever injected non-prescription drugs				
Yes	6.91	---	0.22	---
No	1.00	Reference	1.00	Reference
Took birth control pills in last 3 months				
Yes	N/A		1.46	0.51 – 4.18
No			1.00	Reference
Currently pregnant				
Yes	N/A		0.39	---
No			1.00	Reference

*Ellipses indicate coefficients of variation greater than 100%.

Table 3.12 (continued)

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Age at first intercourse (years)				
≤ 15	1.01	0.38 – 2.65	3.61	1.39 – 9.40
> 15	1.00	Reference	1.00	Reference
Sexual intercourse in past 12 months				
Yes	1.16	0.08 – 16.43	2.71	0.97 – 7.61
No	1.00	Reference	1.00	Reference
Relationship lasting less than 12 months				
Yes	2.18	0.65 – 7.27	2.81	0.87 – 9.09
No	1.00	Reference	1.00	Reference
Number of partners in past 12 months				
≤1	1.00	Reference	1.00	Reference
≥2	2.32	0.60 – 9.01	3.59	0.94 – 13.74

*Ellipses indicate coefficients of variation greater than 100%.

Multivariate analysis. A multivariate analysis for genital herpes among women showed that there were three risk factors independently associated with self-reported disease (Table 3.13). As in the bivariate analysis, women who were aged 15 to 24 years were somewhat less likely to report this STD compared to women age 35 to 59 years, while women aged 25 to 34 years were significantly more likely to have a history of genital herpes compared to this reference group. Regular drinkers were 3.6 times more likely to have self-reported genital herpes, and there was also a slight non-significant increase in self-reported disease among occasional drinkers. Lastly, early age at sexual debut was associated with a more than four-fold increase in reporting of genital herpes in the past two years. Other variables were not important confounders for these associations, and no substantial interactions on a multiplicative scale were detected.

Table 3.13: Summary of multiple logistic regression analysis on factors associated with self-reported genital herpes, 1996-97 NPHS, women aged 15 to 59 (N=15,003).

Risk Factor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age 15-24 years	0.37	0.12 – 1.11	.077
Age 25-34 years	2.37	1.00 – 5.66	.050
Regular drinker	3.60	1.42 – 9.13	.007
Occasional drinker	1.16	0.40 – 3.36	.783
Age at first intercourse ≤15 years	4.11	1.41 – 11.94	.009

4.3.4 Genital Warts

Bivariate analysis. Like gonorrhea and genital herpes, there was inadequate power to detect significant differences between exposure groups for men, with one exception: men who were aged 25 to 34 years were almost six times more likely to report a history of genital warts than men aged 35 to 59 years. Genital warts was also more frequently reported among male respondents who were not regularly employed, had low income adequacy, had at least some post-secondary education, were regular drinkers, had ever injected non-prescription drugs, had relationships lasting less than 12 months, and multiple partners in the past 12 months. Conversely, genital warts was slightly less common among men who were non-White, foreign-born, occasional drinkers, and had early age at first intercourse.

Women had a period prevalence of genital warts (0.52%) twice that reported by males (0.24%), and this difference approached significance (p=0.051). Unlike the other STDs, there was no relationship between age and self-reported genital warts. Women who had never been married were more likely to report this STD than married women, but this was only approached significance (p=.060). Immigrant status was significantly related to a decreased risk of self-reported genital warts, while non-White race was also related to a slightly decreased risk of the disease. Women who reported use of OCP in the three months preceding the interview were four times more likely to have a history of genital warts than non-users. Early age at first intercourse was also related to an increased risk of reported genital warts, but again this difference only approached statistical significance (p=0.057). Relationships lasting less than 12 months and number of partners in the preceding year were also significantly related to a history of genital warts among women.

Table 3.14: Bivariate analysis for self-reported genital warts, 1996-97 NPHS, using bootstrap weights.

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Gender	1.00	Reference	2.13	0.995 – 4.57
Age (years)				
15-24	2.20	0.80 – 6.10	2.90	0.79 – 10.59
25-34	5.74	1.88 – 17.51	1.88	0.68 – 5.17
35-59	1.00	Reference	1.00	Reference
Marital status				
Married/Partner	1.00	Reference	1.00	Reference
Single	0.98	0.32 – 3.01	2.65	0.96 – 7.28
Widow/Div/Separated	0.76	0.00 – 125.5	0.91	0.27 – 3.08
Living with partner				
Yes	1.00	Reference	1.00	Reference
No	1.10	0.38 – 3.19	1.77	0.73 – 4.30
Race/Ethnicity				
White	1.00	Reference	1.00	Reference
Other	0.79	---	0.69	0.05 – 9.66
Country of origin				
Canada	1.00	Reference	1.00	Reference
Other	0.46	0.02 – 12.71	0.33	0.13 – 0.80
Income Level				
Lower	1.31	0.37 – 4.71	1.95	0.75 – 5.50
Middle	1.08	0.32 – 3.66	1.89	0.69 – 8.41
Upper	1.00	Reference	1.00	Reference
Regularly employed in past 12 months				
Yes	1.00	Reference	1.00	Reference
No	1.63	0.64 – 4.14	1.57	0.61 – 4.08
Educational level				
High school or less	1.00	Reference	1.00	Reference
Post-secondary	1.59	0.64 – 3.97	0.79	0.27 – 2.34
Currently in school				
Yes	1.01	0.09 – 11.51	2.86	0.91 – 8.99
No	1.00	Reference	1.00	Reference
Currently pregnant				
Yes	N/A		0.62	---
No			1.00	Reference
Unknown			0.43	0.01 – 26.05
Current smoking status				
Smoker	1.14	0.41 – 3.12	1.69	0.66 – 4.35
Non-smoker	1.00	Reference	1.00	Reference
Type of drinker				
Regular	1.65	0.53 – 5.11	2.27	0.78 – 6.61
Occasional	0.42	0.01 – 32.12	1.82	0.59 – 5.60
Former/abstainer	1.00	Reference	1.00	Reference
Ever injected non-prescription drugs				
Yes	6.79	---	N/A	
No	1.00	Reference		
Took birth control pills in last 3 months				
Yes	N/A		4.01	1.47 – 10.91
No			1.00	Reference

*Ellipses indicate coefficients of variation greater than 100%.

Table 3.14 (continued)

Risk factor	Men		Women	
	OR	95% CI*	OR	95% CI*
Age at first intercourse (years)				
≤ 15	0.77	0.29 – 2.01	2.72	0.97 – 7.62
> 15	1.00	Reference	1.00	Reference
Sexual intercourse in past 12 months				
Yes	3.88	---	1.18	0.42 – 3.36
No	1.00	Reference	1.00	Reference
Relationship lasting less than 12 months				
Yes	1.83	0.62 – 5.41	2.43	1.04 – 5.69
No	1.00	Reference	1.00	Reference
Number of partners in past 12 months				
≤1	1.00	Reference	1.00	Reference
≥2	1.88	0.60 – 5.93	3.65	1.52 – 8.78

*Ellipses indicate coefficients of variation greater than 100%.

Multivariate analysis. As shown in Table 3.15, when the risk factors that were significantly related to self-reported genital warts in bivariate analysis were included in a multivariate model, none of the associations remained statistically significant mainly due to inadequate power.

Table 3.15: Multiple logistic regression model with factors associated with self-reported genital warts in bivariate analysis, 1996-97 NPHS, women aged 15 to 59 (N=17,169).

Risk Factor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Country of origin other than Canada	0.67	0.20 – 2.23	0.518
Oral contraceptive use in the past 3 months	2.86	0.89 – 9.22	0.079
Relationship lasting less than 12 months	0.89	0.24 – 3.33	0.866
Two or more partners in the past 12 months	2.74	0.65 – 11.66	0.172

4.3.2 Condom Use

The question of condom use in relationship(s) lasting less than 12 months was restricted to respondents not in the Alberta RDD sample who were married or living with a partner and reporting more than one partner in the preceding year and those who were unmarried with one or more partners in the past year (n=3,763). With this small sample size and the small number of cases, there was not adequate statistical power to detect significant difference between consistent and inconsistent users in reported STD. Since the variability for all measures was very high, the

95% confidence intervals for crude odds ratios are not presented. However, there are some (non-significant) trends worth noting when stratified by sex (Tables 7a and 7b in Appendix E). For males, inconsistent condom users had a period prevalence of chlamydia about 2.5 times greater than consistent condom users, whereas for females, "always" users were slightly more likely to report this STD. Similarly, genital herpes was greater than three times more likely to be reported by inconsistent condom users than by consistent users in males, with the reverse being true for females. The prevalence of gonorrhea in consistent condom users was about five times greater than for those who reported inconsistent use among both males and females, whereas genital warts was more frequently reported among men and women who reported inconsistent condom use.

The question of condom use at the "last time" was restricted to respondents not in the Alberta RDD sample who were reported having more than one partner in the past 12 months or who had only one partnership which lasted less than 12 months (n=4,250). Again, the statistical power to detect difference between groups was inadequate. The prevalence of STD according to condom use at last sexual encounter is shown in Tables 8a and b of Appendix E. The period prevalence of chlamydia was greater among men and women who did not report using a condom at last sexual encounter. Three cases of gonorrhea were reported by males who had also used a condom at their last sexual encounter, but no cases were reported by males who did not use a condom last time. For females, the number of gonorrhea cases is similarly low, with one case reported by a female who used a condom last time compared to two cases in females who did not. Similar to consistency of condom use, genital herpes was more than twice as likely among males who did not report condom use at last sexual encounter, but about half as likely in females. For genital warts, females who did not report condom use at last sexual encounter reported the disease about twice as often than those who did use a condom last time, whereas there was no notable difference among males.

4.0 DISCUSSION

4.1 Period Prevalences of the STDs

In the 1996-97 NPHS, the two-year period prevalences of self-reported chlamydia, gonorrhea, genital herpes, and genital warts among sexually experienced Canadians aged 15 to 59 years were less than 1% for both men and women (Table 3.3). There are three ways in which the validity of these estimates may be evaluated: comparison with other population-based surveys that rely on self-reported STD history, comparison of population estimates from the NPHS to cases reported to national surveillance systems, and comparison with clinic-based studies which utilise diagnostic tests to determine the point prevalence of STD.

A comparison of survey estimates of self-reported STD would be a useful approach to establishing the credibility of the estimates derived from the NPHS. However, there are no comparable population-based survey estimates made for the general Canadian population. The survey estimates can also be compared to data from U.S. population-based surveys, but a major limitation of this approach is that these surveys may not be generalisable to the Canadian population. As well, all surveys differ in terms of their overall purpose, target population, sample design, mode of data collection, eligibility criteria, operationalisation of measures, and choice of population denominator. The 1996-97 NPHS is also unique in that it asked about STD history in the preceding two years, while most other survey estimates available were based on either a self-reported one-year or lifetime history of STD.

As shown in Table 3.3, the two-year period prevalence of chlamydia was approximately 0.50% for both males and females in the 1996-97 NPHS. This is much lower than the reported lifetime prevalence of about 49% among women respondents of the 1998 CCS (Boroditsky et al., 1999); however, this large difference is probably due to differences in the time periods to which the questions referred, response bias associated with the two survey methods, and target populations. In the 1992 NHSLS, Laumann et al. (1994) found that the one-year period

prevalence of self-reported chlamydia was 0.50% among 3,159 sexually active men and women aged 18 to 59 years. Considering that the annual reported incidence of chlamydia in the U.S. is about twice that reported to Canadian surveillance systems (Division of STD Prevention, 1999; Health Canada, 1999), this appears to be comparable to the NPHS data.

The two-year period prevalence of gonorrhea in the 1996-97 NPHS sample was about 0.17% for both men and women. Gonorrhea is expected to be much lower than chlamydia because gonorrhea surveillance and control programmes are well established in Canada (Gully & Rwetsiba, 1991). This estimate was also much lower than the self-reported lifetime prevalence of gonorrhea in the 1998 CCS (Boroditsky et al., 1999). Using the same logic as before, if we consider that the annual incidence rate of reported gonorrhea in the United States is about eight times that reported to Canadian surveillance systems (Division of STD Prevention, 1999; Health Canada, 1999), this self-reported population estimate is higher than expected when compared to the 1992 NHSLS, which found a one-year period prevalence of 0.20% for men and women combined (Laumann et al., 1994).

The self-reported two year prevalence of genital herpes was 0.81% among women and 0.23% of males reported having had genital herpes in the past two years. There are few population-based estimates with which to compare these figures. However, this self-reported prevalence was much lower than found in the 1989-94 U.S. NHANES, where HSV-2 seroprevalence was 21.9% (Fleming et al., 1997) and in public health laboratories in the U.K., where almost 5% of all samples submitted by adults were HSV-2 seropositive (Vyse et al., 2000). Considering that Steben and Sacks (1997) estimated that the seroprevalence in the Canadian population falls between these two extremes, this again highlights the potential for either under-reporting by respondents, or given the high level of asymptomaticity of genital warts, the under-ascertainment of cases.

A history of genital warts within the past two years was reported by about 0.51% of female respondents of the 1996-97 NPHS and 0.24% of male respondents. This estimate is lower than the conservative national estimate of 1% made by Lytwyn and Sellors (1997) and much lower than the self-reported lifetime prevalence found in the 1998 CCS (Boroditsky et al., 1999).

Compared to surveillance estimates, the population estimate for self-reported chlamydia from the NPHS for men and women was significantly higher for older respondents, whereas the population total for female respondents aged 15 to 24 years was significantly lower than the number of cases reported to surveillance for this age group (Figure 3.1). For gonorrhea, NPHS population totals are also higher than surveillance reports among the older age groups (Figure 3.2). However, the number of cases in males aged 15 to 24 years was dramatically lower than expected from surveillance reports.

There are two potential reasons for these discrepancies. First, there may be under-reporting among young women for chlamydia. Self-presentation bias may strongly influence reporting among women because of the double-standard that supports the view that adolescent sexuality is acceptable for men but not for women (Catania, 1999). It is also possible that adolescents in the survey did not fully understand or were not fully informed about their STD diagnosis (Clark et al., 1997). Second, there may be differences in the populations covered by the survey and the surveillance system (Anderson et al., 1994). Older respondents may be more likely to visit family physicians, whose reporting may be less complete than in public clinics, which in turn are frequented by younger people (Johnson AM et al., 1996). Also, while it is possible that young men are under-reporting gonorrhea in the NPHS, it is also likely that many cases which are reported to surveillance occur in young men who are members of important gonorrhea core groups (groups of individuals which have high rates of infection and sex partner change) (Thomas & Tucker, 1996) which are out-of-scope for this survey, including military recruits, and residents of Indian reserves or correctional facilities.

There are three limitations to this approach. First, surveillance estimates count incident cases or separate episodes, so a single individual may be counted as a case in the two-year period any number of times, whereas survey data does not tell us how many episodes of an STD a person has had. The potential for double-counting may partly explain why in some cases surveillance estimates were higher than survey estimates. Second, the socio-demographic information collected by the surveillance system is limited to age, sex, and province; it would also have been useful to compare estimates stratified by income group, race, or marital status, for example, in order to see where reporting differences occur. Lastly, since genital warts and genital herpes are not reportable, it is not possible to compare these population estimates to other independent sources like surveillance.

Lastly, the self-reported period prevalences are much lower then the point prevalences reported in Canadian clinic-based studies for all four STDs because such studies use self-selected samples and diagnostic tests to detect sub-clinical and asymptomatic cases. In addition, the point prevalence estimates vary greatly among clinic-based studies because of differences in the socio-demographic characteristics and sexual behaviours between study samples, the eligibility criteria for testing, and the prevalence of disease in the underlying population.

In the absence of diagnostic testing with the interview, it is difficult to evaluate the validity of the period prevalences estimated from the NPHS because of a lack of comparable population-based data. Estimates derived from self-reports in U.S. household surveys can provide one basis for comparison, bearing in mind that demographic, cultural, and health care differences exist between the two populations. The comparison of aggregate totals from the NPHS to surveillance reports supports the possibility of under-reporting of chlamydia by adolescent females in the survey setting and under-reporting of chlamydia and gonorrhea to surveillance systems. The self-reported period prevalences are also much lower than point prevalences observed in clinic-based studies of specialized populations.

4.2 Risk Factors for the STDs

4.2.1 Chlamydia

The period prevalence of chlamydia was estimated to be roughly equal for men and women in the NPHS sample. However, in comparison, females in all age groups have higher incidence rates and number of cases of chlamydial infection reported to Canadian surveillance systems (Health Canada, 1999). For example, among women aged 15 to 24 years, the female-to-male surveillance case ratio in 1995-96 was 3.1, compared to 1.5 in the NPHS sample. A high female-to-male ratio would be expected because chlamydia, which is equally asymptomatic in both genders, is probably diagnosed more frequently in women because they come into contact with the health care system more often than men (Bolan et al., 1999). That chlamydia was reported in equal proportions in the NPHS again suggests that the survey estimates are probably influenced by under-reporting of STD history by young women.

Multivariate analysis showed that men who reported two or more partners in the preceding 12 months were 4.5 times more likely to report having had chlamydia in the past two years than men who did not have multiple partners during that time period (Table 3.9). While this was also a significant risk factor for infection in one previous study (Karam et al., 1986), it differs from Vincelette's Montreal study (1991). However, since the study subjects in the former study were asymptomatic men recruited from a hospital emergency room, this group was probably more representative of the general population than the latter, in which subjects were only recruited if they were either symptomatic, had multiple sex partners, or had sexual contact with a known case. As well, 87% of the subjects in Vincelette's study had more than one partner in the previous year, compared to only 11% of men in the NPHS sample.

One unique finding from this analysis was that regular drinkers were significantly more likely to report a recent history of chlamydia than abstainers and former drinkers. In a study of

STD clinic patients in Baltimore, Zenilman et al. (1994) did not find an increased risk of chlamydia among "frequent" drinkers. But again, their results are probably not generalisable, as STD clinic attenders, who make up only a small proportion of the general population, are more likely to have higher levels of alcohol consumption than non-attenders (Johnson AM et al., 1996). While alcohol use may not have a physiological connection to increased STD, it may be an indicator of direct risk behaviours. For instance, in the NPHS sample, Tables 3 and 4 in Appendix E illustrate that men and women respondents who were regular drinkers were significantly more likely to also report two or more sexual partners in the past 12 months than occasional drinkers, with a smaller proportion of non-drinkers reporting this behaviour. A similar pattern is also seen among men and women for reporting relationships lasting less than 12 months. As well, despite their potentially riskier lifestyles, consistent condom use in relationships lasting less than 12 months or at last intercourse was similar among regular drinkers, occasional drinkers, and non-drinkers for both men and women (Tables 5 and 6 in Appendix E). A similar pattern of risk-taking was demonstrated in the 1990 U.S. National Alcohol Survey: respondents who drank or were intoxicated more frequently were more likely to be sexually active and to have had more than one sexual partner in the previous year than non-drinkers, and the use of condoms was not associated with the use of alcohol during a sexual encounter (Leigh et al., 1994). As well, regular alcohol drinkers may simply be more willing to disclose the truth about their behaviour and STD histories because of more liberal attitudes and behaviours (Dunne et al., 1997). Further, it should be noted that occasional drinkers and non-drinkers were significantly less likely to report their chlamydia history than regular drinkers (Table 13 in Appendix E). This is important because if these respondents were systematically concealing a history of chlamydia, the association between regular drinking status and self-reported chlamydia may be over-estimated. One disadvantage of the NPHS is that no data are collected on substance-associated events. Rather than regular alcohol use as a risk marker, the

risk of transmission may be more directly affected by low levels of condom use and multiple partnerships in association with "binge drinking" (Shafer et al., 1993).

Age was an important confounder for number of partners among men. Younger men were significantly more likely to report a history of chlamydia (Table 3.8) as well as multiple partners in the past year (Table 3 in Appendix E) in simple analysis. The relationship between younger age chlamydial infection was demonstrated in other studies reviewed, and its relationship to number of partners has been well documented in a number of population-based surveys (Seidmen & Rieder, 1994). In addition, despite greater reported sexual activity, younger NPHS respondents were only slightly more likely to report consistent condom use in short-term relationships and at last intercourse (Table 5 and 6 of Appendix B).

Young age was a more important risk factor for self-reported chlamydia among women than men in the NPHS (Table 3.10). It was significantly associated with self-reported disease after adjusting for other variables, which echoes what has been shown in the literature. Interestingly, this relationship remains strong even after we consider the high level of under-reporting of chlamydia in the NPHS when compared to surveillance reports.

Women who were born in Canada were significantly more likely to report a history of chlamydia than respondents who were born in a foreign country. This is a unique finding which has a number of possible explanations. First, the NPHS represents a slightly lower number of immigrants than Census estimates (Table 3.1), which could be a result of a failure to recruit new immigrants for the second cycle, as discussed in Section 3.1.1. There may have also been greater unit non-response among these individuals. Although multi-lingual interviewers were available for the NPHS (Statistics Canada, 1997), if immigrants had had less experience with surveys in the past, they may have been reluctant to participate (Groves et al., 1992). Second, there may be reporting biases according to country of origin in the NPHS. While there was no significant difference between groups in non-response of chlamydia history (Table 13 in Appendix E),

immigrants were significantly less likely to partake in the sexual health section altogether (Table 9 in Appendix E). This pattern of partial non-response was also observed in the 1990 National Alcohol Survey (Leigh, 1993), which suggests that self-presentation bias may be operating among immigrants. This is probably a result of varying attitudes towards sex within these different cultures (van den Hoes et al., 1999). Alternatively, immigrants may not have understood the introductory question about their sexual experience. This language barrier was observed in the NABS II, in which Binson and Catania (1998) found that minority respondents were significantly more likely to report difficulty understanding the term "vaginal intercourse". Third, among complete responders, Canadian-born respondents may also be more sexually experienced than immigrants. Canadian-born men and women were significantly more likely to report early age at first intercourse, relationships lasting less than 12 months, and two or more partners in the past 12 months (although these latter differences were only significant for women) compared with immigrants. Therefore, since Canadian-born respondents have higher reported levels of sexual activity, it is not unexpected that they would also report higher levels of STD. Lastly, unintentional mis-reporting of STD history among immigrants may occur if their infections are undiagnosed. For instance, gender inequalities in developing countries have created reduced access to information and health care services for women, and they may also be less likely to seek care even in Canada because of the lower awareness of sexual health and the stigma attached to STD (van Dam et al., 1999; van den Hoek et al., 1999).

Young age at first intercourse was related to an increased risk of self-reported chlamydia among women in simple analysis, but this was not significant after adjusting for other factors, which is consistent with a number of primary studies reviewed. However, it was an important confounder for number of partners in the past year. Early sexual debut may be an indicator for the clustering of high-risk behaviours that cannot be captured by a single measure, including number of sexual partners, sex with high-risk partners, and drug and alcohol use (Greenberg et

al., 1992; Mott & Haurin, 1988). For instance, in the NPHS, men and women who reported early sexual debut were significantly more likely to also report relationships lasting less than 12 months, smoking, and a history of injection drug use, and those with two or more partners in the past 12 months were significantly more likely to report early age at first intercourse (Tables 2 to 4 in Appendix E). However, women were significantly more likely to not answer this question than men (Table 11 of Appendix E). If women with a history of chlamydia were systematically concealing a very young age at first intercourse, the association between age at first intercourse and chlamydia history may be underestimated in this analysis.

There were other findings consistent with the literature: self-reported chlamydia was significantly greater among unmarried respondents, respondents reporting casual relationships, and women who used OCP in the past three months in simple analysis only. As well, there were no significant associations between self-reported chlamydia and employment status, income adequacy, and level of education for men or women. There was also no discernible protective effect of condom use, although the sample sizes were small (Tables 7 and 8 in Appendix E).

4.2.2 Gonorrhea

Due to the small number of cases of self-reported gonorrhea, it was not possible to find significant differences between groups for the various risk factors (Table 3.11). Nevertheless, three interesting findings will be considered briefly. First, gonorrhea was reported in the same proportions as men and women in the 1996-97 NPHS, although surveillance reports showed a male-to-female ratio of 1.35 in 1995-96 (Health Canada, 1999). The dominance of male cases in surveillance is a result of different factors: greater symptomaticity among men (DeMaio et al., 1998), large numbers of men infected by small numbers of women (such as commercial sex workers), or greater levels of infection among men who have sex with men (Fox et al., 1998). The gender distribution observed in the NPHS is similar to estimates from 1996 U.S. surveillance

reports (Fox et al., 1998). Second, as discussed earlier, the age distribution in this sample was also not similar compared to surveillance reports: in 1995 and 1996, about 36% of reported gonorrhea cases in males were among those aged 15 to 24 years, compared to no self-reported cases in the NPHS, which again may be due to a sampling bias.

Third, there was no discernible "core group" identified in this sample, which is at variance with the large number of studies which have demonstrated that gonorrhea is usually concentrated among low SES, minority communities. There was no notable increase in the self-reported period prevalence among respondents who were of low income adequacy, not regularly employed, or non-Whites. This may be related to the representativeness of the survey, since the NPHS sampling frame systematically excludes groups that are often at higher risk: Aboriginals, military personnel, some rural communities, and people of very low SES (e.g., those without telephones or with no fixed address) (Jolly et al., 1995; Rothenberg & Potterat, 1988; Thomas et al., 1996).

4.2.3 Genital Herpes

Women were significantly more likely to report genital herpes than men in the NPHS sample, with a female-to-male period prevalence ratio of 3.52. This ratio is higher than observed in a number of U.K. and U.S. studies which used serological testing to identify cases of HSV-2 (Cowan et al., 1994; Fleming et al., 1997; Siegal et al., 1992). This gender differential may be attributed to under-ascertainment of infection status among men, because in addition to greater use of sexual health care by women, primary episodes of genital herpes cause more severe symptoms in females than males (Kinghorn, 1994).

The inverted U-shaped age distribution of self-reported genital herpes shown in this sample was similarly observed in the 1992 NHSLS (Laumann et al., 1994), the 1988-94 NHANES (Fleming et al., 1997), and several of the clinic-based studies reviewed. Women

respondents aged 25 to 34 years were significantly more likely to report a history of genital herpes than women aged 35 to 59 years, while those aged 15 to 24 years had the lowest reported period prevalence (Table 3.13). As discussed in the previous section, women who are older are more likely to be infected with HSV-2 probably because they have had a longer period of possible exposure to an infected partner. This pattern was also observed for men, although the number of cases was too small to detect significant differences between groups.

Similarly, early age at first intercourse was also associated with a four-fold increase in risk of self-reported genital herpes, after adjusting for other factors. Three other studies found a similar but weaker relationship, with early age at first intercourse associated with more than a two-fold increase in HSV-2 infection after adjusting for other socio-demographic and behavioural variables (Fleming, 1997; Kjaer, 1990; Siegal, 1992). In addition to being an indicator for other high risk behaviours, it also acts as a direct risk factor because women with early sexual debut have had a longer period of time in which they risk exposure to this chronic sexually transmitted infection.

Genital herpes was also significantly associated with regular alcohol consumption among women after adjusting for other variables. Occasional drinkers were only slightly more likely to report this STD than non-drinkers. This differed from Austin's study (1999) of women STD clinic attenders, but again this is a specialized population that may have higher levels of drinking than the general population. A significant relationship between alcohol use and HSV-2 seropositivity was found in simple analysis of the AMEN study, but this association did not remain after adjusting for other factors including age and number of lifetime partners (Siegal et al., 1992). Again, while this may be related to a tendency towards risk-taking behaviour or situational modification in substance-associated events, because it is a chronic infection, current drinking status may not necessarily reflect past sexual behaviour, and a cause-effect relationship is even more difficult to infer. This may also be the case for number of partners in the past year,

which was not significantly associated with self-reported genital herpes. As the literature review revealed, several studies have shown that number of lifetime partners is a more relevant risk factor for herpes infection.

Lastly, although previous studies have shown genital herpes to be concentrated in low SES, minority groups, there were no significant differences in self-reported period prevalence for neither men nor women according to race, country of origin, employment status, levels of education, or income adequacy. While this may again be related to sampling bias, it is also possible that respondents with core group characteristics are less knowledgeable about this STD. For example, in the 1988 NSFG, Anderson et al. (1994) found that only 74% of respondents who did not complete high school knew of genital herpes, compared to 90% of high school graduates and 95% of those with any post-secondary education. Similarly, only 76% of respondents who were at 150% below the poverty threshold had heard of the disease, compared to 92% of those above this level. Gibson et al. (1990), Becker et al. (1996), and Austin et al. (1999) also observed that Blacks and Hispanics tend to underreport a history of genital herpes despite being seropositive for HSV-2.

4.2.4 Genital Warts

The period prevalence of genital warts in women respondents of the NPHS was 2.2 times that estimated for men. This gender differential is greater than observed in two European studies (Persson et al., 1996; Simms et al., 1998), while male cases predominate in the U.S. NDTI (Franco, 1996). This is more likely to be an artefact of sampling bias rather than bias due to under-ascertainment among male respondents because of the high level of symptomaticity and visibility of this disease.

Due to the small number of cases of self-reported genital warts among men, it was not possible to find significant differences between groups for the various risk factors in simple

analysis (Table 3.14). There was one exception: genital warts was reported significantly more often among men aged 25 to 34 years compared to respondents aged 35 to 59 years. Among women, genital warts was reported by similar proportions of all age groups. This is different than previous studies, which have shown that younger men and women were significantly more likely have genital herpes (Evans, 1993; Habel et al., 1998; Hart, 1993; Kjaer et al., 1990; Ross et al., 1996; Wen et al., 1999). Like chlamydia, younger respondents may be more likely to under-report this STD.

As shown in the literature, genital warts was found in a diffuse population, with no significant relationships observed between the STD and employment status, income adequacy, and educational achievement. However, Canadian-born women were significantly more likely to report a history of genital warts than immigrants in simple analysis. Again, this may be a result of under-reporting or partial non-response by immigrants. Koutsky et al. (1988) also suggest that skin colour may affect the detectability of genital warts, although non-White respondents did not have a significantly greater risk of reporting this STD than White respondents in the NPHS sample.

Genital warts was reported significantly more often among women with multiple partners during the past year. This is at variance with Evans' study (1993) among 1,025 women at an STD clinic. However, the women sampled in this primary study reported greater numbers of sexual partners (approximately 35% had more than two partners in the past year), and are therefore not representative of the NPHS population. NPHS respondents who reported relationships lasting less than 12 months in the past year were also significantly more likely to report genital warts in simple analysis.

OCP use was significantly related to a four-fold increase in self-reported genital warts in simple analysis, but again this was not significant in multivariate analysis due to sample size limitations. A relationship between these two variables was also found in two other studies (Hart,

1993; Ross, 1996), and has been previously attributed to increased host susceptibility as a result of OCP use. Lastly, although smoking was shown to be significantly associated with genital warts in four case-control studies (Brisson et al., 1988; Daling et al., 1986; Munk et al., 1997; Wen et al., 1999), there was only a slight non-significant increase in the prevalence of self-reported disease among smokers compared to non-smokers for both genders.

4.2.5 Summary and Implications

There were some differences in the age and gender distributions of the STDs which were not expected, and this is probably a result of a combination of under-reporting and under-ascertainment of infection status and exclusion of some high-risk groups. However, the risk factors for self-reported chlamydia and genital herpes found in this analysis were similar to what has been reported in previous clinic-based and population-based studies, although the finding that regular alcohol use was related to an increased risk of STD was unique. Although there was limited statistical power to detect significant differences between groups for gonorrhea in men and women and for genital herpes for men, one interesting finding was the lack of the existence of "core groups" for these STDs, which is probably related to the representativeness of the sample.

This analysis has a number of implications for further study. First, unit non-response for the NPHS needs to be better understood, by collecting socio-demographic characteristics of non-respondents and reasons for non-participation. This would improve our assessment of the participation biases inherent in health surveys, and provide information on ways to better decrease non-response. In terms of the questionnaire design, our understanding of the sexual behaviour of the general population would be further improved if there were more in-depth questions. For example, while we know that reporting two or more partners in the past year is significantly related to self-reported chlamydia among men, we do not know if these multiple

partnerships are sequential or concurrent, commercial or not, the frequency of sex, the sexual practices engaged in, and the partner-specific contraceptive practices (Laumann et al., 1994). As well, the utility of the survey would be improved if the scope of the questions was expanded. For instance, condom use behaviours should be measured for all sexually experienced respondents. The development and use of a set of standardized items to assess risk behaviour would also be useful (Houston, 1998).

In terms of prevention strategies, the results highlight the need for sexual health education among adolescents, which addresses substance-associated sexual encounters and healthy partner choices. There is some evidence that early age at sexual debut may be modifiable (Kirby et al., 1994), which could have a positive impact on genital herpes and other STDs, but it is equally important to examine the determinants of early sexual debut, such as sexual abuse, in order to establish the best point of intervention. Another area of research that has been largely ignored in Canadian studies is the impact of alcohol use on STD risk.

4.3 Potential Limitations of the Study

4.3.1 Validity of Findings

Validity refers to the degree to which a measurement accurately reflects reality (Clark et al., 1997). Determining the validity of self-reported behaviours and STD history is difficult because the direct observation of sexual behaviours is impractical and possibly unethical (Catania et al., 1990a; Upchurch et al., 1991; Weinhardt et al., 1998). There are a number of other approaches to assess the validity of a sexual behaviour measurement, although there is still a need to develop a gold standard (Catania et al., 1990a). The validity of a retrospective measure in a survey can be tested by comparing it to events recorded by participants in daily or weekly diaries prior to the survey, with the assumption that events recorded in a diary are accurate. For instance, Graham and Bancroft (1997) found that in a group of 75 Scottish women, there was

substantial agreement between daily diaries and the frequency of intercourse in the previous month reported in the interview. In contrast, in a group of 48 adolescent females recruited from an STD clinic, Fortenberry et al. (1997) found that while there was little difference between number of partners and frequency of condom use in the past three months recorded in daily diaries and reported in a retrospective questionnaire, a substantially greater number of coital events was recorded in the diary than was identified in the questionnaire, while the reverse was true for the number of substance-associated coital events. Downey et al. (1995) found that in a study of 87 gay men, there was a significant association between the HIV-risk level of a behaviour and the average extent to which the behaviour was under-reported. Although such discrepancies may be attributed to a social desirability bias that can depend on which sexual behaviours are valued by a subject's peer group, Downey and colleagues have suggested that participants may unintentionally under-report certain high-risk behaviours because these behaviours are not consistent with their self-concept, particularly in an era of HIV prevention.

Inter-partner agreement is a weak indicator of validity for self-reported behaviours that cannot be corroborated otherwise (Padian et al., 1995). Paired *t*-tests of self-reports obtained from 71 couples attending Baltimore STD clinics demonstrated that partners were consistent in their reporting of number of episodes of vaginal intercourse, vaginal intercourse with condom use, and any type of sexual activity, and this agreement did not vary by age, marital status, socio-economic status, or educational level (Upchurch et al., 1991). However, in a study of 162 predominantly young, African-American heterosexual couples, agreement was moderate for reporting use of a condom the first time with the partner, use of condom ever with partner, and classification of partner as "new", and only slight for classification of partner type as regular or casual. Disagreement in inter-partner comparisons may be caused by differential measurement error, if one partner may be more subject to recall or social desirability bias or if perceptions of partners are divergent (van Duynhoven et al., 1999).

Self-reported STD history offers further complications because in addition to accurate reporting, it requires an individual to recognise symptoms (if present), seek care, be told the correct diagnosis, and remember it (Johnson AM et al., 1989). One method to validate both sexual behaviour and STD history is the use of medical records. For example, in a group of 540 adolescents, Shew et al. (1997) found that there was a significant association between more frequent condom use with the last two partners reported in questionnaires and the absence of STDs recorded in medical histories. In contrast, in a prospective cohort study of 598 patients at an STD clinic, similar proportions of "always" and "never" condom users were diagnosed with STD during the follow-up period (Zenilman et al., 1995). In addition to potential self-presentation bias, this discrepancy between expected and observed results may be a result of a differential by perceived risk; in other words, individuals who perceive themselves at high risk may be more likely to use a condom (Johnson AM et al., 1989). Such inconsistencies have also been seen for reports of STD history. Of 126 female patients at an adolescent clinic, 40% of participants inaccurately reported not having had an STD during the follow-up period of six months to one year in interviews, 9% reported fewer episodes than recorded in medical records, and 5% over-reported STD episodes (Clark et al., 1997). However, this approach assumes that medical records are complete and accurate. In a group of 211 pregnant women, women were significantly more likely to report an STD diagnosis in the past 12 months during the interview than was recorded by physicians in medical charts, which would seem to point to clinician mis-reporting or under-ascertainment (O'Campo et al., 1992a). Such physician under-reporting may be one possibility as to why surveillance reports were at times less than the self-reported population totals of STD history in this analysis.

The validity of self-reports of STD history in the NPHS could be improved through the use of diagnostic testing. For example, respondents of NHANES II and III were tested for HSV-2 (and HIV-1 in NHANES III) (Fleming et al., 1997; Johnson RE et al., 1989; McQuillan et al.,

1997). A recent pilot study using ligase chain reaction (LCR) to test urine samples showed that prevalence of chlamydial infection was high enough to justify including LCR in NHANES IV (Mertz et al., 1998). The 1995 NSAM also included urine tests for *C. trachomatis* and *N. gonorrhoeae* (Sonenstein et al., 1997). In addition to eliminating the need to rely solely on self-reported STD history, it can also be used to gauge the accuracy of these self-reports. But in addition to the considerable cost and logistical complexities, a limitation is that participation bias may determine which survey respondents are willing to undergo the medical examination. For example, in the 1988-1991 component of NHANES III, 83% of those selected were interviewed, 74% had some form of medical examination, and only 67% provided a sufficient blood sample (McQuillan et al., 1994). However, in the pilot test of *C. trachomatis* testing of urine samples in the NSAM, their analysis did not reveal any significant socio-demographic differences between those who gave samples and those who did not (Ku et al., 1997). As well, the sensitivity and specificity of the diagnostic test used must be considered in any analysis of risk factors from such prevalence studies (Schachter & Chow, 1995).

The validity of self-reported STD history and sexual behaviour may also be increased through the use of data collection modes that increase a respondent's privacy. Previous studies have shown that the anonymity and limited interviewer-respondent interaction in telephone interviews can reduce the effect of social desirability bias (Catania et al., 1990a; Johnson AM et al., 1989; Wiederman et al., 1994). Compared to face-to-face interviews, respondents tend to report higher levels of stigmatized or illicit activities, including sexual behaviours, and lower levels of normative behaviour in telephone interviews (Czaja, 1987; Hochstim, 1967). Other modes may also be applied to further decrease reporting biases. For instance, in audio computer-assisted self-interview (A-CASI) and telephone A-CASI, the respondent listens to an audio recording and records his or her answers directly on a computer. Previous pilot studies have shown that the use of this newer approach appears to encourage more complete reporting of

sensitive behaviours such as male-male sex, paid-for sex, and substance-associated sexual encounters (Catania et al., 1995; Turner et al., 1998). Pilot testing one of these modes of collection for subsequent cycles of the NPHS could simultaneously provide a quantifiable measure of the extent of reporting bias (thus yielding correction factors for future estimates based on self-reports), as well as a potential solution to the problem (Fu et al., 1998). As well, the questionnaire would also be enhanced if, like the 1988 NSFG, NPHS methodologists incorporated knowledge of the STDs to attempt to gauge the accuracy of the responses.

Although no investigations like those described have been performed to determine the reliability or validity of self-reported sexual behaviours or STD history for the NPHS, the methodologists did use a number of approaches that could help to improve the accuracy of responses, as discussed in section 2.2.3. In this analysis, the level of reporting of STD experience in the NPHS was evaluated by comparing the estimated number of cases with those reported to surveillance systems and the estimated period prevalences to point-prevalences determined in clinic-based studies. Although these data sources tend to cover different populations, these comparisons suggest that there was under-reporting of STDs by NPHS respondents. This under-reporting may be attributed to recall bias, self-presentation bias, and undiagnosed cases. As well, certain groups with documented higher levels of risk behaviours and prevalence of STDs, such as military recruits, prisoners, individuals on Indian reserves, and very low SES individuals (Ku et al., 1997), were under-represented in this survey.

The prevalences of self-reported sexual behaviours in the NPHS were consistent with those reported from previous Canadian population-based surveys, which lends some credibility to the self-reported measures in the NPHS, although there is a potential for consistent reporting bias for these behaviours across surveys. In terms of the relationships between these potential risk behaviours and STD status, systematic mis-reporting may change the strength of these associations or produce spurious associations, as discussed in preceding sections of this paper.

However, it is important to note that the associations identified in this study were largely congruent with those found in previous clinic-based studies that used diagnostic testing to identify cases. Nevertheless, with the multiple potential sources for respondent error in mind, the risk factors reported in this research, and in all other analyses using self-reported STD history, can only mean risks related to *reporting* an STD, and not necessarily for acquiring or being diagnosed with an STD.

4.3.2 Generalisability of Findings

An important consideration in interpreting the findings of this study is that the NPHS population as a whole appears to represent a higher proportion of Canadians with post-secondary education, and a lower proportion of individuals who were unmarried, immigrants, and of low socio-economic status when compared to Census statistics. This inconsistency is probably a result of a biased sample design and unit non-response rates that differ systematically across population sub-groups. As well, a comparison of partial non-responders with complete responders revealed significant differences in a number of socio-demographic and behavioural characteristics between these two groups, which also indicates that the responses may be systematically biased. Like validity, these multiple sources of bias therefore limit the generalisability of the results.

However, this may not necessarily be a disadvantage. Other data sources also have limitations: clinic-based studies focus on self-selected and usually higher risk groups (e.g. STD clinic populations) and surveillance systems rely on physician or laboratory reporting which may also be incomplete and/or subject to diagnostic biases. In contrast, the individuals interviewed in the NPHS may constitute a "low risk" sub-population not completely covered by either of these data sources. The prevalence of a number of sexual behaviours is comparable to what has been observed in previous Canadian surveys, which shows that there is an identifiable subset of higher

SES Canadians participating in health surveys that have low numbers of sex partners and somewhat low levels of condom use. As shown by the population estimates of self-reported STDs, this "low risk" subset does contribute a large number of cases to the national burden of disease. This is the sub-population to which these results are generalisable, and although not necessarily at high risk for disease, they do make up a large proportion of the general Canadian population. Taken together with studies of more specialised sub-populations and surveillance reports, the population-based survey helps to increase our understanding of STDs and sexual behaviours in the entire Canadian population.

One sub-population that should be better explored, however, are new immigrants: they were not recruited in the second cycle, were more likely to be partial non-respondents, may also have been more likely to be unit non-responders, and are usually not specifically addressed in clinic-based studies.

4.3.4 Potential and Limitations of the NPHS as the Basis for Etiological Research

Hill (1965) provided nine criteria that should be considered in attempting to distinguish causal from non-causal associations: strength of the association; consistency across different populations and different circumstances; specificity of a single cause leading to a single effect and vice versa; temporality of cause and effect; presence of a biological gradient or dose-response curve; biological plausibility; coherence with known facts of the natural history and biology of the disease; experimental evidence; and analogy to other cause-effect relationships. More recently, Susser (1991) summarised these criteria into an ascending hierarchy. The first criterion is association between causal factor (X) and the putative effect (Y), though not by chance, as judged by probability. Association is enhanced by strength and consistency upon replication. If association is present, then the second criterion, time order, can be tested, but this can only be judged with adequate access to observation of the relevant variables at the correct

times, which is dependent on the study design. Next, direction must be demonstrated by an asymmetry between X and Y, and also requires the presence of the following other factors. Consistency is persistence of association upon repeated tests and specificity is the precision with which one variable will predict the occurrence of another, to the exclusion of others. Predictive performance is the ability of a causal hypothesis to predict an outcome dependent on the initial association. Lastly, coherence can be subdivided into theoretical coherence, factual coherence, biologic coherence, and statistical coherence.

The NPHS can be used to test associations between a potential risk factor and the outcome. Susser (1988) provides a rule of thumb when considering statistical inference: if the criterion of statistical significance is not met and power is adequate, than the hypothesis that there is an association between exposure and outcome is likely false; if the criterion of significance is not met, but the power is lacking, the test is not null, but indeterminate; and if the criterion of significance is met, whether or not power is adequate, than the result is outside the present bound of chance and the hypothesis of association is supported. Therefore, although power is relatively low in this analysis, the issue of association can still be addressed in most circumstances. In fact, because of the sample size limitations, those risk factors that remained statistically significant in the multivariate models were strongly associated with the outcomes. These strong associations, reflected by their higher odds ratios, may be more likely to reflect a causal relationship because it is less likely that confounding variables not controlled for in the analysis are able to explain the association (Elwood, 2000; Susser, 1988). However, any other true causal factor may still be related to a small increase in risk because it may be one of a number of such factors operating (Elwood, 2000), but the reduced statistical power makes it difficult to evaluate the impact of these other potential risk factors. It is also important to consider the non-causal explanations for the relationship, including sources of bias, including sample representativeness, non-response and participation bias, and respondent error, and

confounding. While the issue of confounding has been dealt with to some extent in the data analysis, confounding by other potential risk factors not measured in the survey (e.g. frequency of intercourse, anal sex, commercial sex) could not be accounted for.

While the 1996-97 NPHS may be used to describe associations between an exposure and an outcome, its cross-sectional design limits its ability to exhibit temporality between cause and effect. For risk factors that are not fixed attributes like race or gender, it is not always clear if "determinants" influence behaviour, if behaviour influences "determinants", or if causality functions in either of these directions depending on other factors (Aral & Peterman, 1996; Flanders et al., 1992). For instance, many studies, including this analysis, have failed to find a clear relationship between current consistent condom use and reduced STD. With the cross-sectional design, it is not possible to determine whether current condom use is a result of a history of STD (such as if the respondent does not wish to transmit the disease to a partner) or if consistent condom use prevented the infection. Therefore, since the question of causality is indeterminate (Susser, 1988), the terms "correlate", "risk factor", or "risk marker" are used to describe variables related to self-reported STD, rather than the word "determinant". Longitudinal cohort studies are a more appropriate form of observational study for evaluating causality (Susser, 1991). However, the use of the longitudinal component of the NPHS could not be applied here because data had not been previously collected for the supplemental RDD sample of the second cycle. As well, the outcome is based on STD history in the past two years, while the time frames for other items vary from current (e.g. pregnancy status), past three months (e.g. OCP use), past 12 months (e.g. number of partners), and lifetime (e.g. injection of non-prescription drugs). Current information is probably too recent to be etiologically relevant, but it may still be useful as a proxy to past exposure (Rothman & Greenland, 1998b). This is reinforced by the finding that only a minority of men and women actually change their behaviour following a diagnosis of STD (O'Campo et al., 1992b; Payn et al., 1997; Warszawski & Meyer, 1998). This

issue may be resolved by framing questions in terms of the onset of symptoms or diagnosis of the STD, such as "Were you using condoms at every sexual encounter before you were diagnosed with the STD?", although this approach is still subject to recall bias (Peterman, 1995).

Therefore, although the issue of temporality is indeed a limitation of this analysis, studies like this are important for providing a picture of the health experience of the population at a specified time and to describe the characteristics of individuals who currently have or have the disease (Hennekens & Buring, 1987). In the absence of longitudinal data to determine the causal nature of these relationships, the usefulness of such cross-sectional data is two-fold: first, it immediately tells us what sub-groups have had the disease recently and therefore who we should consider screening, and second, it provides us with an opportunity to track changes in the prevalences of sexual behaviours over time, which have so far been lacking in Canadian research in this area.

4.3.5 Level of Analysis

Risk factors for STDs can be described at multiple levels. At the smallest level, the "physiological microenvironment" influences infectiousness and host susceptibility and includes microbiologic, hormonal, and immunologic factors. A person's socio-demographic characteristics and sexual, health, and substance abuse behaviours are potential risk factors or risk markers at the individual level. At the population or community level, economic, demographic, organizational, behavioural, and epidemiologic (including STD prevalence) characteristics of a population can have an impact on STD incidence, and interconnections between these societies can also determine the spread of the infection (Aral, 1994; Susser, 1996a; Wasserheit, 1994). The epidemiology of STDs is influenced by the interplay of factors at these various levels (Shiboski & Padian, 1996). Susser and Susser (1996b) suggest that what is traditionally known as chronic disease or "black box" epidemiology, which approaches both

analysis and prevention efforts at the level of the individual only, has been inadequate for controlling the spread of HIV because it largely ignores the social context of transmission, and this may apply to other STDs as well (Shiboski & Padian, 1996). A more appropriate approach may be to analyse determinants and outcomes at the different levels of organization (Susser, 1996a).

A few such approaches incorporate the social context of transmission. For example, prospective or retrospective studies of partners of discordant infection status provide information on the frequency, timing, and type of sexual contacts, but the level of analysis is still limited to the susceptible individual. A second approach involves an examination of sexual networks, which accounts for transmission within or between groups of susceptible individuals linked by exposure to one or more infectious index cases, although few empirical studies examining sexual networks have been published to date (Aral et al., 1999b; Shiboski & Padian, 1996). The advantage of these two approaches is that they account for the fact that the outcome of one person is dependent on the outcomes of his or her partner(s), which can improve the validity of risk assessment (Mackenbach, 1998). Neither of these approaches can be applied to the NPHS because information on the nature of sexual contacts and infection status of partners was not collected and, because of its sample design, it is very unlikely that persons within the same partnership were both included in the Health component of the survey.

A third approach incorporates group-level variables (Mackenbach, 1998). These studies may compare disease occurrence among groups distinguished by geographic area and by factors assumed to be homogeneous within areas, such as SES (Shiboski & Padian, 1996). This type of analysis has been used extensively to demonstrate the existence of gonorrhea core groups (Becker et al., 1998; Blanchard et al., 1998; Hamers et al., 1995; Lacey et al., 1997; Potterat et al., 1985; Rice et al., 1991; Rothenberg, 1983). In addition to the ecological fallacy, a disadvantage of this approach is that while some variables like SES may be best considered at the

group-level, this approach assumes the homogeneity of other potential risk factors, such as host susceptibility or frequency of sexual contact (Shiboski & Padian, 1996). The utility of this approach for use with the NPHS is also very limited because information on cluster and stratum membership are not accessible to the public and analyses at any level lower than the national level would have very high variability.

Therefore, although the analysis of this research is approached at the individual level only, the incorporation of higher level risk factors is limited by the NPHS sample design, the scope of the questions, and the small number of cases. However, all of these approaches can provide different perspectives on the spread of STDs and the possibilities for intervention.

5.0 CONCLUSIONS

The prevention and control of sexually transmitted diseases including chlamydia, gonorrhea, genital herpes, and genital warts, is a significant public health issue in Canada. However, there is a dearth of Canadian data, especially data that are representative of the general "low risk" population. Using the NPHS data, this research sought to address some of the gaps that exist in the knowledge of the STDs in Canada. There were two methodological issues considered to be critical to this research. First, the complex survey design was dealt with using the bootstrap method, which accounted for the various design features including stratification, multiple stages of selection, unequal probabilities of selection of respondents, and clustering in this study. However, an important limitation of this study was that the strong clustering effect and the small number of positive counts had a negative impact on the variance estimation, the statistical power of the analyses, and the accuracy of the confidence intervals.

Second, the multiple sources of non-sampling error were also addressed. It was demonstrated in this study that sampling bias and participation bias are existent in the survey, resulting in the over-representation of better educated, higher SES Canadians and the under-representation of generally high risk groups. The comparison of self-reported levels of STD experience to aggregate data and findings from previous clinic-based studies suggested under-reporting of STD history in the NPHS, and are likely a result of recall bias, self-presentation bias, and undiagnosed cases. The mis-reporting of stigmatised sexual behaviours is also an important issue to consider, although this has been a persistent problem for sexual behaviour research over the past forty years (Catania et al., 1990a).

To adequately address these limitations, there needs to be an evaluation of the validity of STD and sexual behaviour self-reports in the NPHS, as well as feasibility studies of ways to improve the validity of these self-reports, such as computer-assisted self-interviewing and diagnostic testing. A qualitative analysis of how the STD and sexual behaviour questions are

interpreted by respondents must also be undertaken as well in order to inform an investigator's interpretation of his or her research findings. Our understanding of the relationships between the STDs and potential risk factors would be enhanced by framing relevant sexual behaviour items with reference to the STD, increasing the scope of the questions rather than limiting items to only a subset of available respondents, and collecting more detailed information on other potential risk factors such as frequency and type of intercourse. Lastly, a more in-depth investigation of the potential bias from non-response is required to learn what necessary changes must be made for future surveys to be more representative of the general population.

A final caveat is that since this is a cross-sectional study, the associations between self-reported behaviours and STD history cannot be interpreted to be causal relationships, and can only be used to describe the characteristics of those individuals *reporting* the disease. For example, as a direct determinant of the reproductive rate of infection, having multiple sexual partners in the preceding year was consistently related to higher prevalences of STD among NPHS respondents. Canadian origin and regular alcohol consumption were potential indicators of a higher risk lifestyle that may increase STD risks for both men and women. Gender and age were also important correlates of STD history, playing roles as both direct risk factors influencing susceptibility to infection and as risk markers of higher risk sexual activity. Age at first intercourse may also be another useful point of intervention through its potential impact on direct risk factors such as number of sexual partners and cumulative exposure time. These findings help to reinforce the need for sexual health education for adolescents. The results also highlight another interesting area for further research: whether immigrant status is truly related to a lower risk of acquiring STD or if it is a matter of sampling bias, insufficient access to diagnostic facilities, refusal to seek care, or restrictive attitudes towards discussing sexual health.

Finally, despite the apparent limitations of this data source, this research is able provide some insight into the social and behavioural risk factors for STDs in the broader Canadian

population, which until now has been largely overlooked in the literature. Together with surveillance systems and clinic-based studies, the information from the National Population Health Survey and other population-based surveys can provide a clearer and more complete picture of the sexually transmitted disease problem in Canada.

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Appendix A:

Natural Histories of the Sexually Transmitted Diseases (STDs)

Table 1: Natural History of Chlamydia

Causative Agent	The trachoma biovar of *Chlamydia trachomatis*, an intracellular species of bacteria that was first isolated from the genital tract in 1959 (Schachter, 1999).
Incubation Period	7 to 21 days before symptoms appear (if present) (Stamm, 1999).
Symptoms & Sequelae	*Males:* Early symptoms include urethral discharge and dysuria, possibly leading to urethritis, epididymitis, and prostatitis. *Females:* Early symptoms include mucoprurulent discharge and hypertrophic ectopy. Chlamydial infection can cause cervicitis, urethritis, and barthinolitis. Complications of untreated infection can include perihepatitis and endometritis. Up to 30% of untreated infections may also lead to pelvic inflammatory disease (Rowley & Berkley, 1998). *Males and Females*: Fifty percent or more of males and females may be asymptomatic. Symptomatic pharyngeal or rectal infections can also occur. Untreated infections may also lead to arthritis (Reiter's syndrome). *Infants:* Infants passing through an infected cervix during birth may develop chlamydial ophthalmia or pneumonia within the first few weeks (Schachter & Alexander, 1998).
Transmission	*Routes of Transmission:* Sexual contact, mother-to-child transmission. *Transmissibility:* Chlamydia appears to be less contagious than gonorrhea. One study of individuals with dual infection of gonorrhea and chlamydia found that 45% of females and 30% of males whose sexual partners had chlamydia were infected (Lycke, 1980). A more recent study using PCR to detect *C. trachomatis* showed a nearly identical rate of transmission of 68%, with a significantly higher concordance rate than demonstrated by culture (Quinn et al., 1996).
Diagnosis	Cell culture (traditionally the Gold standard), direct fluorescent antibody (DFA), enzyme immunoassay (EIA); more recently, polymerase chain reaction (PCR) and ligase chain reation (LCR) are more sensitive than culture and are highly specific (LCDC Expert Working Group, 1998).
Treatment	Antibiotics (azithromycin 1 g orally in a single dose preferred for most adults) (LCDC Expert Working Group, 1998). Antibiotic resistance has not been shown (Schachter & Alexander, 1998).
Estimated Costs	The burden of illness estimate for women alone is approximately $41 to $123 million annually in Canada (Goeree & Gully, 1993). In the United States, the direct and indirect costs of treating chlamydia and its complications ranged from $668 to $1,514 million in 1994 (Siegel & Aral, 1999).

Table 2: Natural History of Gonorrhea

Causative Agent	*Neisseria gonorrhoeae*, a gram-negative diplococci first cultured in 1885 (DeMaio et al., 1998).
Incubation Period	*Males:* Usually 1 to 14 days, the majority developing symptoms within 2 to 5 days. *Females:* Approximately 10 days before symptoms appear (Hook, 1999).
Symptoms & Sequelae	*Males:* Early symptoms can include urethral discharge and dysuria, and can lead to urethritis and epididymitis. About 5% of males are asymptomatic. *Females:* Early symptoms can include increased vaginal discharge, dysuria, and abnormal menses, which can lead to cervicitis, urethritis, and barthinolitis. Approximately 50% of cases are asymptomatic. Ten to 20% of untreated cervical gonococcal infections can result in pelvic inflammatory disease which can cause infertility, ectopic pregnancy, and chronic pelvic pain. *Males and Females*: Anorectal infections can found in men reporting rectal intercourse and in approximately 30% to 50% of women with coexistent cervical infection. Although rare, other sequelae include pharyngeal infections, gonococcal perihepatitis, gonococcal ophthalmia, disseminated gonococcal infection, and gonococcal endocarditis and meningitis. *Infants:* Infection during pregnancy can result in spontaneous abortion, premature rupture of fetal membranes, premature delivery, and neonatal infections of the eye and pharynx (DeMaio et al., 1998; Hook, 1999; Ronald & Peeling, 1993).
Transmission	*Routes of transmission:* Sexual contact, mother-to-child transmission. *Transmissibility:* Following a single act of intercourse, the risk of acquiring infection for a male is about 20% (Holmes et al., 1970), compared to 50% to 90% risk for a female (Platt et al., 1983).
Diagnosis	Culture (Gold standard), Gram stain. Non-culture techniques include EIA, PCR and LCR, but these are less widely available (LCDC Expert Working Group, 1998).
Treatment	Antibiotics (cefixime 400 mg orally in a single dose preferred for most adults) plus dual treatment for chlamydial and other non-gonococcal infections. However, resistance to penicillin and/or tetracyclines is growing worldwide (LCDC Expert Working Group, 1998).
Estimated Costs	The burden of illness estimate for women alone is approximately $43 million annually (Goeree & Gully, 1993). In the United States, the direct and indirect costs of treating gonorrhea and its complications ranged from $791 and $1,050 million in 1994 (Siegel, 1999).

Table 3: Natural History of Genital Herpes

Causative Agent	Predominantly herpes simplex virus type 2 (HSV-2); less commonly type 1 (HSV-1).
Incubation Period	2 to 21 days (LCDC Expert Working Group, 1998)
Symptoms & Sequelae	*Males and Females:* Primary episodes can last three to four weeks and involve ulcerations at or near the site of inoculation, including external genitalia, pubis, perineum, and perianal regions, cervix, anus or urethra, as well as dysuria, fever and myalgia (Corey, 1999; LCDC Expert Working Group, 1998). First episode symptoms are generally more severe in women than in men (Kinghorn, 1994). Primary HSV-2 infections can cause complications including pharyngitis, autonomic nervous system sacral radiculopathy, benign aseptic meningitis, or disseminated infection (Brugha et al., 1997; Corey & Wald, 1999). More than 60% may have no history of symptoms (Koutsky et al., 1990; Mertz et al., 1985). Prior HSV-1 infection may confer partial immunity, resulting in a reduction of clinical symptoms of subsequent HSV-2 infections (Boucher et al., 1990; Corey & Spear, 1986; Gibson et al., 1990; Steben & Sacks, 1997). Genital herpes is chronic and non-curable and most morbidity is from painful recurrences (LCDC Expert Working Group, 1998). *Infants:* Primary infection during pregnancy may result in spontaneous abortion, prematurity, intrauterine infection and fetal growth retardation, while symptomatic or asymptomatic shedding of virus from primary or recurrent episodes during labour may cause neonatal herpes (Boucher et al., 1990; Brown et al., 1997; Martin & Ison, 2000).
Transmission	*Routes of Transmission:* HSV-1 is transmitted chiefly via non-genital contact, but can be transmitted through sexual contact to cause genital herpes. HSV-2 is most commonly transmitted through sexual contact (Stanberry et al., 1997). Intrauterine transmission is less common, and HSV can also be transmitted to the infant during delivery (LCDC Expert Working Group, 1998). *Transmissibility:* In a prospective couple studies, the acquisition rate of genital herpes (HSV-1 or -2) was 16.9% in couples with a male source partner and 3.8% of those with a female source partner. In addition to symptomatic shedding from lesions, asymptomatic shedding can occur and is responsible for 60% to 70% of virus circulation and spread of genital herpes (Lowhagen et al., 1990; Mertz et al., 1985; Mertz et al., 1992).
Diagnosis	Culture (Gold standard which allows for typing the viral strain), PCR, and HSV antigen detection by EIA or DFA (Corey & Wald, 1999; LCDC Expert Working Group, 1998).
Treatment	Although HSV infection is incurable, treatment with antivirals (such as acyclovir or famcyclovir) is useful in reducing symptoms, complications, and virus shedding in primary and recurrent episodes. Chronic suppressive treatment with antivirals can reduce frequency and severity of recurrences and asymptomatic virus shedding (LCDC Expert Working Group, 1998).
Estimated Costs	In the United States, the direct and indirect costs of treating genital herpes including neonatal infections was approximately $178 million in 1994 (Siegel, 1999).

Table 4: Natural History of Genital Warts

Causative Agent	Most commonly caused by human papilloma virus (HPV) types 6 and 11, but can also be caused by HPV types 42-44 and 54 (Koutsky & Kiviat, 1999).
Incubation Period	2 to 3 months (LCDC Expert Working Group, 1998).
Symptoms & Sequelae	*Males and Females:* There are four morphological types that canoccur on ano-genital skin and/or mucous membranes: condyloma acuminata that are cauliflower-shaped, dome-shaped papular warts, thick keratotic genital warts, and flat-topped papules (Beutner et al., 1998). Symptoms other than growths are rare (Koutsky & Kiviat, 1999). Genital warts caused by low-risk HPV types are rarely associated with cancer. Genital warts may fluctuate in size and number and tend to regress spontaneously (80% experience complete clearance). They may also recur even after treatment (LCDC Expert Working Group, 1998; Schiffman & Burk, 1997). *Infants:* Perinatal transmission may cause development of condylomata during the first few weeks of life (Koutsky & Kiviat, 1999).
Transmission	*Routes of Transmission:* Sexual contact. Perinatal transmission of genital warts is infrequent (LCDC Expert Working Group, 1998). *Transmissibility:* One study found that 64% of 88 partners of individuals with genital warts developed warts within nine months, and that newly developed warts were more infectious than older lesions (Oriel, 1971).
Diagnosis	Direct examination with hand lens or colposcope. HPV DNA typing of genital warts is possible but not useful for management (Beutner et al., 1998; LCDC Expert Working Group, 1998).
Treatment	Treatments do not guarantee cure of HPV infection. Cryotherapy, topically applied antimitotics such as podofilox, electro-surgery, and laser surgery are options for wart removal depending on the type and size of lesion (Beutner et al., 1998; LCDC Expert Working Group, 1998).
Estimated Costs	In the United States, the direct and indirect costs of treating genital warts was approximately $2,878 million in 1994 (Siegel, 1999).

Appendix B:

Summary of Canada and U.S. Population-Based Studies with Sexual Behaviour and STD History Content

Survey	Year	Survey Mode and Sample Description	Response Rate (%)	Number of Respondents	Level of Sexual Behaviour Content [a]
Canada					
Health Promotion Survey (HPS) (Willamson, 1993)	1990	Random digit dialling (RDD) telephone survey; respondents living in households in provinces aged ≥15 years	78	13,792	Low
Ontario Health Survey (Kasenda et al., 1997)	1990	Random multistage stratified cluster sample of individuals living in households; interviewer-administered questionnaire for household, self-administered questionnaire (SAQ) for in-depth health items	Interviewer: 88 SAQ: 77	61,239	Moderate
British Columbia Adolescent Health Survey (Houston, 1998)	1992	School-based interview of students grades 7 through 12	74	15,549	Moderate
Canada Health Monitor #11, 13 and #16 (CHM) (Houston, 1998)	1994 1996 1997	National telephone survey; respondents aged ≥15 years	--- --- 49.1	--- --- 2,592	Moderate
National Population Health Survey (NPHS) (Statistics Canada, 1995; Statistics Canada, 1997)	1994-95 1996-97	Face-to-face (FTF) and telephone interviews *General*: National household sample excluding military bases, Indian reserves, and institutions *Health*: Selected member of each household *Supplemental* (includes sexual health section, 1994-95 only): Core sample of longitudinal respondents aged ≥12 years	1994-95: General: 88.7 Health: 96.1 Supplement: 90.6 1996-97: General: 82.6 Health: 95.6 (excludes RDD-child)	 20,725 17,626 14,786 210,377 81,804	Low
Canadian Contraception Study (CCS) (Boroditsky et al., 1999)	1998	National mail survey of females respondents aged 15-44 years randomly chosen from a panel of households pre-recruited by a marketing firm	55	1,599	Moderate

[a] Sexual behaviour content classified as:

low: small number of sexual behaviour questions as part of a larger general health survey;
moderate: part of a general health survey, with a larger number of questions including more in-depth questions (e.g. condom use by partner type, type of sexual activity);
high: main focus of survey is sexual health and STD history, questions are in-depth.

Survey	Year	Survey Mode and Sample Description	Response Rate (%)	Number of Respondents	Level of Sexual Behaviour Content [a]
United States					
National Survey of Family Growth (NSFG) (Mosher & Aral, 1991)	1988 1995	FTF interview for sexual behaviour items, SAQ for other data; female participants of the National Health Interview Survey, aged 15 to 44 years	79 79	8,450 10,847	Moderate
General Social Survey (GSS) (Smith, 1992; Turner et al., 1995)	1988 1989 1991	FTF interview with SAQ for sexual behaviour supplement; full probability surveys of adults living in households	Overall: 77.3 (1988) 77.6 (1989) 74.0 (1990) 73.9 (1991) Supplement: 93.9 (1988) 91.2 (1989) 85.5 (1990)	1988: 1,481 1989: 1,537 1990: 1,372 1991: 1,517	Low
National Alcohol Survey (Ericksen & Trocki, 1994)	1990	FTF interview; multistage area probability sample of the adult household population aged ≥18	70.3	2,058	Low
National AIDS Behavioural Survey (NABS) (Catania et al., 1992; Turner, 1999)	1990 1991	Telephone survey; respondents aged 18 to 75 years with oversampling of Black and Hispanic respondents aged 18 to 49 years	65 66.0	10,630 13,690	High
National Survey of Men (NSM) (Tanfer, 1993)	1991	FTF interview; males aged 20 to 39 years with oversampling of Black males	69.9	3,321	High
National Survey of Women (NSW) (Tanfer et al., 1995)	1991	FTF interview; females aged 20 to 37 years with oversampling of Black females	71	1.669	High
National Health and Social Life Survey (NHSLS) (Laumann et al., 1994)	1992	FTF interview with SAQs for sensitive subjects; English-speaking residents of households, aged 18 to 59 years	78.6	3,432	High
National Health and Nutrition Examination Survey (NHANES) (Fleming et al., 1997; Korn & Graubard, 1999)	1976-80 1988-94	FTF interview plus medical examination; national household sample	73 82.5	27,801 33,994	Low
National Survey of Adolescent Males (NSAM) (Ku et al., 1993; Sonenstein et al., 1997; Turner et al., 1997)	1988 1991 1995	SAQ (1988), audio computer-assisted self-interview (1995); males aged 15 to 19 years living in households	73.9 89.0 74.7	1,880 1,676 1,741	High
Youth Risk Behaviour Survey (YRBS) (Kann et al., 1996)	1995	SAQ; national high school-based surveys	60	10,904	Low

Appendix C:

Summary of Risk Factors for The Sexually Transmitted Diseases

Methods

In order to determine the risk factors for the four sexually transmitted diseases, a MEDLINE search was conducted to find relevant epidemiological studies. The reference lists from retrieved articles were manually searched in order to find further relevant studies. Studies were included in the review if they met the following criteria: primary research examining socio-demographic and behavioural risk factors associated with gonorrhea, chlamydia, genital herpes (HSV-1 or HSV-2), or genital warts (or HSV type 6/11 infection) using multivariate analysis; published in 1985 or later; and study subjects 12 years and older. As well, the study site had to be located in Canada, the United States, Australia, New Zealand or Europe, because the epidemiology of gonorrhea in developed countries is very distinct from that in developing countries due to differences in health care accessibility, public sector resources, health care-seeking behaviours, and gender inequalities (van Dam et al., 1999). Studies which exclusively compared repeat cases of these infection with initial cases were excluded from this review in order to make comparisons between studies more meaningful; all other studies compared individuals who were infected with the STD of interest to individuals who were not infected.

TABLE 1. Description of studies of chlamydia

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
U.S., 1985	Harrison	Cross-sectional	University clinic	162 females	Consecutive non-pregnant patients	Culture
U.S., 1985	McCormack	Cross-sectional	University clinic	431 females	Consecutive patients	Culture
U.S., 1986	Handsfield	Cross-sectional	2 family planning clinics	1,059 females	Consecutive patients who have had intercourse, ≥14 years	Culture
U.S., 1986	Karam	Cross-sectional	Hospital emergency room	85 males	Asymptomatic, heterosexual, sexually active in past 3 months, ≥18 years	Culture
U.S., 1987	Addiss	Cross-sectional	4 family planning clinics	335 females	Patients having a pelvic exam	Direct fluorescein antibody (DFA)
U.S., 1989	Oh	Cross-sectional	1 teen family planning clinic	376 females	Consecutive patients, 12 to 18 years	Culture
U.S., 1989	Phillips	Cross-sectional	4 private practices, 1 hospital-based OB-GYN practice	1,141 females	Consecutive on-pregnant patients having a routine pelvic exam, 18 to 50 years	Culture
U.S., 1990	Addiss	Cross-sectional	2 family planning clinics, 1 community health centre	849 females	Patients having a pelvic exam	Culture
Denmark, 1990	Bro	Cross-sectional	29 general practices	577 females	Non-pregnant women complaining of discharge or having a pelvic examination	Culture
U.S., 1990	Johnson BA	Cross-sectional	University clinic	2,271 females	Patients having a pelvic exam	Culture
U.S., 1990	Malotte	Cross-sectional	University clinic	1,320 females	Patients having a pelvic exam	Enzyme immunoassay (EIA)
Canada, 1990	Pereira	Cross-sectional	STD clinic	247 females	Consecutive patients	Culture
Netherlands, 1990	Thewessen	Cross-sectional	STD and abortion clinics	1,052 females	Consecutive patients	Culture
U.S., 1990	Winter	Cross-sectional	4 family planning clinics	889 females	Consecutive patients attending for physical examination or contraceptive counselling	EIA
Canada, 1991	Masse	Cross-sectional	1 primary health clinic	717 females	Patients having a pelvic exam, excluding those presenting specifically for an STD or who have taken antibiotics in past 6 weeks	Culture
Sweden, 1991	Rahm	Cohort	1 adolescent clinic	301 females	Sexually active adolescent attenders	Culture
U.S., 1991	Rietmeijer	Cross-sectional	STD clinic	438 males	Men who did not have conventional clinical indications for chlamydial treatment	EIA
Canada, 1991	Vincelette	Cross-sectional	23 provider sites†	2,018 females 838 males	Symptomatic or history of contact with known or suspected partner or history of multiple partnerships or presenting for an abortion	EIA
Australia, 1992	Hart	Cross-sectional	STD clinic	3,533 females	Consecutive sexually active patients	EIA
U.S., 1992	Hook	Cross-sectional	STD clinic	400 females 400 males	Consecutive patients	Culture
U.S., 1992	Humphreys	Cross-sectional	22 family planning clinics	11,793 females	Consecutive patients	EIA
Sweden, 1992	Ramstedt	Cross-sectional	Family planning clinics	5,785 females	Consecutive patients, ≤25 years	Culture

TABLE 1 (continued)

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
Canada, 1992	Sellors	Cross-sectional	2 family planning clinics	1,002 females	Patients having a pelvic examination, ≥16 years	Culture or EIA
U.S., 1992	Weinstock	Cross-sectional	4 family planning clinics	1,348 females	Consecutive patients attending for physical examination or contraceptive counselling who were not screened in the past year, 13 to 50 years	DFA
U.S., 1993	Addiss	Cross-sectional	5 family planning clinics	1,757 females	All patients having a pelvic exam	DFA (nonurban) EIA (urban)
United Kingdom, 1993	Evans	Cross-sectional	Genitourinary medicine (GUM) clinic	1,025 females	Consecutive, new attenders	Culture
U.S., 1993	Han	Cross-sectional	10 provider sites†	1,531 females	Different criteria at sites	Culture
Australia, 1993	Hart (a)	Cross-sectional	STD clinic	6,125 females 12,170 males	Consecutive patients	EIA
Australia, 1993	Hart (b)	Cross-sectional	STD clinic	7,992 males	Consecutive patients	EIA
U.S., 1993	Stergachis	Cross-sectional	2 primary care clinics	1,804 females	Symptomatic or having a pelvic exam in clinic A or randomly chosen at clinic B, 15 to 34 years	Culture
U.S., 1994	Anderson	Cross-sectional	National Survey of Family Growth	8,450 females	Household-based sample, 15 to 44 years	Self-report
Netherlands, 1994	Prins	Cohort	STD clinic	234 females 155 males	Consecutive patients, heterosexual, reported ≥5 partners in the past 6 months, ≥18 years	Culture
Canada, 1995	Jolly	Cross-sectional	Public health lab reports	400 females	Random sample of those tested at public health laboratory	EIA
Sweden, 1995	Jonsson	Cross-sectional	Population-based survey	611 females	Living in catchment area and 19, 21, 23, or 25 years	DFA
U.S., 1995	Ellen	Cross-sectional	Public health lab reports	1,974 males and females	All non-repeat cases reported to the San Francisco Department of Public Health, 12 to 20 years	Not known
U.S., 1996	Finelli	Cross-sectional	5 STD, 5 family planning and 5 college health clinics	5,128 females	Patients presenting for a pelvic examination or symptoms, 12 to 29 years	EIA
U.S., 1996	Gershman	Cross-sectional	52 family planning clinics	12,926 females	Patients having a pelvic exam, presenting for symptoms, a history of risk, or a recent contact with a partner with STD	Nucleic acid hybridization
U.S., 1996	Mosure	Cohort	160 family planning clinics	26,921 females	Sexually active patients having a pelvic examination who were tested for chlamydia on two or more occasions between 1988 and 1992, 15 to 19 years	DFA
U.S., 1997	Han	Cross-sectional	4 family planning clinics	8,920 females	Patients having a pelvic examination or presenting symptoms	EIA

TABLE 1 (continued)

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
U.S., 1997	Marrazzo	Cross-sectional	12 provider sites†	4,968 females 5,150 males	Consecutive patients, ≥12 years	Ligase chain reaction (LCR)
U.S., 1997	Mosure	Cross-sectional	160 family planning clinics	148,650 females	Sexually active patients having a pelvic examination, 15 to 19 years	DFA
Netherlands, 1997	Van Duynhoven	Cross-sectional	STD clinic	1,288 females 1, 696 males	Consecutive patients	Culture and nucleic acid hybridization
U.S., 1998	Burstein (a)	Cohort	Family planning, STD and school-based clinics	3,202 females	Consecutive patients, 12 to 19 years	PCR
U.S., 1998	Burstein (b)	Cohort	3 middle school clinics	188 females	Consecutive patients	LCR
U.S., 1998	Neu	Case-control	2 family planning clinics	4,190 women	Women who were tested for chlamydia and for whom medical records were available, ≤30 years	EIA or DNA hybridization
United Kingdom, 1998	Oakeshott	Cross-sectional	30 general practices	1,049 females	Consecutive patients attending for a cervical smear test, <35 years	EIA
Denmark, 1999	Munk	Cross-sectional	Population-based survey	522 females	Randomly selected from a population-based cohort, 20 to 29 years	Polymerase chain reaction (PCR)
Belgium, 1999	Vuylsteke	Cross-sectional	17 school medical centers	1,433 females	Students due for medical check-up, ever had intercourse, 16 to 18 years	LCR

TABLE 2. Risk factors for chlamydia in females*

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	OCP use	Age at first intercourse	Number of partners in past year	Casual partner	Barrier contra-ceptive use
1985	Harrison	*		-					+				
	McCormack	-		+	-				-		-		-
1986	Handsfield	+	*	-						-	*		+
1987	Addiss	+	-	-		-			-		-		
1989	Oh								+				
	Phillips	*	-	+	-	*				*			*
1990	Addiss	+	*	*					*	*	+		*
	Bro	+							*				*
	Johnson			-					-				
	BA												-
	Malotte	+	-						*				-
	Pereira	+	-						+	-			-
	Thewessen	+							*				-
	Winter	+		-					*				*
1991	Masse	+							-		-		
	Rahm						+		-		*		
	Vincelette	+									+		
1992	Hart	+	*	+	-				+				
	Hook	+								-	-	-	
	Humphreys	+							-		+		+
	Ramstedt	+			*							+	+
	Sellors	*			*	*							
	Weinstock	+	+	*					-				+
1993	Addiss	+							-		+		+
	Evans	+	*	*					*	*	+		-
	Han	+		-					+				
	Hart (a)	+	-	-	-				+				
	Stergachis	+	+	+	*	-	-		-		+		-
1994	Anderson	-	-	-	-					-			
	Prins	+											
1995	Jolly	+		+	-								
	Jonsson	-	*		*	*	*	*		+	*	*	*
	Ellen ‡			+	-								

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 2 (continued)

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	OCP Use	Age at first intercourse	Number of partners in past year	Casual partner	Barrier contra-ceptive use
1996	Finelli	+		*									-
	Gershman	+		+									
	Mosure			+					+				+
1997	Van Duynhoven	+	+						+				+
	Han	+		+					-				
	Marrazzo	+		-									-
	Mosure			+					+				+
1998	Burstein (b)												+
	Burstein (a)												-
	Neu	*	*		-	-			*	*			
	Oakeshott	+		+							+		-
1999	Munk	+											-
	Vuylsteke	*	*							*	*		*

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 3. Risk factors for chlamydia in males*

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	Age at first intercourse	Number of partners in past year	Casual partners	Barrier contra-ceptive use
1986	Karam	+	-	-		-			-	+		
1991	Vincelette	+								-		
	Reitmeyer	+		-								-
1992	Hook	-									+	
1993	Hart (a)	+	+	-	-							
	Hart (b)	+	+	-	-							
1994	Prins	-	-									
1995	Ellen ‡			+	-							
1997	Van Duynhoven	+	+								*	+
	Marrazzo	*		+								+

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.
‡ Analysis combines male and female study subjects.

TABLE 4. Description of studies of gonorrhea

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
Canada, 1985	Allard	Cross-sectional	Physicians' offices participating in a programme for treating STDs in high-risk groups	715 females 2,429 males	New asymptomatic patients	Culture
U.S., 1988	Phillips	Cross-sectional	OB/GYN hospital services	1,441 females	Patients receiving pelvic examinations, 18 to 50 years	Culture
Canada, 1990	Pereira	Cross-sectional	STD clinic	247 females	Consecutive patients	Culture
U.S., 1990	Upchurch	Cross-sectional	STD clinic	194 females 413 males	Consecutive patients	Culture
U.S., 1991	Aral	Cross-sectional	STD clinics	426 females 488 males	Consecutive patients	Culture
Canada, 1991	Vincelette	Cross-sectional	23 provider sites†	2,018 females 838 males	Patients with symptoms compatible with an STD; a history of sexual contact with a person known or suspected to have chlamydial infection in the past year; or a history of more than one sexual partner or of a nonexclusive relationship; or were presenting for voluntary termination of pregnancy	Culture
Australia, 1992	Hart	Cross-sectional	STD clinic	3,510 females	Consecutive patients, first episode only	Culture
U.S., 1992	Hook	Cross-sectional	STD clinic	400 females 400 males	Consecutive patients	Culture
U.K., 1993	Evans	Cross-sectional	Genito-urinary medicine (GUM) clinic	1,025 females	Consecutive new patients	Culture
Australia, 1993	Hart (a)	Cross-sectional	STD clinic	6,125 females 12,170 males	Consecutive patients, first episode only	Culture
Australia, 1993	Hart (b)	Cross-sectional	STD clinic	7,992 males	Consecutive patients, first episode only	Culture
Canada, 1995	Jolly	Cross-sectional	Laboratory records	400 females	Random sample of specimens tested at public health laboratory	Culture
U.S., 1994	Anderson	Cross-sectional	National Survey of Family Growth	8,450 females	Household-based sample, 15 to 44 years	Self-report

TABLE 4. (Continued)

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
U.S., 1995	Ellen	Cross-sectional	Dept. of Public Health reports	1,938 males and females	All non-repeat cases of Black and White adolescents, 12 to 20 years, reported to San Francisco Department of Public Health	Culture
U.S., 1996	Gershman	Cross-sectional	Public and private family planning clinics	12,296 females	*All clinics:* Patients attending for intrauterine device (IUD) insertion; signs of mucopurulent cervicitis or pelvic inflammatory disease (PID); sexual contact with a partner with gonorrhea or nongonococcal urethritis; or requesting testing *Private clinics:* Multiple recent sex partners; a history of gonorrhea, chlamydia, or PID; or current IUD use	Culture
Yugoslavia, 1997	Bjekic	Case-control	City dept. for skin & venereal diseases	212 females 788 males	*Cases:* Symptomatic patients with gonorrhea *Controls I:* Patients presenting with genitourinary infections other than gonorrhea *Controls II:* Patients presenting for various skin diseases	Culture
U.K., 1997	Lacey	Cohort	Hospital-based STD clinic	11,416 males and females	Patients residing in the catchment area with culture-confirmed cases of gonorrhea during 1989-93	Culture
U.K., 1997	Low	Cross-sectional	11 GUM clinics	646 females 1,332 males	Patients diagnosed with gonorrhea, first episodes only, 15 to 59 years	Culture
U.S., 1997	Mertz	Cross-sectional	60 provider sites†	44,366 females	Patients who were pregnant, had PID, had known exposure to a STD, or were undergoing test of cure were excluded	Culture
Netherlands, 1997	Van Duynhoven	Cross-sectional	STD clinic	1,288 females 1,696 males	Consecutive patients	Culture
U.S., 1998	Burstein (b)	Cohort	3 middle school clinics	170 females	Consecutive patients	Culture

†A combination of sites, which may include any of the following: family planning clinics, private physician offices, OB/GYN clinics, emergency rooms, hospital outpatient clinics, correctional centers, student health centers, adolescent clinics, abortion clinics, or STD clinics.

TABLE 5. Risk factors for gonorrhea **in females†**

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	OCP Use	Smoking status	Type of drinker	Age at first intercourse	Number of partners in past year	Casual partners	Condom use
1985	Allard ‡	+											
1988	Phillips	*	*	*	+	*				+			-
1990	Pereira	*	-							*			-
	Upchurch	+										-	+
1991	Aral	+		-							-		
	Vincelette	+									-		-
1992	Hart	+	-	+	-								
	Hook	+										-	
1993	Evans	+	*	+							+		-
	Hart (a)	+	-	+	-								
1994	Anderson	-	+	+	+					+			-
1995	Ellen ‡			+	+								
	Jolly	+		+	-								
1996	Gershman	+		+									
1997	Bjekic	+	-		*	+			-	-	+	*	*
	Lacey	+		+	+								
	Low	+		+	+								
	Mertz	+	+	*									
	Van Duynhoven	-	+				-						-
1998	Burstein												+

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 6. Risk factors for gonorrhea **in males†**

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	Age at first intercourse	Number of partners in the past year	Casual partners	Condom use
1985	Allard ‡	+										
1990	Upchurch	-									+	-
1991	Aral	+		+						+		
	Vincelette	*								-		-
1992	Hook	+									*	
1993	Hart (a)	*	-	+	-							
	Hart (b)	*	*	+	*							
1995	Ellen ‡			+	+							
1997	Bjekic	-	-		*	+		*	-	*	+	+
	Lacey	+		+	+							
	Low	+		+	+							
	Van Duynhoven	-	+								+	+

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 7. Description of studies of genital herpes

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
United States, 1989	Johnson RE	Cross-sectional	Population-based survey	4,201 males and females	Random sub-sample of respondents giving serum samples for the National Health and Nutrition Examination Survey 1976-80.	ELISA
Greenland & Denmark, 1990	Kjaer	Case-control	Population-based survey	1,600 females	Random sample.	EIA
United States, 1990	Breining	Cross-sectional	Family planning clinics	4,527 females	Consecutive patients ≥17 years old.	Immunodot assay
United States, 1990	Gibson	Cross-sectional	University student population	518 females 554 males	Random sample of university freshman and seniors >18 years.	EIA
United States, 1992	Siegel	Cross-sectional	Community-based random household survey	611 females 601 males	Currently unmarried residents of 16 census tracts of San Francisco, 20 to 44 years.	EIA
United Kingdom, 1993	Evans	Cross-sectional	Hospital-based genitourinary medicine (GUM) clinic	1,025 females	Consecutive patients with clinical indications (erosion or ulcerations) of anogenital herpes.	Clinical diagnosis by a physician
Australia, 1993	Hart (a)	Cross-sectional	STD clinic	6,125 females 10,170 males	Consecutive patients.	EIA
Australia, 1994	Bassett	Case-control	STD clinic	300 males	Consecutive heterosexual patients.	Complement fixing antibody
United Kingdom, 1994	Cowan	Cross-sectional	Hospital-based GUM clinic	Clinic: 486 males, 347 females Blood donors: 708 males, 639 females	Patients attending at systematically selected sessions for a new clinical problem and who were having a blood sample taken for other reasons. Consecutive blood donors were also recruited.	Western Blot assay
United States, 1995	Oliver	Cross-sectional	Family medicine clinic	315 females 185 males	Randomly selected non-pregnant patients who spoke English, between 18 and 45 years.	Western Blot assay
United States, 1996	Becker	Cross-sectional	Gynaecology clinics	595 females	Non-pregnant Hispanic and non-Hispanic white women between 18 and 40 years, recruited from a case-control study of cervical dysplasia. Multivariate analysis included only those with normal Pap smears.	EIA
United States, 1997	Fleming	Cross-sectional	Population-based survey	6,687 females 6,407 males	All respondents of the National Health and Nutrition Examination Survey 1988-94 with serum samples.	Immunodot assay
United States, 1997	Rosenthal	Cross-sectional	Adolescent clinic and Job Corps site	265 females 134 males	Patients selected if positive culture for any STD or randomly selected from clinic roster, 12 to 22 years.	ELISA

Table 7 (continued)

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
The Netherlands, 1998	van de Laar	Cross-sectional	STD clinic	580 females 1,099 males	Consecutive patients.	EIA
United States, 1999	Austin	Cross-sectional	STD clinic	1,101 females	Patients between ages 18 and 34 years who were not pregnant or planning to become pregnant in the next 6 months and who have not had a hysterectomy.	EIA

TABLE 8. Risk factors for HSV-2 / genital herpes in females†

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	OCP use	Age at first intercourse	Number of partners in the past year	Casual partner	Condom use
1989	Johnson RE‡	+	+	+	*								
1990	Breining	+		+	+	-							
1990	Gibson‡	*		+	*					*			
1990	Kjaer	+					-		-	+			-
1992	Siegal	+		+	-	+		+					
1993	Evans	-	-	-						+			-
1993	Hart (a)	-	+	-	-								
1994	Cowan‡			+						-			
1995	Oliver ‡	+	-	+	+	*							
1996	Becker	+					-		-	+			-
1997	Fleming‡	+	*	+	+	+				*			
1997	Rosenthal	*		+									
1998	van de Laar‡			+						-		-	-
1999	Austin	+		+	-		-	-		+			-

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 9. Risk factors for HSV-2 / genital herpes in males†

Year	Primary Aurthor	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	Age at first intercourse	Number of partners in the past year	Casual partner	Condom use
1989	Johnson RE‡	+	+	+	*	*						
1990	Gibson‡	*		+	*							
1992	Siegel	+		-	-	+		+				
1993	Hart (a)	+	+	-	-		+					
1994	Cowan‡			+					-			-
1994	Bassett	-				+						
1995	Oliver ‡	+	-	+	+	+						
1997	Fleming‡	+	*	+	+				*			*
1997	Rosenthal	*		-								
1998	van de Laar‡			*			-		*		-	*

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 9. Description of studies of genital warts

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
United States, 1986	Daling	Case-control	Community-based	49 female cases and 196 female controls	Sample drawn from a case-control study of infertility	Self-report
Canada, 1988	Brisson	Case-control	Hospital-based colposcopy clinic	136 female cases and 137 female controls	*Cases:* Females under 50 years with histologically confirmed cervical condyloma. *Controls:* Non-pregnant females under 50 years who had never been treated for cervical condyloma, cervical neoplasia, or any type of cancer.	Clinical diagnosis
Greenland & Denmark, 1990	Kjaer	Case-control	Population-based survey	1,600 females	Random sample.	DNA hybridization of HPV 6/11
United Kingdom, 1993	Evans	Cross-sectional	Hospital-based genitourinary medicine (GUM) clinic	1,025 females	Consecutive patients.	Clinical diagnosis by a physician
Australia, 1993	Hart (a)	Cross-sectional	STD clinic	6,125 females 10,170 males	Consecutive patients.	Clinical diagnosis by a physician
United Kingdom, 1996	Ross	Case-control	GUM clinic	429 female cases 418 female controls	*Cases:* First episode of genital warts, HIV-negative, age 15 years and older. *Controls:* Randomly selected patients attending over the same time period, HIV-negative, age 15 years and older.	Clinical diagnosis
Denmark, 1997	Munk	Case-control	Recruited from a cohort drawn from the Central Person Registry	1,820 female cases 9,018 female controls	*Cases:* Women aged 20-29 years with a history of genital warts. *Controls:* Women aged 20-29 years without a history of genital warts.	Self-report
United States, 1998	Habel	Case-control	Population-based, recruited from a health maintenance organisation	149 female cases 133 female controls	*Cases:* Diagnosed with genital warts, age 18 years and older. *Controls:* Randomly selected patients attending over the same time period with no history of genital warts, age 18 years and older, matched by clinic, age group and gender	Clinical diagnosis by a physician
United States, 1998	van den Eeden	Case-control	Population-based, recruited from a health maintenance organisation	179 male cases 188 male controls	*Cases:* Diagnosed with genital warts, age 18 years and older. *Controls:* Randomly selected patients attending over the same time period with no history of genital warts, age 18 years and older, matched by clinic, age group and race	Clinical diagnosis by a physician

Table 9 (continued)

Location and Year of Publication	Primary Author	Study Design	Study Site	Study Subjects	Eligibility Criteria	Primary Method of Detection
Australia, 1999	Wen	Case-control	Sexual health centre	977 male and female cases 977 male and female controls	*Cases:* First episode of genital warts, excluding those with cervical intraepithelial neoplasia or HPV-unspecified diagnosis. *Controls:* Patients without genital warts, matched by sex and date of attendance.	Clinical diagnosis

TABLE 10. Risk factors for genital warts in females†

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	OCP use	Smoking Status	Type of drinker	Age at first intercourse	Number of partners in the past year	Casual partners	Condom use
1986	Daling				-	-	-	+					
1988	Brisson	-						+		-			
1990	Kjaer	+					+	-		-			-
1993	Evans	+	-	-						-	*		-
	Hart	+	+	-	-								
1996	Ross	+			-		+						
1997	Munk	*	-		-	-	*	+		*			-
1998	Habel	+	+	-	+	-	-	-		-			-
1999	Wen	+	+		+			*	*				+

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

TABLE 11. Risk factors for genital warts in males†

Year	Primary Author	Age	Marital status	Race	Socio-economic status	Education level	Smoking status	Type of drinker	Age at first intercourse	Number of partners in the past year	Casual partners	Condom use
1993	Hart	+	+	-	-							
1998	van den Eeden		+	-	-	-	-	-	+			+
1999	Wen	+	-		-		+	*				+

† Key: +, positive correlation, statistically significant in multivariate analysis; *, positive correlation, statistically significant in single factor analysis only; -, no correlation; blank space, not determined.

‡ Analysis combines male and female study subjects.

Appendix D:

1994-95 National Population Health Survey Questionnaire: Sexual Health Section

AHS-Q4
SVP6_4

Overall, how would you rate the *availability* of health care services in your community? (READ LIST. MARK ONE ONLY.)

1 Excellent
2 Good
3 Fair
4 Poor

AHS-Q5
SVP6_5

Overall, how would you rate the *quality* of health care services in your community? (READ LIST. MARK ONE ONLY.)

1 Excellent
2 Good
3 Fair
4 Poor

AHS-Q6
SVP6_6

How difficult is it for you to get the health care services that you need? (READ LIST. MARK ONE ONLY.)

1 Very easy
2 Easy
3 A bit difficult
4 Very difficult

AHS-C7

If UTIL-FLAG=1 (i.e. if UTIL-Q1=1 or if any UTIL-Q2 > 0), go to AHS-Q7. Otherwise, go to next section.

AHS-Q7
SVP6_7

Overall, how would you rate the quality of any health care *you* received in the past 12 months? (READ LIST. MARK ONE ONLY.)

1 Excellent
2 Good
3 Fair
4 Poor
5 DIDN'T RECEIVE ANY HEALTH CARE SERVICES

Sexual Health (HPS)

(Non-proxy only and persons aged 15 to 59 years of age)

SSH-INT

I would like to ask you a few personal questions about sexual behavior because of its importance to personal health and social problems. You can be assured that anything you tell me will remain confidential.

SSH-Q1
SHS6_1

Have you ever had sexual intercourse?

1 YES
2 NO (Go to next section)
DK, R (Go to next section)

SSH-Q2 How old were you when you first had sexual intercourse?

SHS6_2

__ ENTER AGE (MIN: 10; warning before 12) (MAX: current age)

SSH-Q3 In the past 12 months have you had sexual intercourse?

SHS6_3

1 YES
2 NO (Go to SSH-Q8)
DK, R (Go to next section)

SSH-C4 If Alberta RDD, go to SSH-Q8.

SSH-Q4 With how many different partners?

SHS6_4

1 1 PARTNER
2 2 PARTNERS (Go to SSH-Q6)
3 3 PARTNERS (Go to SSH-Q6)
4 4 OR MORE PARTNERS (Go to SSH-Q6)
DK, R (Go to SSH-Q8)

SSH-C5 If married, common-law or living with a partner, go to SSH-Q8.

SSH-Q5 Did this relationship last 12 months or longer?

SHS6_5

1 YES
2 NO (Go to SSH-Q7)

GO TO SSH-Q8

SSH-Q6 Did any of these relationships last less than 12 months?

SHS6_6

1 YES
2 NO (Go to SSH-Q7A)
DK, R (Go to SSH-Q8)

SSH-Q7 For that(these) relationship(s) that lasted less than a year, how often did you use a condom in the past 12 months?

SHS6_7

(READ LIST. MARK ONE ONLY.)

1 Always (Go to SSH-Q8) (SSH-Q7A=1was filled during processing)
2 Usually
3 Occasionally
4 Never (Go to SSH-Q8) (SSH-Q7A=2 was filled during processing)
DK, R (Go to SSH-Q8)

SSH-Q7A Did you use a condom the last time?

SHS6_7A

1 YES
2 NO

SSH-Q8 *SHS6_8*

Do you currently have, or in the past 2 years, have you had any of the following sexually transmitted diseases ... chlamydia?

1 YES
2 NO
DK, R (Go to next section)

SSH-Q9 *SHS6_9*

... gonorrhea? (transmitted sexually)

1 YES
2 NO

SSH-Q10 *SHS6_10*

... syphilis? (transmitted sexually)

1 YES
2 NO

SSH-Q11 *SHS6_11*

... genital warts? (transmitted sexually)

1 YES
2 NO

SSH-Q12 *SHS6_12*

... genital herpes? (transmitted sexually)

1 YES
2 NO

SSH-Q13 *SHS6_13*

... Hepatitis B? (transmitted sexually)

1 YES
2 NO

SSH-Q14 *SHS6_14*

... HIV/AIDS? (transmitted sexually)

1 YES
2 NO

SSH-C15

If male, go to SSH-Q16.

SSH-Q15 *SHS6_15*

.. pelvic inflammatory disease? (transmitted sexually)

1 YES
2 NO

SSH-Q16 *SHS6_16*

... any other sexually transmitted disease?

1 YES (SPECIFY)
2 NO (Go to next section)

Appendix E:

Supplementary Tables

CHARACTERISTICS OF RESPONDENTS REPORTING RISK FACTORS

Table 1: Socio-demographic characteristics of 1996-97 NPHS female respondents aged 15 to 49 years reporting use of oral contraceptive pills (OCP) in the three months preceding the survey.

Characteristic	Proportion (%) Reporting OCP Use	95% Confidence Intervals
TOTAL	19.49	18.35, 20.63
Age group		
15-24	48.33	44.50, 52.15
25-34	25.07	22.87, 27.27
35-49	4.73	3.91, 5.56
Marital status		
Married/Common law	9.18	8.27, 10.10
Single	36.28	33.88, 38.57
Widow/Divorce/Separated	11.58	8.62, 14.53
Living arrangement		
With partner	12.36	11.17, 13.54
Not with partner	29.80	27.59, 32.01
Country of origin		
Canada	21.65	20.37, 22.93
Not Canada	7.94	6.48, 9.39
Race		
White	20.56	19.35, 21.77
Non-White	8.55	6.25, 10.85
Highest level of education		
≤High school	16.19	14.31, 18.07
Post-secondary	21.25	19.78, 22.72
Income adequacy		
Low	19.62	16.46, 22.78
Middle	18.48	16.35, 20.62
High	19.92	18.02, 21.82
Current smoker		
Yes	20.38	18.23, 22.53
No	19.06	17.72, 20.41
Type of drinker		
Regular	24.27	22.47, 26.06
Occasional	16.87	14.95, 18.80
Former/abstainer	10.28	8.31, 12.25
Number of partners in the past 12 months	17.68	16.46, 18.91
≤1	41.94	34.90, 48.97
>1		
Relationship lasting less than 12 months		
Yes	41.31	35.20, 47.47
No	27.69	25.03, 30.36

Table 2: Socio-demographic characteristics of 1996-97 NPHS respondents reporting age at first intercourse 15 years or less.

Characteristic	Proportion (%) Reporting Age at First Intercourse ≤15 Years			
	Males	95% Confidence Intervals	Females	95% Confidence Intervals
TOTAL	19.55	18.37, 20.72	13.72	12.67, 14.78
Age group				
15-24	31.37	27.85, 34.88	34.81	31.27, 38.34
25-34	21.55	19.27, 23.84	16.54	14.30, 18.79
35-59	15.62	14.20, 17.04	6.73	5.83, 7.63
Marital status				
Married/Common Law	9.05	8.17, 9.94	4.49	3.91, 5.08
Single	11.08	10.11, 12.04	8.97	8.05, 9.90
Widow/Divorce/Separated	1.83	1.47, 2.20	1.90	1.12, 2.39
Living arrangement				
With partner	16.10	14.63, 17.57	9.35	8.32, 10.38
Not with partner	24.59	22.54, 26.65	20.58	18.59, 22.56
Country of origin				
Canada	20.44	19.14, 21.74	15.28	14.05, 16.51
Not Canada	15.08	12.40, 17.76	5.90	3.88, 7.91
Race				
White	19.86	18.60, 21.11	14.11	13.01, 15.22
Non-White	16.68	13.14, 20.22	9.92	6.23, 13.62
Highest level of education				
≤High school	25.85	23.74, 27.95	18.03	16.12, 19.94
Post-secondary	16.06	14.80, 17.31	11.31	10.11, 12.51
Income adequacy				
Low	28.67	24.43, 32.91	21.81	18.73, 24.89
Middle	20.96	18.41, 23.51	14.69	12.48, 16.90
High	17.13	15.66, 18.60	11.07	9.50, 12.65
Current smoker				
Yes	28.42	26.50, 30.34	22.97	21.04, 24.91
No	14.48	13.13, 15.82	9.51	8.43, 10.58
Ever injected non-prescription drugs				
Yes	57.87	44.98, 70.76	35.24	19.89, 50.59
No	18.21	16.94, 19.49	11.96	10.88, 13.04
Type of drinker				
Regular	19.92	18.56, 21.29	14.16	12.56, 15.77
Occasional	20.71	17.69, 23.73	15.06	13.37, 16.74
Former/abstainer	16.26	13.35, 19.18	10.94	8.91, 12.97
Number of partners in the past 12 months				
≤1	17.65	16.35, 18.95	12.78	11.77, 13.79
>1	38.19	33.35, 43.03	36.24	30.28, 42.20

Table 3: Socio-demographic characteristics of 1996-97 NPHS respondents reporting two or more partners in the past 12 months.

Characteristic	Proportion (%) Reporting Two or More Partners in the Past 12 Months			
	Males	95% Confidence Intervals	Females	95% Confidence Intervals
TOTAL	10.47	9.52, 11.42	5.93	5.27, 6.59
Age group				
15-24	26.97	23.62, 30.33	19.21	16.19, 22.24
25-34	13.01	10.79, 15.22	6.82	5.34, 8.31
35-59	5.20	4.17, 6.24	1.97	1.52, 2.43
Marital status				
Married/Common Law	1.04	0.62, 1.47	0.56	0.30, 0.82
Single	22.29	20.25, 24.33	14.16	12.35, 15.96
Widow/Divorce/Separated	23.23	18.19, 28.26	9.78	7.41, 12.15
Living arrangement				
With partner	1.39	0.94, 1.83	0.83	0.49, 1.16
Not with partner	24.21	22.15, 26.26	14.00	12.45, 15.55
Country of origin				
Canada	10.94	9.84, 12.03	6.49	5.73, 7.24
Not Canada	7.98	5.74, 10.22	3.16	1.88, 4.43
Race				
White	10.46	9.43, 11.49	6.16	5.46, 6.86
Non-White	10.68	7.58, 13.79	3.15	1.94, 4.36
Highest level of education				
≤High school	11.32	9.60, 13.03	5.73	4.57, 6.89
Post-secondary	10.07	8.85, 11.29	6.05	5.21, 6.90
Income adequacy				
Low	16.88	12.88, 20.89	13.07	10.24, 15.91
Middle	9.89	7.92, 11.87	6.63	5.16, 8.09
High	9.41	8.11, 10.70	3.80	2.97, 4.64
Current smoker				
Yes	14.20	12.50, 15.90	11.49	9.76, 13.23
No	8.32	7.18, 9.47	3.42	2.78, 4.05
Type of drinker				
Regular	12.18	11.02, 13.35	9.50	8.39, 10.61
Occasional	6.30	4.38, 8.22	2.75	1.91, 3.59
Former/abstainer	4.37	2.86, 5.89	1.29	0.52, 2.07

Table 4: Socio-demographic characteristics of 1996-97 NPHS respondents reporting relationships lasting less than 12 months.

Characteristic	Proportion (%) Reporting Relationships Lasting Less than 12 Months			
	Males	95% Confidence Intervals	Females	95% Confidence Intervals
Total	13.83	12.82, 14.83	8.83	7.99, 9.67
Age group				
15-24	40.19	36.59, 44.39	27.69	24.18, 31.20
25-34	16.15	13.78, 18.53	9.07	7.37, 10.78
35-59	6.04	5.17, 6.92	3.68	3.01, 4.35
Marital status				
Married/Common Law	0.61	0.31, 0.91	0.29	0.10, 0.49
Single	31.10	28.76, 33.44	21.62	19.32, 23.92
Widow/Divorce/Separated	27.89	23.54, 32.25	15.40	12.75, 18.06
Living arrangement				
With partner	0.91	0.56, 1.26	0.49	0.27, 0.72
Not with partner	33.35	31.14, 35.56	22.02	19.98, 24.06
Country of origin				
Canada	14.83	13.66, 16.00	9.84	8.85, 10.83
Not Canada	8.48	6.35, 10.61	3.82	2.56, 5.07
Race				
White	13.63	12.59, 14.67	9.32	8.40, 10.24
Non-White	15.67	11.51, 19.83	3.70	2.48, 4.93
Highest level of education				
≤High school	14.98	13.43, 16.54	9.23	7.67, 10.80
Post-secondary	13.23	11.87, 14.60	8.63	7.64, 9.62
Income adequacy				
Low	20.97	17.23, 24.72	18.27	15.25, 21.29
Middle	13.99	11.63, 16.34	9.05	7.13, 10.97
High	11.99	10.67, 13.31	6.10	5.09, 7.11
Current smoker				
Yes	17.63	15.90, 19.37	15.11	13.11, 17.11
No	11.64	10.35, 12.93	6.00	5.20, 6.81
Ever injected non-prescription drugs				
Yes	1.57	0.52, 2.61	0.61	0.18, 1.05
No	1.14	0.75, 1.53	0.55	0.30, 0.81
Type of drinker				
Regular	15.54	14.32, 16.75	12.92	11.57, 14.28
Occasional	11.07	8.63, 13.52	5.94	4.56, 7.32
Former/abstainer	6.37	4.58, 8.16	2.55	1.73, 3.38
Age at first intercourse				
≤15 years	32.80	28.59, 37.09	29.28	24.24, 32.33
>15 years	22.00	19.57, 24.43	19.79	17.56, 22.03
Number of partners in the past 12 months				
≤1	6.21	5.35, 7.08	4.57	3.89, 5.26
>1	80.45	76.20, 84.70	78.31	72.86, 83.77

Table 5: Socio-demographic characteristics of 1996-97 NPHS respondents reporting always using condoms in relationships lasting less than 12 months.

Characteristic	Proportion (%) Reporting Always Using Condoms in Relationships Lasting Less than 12 Months			
	Males	95% Confidence Intervals	Females	95% Confidence Intervals
Total	54.65	50.48, 58.82	53.63	48.21, 59.04
Age group				
15-24	57.93	51.81, 64.06	59.17	51.04, 67.31
25-34	58.67	49.96, 67.37	53.35	42.97, 63.74
35-59	44.63	36.86, 52.39	42.75	33.60, 51.91
Marital status				
Married/Common Law	34.60	13.47, 55.73	32.34	50.91, 63.47
Single	57.10	52.43, 61.77	57.19	34.07, 52.28
Widow/Divorce/Separated	43.61	33.85, 53.37	43.17	40.16, 57.73
Living arrangement				
With partner	31.63	14.61, 48.65	38.23	14.17, 62.29
Not with partner	55.61	51.43, 59.79	54.17	48.69, 59.66
Country of origin				
Canada	54.97	50.59, 59.35	52.73	47.09, 58.36
Not Canada	52.58	39.18, 65.98	65.92	49.34, 82.51
Race				
White	54.99	50.69, 59.28	54.10	48.50, 59.71
Non-White	51.07	35.49, 66.65	43.08	27.61, 58.54
Highest level of education				
≤High school	57.64	51.18, 64.10	57.65	48.70, 66.60
Post-secondary	52.94	47.03, 58.86	51.14	44.46, 57.82
Income adequacy				
Low	48.43	38.38, 58.58	47.47	38.35, 56.59
Middle	50.18	41.16, 59.19	48.44	38.83, 58.06
High	56.82	50.55, 63.09	61.22	51.31, 71.14
Current smoker				
Yes	52.54	46.86, 58.22	54.67	47.31, 62.03
No	56.50	50.29, 62.71	52.44	45.40, 59.48
Ever injected non-prescription drugs				
Yes	56.77	21.05, 92.50	45.17	7.18, 83.15
No	52.80	78.18, 57.12	51.68	46.06, 57.31
Type of drinker				
Regular	54.28	49.43, 59.13	54.84	48.68, 60.99
Occasional	58.03	44.77, 71.30	52.01	40.09, 63.92
Former/abstainer	53.79	38.71, 68.88	43.17	25.52, 60.82
OCP use				
Yes	N/A		48.94	40.16, 57.73
No			51.16	41.00, 59.63
Number of partners in the past 12 months				
Yes	56.71	49.99, 63.44	51.32	43.80, 53.84
No	53.32	48.05, 58.59	55.71	48.34, 63.07

Table 6: Socio-demographic characteristics of 1996-97 NPHS respondents with two or more partners in the past 12 months or one relationship lasting less than 12 months reporting condom use at last intercourse.

Characteristic	Proportion (%) Reporting Condom Use at Last Intercourse			
	Males	95% Confidence Intervals	Females	95% Confidence Intervals
Total	67.31	63.85, 70.76	62.27	57.59, 66.95
Age group 15-24	75.47	70.62, 80.32	67.87	60.66, 75.07
25-34	70.12	63.04, 77.21	60.95	51.92, 69.98
35-59	51.60	44.13, 59.07	52.20	43.44, 60.95
Marital status				
Married/Common Law	42.59	23.57, 61.60	21.98	1.73, 42.22
Single	71.27	67.31, 75.23	65.38	59.77, 70.98
Widow/Divorce/Separated	51.92	42.07, 61.76	55.67	47.43, 63.91
Living arrangement				
With partner	39.74	24.07, 55.40	41.22	19.06, 63.38
Not with partner	68.86	65.29, 72.42	63.42	58.60, 68.24
Country of origin				
Canada	67.68	64.07, 71.30	61.65	56.77, 66.53
Not Canada	63.31	50.57, 76.04	69.80	56.02, 83.58
Race				
White	66.92	63.31, 70.53	61.91	57.02, 66.80
Non-White	70.13	58.14, 82.12	67.20	54.02, 80.38
Highest level of education				
≤High school	72.30	66.57, 78.02	62.96	55.71, 70.22
Post-secondary	64.33	59.52, 69.15	61.80	55.80, 67.80
Income adequacy				
Low	66.14	56.79, 75.50	59.40	44.70, 62.20
Middle	64.53	56.60, 72.47	53.45	60.76, 76.78
High	67.21	62.01, 72.41	68.77	60.34, 81.34
Current smoker				
Yes	65.67	60.81, 70.52	60.51	53.94, 67.08
No	68.82	63.80, 73.85	64.30	58.45, 70.16
Ever injected non-prescription drugs				
Yes	71.20	42.53, 99.86	51.39	17.87, 84.91
No	65.22	61.43, 69.01	60.71	55.71, 65.70
Type of drinker				
Regular	67.23	63.19, 71.28	63.48	58.09, 68.87
Occasional	68.31	55.80, 80.83	59.52	48.22, 70.83
Former/abstainer	66.40	51.11, 81.70	55.99	39.45, 72.53
OCP use Yes	N/A		59.61	51.64, 67.58
No			65.98	50.14, 71.82
Relationship lasting less than 12 months				
Yes	67.90	64.03, 71.76	63.05	58.02, 68.07
No	63.36	51.66, 75.06	56.79	44.35, 69.24
Number of partners in the past 12 months				
≤1	67.62	61.55, 73.70	59.06	51.75, 66.38
>1	67.15	62.68, 71.61	64.54	58.59, 70.48

CONDOM USE ANALYSIS

Table 7a: Prevalence of STDs (%) according to consistency of condom use in relationships lasting less than 12 months and odds ratios for males only (n=2,276)*.

Sexually Transmitted Disease	Consistency of Condom Use – Males				Odds ratios Reference group: Always (95% CI*)
	Always (n=1,263)		Not Always (n=1,013)		
	Number of Cases	Prevalence (%) (95% CI)	Number of Cases	Prevalence (%) (95% CI)	
Chlamydia	6	0.64 (-0.38, 2.85)	16	1.58 (0.30, 2.85)	2.47 (---)
Gonorrhea	2	0.68 (-0.26, 1.62)	1	0.12 (-0.06, 0.29)	0.12 (---)
Genital Warts	5	0.46 (0.07, 0.85)	8	0.89 (0.35, 1.42)	1.67 (---)
Genital Herpes	5	0.26 (0.01, 0.52)	8	0.85 (-0.13, 1.83)	3.23 (---)

* Ellipses indicate estimates with coefficients of variation greater than 100%.

Table 7b: Prevalence of STDs (%) according to consistency of condom use in relationships lasting less than 12 months and odds ratios for females only, using bootstrap weights (n=1,476).

Sexually Transmitted Disease	Consistency of Condom Use - Females				Odds ratios Reference group: Always (95% CI*)
	Always (n=720)		Not Always (n=748)		
	Number of Cases	Prevalence (%) (95% CI)	Number of Cases	Prevalence (%) (95% CI)	
Chlamydia	14	2.54 (0.35, 4.74)	16	2.32 (0.50, 4.14)	0.91 (---)
Gonorrhea	1	0.90 (-0.87, 2.67)	1	0.20 (-0.19, 0.58)	0.22 (---)
Genital Warts	7	0.78 (-0.11, 1.66)	11	1.56 (0.31, 2.81)	2.03 (---)
Genital Herpes	5	2.38 (-0.58, 5.35)	8	1.48 (0.27, 2.68)	0.61 (---)

* Ellipses indicate estimates with coefficients of variation greater than 100%.

Table 8a: Prevalence of STDs (%) according to condom use at last sexual encounter and odds ratios for males only (n=2,558).

Sexually Transmitted Disease	Condom Use at Last Sexual Encounter - Males				Odds ratios Reference group: Yes (95% CI*)
	Yes (n=1,726)		No (n=832)		
	Number of Cases	Prevalence (%) (95% CI)	Number of Cases	Prevalence (%) (95% CI)	
Chlamydia	17	1.35 (0.29, 2.40)	8	1.00 (-0.10, 2.10)	0.74 (---)
Gonorrhea	3	0.42 (-0.29, 1.13)	0	--	N/A (---)
Genital Warts	9	0.30 (0.05, 0.55)	5	0.33 (0.00, 0.65)	1.09 (---)
Genital Herpes	8	0.36 (0.07, 0.65)	6	0.85 (-0.33, 2.04)	2.36 (---)

* Ellipses indicate estimates with coefficients of variation greater than 100%.

Table 8b: Prevalence of STDs (%) according to condom use at last sexual encounter and odds ratios for females only (n=1,682).

Sexually Transmitted Disease	Condom Use at Last Sexual Encounter - Females				Odds ratios Reference group: Yes (95% CI*)
	Yes (n=975)		No (n=707)		
	Number of Cases	Prevalence (%) (95% CI)	Number of Cases	Prevalence (%) (95% CI)	
Chlamydia	19	2.82 (0.84, 4.80)	12	1.45 (0.27, 2.62)	0.51 (---)
Gonorrhea	1	0.68 (-0.66, 2.02)	2	0.47 (-0.20, 1.14)	0.69 (---)
Genital Warts	10	0.89 (0.07, 1.72)	10	1.87 (0.42, 3.32)	2.12 (---)
Genital Herpes	10	2.54 (0.22, 4.86)	6	1.18 (0.03, 2.33)	0.46 (---)

* Ellipses indicate estimates with coefficients of variation greater than 100%.

NON-RESPONSE ANALYSIS

Table 9: Characteristics of complete responders and partial non-responders: Ever had sexual intercourse.

Characteristic	Proportion (%, 95% confidence interval)	
	Non-Responders	**Responders**
Male	49.51 (47.37-51.66)	49.92 (49.55-50.29)
Age 15-24 years	13.85 (12.49-15.22)	21.65 (21.27-22.03)
Single status	32.93 (30.49-35.36)	40.58 (39.77-41.39)
Not living with a partner	45.45 (43.29-47.60)	45.14 (44.23-46.05)
Country of origin other than Canada	35.49 (33.28-37.73)	16.75 (15.85-17.65)
Non-white race	77.11 (75.11-79.11)	89.31 (88.61-90.01)
Smoker	25.10 (23.16-27.03)	31.97 (31.15-32.79)
Regular drinker	44.37 (42.16-46.57)	60.04 (59.16-60.93)
Highest level of education high school or less	42.42 (40.27-44.56)	38.65 (37.70-39.60)
Low income adequacy	9.73 (7.99-11.46)	12.00 (11.32-12.67)

Table 10: Characteristics of item responders and non-responders: Age at first intercourse.

Characteristic	Proportion (%, 95% confidence interval)	
	Non-Responders	**Responders**
Male	49.26 (48.70-49.82)	54.38 (50.31-58.45)
Age 15-24 years	16.35 (15.80-16.90)	7.14 (5.38-8.91)
Single status	36.02 (35.14-36.90)	21.90 (18.90-24.91)
Not living with a partner	40.66 (39.58-41.73)	29.69 (26.15-33.23)
Country of origin other than Canada	15.49 (14.64-16.35)	27.52 (22.86-32.17)
Non-white race	8.75 (8.04-9.47)	16.27 (13.74-19.71)
Smoker	34.51 (33.59-35.43)	26.74 (23.62-29.87)
Regular drinker	64.37 (63.43-65.30)	48.49 (45.17-51.82)
Highest level of education high school or less	35.42 (34.37-36.46)	40.64 (37.43-43.86)
Low income adequacy	12.04 (11.31-12.78)	9.04 (7.05-11.03)

Table 11: Characteristics of item responders and non-responders: Sexual intercourse in the past 12 months.

Characteristic	Proportion (%, 95% confidence interval)	
	Non-Responders	**Responders**
Male	45.00 (37.24-52.76)	49.78 (49.34-50.22)
Age 15-24 years	6.16 (3.21-9.12)	15.79 (15.29-16.29)
Single status	19.03 (14.43-23.63)	35.18 (34.29-36.08)
Not living with partner	34.37 (27.09-41.66)	39.87 (38.82-40.91)
Country of origin other than Canada	36.43 (28.25-44.62)	16.07 (15.15-16.99)
Non-white race	19.71 (11.39-28.03)	9.20 (8.50-9.89)
Smoker	34.11 (33.26-34.97)	22.26 (17.03-27.49)
Regular drinker	44.69 (37.18-52.19)	63.44 (62.51-64.38)
Highest level of education high school or less	35.55 (27.56-43.55)	35.85 (34.85-36.86)
Low income	8.55 (4.43-12.67)	11.86 (11.16-12.57)

Table 12: Characteristics of item responders and non-responders: Number of partners in the past 12 months.

Characteristic	Proportion (%, 95% confidence interval)	
	Non-Responders	**Responders**
Male	69.45 (58.03-80.87)	50.90 (50.30-51.51)
Age 15-24 years	29.74 (13.70-45.78)	15.36 (14.74-15.98)
Single status	62.65 (47.52-77.78)	33.10 (32.14-34.06)
Not living with partner	63.13 (49.42-76.85)	34.56 (33.46-35.66)
Country of origin other than Canada	12.26 (4.51-20.02)	15.78 (14.78-16.77)
Non-white race	11.24 (3.82-18.65)	8.32 (7.58-9.06)
Smoker	40.44 (25.43-55.45)	33.64 (32.71-34.58)
Regular drinker	76.86 (66.81-86.90)	64.68 (63.64-65.72)
Highest level of education high school or less	26.20 (13.81-38.60)	35.33 (34.21-36.45)
Low income	8.27 (1.90-14.64)	11.26 (10.48-12.04)

Table 13: Characteristics of item responders and non-responders: Chlamydia in the past two years or currently.

Characteristic	Proportion (%, 95% confidence interval)	
	Non-Responders	**Responders**
Male	52.28 (29.04-75.52)	49.78 (49.33-50.22)
Age 15-24 years	17.63 (-3.83-39.09)	15.79 (15.28-16.29)
Single status	30.45 (11.19-49.71)	35.20 (34.31-36.09)
Not living with a partner	51.21 (28.81-73.61)	39.85 (38.80-40.89)
Country of origin other than Canada	16.71 (2.31-31.11)	16.07 (15.15-16.99)
Non-white race	80.45 (60.95-99.96)	90.84 (90.15-91.53)
Smoker	13.21 (3.09-23.32)	34.15 (33.29-35.01)
Regular drinker	36.48 (13.77-59.19)	63.52 (62.58-64.45)
Highest level of education high school or less	41.17 (15.10-67.24)	35.83 (34.82-36.84)
Low income adequacy	11.40 (-6.24-29.04)	11.87 (11.17-12.57)