

**Use of Respondent-Driven Sampling to Access Winnipeg Street-Involved Youth for
the Purpose of Urine-Based Chlamydia and Gonorrhea Testing and Treatment in
Non-Clinical Venues**

by

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**A Thesis submitted to the Faculty of Graduate Studies
of**

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in partial fulfilment of the requirements of the degree of

MASTER OF SCIENCE

Department of Community Health Sciences

University of Manitoba

Winnipeg

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Abstract

Purpose: Street-involved youth have a high prevalence of chlamydia and gonorrhea and experience barriers to testing and treatment. This population is difficult to access by traditional means. In the present study, the effectiveness of Respondent Driven Sampling (RDS) for accessing street-involved youth and the use of urine-based testing in non-clinical venues is investigated.

Methods: Street-involved youth aged 14-24 were selected as seeds to recruit their peers into the study using RDS. A questionnaire was administered, a urine specimen obtained, and recruitment coupons provided to participants. A week later, participants received test results and treatment. RDS Analysis Tool was used to assess the use of RDS and define the social structure. Fisher's Exact test was used to identify correlates of infection.

Results: Most participants provided a urine specimen and 73% returned to obtain their results. Among those who returned, 83% reported distributing recruitment coupons and 43% of participants recruited at least one person. However, the majority of recruitment chains were short. Street-involved youth are connected to those who share similar health related behaviors. The sample prevalence of chlamydia and/or gonorrhea infection was 15%, with female gender associated with infection. Participants congregated Downtown and at one particular mall.

Conclusions: Urine-based testing in non-clinical venues is acceptable to street-involved youth. RDS is an effective method to access street-involved youth, but would be more useful with fewer, more productive seeds. There is a need for increased testing options in this group, and an ideal location for services designed for street-involved youth is Downtown and at the particular mall in which they commonly spend time.

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Dedication

For Julia, Anne, Louisa, Harriet, and Teresa

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Chapter 1

Introduction and Study Objectives

1.1 Introduction

The majority of reported chlamydia and gonorrhea infections in Manitoba are among youth aged 15 to 24 (Manitoba Health, 2007). Results from Phases I to IV of the national Enhanced Surveillance of Canadian Street Youth Study (Public Health Agency of Canada, 2006) show that chlamydia prevalence among street-involved youth sampled from several cities across Canada had increased from 8.6% in 1999 to 11% in 2003. Gonorrhea prevalence increased from 1.4% to 3.1% in the same period. These rates are 10 to 30 times higher than that of the general youth population (Public Health Agency of Canada, 2006).

Street-involved youth are known to be hesitant to access mainstream health care services (Johnston et al, 2006) and require effective targeted health services including testing and treatment services for sexually transmitted infections (Higgitt et al, 2005). To encourage testing and treatment for sexually transmitted infections among street-involved youth, these services must be offered in locations that are convenient and in types of places that are non-intimidating, non-stigmatizing, and generally comfortable for them, such as non-clinical venues in neighborhoods where they already spend time. Chlamydia screening projects in non-clinical settings such as schools, jails, and community-based organizations in California have successfully improved access to education and health care for high-risk youth (Kajubi et al, 2007).

Respondent Driven Sampling (RDS) (Heckathorn, 1997) has increasingly been used for the recruitment of members of “hidden” populations such as injection drug users,

sex workers, and men who have sex with men (MSM). As random sampling methods will not produce a probability sample in these populations, RDS uses peer-recruitment through existing social networks and applies a mathematical weighting system to adjust for non-random selection. Recently, RDS has been shown to be effective in recruiting female sex workers in Vietnam (Johnston et al, 2006), men who have sex with men in Uganda (Kajubi et al, 2007) and Bangladesh (Johnston et al, 2007), transgender persons (Ramirez-Valles et al, 2005) and injection drug users (IDUs) in Mexico (Moyer et al, 2008) and Thailand (Wattana et al, 2007).

In the present study, RDS was used to recruit Winnipeg street-involved youth, in the first reported use of RDS among street-involved youth and within a Canadian population. The purpose of employing RDS was twofold: 1) to explore the use of RDS among this population and the social structure information that RDS provides and 2) as a recruitment mechanism to access street-involved youth for chlamydia and gonorrhea testing and questionnaire administration. Specimens for chlamydia and gonorrhea testing were provided by participants in non-clinical venues and any necessary treatment was provided by study staff in non-clinical venues as well, and the acceptability of this was assessed among the participants. The questionnaire was designed to explore the characteristics of participants and common places of shelter and hangouts among street-involved youth in Winnipeg.

1.2 Study Purpose and Objectives

Street-involved youth are at high risk for chlamydia and gonorrhea infection and many are unlikely to receive testing and treatment in clinical venues. Street-involved youth require unique strategies for accessing STI testing and treatment. The ultimate

purpose of the project was to evaluate the effectiveness of RDS for accessing street-involved youth in Winnipeg and to evaluate the potential for anonymous, community-based urine screening and treatment for chlamydia and gonorrhea among these youth.

Guided by this purpose are the following objectives:

1. To determine whether chlamydia and gonorrhea testing and treatment in non-clinical venues is acceptable among Winnipeg street-involved youth.
2. To determine whether RDS is an effective method to access street-involved youth in Winnipeg.
3. To examine the characteristics and social structure of Winnipeg street-involved youth.
4. To determine whether infection with chlamydia and/or gonorrhea is associated with individual characteristics.
5. To examine the geographic distribution of street-involved youth across Winnipeg.

The results of this study will provide researchers, policy makers, program developers, and service providers with a greater understanding of the effectiveness of testing and treatment outside of traditional clinical settings, the effectiveness of peer recruitment to access street-involved youth, and characteristics of street-involved youth in Winnipeg.

Chapter 2

Background and Literature Review

This chapter provides definitions and an overview of topics relevant to this study. These topics include sexually transmitted infections, street-involved youth, and the use and theory of Respondent-Driven Sampling (RDS).

2.1 Sexually Transmitted Infections

2.1.1 Chlamydia

Chlamydia is a bacterial infection caused by the organism *Chlamydia trachomatis*. Many people infected with chlamydia are not tested and treated because an estimated 25 percent of infected males and 70 percent of infected females are asymptomatic (Cates and Wasserheit, 1991). Despite the lack of symptoms, treatment is important because asymptomatic individuals are still able to transmit chlamydia to their sexual partners through oral, vaginal, rectal, cervical or urethral routes. (Manitoba Health, 2005).

If symptoms occur, they typically begin one to three weeks after infection (Health Canada, 2002). Males that have symptoms of chlamydia infection may experience a milky or watery discharge, a burning sensation during urination, testicular pain or swelling, and itchiness inside the penis, and may result in epididymitis and infertility (Health Canada, 2002). Females that have symptoms may experience a new vaginal discharge, burning during urination, unusual vaginal bleeding, pain during intercourse, vaginal bleeding after intercourse, abdominal pain, fever, and chills (Health Canada, 2002). In women, this infection may progress to pelvic inflammatory disease and infertility or cause ectopic pregnancy (Health Canada, 2002). Also, chlamydia can be

transmitted to a baby at birth, which may lead to eye and lung infections (Tiller, 2002). Chlamydia can be treated with a single dose of the antibiotic azithromycin or a week of doxycycline.

2.1.2 Gonorrhea

Gonorrhea is a bacterial infection caused by the organism *Neisseria gonorrhea* which is also often asymptomatic (Health Canada, 2002). Males that have symptoms of gonorrhea infection may experience a thick, yellow-green discharge, a burning sensation during urination, testicular pain or swelling, and rectal pain and discharge (Health Canada, 2002). Females that have symptoms may experience a new vaginal discharge, burning during urination, unusual vaginal bleeding, pain during intercourse, vaginal bleeding after intercourse, lower abdominal pain, fever, chills, and rectal pain and discharge (Health Canada, 2002). In women, this infection may progress to pelvic inflammatory disease and infertility (Health Canada, 2002). Also, gonorrhea can be transmitted to an infant at birth, which may lead to serious eye infections and blindness (Health Canada, 2002). Gonorrhea can be treated with a single dose of one of the following antibiotics: cefixime, ceftriaxone, ciprofloxacin, or ofloxacin (Public Health Agency of Canada, 2004).

2.1.3 Epidemiology of Chlamydia and Gonorrhea

In 2007, Manitoba had the highest reported incidence of chlamydia and gonorrhea among the Canadian provinces (PHAC, 2008), with the highest rates among females aged 15 to 24 in northern communities and in Winnipeg's inner-city (Manitoba Health, 2008). Currently, chlamydia and gonorrhea testing occurs in clinical settings as part of routine physical examinations for those at risk of infection, when an individual requests testing,

and when one is contacted after being identified as a sexual partner of a confirmed case through the process of contact tracing.

Street-involved youth sampled from several cities across Canada as part of the national Enhanced Surveillance of Canadian Street Youth Study had a prevalence of chlamydia of 11% in 2003, an increase from 8.6% in 1999, which was about 10 times higher than the reported prevalence among general population of youth aged 15 to 24 (Public Health Agency of Canada, 2006). Similarly, the prevalence of gonorrhea increased during this time period from 1.4% to 3.1% and was about 30 times higher than in the general youth population (Public Health Agency of Canada, 2006).

Regardless of any previous history of infection, 62.7% of the Winnipeg-based street-involved youth participating in the national study perceived themselves as being at little or no risk of acquiring a sexually transmitted infection (Beaudoin, 2004). Considering the high prevalence of chlamydia and gonorrhea among this population, this suggests that street-involved youth need to be educated about the high incidence of chlamydia and gonorrhea among street-involved youth. More importantly, the barriers that prevent street-involved youth from accessing testing and treatment need to be identified and resolved.

2.2 Street-Involved Youth

2.2.1 Hidden Populations

A population is considered to be “hidden” when no sampling frame exists, meaning that the size and boundaries of the population are unknown, and when membership involves stigmatized or illegal behavior (Heckathorn, 1997). This latter characteristic often leads individuals to be uncooperative or unreliable in the research

process, in an attempt to protect their privacy (Heckathorn, 1997). In addition, most hidden populations have low membership and it cannot be assumed that members of the hidden population have telephone and internet access or a permanent residence, causing many traditional sampling methods such as household and telephone surveys to be ineffective.

2.2.2 Street-Involved Youth

There is no standard definition of street-involved youth in the literature. The United Nations distinguishes between two distinct groups of “homeless youth” – the “absolute homeless” who live outdoors, in abandoned buildings, and in hostels and shelters, and the “relatively homeless” who live in unsafe, inadequate or insecure housing, or who pay too much of their income for rent (Kelly and Caputo, 2007). For this study, street-involved youth are defined as any individual aged 14 to 24 who had spent at least three nights during the previous six months away from a permanent home because staying there was not an option. This definition was selected to be inclusive of all stages of street-involvement and for flexibility to allow recruitment to follow social ties, assuming that there would be social connections between the “absolute homeless” and the “relatively homeless”. Other studies have used definitions that include youth aged 15 to 24 with unstable housing, defined as at least two nights in the prior six months in a place that was not their home because they could not stay in their home or did not have a home (Auerswald et al, 2006), being homeless for at least two night in the past year (Roy et al, 2002), in the past month (Barkin et al, 2003), or on the previous night (Ennett et al, 1999).

Street-involved youth can be classified along a continuum spanning from “curbsiders” that bounce between the street and home to entrenched street youth with no connections to home and greater involvement in drugs, crime, and prostitution (Caputo et al., 1997). Ties are cut with mainstream society, which makes entrenched street-involved youth more difficult to reach for interventions. Street-involved youth have been found to be most receptive to interventions during their first few weeks on the street (Caputo et al., 1997).

It is difficult to determine the number of street-involved youth, but it has previously been estimated that there are approximately 150,000 in Canada (Caputo et al., 1997). Street-involved youth come from a variety of family backgrounds, but are more likely to have experienced abuse and neglect than other youth (Zerger et al, 2008). In one Seattle study, 82% of runaway and homeless youth had experienced physical abuse at home, 43% had experienced neglect, and 26% had experienced sexual abuse (Tyler et al, 2004). Another study revealed that 17.7% of 356 street youth had been removed from their homes by the authorities, half due to sexual abuse (MacLean et al., 1999). Street-involved youth with a history of physical or sexual abuse are more likely to engage in risky sexual behaviors (eg. inconsistent condom use, multiple partners, sexual activity while under the influence of alcohol or drugs) two to three years earlier than others (Walters, 1999) and to participate in survival sex (Tyler and Cauce, 2002). A study of 360 homeless youth in Toronto revealed that 43% had lived in foster care (Gaetz and O’Grady, 2002). Reasons for becoming homeless may include escaping from an abusive home, being kicked out by disapproving parents, or “aging out” of foster care or the youth corrections system (Zerger et al, 2008).

Alcohol and drug use is common among teenagers, and according to the Ontario Student Drug Use Survey (1997-2007), two thirds of participants had consumed alcohol within the previous year and one third had used cannabis (Leslie, 2008). Among the participants of this study, the consumption of ecstasy, LSD, cocaine and crystal methamphetamine was much less common, at about 5% (Leslie, 2008). Studies have indicated that a higher proportion of street-involved youth consume these substances compared to other youth. Among street-involved youth in Denver, 69% had used alcohol in the previous nine months, 75% had used cannabis, 30% had used hallucinogens, 25% had used ecstasy, 18% had used crystal methamphetamine, 19% had used cocaine, 13% had used ketamine, and 12% had used heroin (Van Leeuwen et al, 2004). In Canada, injection drug use has ranged from about 17% of street-involved youth in Toronto (DeMatteo et al, 1999) to about 44% in Montreal (Roy et al, 2007). In Toronto, 84% of participants had reported alcohol consumption in the previous 6 months and 33% consumed alcohol daily (DeMatteo et al, 1999). Sixty-five percent report consumption of non-alcohol drugs in the previous six months, with a higher proportion among older youth (DeMatteo et al, 1999). Studies have indicated that alcohol and drug use increase the likelihood of youth engaging in high risk sexual behaviors, putting them at risk for sexually transmitted infections and unwanted pregnancies (Gleghorn et al, 1998; Poulin et al, 2001).

Many street-involved youth lack the skills and education necessary to get well-paying jobs and therefore are left with limited low-paying and menial job options (Higgitt et al, 2003). With few options, many street-involved youth turn to panhandling, flagging, squeegeeing, drug dealing and sex work as sources of income (Kelly and Caputo, 2007).

A Montreal study among male street-involved youth found that 27.7% had engaged in survival sex (Haley et al, 2004), and in another study among female Montreal street-involved youth, 27% had engaged in sex work (Weber et al, 2002).

Street-involved youth are generally knowledgeable about the symptoms, transmission, prevention, and treatment of sexually transmitted infections (Rew et al, 2002). Street-involved youth require appropriate and sensitive interventions designed specifically for them because youth often fall through the gaps between services designed for children and adults (Novac et al., 2002) and also because many are hesitant to seek out traditional/mainstream services. Street-involved youth rarely access health care services (Barkin et al, 2003 and Shiner, 1995). Many street-involved youth have been documented to suffer from “street sickness,” a constant feeling of malaise due to exposure to the elements, sleep deprivation, lack of nutrition, and poor hygiene, but are hesitant to seek medical care for acute or chronic health conditions unless it is absolutely necessary (Higgitt et al, 2005). Females face additional dangers to their health and wellbeing, as they are significantly more likely to be sexually assaulted than males (Tyler et al, 2001 and Rew et al, 2001) may be more likely to commit suicide (Leslie et al, 2002 and Molnar et al, 1998), have more serious sequelae of STIs, such as pelvic inflammatory disease, and may have health care needs as a result of pregnancy, and therefore may be even more likely to be in need of health care than males. As one Winnipeg street-involved youth said,

“I would never go to the hospital. I don't like doctors. They don't know

what they are doing. All they do is call the police

and I don't need bullshit from the boys.” (Higgitt et al, 2005)

In addition to the fear of police involvement, street-involved youth have reported feeling uncomfortable in facilities that do not specifically cater to youth because they perceived that the adult clientele had mental health issues (Higgitt et al, 2005). Further barriers to access health care include fears of discriminatory attitudes (Gerber, 1997), fears of being negatively judged by health care providers (Reid et al, 2005 and Ensign, 2001). Practical barriers also exist, such as lack of proper identification or health card, not knowing where to go to access health care services, lack of transportation, particularly if a clinic is inconveniently located (Rew et al, 2002), and the inability to afford prescription medications (Higgitt et al, 2005). Also, some street-involved youth may be unaware that no-cost treatment for chlamydia and gonorrhea is available.

Services designed for street-involved youth should employ individuals who are perceived to be honest, respectful, non-judgmental, and likely to respect the privacy of clients (Ulager et al, 2005). Suggestions for the design of services for street-involved youth include addressing youth by their street names, offering flexible clinic hours, and providing clear information about client rights (Zerger et al, 2008). They should also provide transition services to facilitate the progression of older youth to services designed for adults (Miles et al, 2004), based on developmental and/or life stage rather than chronological age (Zerger et al, 2008).

For many street-involved youth, life may be a constant struggle to meet basic needs such as shelter, safety, money, and food. Some may engage in stigmatized or illegal activities such as survival sex, squeegeeing, or flagging for money, and drugs or alcohol may be used as a coping mechanism (Novac et al, 2002). Flagging involves

sitting or standing on the sidewalk or median of a busy street holding a sign asking for money.

Winnipeg street-involved youth face unique challenges including very cold winter temperatures, which prompts some to relocate to warmer locations by hitch hiking, and the fact that few resources exist that specifically target street youth (Higgitt et al, 2005). Also, while Winnipeg does not suffer from the affordable housing shortage of other cities, most of the low cost housing is of poor quality, inadequate, and located in areas with poverty and crime (Novac et al., 2002).

A high proportion of Winnipeg street-involved youth identify themselves as Aboriginal. Fifty-three percent of the 320 street-involved youth interviewed in 1999 identified themselves as Aboriginal (Beaudoin, 2004). Aboriginal street-involved youth may face additional challenges that place them at increased risk of infection. Racism and discrimination, physical and mental health conditions, adverse economic conditions and migration from reserves as a result of limited opportunities and poor housing, and the lack of culturally sensitive services and resources decrease overall health status, increase vulnerability, and may act as barriers to accessing health services (Begin et al, 1999).

2.3 Respondent Driven Sampling

Respondent Driven Sampling (RDS) is a method developed by Heckathorn in 1997 to facilitate and track the recruitment of participants into a study, and can be used to make population and network estimates based on the social network of the sample using software developed by Heckathorn. RDS is designed to reduce the bias produced by the non-random selection of initial recruits, adapting chain-referral sampling techniques like snowball sampling to access “hidden” populations such as street-involved youth

(Heckathorn, 1997). RDS has been demonstrated to be an effective method for studies involving Latino gay and bisexual men, transgender persons (Ramirez-Valles et al., 2005) and illicit drug users (Wang et al., 2005) in the United States.

“Hidden” populations have traditionally been sampled using snowball sampling, key informant sampling, and targeted sampling. Snowball sampling, the best approach of the three, is a type of chain-referral sampling that uses a randomly selected sample of initial contacts (though in practice these individuals are typically selected based on ease of access) to provide the names of a fixed number of other individuals who fit the selection criteria (Goodman, 1961). These individuals form the second “wave” of sampling and are similarly asked to provide the names of a fixed number of additional individuals, and this process is repeated until the desired number of waves are attained.

Potential biases inherent in snowball sampling derive from the fact that the selection of study members is nonrandom, the more cooperative population members are more likely to participate, “masking” – whereby friends are not referred in the interest of protecting them, and the fact that individuals with larger personal networks will theoretically be oversampled and those with smaller personal networks will be undersampled (Erickson, 1979). Empirical tests, however, have not found evidence of this last point (Welch, 1975 and Heckathorn, 1997).

Key-informant sampling is intended to overcome response bias by selecting very knowledgeable respondents (such as counselors) and asking them about the behaviors of others (Deaux and Callaghan, 1985). While this method is more likely to report stigmatized or disreputable behaviors, responses might be biased by the particular background (professional or other) of the informant or by lack of knowledge

(Heckathorn, 1997). Also, if the informant is a professional, institutional bias may be an issue because the informant may only have contact with a select sub-population of the group of interest (Heckathorn, 1997).

Targeted sampling starts with ethnographic mapping of the target population to prevent undersampling and then a specific number of subjects are recruited from sites identified by the ethnographic mapping to ensure that the sample includes subjects from different areas and subgroups (Watters and Biernacki, 1989). Biases are introduced in the ethnographic mapping stage, as the location, time, and strategy of the mapping influence the completeness and accuracy of the map (Heckathorn, 1997).

With these three methods, the unresolved problem is the nonrandom selection of the initial sample, which introduces biases because the characteristics of the initial sample will theoretically influence the characteristics of the final sample. Respondent-Driven Sampling is able to overcome the bias associated with the non-random selection of seeds as recruitment chains approach six waves. The *law of large numbers of regular Markov chains* asserts that as recruitment chains lengthen, sample proportions reach an equilibrium whereby additional recruitment waves do not result in a substantial change in the sample proportions of participant characteristics. This *convergence to equilibrium* indicates that the sample has become independent of the characteristics of the seeds, and therefore the bias associated with the non-random selection of seeds has been overcome (Heckathorn, 1997).

The process of RDS starts with the selection of a handful of accessible members of the population of interest, selected to be as diverse as possible. These "seeds" are assigned a unique code and provided with three recruitment coupons. Written on the

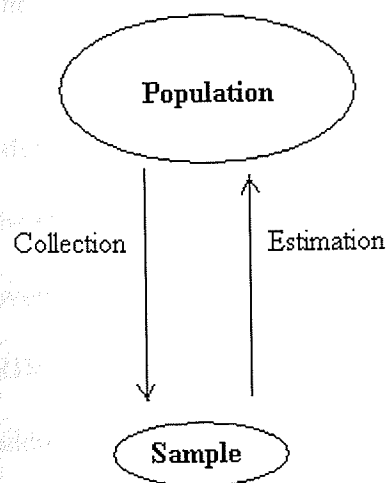
coupons is a code that identifies the participant who distributed them and information about how to contact study staff (such as a telephone number). If an individual who receives a coupon wishes to enter a study, they will be assigned a unique participant code which will be identified on the coupons they distribute. Thus, participants facilitate recruitment and connections between study participants are tracked linearly.

Respondent-Driven Sampling differs from snowball sampling because of the use of recruitment coupons, the use of codes to track recruitment chains and because RDS uses an incentive system to encourage participation (Heckathorn, 1997). A reward is given for being interviewed and in some studies a reward is also given for recruiting others into the study (Heckathorn, 1997). The rewards are both monetary and symbolic (eg. the opportunity to be helpful) (Heckathorn, 1997). The present study utilized a primary incentive as a means of encouraging individuals to participate in the study, by providing a material gain in the form of an honorarium for participation. RDS is unique in its ability to capitalize on secondary reward incentives, gained, for example, when study members recruit others into the study. Secondary incentives, which are monetary rewards for each individual a participant recruits into the study, were not provided in the present study. Secondary incentives are considered useful because peers much more effectively monitor each other than the police or teachers do and the offer of the primary incentive as well as gaining the approval of the recruiter (who wants their secondary incentive) may result in a high recruitment rate (Heckathorn, 1997). However, secondary incentives may result in the commodification of coupons, coercive behavior towards potential recruits, and the distribution of coupons to individuals who are not a friend or family member of the recruiter (Scott, 2008).

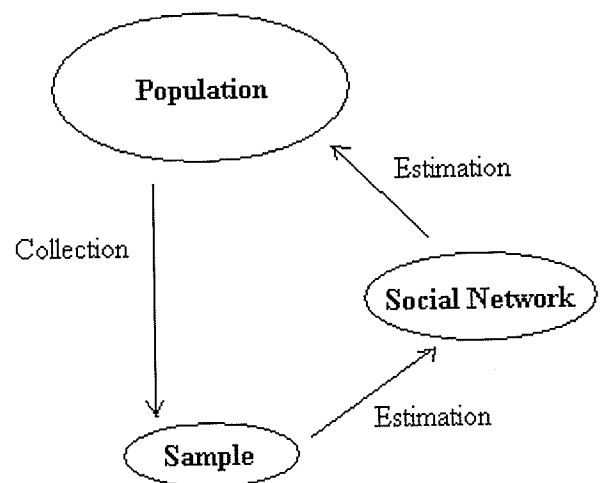
The potential bias due to oversampling subjects with larger personal networks, which has been investigated but not found to exist (Welch, 1975 and Heckathorn, 1997), can be prevented by weighting samples inversely with subjects' self-reported network size, by focusing sampling on saturating target areas to capture everyone regardless of network size, or by using incentives that promote the recruitment of the individuals with small personal networks (Heckathorn, 1997).

RDS uses an indirect method to make estimates about the population from the sample, unlike traditional methods such as snowball sampling (Figure 1).

Figure 1. Schematic representation of the difference between (a) traditional sampling methods such as snowball sampling and (b) Respondent-Driven Sampling. Adapted from Salganik and Heckathorn, 2004.



(a) Traditional sampling and estimation.



(b) Respondent-Driven Sampling.

In RDS, the sample is used to make estimates about the social network, which is in turn used to derive the proportion of the population in different groups (Salganik and Heckathorn, 2004). The information used by RDS software for these calculations are the self-reported number of people the respondent knows within the target population, the respondent's unique code (which appears on the coupons this respondent distributes), and the code on the coupon that this respondent received and was recruited with. The mathematical formulae used for these estimations assume that sampling always occurs with replacement, that the hidden population is composed of one connected social network, that all respondents are only recruited into the study once, and that the seeds are selected with probability proportional to their number of social contacts (a person with ten friends is twice as likely to be selected as someone with five friends) (Salganik and Heckathorn, 2004). This last point stems from the idea that people with more social contacts are more likely to be known by the researchers and selected as a seed (Salganik and Heckathorn, 2004).

At a conference at Princeton University in 2000, Dr. Heckathorn outlined the advantages and limitations of RDS (DiMaggio, 2000). Among the practical advantages is the ability to start with the most energetic and helpful participants without the outcome of overrecruiting similar individuals, the fact that ethnographic research prior to the use of RDS is not required, and the ability to reach people who do not have a regular home address. In addition, RDS provides information about the network structure of the population as well as sample characteristics. Among the limitations is the fact that members of a population who are completely isolated from other members cannot be reached using RDS.

Chapter 3

Study Design and Methodology

3.1 Study Design

Data collection for this study took place in Winnipeg, Manitoba from December 2006 to early April 2007. Winnipeg is the largest city in Manitoba, with a population of 667,038, which includes approximately 90,827 youth aged 15 to 24 (Manitoba Health Population Report, June 1, 2006). Located at the eastern edge of the Canadian Prairies, Winnipeg is located near the geographic center of Canada. Winnipeg has a relatively large Aboriginal population, which accounts for approximately 10.2 % of the population (Statistics Canada, 2006) and is surrounded by prairie agricultural lands.

For the purposes of this study, street-involved youth were defined as young people aged 14 to 24 who had been away from a permanent home for at least three nights during the previous six months because staying there was not an option. Eleven individuals were selected by study staff as seeds for the Respondent-Driven Sampling (RDS) recruitment which resulted in a sample size of 169 individuals. Study staff were well-known and trusted by the street-involved youth community, community health centers, and within the research community. The seeds were known to study staff, met the definition of street-involved youth and were thought to be representative of this group, and were known to be socially well-connected to other street-involved youth. Prospective participants contacted study staff, were provided with a description of the study, and arrangements were made for a mutually agreed upon time and location for the first interview. Locations included community drop-in centers (50.3%), fast food restaurants (26.0%), malls (18.3%), bars (1.8%), clinics (1.8%), homes (1.2%), and the

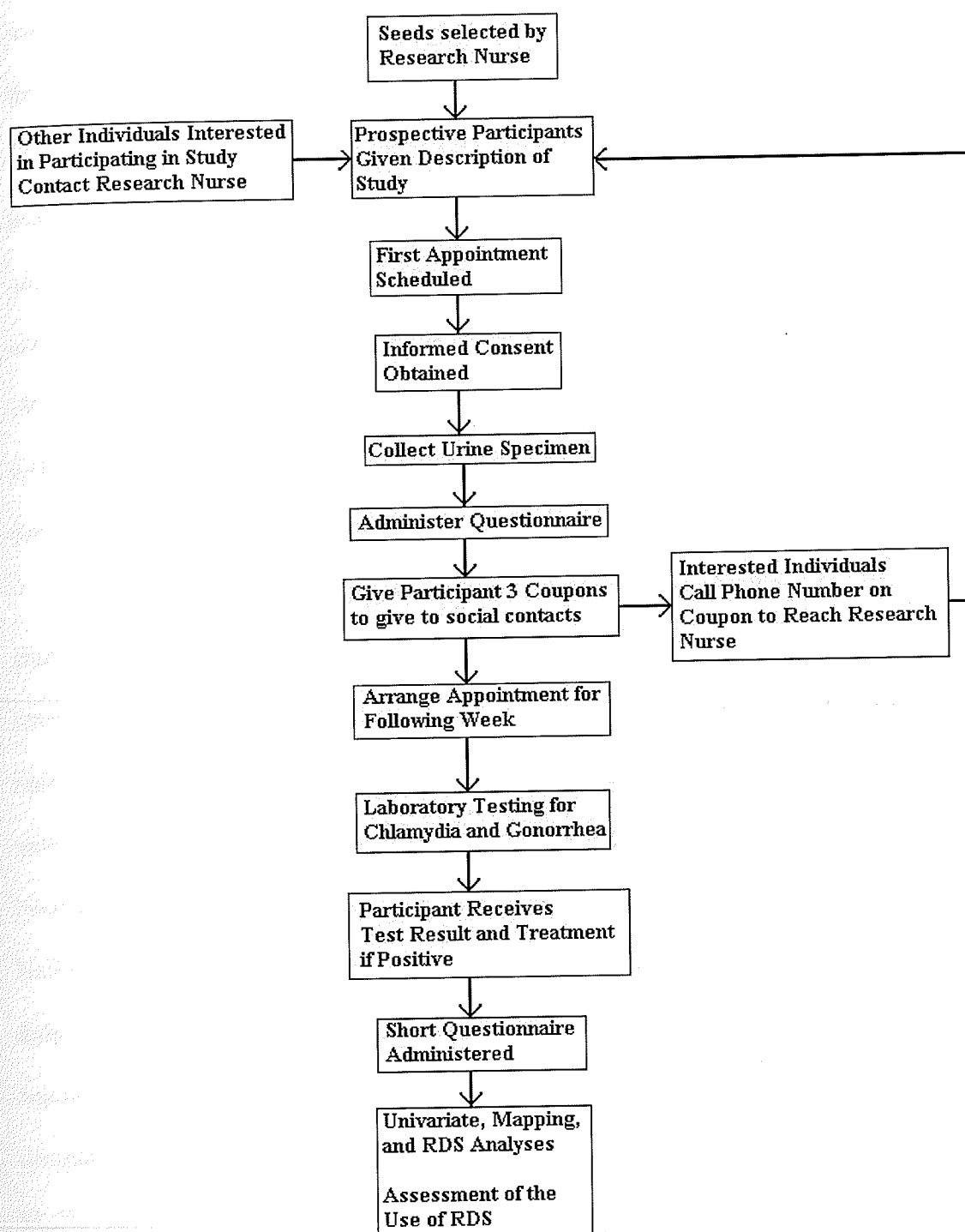
street (0.6%). At the first interview, informed consent was obtained (Appendix A), a questionnaire (Appendix B) was administered, and a urine specimen was obtained and immediately transported to Cadham Provincial Public Health Laboratory for standard chlamydia and gonorrhea testing using the Becton Dickinson ProbeTec ET CT/GC diagnostic test. A second appointment for approximately one week later was arranged for return of diagnostic test results and treatment if necessary. Each participant was provided three RDS recruitment coupons to give to their friends aged 14 to 24 who met the definition of street-involved youth. Each RDS coupon had a telephone number to reach study staff and a unique four digit non-nominal code to identify the participant that the coupon originated from and to distinguish between individuals recruited by that participant (ie. each of the three coupons originating from one participant were also coded as 1, 2, or 3). These codes were used to identify social network connections between participants of the study.

Individuals who met the definition of a street-involved youth, and who contacted study staff but were not in possession of an RDS coupon were allowed to enter the study as additional seeds. This allowed us to maintain the trust and rapport required to work with this population. As with the seeds, RDS Analysis Tool is able to circumvent the biases related to the non-random selection of individuals who ask to participate in the study, as it produces samples that are independent of the initial subjects from which sampling begins, rendering nonrandom selection of the initial sample inconsequential (Heckathorn, 1997). An honorarium of \$20 was provided to participants at the first appointment as compensation for their time. A recruitment bonus, used in some studies as an incentive for participants to recruit (Heckathorn, 1997), was not provided as part of

this study. At the second appointment, the participants were provided with their test result and, if positive, were provided the standard treatment; 1 gram of Azithromycin in a single dose for chlamydia, and 400 milligrams Suprax (Cefixime) in a single dose for gonorrhea. A second questionnaire (Appendix B) was also administered to gather information about the participants' experiences in the study. An honorarium of \$10 was provided to participants at the second appointment.

Given the anonymous nature of the study, routine contact tracing was not feasible. As in similar past studies, approval to not conduct contact tracing for study participants who tested positive for chlamydia and/or gonorrhea was obtained by the Communicable Disease Control Branch at Manitoba Health. Youth who tested positive in this study were provided with antibiotics to treat the infection, information about the symptoms, complications, transmission, and treatment of their infection, and were encouraged to contact public health. This study was approved by the University of Manitoba Health Research Ethics Board. The study outline is illustrated in Figure 2.

Figure 2. Study Outline



3.2 Study Sample

The eleven participants selected to be study seeds ranged in age from 18 to 23, with an average age of 20 (average = 20.09, standard deviation = 1.51). Three were female and eight male, with two self-identifying as men who have sex with men (MSM), one bisexual male, and one bisexual female. Two of these individuals were Caucasian and nine identified as First Nations, Métis, or Inuit. The highest grade in school completed among the seeds ranged from grades 6 to 12. On average, the seeds had completed grade 10 (average = 9.91, standard deviation = 1.29). Among the seeds, 10 (90.9%) received a negative test result for chlamydia and gonorrhea. One person was not tested. 72.7% of the seeds had had some schooling disruption, either in the form of dropping out or being kicked out.

Using the coupon recruitment method, 101 individuals were recruited into the study. These individuals ranged in age from 14 to 24, with an average age of 18.61 (standard deviation = 2.98). Fifty-seven were female, forty-three were male, and one was male-to-female transgender, with two females self-identifying as women who have sex with women (WSW), thirteen females identifying as bisexual and six males identifying as bisexual. Eighteen of these individuals were Caucasian, seventy-five identified as First Nations, Métis, or Inuit, two were Black, one was Hispanic, one was Middle Eastern, one didn't know, and three identified as "other". The highest grade in school completed among the seeds ranged from grades 2 to 12. On average, the coupon recruits had completed grade 9 (average = 9.42, standard deviation = 1.63). Among this group, 81.2% (82) were not infected with chlamydia and/or gonorrhea, 14.9% (15) were infected, and 4.0% (4) were not tested, either due to insufficient specimen quantities or

refusal to provide a specimen. Ninety-two percent of the coupon recruits had either dropped out of school or been kicked out.

In addition to the individuals recruited because they received a coupon, 57 individuals were recruited into this study without a coupon because they had heard about the study and had told the research nurse that they wanted to participate. These individuals were treated like seeds, and given three contact coupons to distribute. These individuals ranged in age from 14 to 24, with an average age of 18.1 (standard deviation = 3.10). Twenty-six were female, twenty-nine were male, and two were male-to-female transgender, with eight females identifying as bisexual, two males identifying as bisexual, and two males identifying as MSM. Eleven of these individuals were Caucasian, forty identified as First Nations, Métis, or Inuit, two were Black, and four identified as "other". The highest grade in school completed among the seeds ranged from grades 5 to 11. On average, these individuals had completed grade 9 (average = 8.93, standard deviation = 1.39). Among this group, 77.2% (44) received a negative result for chlamydia and/or gonorrhea, 15.8% (9) were positive, and 7.0% (4) were not tested. 91.2% of these participants had either dropped out of school or been kicked out.

There were no statistically significant differences between the seeds, coupon recruits, and self-recruited participants for any of the twenty variables included in the study analyses.

In total, there were 169 participants, with an average age of 18.5 (SD=2.98), including 86 females (51%), 80 males (47%) and 3 transgender (2%). Two female participants identified as lesbian and 22 identified as bisexual. Among the male participants, 4 identified as gay and 9 as bisexual. Thirty-one (18%) participants were

Caucasian, 124 (73%) were Aboriginal, 4 were Black, 1 was Hispanic, 1 Middle Eastern, 1 indicated "unsure", and 7 indicated "other". The highest grade completed in school ranged from 2 to 12, with an average of 9.28 (standard deviation = 1.59). Only 16 of the participants (9.5%) had never experienced disruption in their schooling in the form of being kicked out or dropping out.

3.3 Measures

A cross-sectional questionnaire (Appendix B) was used to collect demographic information, information about health-related behaviors (history of STD infection, testing and condom use), and social variables as indicators of the extent of street-involvement. Indicators of street involvement included a history of problems with school, having been in foster care, criminal charges or incarceration, as well as having received money by squeegeeing, panhandling, dealing drugs or sex work in the past six months, and types of places and intersection locations of hangouts and shelters, with most frequent hangouts and shelters identified.

Each RDS coupon had a unique four digit non-nominal code to identify the participant that gave them out and to distinguish between individuals recruited by that participant. Questionnaires and urine samples were linked to the corresponding code on the coupon that recruited the participant. These codes were used to identify social network connections between participants of the study.

For most variables, only responses of "yes" and "no" were included in analyses; responses of "unsure" or "refused" were not included in analyses. However, responses of "unsure" for sex work and dealing drugs were recoded to "yes" because a response of unsure implies that the person engages in behaviors that may be considered sex work and

drug dealing, and these behaviors would likely involve the same risks associated with sex work and drug dealing.

3.4 Analysis

The RDS recruitment diagram was produced using NETDraw 2.064 software (Analytic Technologies, 2007).

Respondent Driven Sampling Analysis Tool (RDSAT) version 5.0.1, developed by Heckathorn and colleagues (Cornell University, 2003) was used to calculate homophily, heterophily, sample proportions, equilibrium sample proportions, estimated population proportions, and 90% confidence intervals (Salganik, 2006) for selected questionnaire-item variables. Bootstrapping was performed using 2500 resamples.

Weighted mean absolute discrepancies between sample proportions and equilibrium sample proportions were calculated following published procedures (Wang, 2005). RDSAT output provides the sample proportion, which is the proportion of participants in the complete sample that fit within each category of the variables.

RDSAT also calculates the equilibrium sample proportion, which is what the proportion of each category would be if the sample reached a size large enough for the addition of additional participants to not affect the sample proportions. Weighted mean absolute discrepancies are then calculated. For example, in the overall sample, the sample proportions for gender were 48.1% male and 51.8% female. However, excluding seeds, 44% were male and 56% were female. RDSAT calculated the equilibrium sample proportion for males to be 43.4% and 56.5% for females. The following formula is used to calculate the weighted mean absolute discrepancies:

$$(|0.481 - 0.434| \times 0.44) + (|0.518 - 0.565| \times 0.56) = 0.021 + 0.026 \\ = 0.047$$

Discrepancies that are smaller than the measure of *tolerance*, defined as 2% by Heckathorn (1997), indicate that the actual sample composition approximates the equilibrium sample compositions and that the RDS was therefore successful. Once the sample composition approximated the equilibrium sample composition for a given variable, the sample has converged to equilibrium, and the inclusion of data from subsequent waves of recruitment is not expected to result in a substantial change in the sample composition for that variable. In the above example, $0.047 > 0.02$ and therefore equilibrium was not reached for that particular variable.

To determine whether the sample was representative of the target population, a test statistic (Two-tailed Student's t-test) was applied to the absolute discrepancy between sample proportions and the estimated population proportions, following the method used by Wang et al (2005). The formula for the test statistic is as follows:

$$t = \frac{(\text{sample proportion} - \text{estimated population proportion})}{\{[(\text{sample proportion}) \times (1 - \text{sample proportion})] \div N_{\text{used by RDS}}\}^{1/2}} \quad (I)$$

Degrees of freedom were then calculated as $N_{\text{used by RDS}} - 1$ and used to determine the p-value for the test statistic. P-values that indicate non-significance (>0.05) indicate that there were no significant differences between the sample proportion and estimated population proportion for the given category, and mean that a representative sample was attained. These calculations were performed for each category of every variable.

Homophily is a measure of preference for social connections with members of one's own group for a particular characteristic, based on study recruitment patterns.

Homophily can vary from -1 to +1, with 0 as random recruitment (-1 for males would indicate that males only recruited females; +1 for males would indicate that males only recruited males). Homophily can vary for different states of the same variable – for example, if males only recruit males but females recruit males and females equally. Heterophily, in contrast, measures the preference to recruit between groups (males recruiting females, for example).

The prevalence of chlamydia and gonorrhea (and other categorical variables) among the Winnipeg street-involved youth population was estimated using RDS Analysis Tool v. 5.0.1 (Heckathorn, 2004), based on the following data for each individual: infection status (or category of other variables), personal network size (the number of people the respondent knows within the target population), the respondent's code (the code on the coupon that this person received from a contact), and the respondent's recruiting code (the code on the coupon that this person gives to contacts). Due to the fact that the sampling frame is not known for "hidden populations" and the non-random selection of seeds, population estimates cannot be made directly from the sample. Personal network sizes and participant codes are incorporated because they allow for estimates to be made about the social network based on the sample, and this is in turn used to make estimates about the prevalence of a trait within the population. This is important to ensure that population estimates are not biased by recruitment patterns and the limitation placed on the number of recruits allowed per participant. For example, a participant who has been in jail knows many other people who were in jail at the same time, and this participant would potentially recruit many people who had been in jail if they weren't limited to just three coupons. In the following formula for a two-category

variable, P_a represents the estimated proportion of As in the population, S_{ba} is the proportion of As recruited by Bs, S_{ab} is the proportion of Bs recruited by As, N_a is the combined average network size for group A, and N_b is the combined average network size for group B.

$$P_a = \frac{S_{ba}N_b}{S_{ba}N_b + S_{ab}N_a} \quad (II)$$

In this formula, P_a is negatively related to the network size of group A, and positively related to the network size of group B, to compensate for oversampling of the group with the larger network size. As P_a depends on the proportion of inter-category recruitment rather than intra-category recruitment, differences in recruitment effectiveness between the groups will not bias the prevalence calculation.

Using STATA 9.0, the Fisher's Exact Test was used to assess univariate associations between twenty categorical variables and infection with chlamydia and/or gonorrhea at the time of the study, with statistical significance as $p < 0.05$. The Fisher's Exact test was used because only 20 individuals were positive for chlamydia and/or gonorrhea, and the resultant Chi2 cell sizes were small. For those variables with two categories, the cs command in STATA was used to calculate odds ratios and 95% confidence intervals. The cs command can be used for cohort studies and cross-sectional studies to calculate a point estimate for the odds ratio and the corresponding 95% confidence interval, but only for variables with two categories. Odds ratios were not calculated for the few variables with more than two categories. With 20 variables, there may be 1 variable erroneously found to be significant, at the 5% significance level.

The following 4 demographic variables were included in the analyses: gender (female, male; the 3 transgendered individuals were not included because the group was too small), age group (14 to 19 and 20 to 24), ethnicity (Aboriginal, not Aboriginal), and sexuality (opposite sex partners, any same sex partners at all). Sexual orientation was not determined for six individuals, three of whom were transgendered and three of whom indicated sex with "nobody."

The following 3 health related variables were also included in the analyses: previous test for chlamydia and gonorrhea, previous receipt of a positive test result for chlamydia or gonorrhea, and condom use. Condom use was determined from the social network questions which were not analyzed as part of this thesis. Participants were asked to consider five close friends. For each friend, they were asked about their relationship to that person, whether they get drunk or high together and whether they have sex with that person and, if so, whether they use condoms. Any suggestion of not always using a condom with a sex partner was scored as not using a condom, as any occurrence of sex without a condom is an opportunity for transmission to occur. As only 75 participants listed a sex partner among the five close friends, the sample size for this variable was cut to 75.

Thirteen social variables were included in the analyses. These included: ever having had problems in school in the form of having been kicked out or dropping out, ever having been in foster care, ever having been charged with a crime, and ever having been in jail (youth and/or adult). Also included were squeegeeing, panning, or flagging (combined as one variable), selling drugs, doing sex work (hooking and escort services combined into one variable), traveling to or living in other locations within Manitoba,

and traveling to or living in other locations outside of Manitoba within the previous six months. Finally, four variables included the neighborhood and type of place of most frequent hangout and shelter in the past month. Neighborhoods included downtown, north end, and suburbs. The north end included Point Douglas and Inkster community areas. The suburbs included Seven Oaks, River East, Transcona, St. Boniface, St. Vital, River Heights, Fort Garry, Assiniboine South, and St. James Assiniboia community areas. However, none of the participants listed St. Boniface. Places of hangout included three groups: 1) own or parents' place, 2) friend, boyfriend, girlfriend, or relative's place, 3) school, community centre, mall, street, or other. Places of shelter included four groups: 1) own place, 2) parents' place, 3) friend, boyfriend, girlfriend or relative's place, 4) foster home, group home, hotel, shelter or jail.

As the infection status of 9 individuals (5 male and 4 female) could not be determined, these individuals were eliminated from the analysis, leaving a sample size of 160. For some of the variables, the number of responses were less than 160. The values may have been missing because the participant responded that they were not sure of the answer, because the question was left blank, or because the missing values would have formed a unique group that would have been too small to be analyzed, such as the transgendered individuals who would have formed their own gender categories. Also, for the variable "previously infected", 54 individuals were not included, as they had not been previously tested. This left a sample size of 106 for this variable.

The responses of males and females were separated and Fisher's Exact tests were applied to the 20 variables in a gender-stratified analysis. Due to the fact that gender stratification effectively cut the sample size in half, for many variables there were no

infected individuals in some categories, rendering Fisher's Exact results invalid for those variables. Data from transgender participants were included in all analyses except those that looked for significance by gender, because the inclusion of these three individuals as their own group would have resulted in cells that contained 0 individuals, as none of the transgender individuals were infected.

Using Epi Info Map v. 3.3.2 (CDC, 2005), a dot density map was generated to illustrate the density of participants hanging out or living within the twelve Community Characterization Areas (CCAs) (City of Winnipeg, 2007). Note that in the maps dots are randomly distributed within the CCAs to avoid identifying specific places. CCAs were combined into three neighborhoods to facilitate the calculation of stable rates of infection. The neighborhood denoted 'suburbs' includes the following CCAs: St. James/Assiniboia, Assiniboine South, Fort Garry, St. Vital, St. Boniface, Transcona, River East, and Seven Oaks. The neighborhood denoted 'north end' includes Inkster and Point Douglas CCAs. The 'downtown' neighborhood is the same area as the Downtown CCA. A figure in the results section illustrates the boundaries of the CCAs.

Chapter 4

Results

This chapter provides a summary of the results from the analyses conducted for this study.

4.1 Results for Objective 1: To determine whether chlamydia and gonorrhea testing and treatment in non-clinical venues is acceptable among Winnipeg street-involved youth.

Objective 1 was explored by determining the proportion of participants who provided a specimen for laboratory testing, the proportion who returned for the second appointment, and the motivation for this return. These results were used to assess the level of acceptance of chlamydia and gonorrhea testing and treatment in non-clinical venues among this population.

4.1.1 Urine Specimen Provision

A result for the chlamydia and gonorrhea test was obtained for the majority (95%) of participants in the study. Of the nine participants for whom a result was not obtained, 3 had provided a urine sample but the quantities were too low for analysis. Only six individuals (3 male, 3 female) refused to provide a sample (representing only 3.6% of the participants).

Notably, 33% of the 160 participants who were tested as part of the study had never been previously tested for chlamydia and gonorrhea. Seventy-five percent of those who had not previously been tested were male.

4.1.2 Return for Test Result and Treatment if Necessary

Of the 160 participants for whom a test result was available, 116 (72.5%) returned for the second appointment and therefore obtained their result and treatment, if necessary. Seventy-five percent of the infected participants were among this group, and therefore obtained their result and single dose treatment.

Among the participants who returned for the second appointment, 75% (87/116) indicated that they had returned because they wanted their test result and an additional 10 participants indicated that they had returned because they wanted their test result and their honorarium. Therefore, 83.6% of participants who returned were at least partially motivated to return because they wanted their test result.

4.2 Results for Objective 2: To determine whether RDS is an effective method to access street-involved youth in Winnipeg.

The success of RDS requires that participants hand out recruitment coupons and that those who receive the recruitment coupons choose to become recruited. Recording and tracking the coupon codes associated with participants and recruits allowed for the evaluation of the success of coupon recruitment in this population. The success of RDS also requires that sample convergence to equilibrium occurs and that sample representativeness is achieved.

4.2.1 Coupon Recruitment

Of 169 participants, 11 were selected as seeds by study staff, 57 individuals were recruited into the study without a coupon and designated as seeds, and 101 were recruited via coupons distributed by study participants. A total of 136 participants were given 3 coupons to distribute. Twenty participants were given two coupons and thirteen

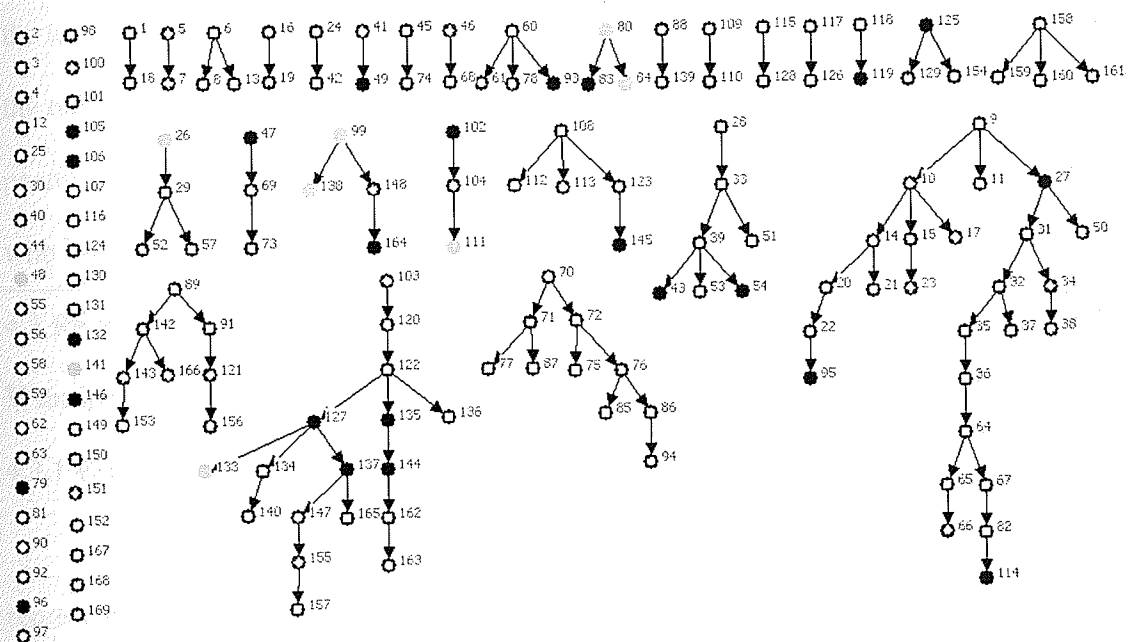
participants were not given coupons, as a method of winding down the study, and in the case of seven of them, because they were suspected as likely to give coupons to people who did not meet the definition of "street-involved youth". Therefore, a total of 448 coupons given to 156 participants resulted in the recruitment of 101 individuals (ie. 22.5% of distributed coupons resulted in recruitment). Of 156 participants provided with coupons, 67 (42.9%) recruited at least one person to the study. Among the twenty individuals given 2 coupons to distribute, 17 (85%) did not recruit anyone, 2 (10%) recruited one participant, and one (5%) recruited two. Among the 136 individuals given 3 coupons to distribute, 72 (52.9%) did not recruit anyone, 39 (28.7%) recruited one person, 17 (12.5%) recruited two, and 8 (5.9%) recruited three participants in the study.

At the second interview, participants were asked whether they had handed out coupons and if so, how many coupons they had handed out. Interestingly, at the second interview, three of the thirteen individuals who had not been given any coupons by study staff indicated that they had distributed coupons. Of the 116 participants who returned for the second interview, 96 (82.8%) indicated that they had distributed coupons since the first interview. Out of these 96 individuals, 48 (50%) did not recruit anyone, 29 (30.2%) recruited one person, 12 (12.5%) recruited two, and 7 (7.3%) recruited three. Of the twenty who indicated they had not yet distributed coupons, 15 (75%) did not recruit anyone, but 4 (20%) recruited one person and one (5%) recruited two people. Of the 53 participants who did not return for the second interview, 39 (73.6%) did not recruit anyone, 8 (15.1%) recruited one person, 5 (9.4%) recruited two people, and 1 (1.9%) recruited three people into the study.

Importantly, 91.1% (92/101) of individuals recruited into the study by a coupon reported that they had been recruited by a friend, boyfriend or girlfriend, ex-boyfriend or ex-girlfriend, or family member. Another 6.9% (7 participants) were recruited by an acquaintance, and 2 were recruited by a stranger (2.0%). This is important because RDS relies on pre-existing social relationships, termed the “reciprocity model”, to estimate population compositions (Heckathorn, 2002). The fact that most of the recruited individuals received a coupon from someone they knew indicates that the assumptions of the reciprocity model were met.

Among the 68 participants who were not recruited into the study by another participant (ie. the 11 study staff-selected seeds and the 57 self-recruited participants), 8 were not given any coupons to distribute. Among the remaining 60 “seeds”, 33 did not recruit anyone. In total, there were 27 chains with at least one recruitment wave. The number of waves in each chain is indicative of the success of respondent driven sampling. There were 17 chains that contained 2 waves (41 participants), 5 that contained 3 waves (19 participants), 2 that contained 4 waves (15 participants), one that contained 5 waves (10 participants), one that contained 8 waves (17 participants), and 1 that contained 10 waves (26 participants). The following recruitment diagram (Figure 3) illustrates the chains described above.

Figure 3. Respondent driven sampling recruitment diagram. Each circle represents a participant in the study, with seeds at the top of a chain and a single line connecting them to individuals they recruited. Individuals who are not connected to anyone else via a line were not recruited into the study by another participant and did not recruit anyone. White circles indicate that the participant was not infected, black indicates infection, and grey indicates that infection status could not be determined, either due to refusal to provide a sample or insufficient sample quantities. Numbers next to the circles indicate the order in which the participants entered the study.



4.2.2 Convergence to Equilibrium

Sample convergence was reached for many variables: age group, ethnicity, infection status, history of foster care, criminal charges, squeegeeing or panhandling, drug dealing, traveling within Manitoba in the past 6 months, and traveling outside of

Manitoba in the past 6 months. As indicated by a weighted mean discrepancy greater than the measure of *tolerance*, 0.02, sample convergence was not reached for gender, sexual orientation, past sexually transmitted infection, past STI testing, condom use, school problems, history of sex work, and incarceration (Table 1). Therefore, for these variables elimination of bias related to the non-random selection of seeds was not achieved. Results should be considered to be less accurate for these variables than results for variables that did converge to equilibrium.

4.2.3 Representativeness

Representativeness was considered to have been reached for variables for which the test statistic was not significant, with $p > 0.05$ (Table 1). Of the variables listed above, the only variable for which representativeness was not achieved was having tested positive for chlamydia and/or gonorrhea in the past ($p = 0.044$), indicating that individuals who had tested positive in the past were under-represented in the sample.

4.3 Results for Objective 3: To examine the characteristics and social structure of Winnipeg street-involved youth.

4.3.1 Estimated Population Proportions

There were eight variables for which convergence to equilibrium and representativeness were reached, and therefore estimated population proportions (Table 1) can be considered to be accurate. Among this street-involved youth population, therefore, approximately 55.6% are between the ages of 14 and 19, with 44.4% aged 20 to 24. Seventy-three percent are Aboriginal, 17.4% are Caucasian, and 9.6% are of another ethnicity. An estimated 14.4% of Winnipeg street-involved youth are infected with chlamydia and/or gonorrhea. Approximately 58.5% have been in foster care, 63.1%

have been charged with a crime, 10.8% squeegee, flag, or panhandle, and 29.7% deal drugs. About 59% will have traveled to other parts of Manitoba within the last six months, and 22.7% will have been outside of Manitoba during the same period of time.

Table 1. RDS Analysis Tool output indicating sample and population proportions of key variables and indicators of convergence and representativeness.

			Assessment of Convergence to Equilibrium			Assessment of Representativeness			
<i>Variable</i>		N Used by RDS	Sample Proportion	Equilibrium Sample Proportion	Weighted Mean Discrepancy (Sample- Equilibrium)	Estimated Population Proportion	Confidence Interval with alpha=0.05, 90%CI	T-test (Sample - Estimated)	p- value for T- test
Demographic Variables									
Gender					0.047				
	Male	44	0.481	0.434		0.413	0.22-0.497	0.903	0.372
	Female	56	0.518	0.565		0.586	0.503-0.779	-1.018	0.313
Age Group					0.005				
	14-19	67	0.663	0.658		0.556	0.465-0.756	1.853	0.068
	20-24	34	0.337	0.342		0.444	0.244-0.535	-1.320	0.196
Ethnicity					0.010				
	Aboriginal	75	0.733	0.742		0.73	0.509-0.799	0.059	0.953
	Caucasian	18	0.183	0.167		0.174	0.08-0.362	0.099	0.922
	Other	8	0.082	0.089		0.095	0.032-0.269	-0.134	0.897

			Assessment of Convergence to Equilibrium			Assessment of Representativeness			
<i>Variable</i>		N Used by RDS	Sample Proportion	Equilibrium Sample Proportion	Weighted Mean Discrepancy (Sample-Equilibrium)	Estimated Population Proportion	Confidence Interval with $\alpha=0.05$, 90%CI	T-test (Sample - Estimated)	p-value for T-test
Sexuality					0.021				
	Opposite Sex Partners Only	76	0.758	0.778		0.733	0.591-0.855	0.509	0.612
	Opposite and Same Sex Partners	19	0.188	0.209		0.245	0.120-0.379	-0.636	0.533
	Same Sex Partners Only	3	0.055	0.012		0.023	0.014-0.069	0.243	0.831
Health Related Variables									
Infected					0.000				
	No	82	0.850	0.850		0.855	0.792-0.955	-0.127	0.899
	Yes	15	0.150	0.149		0.144	0.044-0.207	0.065	0.949
Tested Before					0.083				
	No	28	0.339	0.256		0.245	0.183-0.417	1.051	0.303
	Yes	73	0.661	0.744		0.755	0.584-0.817	-1.697	0.094

			Assessment of Convergence to Equilibrium			Assessment of Representativeness			
<i>Variable</i>		N Used by RDS	Sample Proportion	Equilibrium Sample Proportion	Weighted Mean Discrepancy (Sample- Equilibrium)	Estimated Population Proportion	Confidence Interval with alpha=0.05, 90%CI	T-test (Sample - Estimated)	p-value for T-test
Tested Positive in the Past					0.075				
	No	33	0.335	0.320		0.291	0.150-0.367	0.536	0.596
	Yes	39	0.317	0.430		0.472	0.318-0.635	-2.080	0.044
	Never Tested in the Past	28	0.347	0.250		0.237	0.153-0.387	1.223	0.232
Condom Use					0.039				
	No	34	0.728	0.767		0.769	0.554-0.955	-0.537	0.595
	Yes	11	0.272	0.233		0.231	0.046-0.452	0.306	0.766
Social Variables									
School Problems					0.030				
	No	7	0.094	0.064		0.060	0.014-0.114	0.308	0.768
	Yes	94	0.906	0.936		0.940	0.885-0.985	-1.130	0.261
Ever Been in Foster Care					0.001				
	No	41	0.408	0.407		0.415	0.361-0.597	-0.091	0.928
	Yes	60	0.592	0.593		0.585	0.403-0.640	0.110	0.913

			Assessment of Convergence to Equilibrium			Assessment of Representativeness			
<i>Variable</i>		N Used by RDS	Sample Proportion	Equilibrium Sample Proportion	Weighted Mean Discrepancy (Sample- Equilibrium)	Estimated Population Proportion	Confidence Interval with alpha=0.05, 90%CI	T-test (Sample - Estimated)	p- value for T- test
Ever Been Charged					0.002				
	No	32	0.317	0.319		0.369	0.337-0.576	-0.632	0.532
	Yes	68	0.683	0.681		0.631	0.424-0.664	0.922	0.360
Ever Been in Jail					0.031				
	No	41	0.432	0.401		0.419	0.368-0.644	0.168	0.867
	Yes	60	0.568	0.599		0.581	0.356-0.633	-0.203	0.840
Squeegeeing, Panhandling, Flagging					0.014				
	No	86	0.846	0.860		0.892	0.861-0.966	-1.182	0.241
	Yes	15	0.154	0.140		0.108	0.034-0.139	0.494	0.629
Drug Dealing					0.003				
	No	66	0.650	0.653		0.702	0.661-0.842	-0.886	0.379
	Yes	35	0.349	0.346		0.297	0.157-0.339	0.645	0.523
Sex Work					0.038				
	No	83	0.786	0.824		0.739	0.624-0.860	1.044	0.300
	Yes	18	0.213	0.175		0.26	0.139-0.375	-0.487	0.632

			Assessment of Convergence to Equilibrium			Assessment of Representativeness			
<i>Variable</i>		N Used by RDS	Sample Proportion	Equilibrium Sample Proportion	Weighted Mean Discrepancy (Sample- Equilibrium)	Estimated Population Proportion	Confidence Interval with $\alpha=0.05$, 90%CI	T-test (Sample - Estimated)	p- value for T- test
Travel Within Manitoba					0.003				
	No	37	0.360	0.363		0.408	0.253-0.469	-0.608	0.547
	Yes	64	0.639	0.636		0.591	0.531-0.746	0.800	0.427
Travel Outside of Manitoba					0.009				
	No	79	0.786	0.777		0.772	0.666-0.854	0.303	0.763
	Yes	22	0.213	0.222		0.227	0.145-0.333	-0.160	0.874

4.3.2 Homophily and Heterophily as an Indicator of Social Structure

The affiliation matrix presents both homophily and heterophily values (Table 2). In general, individuals in this sample recruited others with similar demographic characteristics. Positive homophily values were found for gender, ethnicity, and age group, and among individuals with opposite sex partners. A moderate tendency towards in-group affiliation was found for those with both same and opposite sex partners, those with same sex partners only, and also among individuals who travel to other parts of Manitoba.

Individuals also appear to group socially based on health-related behaviors. A tendency towards in-group affiliation was found based on condom use behaviors, among individuals who had never been tested for chlamydia or gonorrhea and among individuals who had tested positive for chlamydia or gonorrhea in the past. A moderate tendency for in-group affiliation was found for individuals who had been tested in the past for chlamydia or gonorrhea, and for individuals who had tested positive for chlamydia or gonorrhea in the past.

Individuals who hang out in the north end form a tight-knit group, as indicated by the relatively high homophily (0.470) and did not have a tendency to affiliate with individuals from other areas of the city, as indicated by the low heterophily values to and from both the suburbs and downtown (-0.397, -0.487, -0.538, and -0.551, respectively) (Table 2). Similarly, individuals who obtain shelter in the north end form a tight-knit group, as do individuals who obtain shelter in the suburbs. As presented in section 4.4.1, there is overlap in the individuals who obtain shelter and those who hang out in certain neighborhoods. Individuals who have obtained shelter most frequently in a foster home,

group home, hotel, shelter, or jail also form a relatively tight-knit group, with a homophily of 0.251. Type of most common hangout place had little influence on recruitment.

Characteristics that indicate a higher degree of street-involvement also influenced social affiliation. A preference for recruiting similar individuals was found based on whether or not a person had ever been in jail, whether a person had been charged with a crime, and among individuals who squeegee, panhandle, and flag, and among non-sex workers.

Characteristics that had little influence on social affiliation included whether or not a person sold drugs or had been in foster care. Similarly, participants who had never been charged with a crime, never had school system problems, and had not squeegeed, panhandled, or flagged were just as likely to associate with individuals who had been involved in these activities as individuals who had not.

Table 2. Affiliation matrix indicating homophily (in-group affiliation in table cells diagonally from upper left to lower right) and heterophily (out-group affiliation in all other table cells) values for key variables obtained from RDS Analysis Tool output.

<i>Source of Affiliation (Recruiters), n</i>		<i>Target of Affiliation (Recruits)</i>			
Gender		Male	Female		
44	Male	0.347	-0.347		
56	Female	-0.289	0.289		
Age Group		14-19	20-24		
67	14-19	0.503	-0.503		
34	20-24	-0.237	0.237		
Ethnicity		Aboriginal	Caucasian	Other	
75	Aboriginal	0.456	-0.423	-0.518	
18	Caucasian	-0.387	0.426	-0.724	
8	Other	-0.480	-0.719	0.526	
Sexuality		Opposite Sex Partners Only	Opposite and Same Sex Partners	Same Sex Partners Only	
76	Opposite Sex Partners Only	0.352	-0.335	-0.530	
19	Opposite and Same Sex Partners	-0.174	0.185	-0.562	
3	Same Sex Partners Only	-0.090	-0.319	0.147	
Infected		No	Yes		
82	No	-0.002	0.002		
15	Yes	-0.026	0.026		
Tested Before		No	Yes		
28	No	0.243	-0.243		
73	Yes	-0.195	0.195		

<i>Source of Affiliation (Recruiters), n</i>		<i>Target of Affiliation (Recruits)</i>			
Tested Positive in the Past		No	Yes	Never Tested in the Past	
33	No	0.102	-0.248	0.058	
39	Yes	-0.092	0.267	-0.482	
28	Never Tested in the Past	0.098	-0.553	0.251	
Condom Use		No	Yes		
34	No	0.231	-0.213		
11	Yes	-0.220	0.220		
School Problems		No	Yes		
	No	0.113	-0.113		
	Yes	-0.078	0.078		
Ever Been in Foster Care		No	Yes		
41	No	-0.008	0.008		
60	Yes	-0.029	0.029		
Ever Been Charged with a Crime		No	Yes		
32	No	0.048	-0.048		
68	Yes	-0.239	0.239		
Ever Been in Jail		No	Yes		
41	No	0.303	-0.303		
60	Yes	-0.353	0.353		
Squeegeeing, Panhandling, Flagging		No	Yes		
86	No	-0.001	0.001		
15	Yes	-0.253	0.253		
Drug Dealing		No	Yes		
66	No	-0.094	0.094		
35	Yes	-0.023	0.023		

<i>Source of Affiliation (Recruiters), n</i>		<i>Target of Affiliation (Recruits)</i>			
Sex Work		No	Yes		
83	No	0.484	-0.484		
18	Yes	-0.146	0.146		
Travel Within Manitoba		No	Yes		
37	No	0.029	-0.027		
64	Yes	-0.197	0.197		
Travel Outside of Manitoba		No	Yes		
79	No	0.111	-0.111		
22	Yes	-0.086	0.086		
Neighborhood of Hangout Most Often		Suburbs	Downtown	North End	
13	Suburbs	0.139	-0.035	-0.538	
48	Downtown	0.019	0.243	-0.551	
19	North End	-0.397	-0.487	0.470	
Neighborhood of Shelter Most Often		Suburbs	Downtown	North End	
19	Suburbs	0.353	-0.419	-0.200	
46	Downtown	0.007	0.111	-0.191	
25	North End	0.001	-0.437	0.359	

<i>Source of Affiliation (Recruiters), n</i>		<i>Target of Affiliation (Recruits)</i>			
Type of Most Frequent Shelter		Own Place	Parents' Place	Friend, Boy/ Girlfriend, Relative	Foster Home, Group Home, Hotel, Shelter, Jail
32	Own Place	0.085	-0.207	-0.004	-0.507
21	Parents' Place	-0.615	0.145	0.187	0.015
39	Friend, Boy/ Girlfriend, Relative	-0.177	0.159	-0.218	0.026
9	Foster Home, Group Home, Hotel, Shelter, Jail	-0.735	0.063	0.004	0.251
Type of Most Frequent Hangout		Own Place or Parents' Place	Friend, Boy/ Girlfriend, Relative	School, Community Centre, Mall, Street, Other	
22	Own Place or Parents' Place	-0.088	-0.089	0.088	
39	Friend, Boy/Girlfrie nd, Relative	-0.220	0.119	-0.055	
38	School, Community Centre, Mall, Street, Other	0.008	-0.010	-0.007	

4.4 Results for Objective 4: To determine whether infection with chlamydia and/or gonorrhea is associated with individual characteristics.

4.4.1 Prevalence and Correlates of Chlamydia and Gonorrhea Infection

Of the 169 participants, 6 refused to provide a urine sample and 3 provided samples in insufficient quantities for the test. Of the 160 participants who did receive laboratory testing, 136 were uninfected (85%), 20 were infected with chlamydia only (13%), 3 were infected with gonorrhea only (2%), and one was co-infected with both chlamydia and gonorrhea. The overall prevalence of chlamydia and/or gonorrhea infection was 15%.

The only study variable significantly correlated with present infection was gender ($p=0.025$), with 22% of female participants testing positive, compared to only 8% of male participants (Table 3). The odds ratio of 3.23 indicates that females had an approximately three times greater odds of being infected compared to the males (95% confidence interval 1.24 and 8.4). Only 47% (35/75) of male participants had been tested for chlamydia and/or gonorrhea in the past, compared to 84% (68/81) of females.

Table 3. Univariate associations between street-involved youth variables and chlamydia and/or gonorrhea infection using the Fisher's Exact Test, N=160*

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p-value
Demographic Variables							
Gender							
	Male	75	69 (92.0)	6 (8.0)	ref		
	Female	82	64 (78.0)	18 (22.0)	3.23	1.24-8.40	0.025
Age Group							
	14-19	106	91 (85.8)	15 (14.2)	ref		
	20-24	54	45 (83.3)	9 (16.7)	1.21	0.50-2.93	0.649
Ethnicity							
	Aboriginal	117	99 (84.6)	18 (15.4)	ref		
	Non-Aboriginal	43	37 (86.0)	6 (14.0)	1.12	0.42-2.95	1.000
Sexuality							
	Opposite Sex Partners Only	119	101 (84.9)	18 (15.1)	ref		
	Same Sex Partners All or Some of the time	37	32 (86.5)	5 (13.5)	0.87	0.31-2.47	1.000
Health-Related Variables							
Tested Before							
	No	53	49 (92.5)	4 (7.5)	ref		
	Yes	106	86 (81.1)	20 (18.9)	2.85	0.96-8.39	0.065
Previously Infected							
	No	53	43 (81.1)	10 (18.9)	ref		
	Yes	51	42 (82.4)	9 (17.6)	0.92	0.35-2.44	1.000

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Condom Use							
	No	19	16 (84.2)	3 (15.8)	ref		
	Yes	56	47 (83.9)	9 (16.1)	0.98	0.26- 3.83	1.000
Social Variables							
School Problems							
(dropped out, kicked out)	No	16	15 (93.8)	1 (6.2)	ref		
	Yes	144	121 (84.0)	23 (16.0)	2.85	0.454-	0.470
Ever Been in Foster Care							
	No	66	58 (87.9)	8 (12.1)	ref		
	Yes	94	78 (83.0)	16 (17.0)	1.49	0.61- 3.63	0.502
Ever Been Charged							
With a Crime	No	49	41 (83.7)	8 (16.3)	ref		
	Yes	109	93 (85.3)	16 (14.7)	0.88	0.36- 2.17	0.813
Ever Been in Jail							
	No	68	59 (86.8)	9 (13.2)	ref		
	Yes	92	77 (83.7)	15 (16.3)	1.28	0.53- 3.06	0.659
Squeegeeing, Panhandling, Flagging							
	No	135	113 (83.7)	22 (16.3)	ref		
	Yes	25	23 (92.0)	2 (8.0)	0.45	0.00- 1.84	0.374

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Drug Dealing							
	No	103	87 (84.5)	16 (15.5)	ref		
	Yes	57	49 (86.0)	8 (14.0)	0.89	0.36- 2.18	1.000
Sex Work							
	No	125	108 (86.4)	17 (13.6)	ref		
	Yes	35	28 (80.0)	7 (20.0)	1.59	0.62- 4.12	0.421
Travel Within Manitoba							
	No	104	90 (86.5)	14 (13.5)	ref		
	Yes	56	46 (82.1)	10 (17.9)	1.40	0.59- 3.33	0.491
Travel Outside Manitoba							
	No	126	106 (84.1)	20 (15.9)	ref		
	Yes	34	30 (88.2)	4 (11.8)	0.71	0.24- 2.14	0.787
Neighborhood of Hangout Most Often							
	Suburbs	20	17 (85.0)	3 (15.0)	ref		
	Downtown	79	68 (86.1)	11 (13.9)			0.813
	North End	31	28 (90.3)	3 (9.7)			

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Type of Most Frequent Hangout							
	Own Place or Parents' Place	28	24 (85.7)	4 (14.3)	ref		
	Friend, Boy/Girlfriend, Relative	62	50 (80.6)	12 (19.4)			0.363
	School, Community Centre, Mall, Street, Other	67	60 (89.6)	7 (10.4)			
Neighborhood of Shelter Most Often							
	Suburbs	27	22 (81.5)	5 (18.5)	ref		
	Downtown	72	63 (87.5)	9 (12.5)			0.690
	North End	42	36 (85.7)	6 (14.3)			
Type of Most Frequent Shelter							
	Own Place	51	44 (86.3)	7 (13.7)	ref		
	Parents' Place	26	23 (88.5)	3 (11.5)			0.915
	Friend, Boy/Girlfriend, Relative	60	50 (83.3)	10 (16.7)			
	Foster Home, Group Home, Hotel, Shelter, Jail	23	19 (82.6)	4 (17.4)			

* The maximum sample size for univariate analyses is 160, as the 9 participants for

which a lab test result was not obtained are not included. The actual sample size used for some variables may be less than 160 because some participants refused to answer the particular question.

In the gender stratified analyses (Tables 4 and 5), none of the variables that could be included in the analysis among this subset were significant. Given the small sample size, many variables had small cell sizes, resulting in poorly defined odds ratios and 95% confidence intervals.

Table 4. Univariate associations between street-involved youth variables and chlamydia and/or gonorrhea infection, male subset, N=75*

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p-value
Demographic Variables							
Age Group							
	14-19	54	49 (90.7)	5 (9.3)	Ref		
	20-24	21	20 (95.2)	1 (4.8)	0.49	0.00-3.45	1.000
Ethnicity							
	Aboriginal	52	48 (92.3)	4 (7.7)	Ref		
	Non-Aboriginal	23	21 (91.3)	2 (8.7)	0.88	0.17-	1.000
Sexuality							
	Opposite Sex Partners Only	62	57 (91.9)	5 (8.1)	Ref		
	Same Sex Partners All or Some of the time	12	11 (91.7)	1 (8.3)	1.04	0.00-7.64	1.000
Health-Related Variables							
Tested Before							
	No	40	36 (90.0)	4 (10.0)	Ref		
	Yes	35	33 (94.3)	2 (5.7)	0.55	0.00-2.75	0.679
Previously Infected							
	No	22	20 (90.9)	2 (9.1)	Ref		
	Yes	13	13 (100.0)	0 (0.0)	**		
Condom Use							
	No	25	23 (92.0)	2 (8.0)	Ref		
	Yes	11	11 (100.0)	0 (0.0)	**		

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Social Variables							
School Problems							
(dropped out, kicked out)	No	8	8 (100.0)	0 (0.0)	Ref		
	Yes	67	61 (90.0)	6 (10.0)	**		
Ever Been in Foster Care							
	No	28	25 (89.3)	3 (10.7)	Ref		
	Yes	47	44 (93.6)	3 (6.4)	0.57	0.12- 2.66	0.665
Ever Been Charged							
	No	17	15 (88.2)	2 (11.76)	Ref		
	Yes	57	53 (93.0)	4 (7.0)	0.57	0.11-	0.616
Ever Been in Jail							
	No	27	25 (92.6)	2 (7.4)	Ref		
	Yes	48	44 (91.7)	4 (8.3)	1.14	0.22-	1.000
Squeegeeing, Panhandling, Flagging							
	No	63	57 (90.48)	6 (9.52)	Ref		
	Yes	12	12 (100.0)	0 (0.0)	**		
Drug Dealing							
	No	42	39 (92.9)	3 (7.1)	Ref		
	Yes	33	30 (90.9)	3 (9.1)	1.30	0.28- 6.07	1.000

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Sex Work							
	No	67	62 (92.5)	5 (7.5)	Ref		
	Yes	8	7 (87.5)	1 (12.5)	1.77	0.0- 13.76	0.504
Travel Within Manitoba							
	No	45	43 (95.6)	2 (4.4)	Ref		
	Yes	30	26 (86.7)	4 (13.3)	3.31	0.65-	0.210
Travel Outside Manitoba							
	No	55	50 (90.9)	5 (9.1)	Ref		
	Yes	20	19 (95.0)	1 (5.0)	0.53	0.0- 3.72	1.000
Neighborhood of Hangout Most Often							
	Suburbs	8	7 (87.5)	1 (12.5)	Ref		
	Downtown	36	35 (97.2)	1 (2.8)			
	North End	11	11 (100.0)	0 (0.0)	**		
Type of Most Frequent Hangout							
	Own Place or Parents' Place	14	13 (92.9)	1 (7.1)	Ref		
	Friend, Boy/Girlfriend, Relative	29	26 (89.7)	3 (10.3)			0.864
	School, Community Centre, Mall, Street, Other	30	28 (93.3)	2 (6.7)			

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p-value
Neighborhood of Shelter Most Often							
	Suburbs	12	10 (83.3)	2 (16.7)	Ref		
	Downtown	35	34 (97.1)	1 (2.9)			0.142
	North End	16	15 (93.8)	1 (6.3)			
Type of Most Frequent Shelter							
	Own Place	23	23 (100.0)	0 (0.0)	Ref		
	Parents' Place	11	10 (90.9)	1 (9.1)			
	Friend, Boy/Girlfriend, Relative	29	26 (89.7)	3 (10.3)			
	Foster Home, Group Home, Hotel, Shelter, Jail	12	10 (83.3)	2 (16.7)	**		

*Does not include the 5 male participants for which a lab test result was not obtained.

The actual sample size used for some variables may differ because some participants refused to provide answer the particular question.

**No further calculations were performed for variables with a cell size of zero. Odds ratio, 95% confidence interval, and p-value undefined.

Table 5. Univariate associations between street-involved youth variables and chlamydia and/or gonorrhea infection, female subset, N=82*

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Demographic Variables							
Age Group							
	14-19	52	42 (80.8)	10 (19.2)	Ref		
	20-24	30	22 (73.3)	8 (26.7)	1.53	0.54- 4.33	0.580
Ethnicity							
	Aboriginal	62	48 (77.4)	14 (22.6)	Ref		
	Non- Aboriginal	20	16 (80.0)	4 (20.0)	1.17	0.35- 3.84	1.000
Sexuality							
	Opposite Sex Partners Only	57	44 (77.2)	13 (22.8)	Ref		
	Same Sex Partners All or Some of the time	22	18 (81.8)	4 (18.2)	0.75	0.23- 2.52	0.767
Health- Related Variables							
Tested Before							
	No	13	13 (100.0)	0 (0.0)	Ref		
	Yes	68	50 (73.5)	18 (26.5)	**		
Previously Infected							
	No	28	20 (71.4)	8 (28.6)	Ref		
	Yes	38	29 (76.3)	9 (23.7)	0.78	0.26- 2.29	0.778
Condom Use							
	No	31	24 (77.4)	7 (22.6)	Ref		
	Yes	8	5 (62.5)	3 (37.5)	2.06	0.43- 10.12	0.399

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Social Variables							
School Problems							
(dropped out, kicked out)	No	8	7 (87.5)	1 (12.5)	Ref		
	Yes	74	57 (77.0)	17 (23.0)	2.09	0.31-	0.678
Ever Been in Foster Care							
	No	38	33 (86.8)	5 (13.2)	Ref		
	Yes	44	31 (70.5)	13 (29.5)	2.77	0.91- 8.33	0.108
Ever Been Charged							
	No	31	25 (80.7)	6 (19.3)	Ref		
	Yes	50	38 (76.0)	12 (24.0)	1.32	0.45- 3.83	0.785
Ever Been in Jail							
	No	41	34 (82.9)	7 (17.1)	Ref		
	Yes	41	30 (73.2)	11 (26.8)	1.78	0.63- 5.04	0.424
Squeegeeing, Panhandling, Flagging							
	No	70	54 (77.1)	16 (22.9)	Ref		
	Yes	12	10 (83.3)	2 (16.7)	0.68	0.00- 3.08	1.000
Drug Dealing							
	No	60	47 (78.3)	13 (21.7)	Ref		
	Yes	22	17 (77.3)	18 (22.7)	1.06	0.34- 3.32	1.000

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p-value
Sex Work							
	No	58	46 (79.3)	12 (20.7)	Ref		
	Yes	24	18 (75.0)	6 (25.0)	1.28	0.43-3.83	0.771
Travel Within Manitoba							
	No	56	44 (78.6)	12 (21.4)	Ref		
	Yes	26	20 (76.9)	6 (23.1)	1.10	0.37-3.27	1.000
Travel Outside Manitoba							
	No	68	53 (77.9)	15 (22.1)	Ref		
	Yes	14	11 (78.6)	3 (21.4)	0.96	0.26-3.68	1.000
Neighborhood of Hangout Most Often							
	Suburbs	12	10 (83.3)	2 (16.7)	Ref		
	Downtown	41	31 (75.6)	10 (24.4)			0.724
	North End	19	16 (84.2)	3 (15.8)			
Type of Most Frequent Hangout							
	Own Place or Parents' Place	13	10 (76.9)	3 (23.1)	Ref		
	Friend, Boy/Girlfriend, Relative	33	24 (72.7)	9 (27.3)			0.412
	School, Community Centre, Mall, Street, Other	35	30 (85.7)	5 (14.3)			

<i>Variable</i>		N	Not Infected (%)	Infected (%)	OR	95% CI	p- value
Neighborhood of Shelter Most Often							
	Suburbs	15	12 (80.0)	3 (20.0)	Ref		
	Downtown	34	26 (76.5)	8 (23.5)			0.934
	North End	26	21 (80.8)	5 (19.2)			
Type of Most Frequent Shelter							
	Own Place	25	18 (72.0)	7 (28.0)	Ref		
	Parents' Place	15	13 (86.7)	2 (13.3)			0.797
	Friend, Boy/Girlfriend, Relative	31	24 (77.4)	7 (22.6)			
	Foster Home, Group Home, Hotel, Shelter, Jail	11	9 (81.8)	2 (18.2)			

*Does not include the 4 female participants for which a lab test result was not obtained.

The actual sample size used for some variables may differ because some participants refused to provide answer the particular question.

**No further calculations were performed for variables with a cell size of zero. Odds ratio, 95% confidence interval, and p-value undefined.

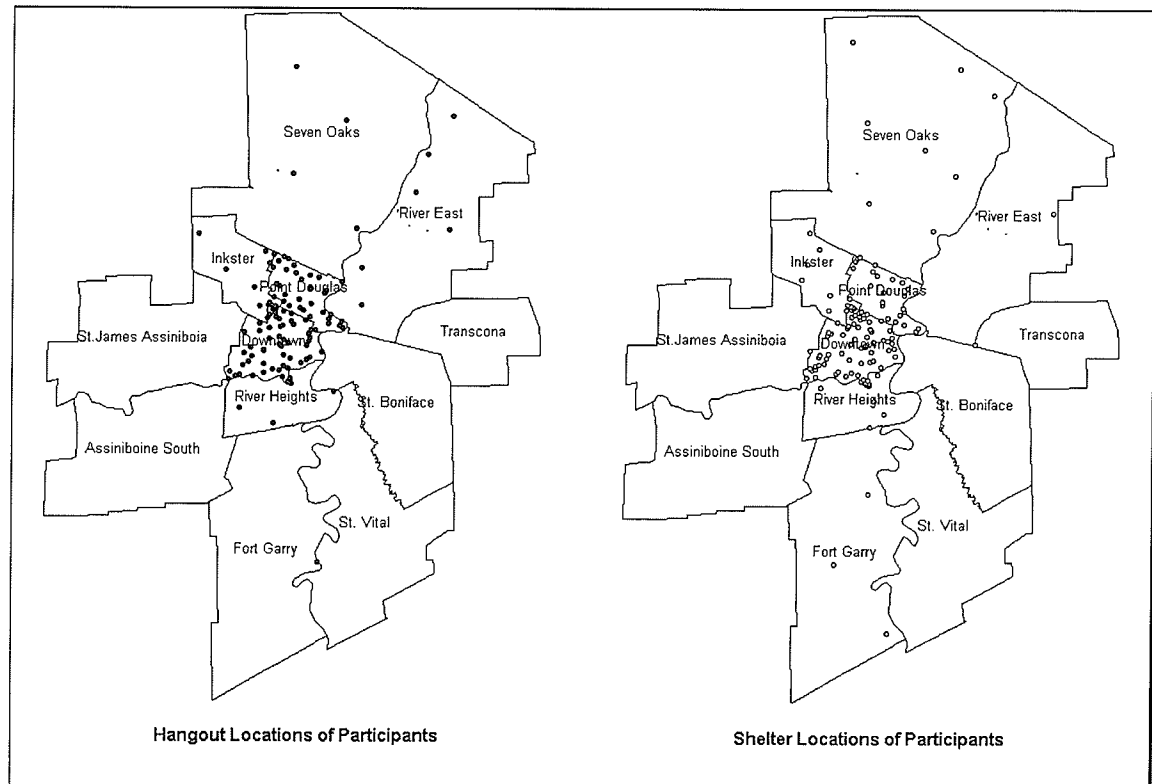
4.5 Results for Objective 5: To examine the geographic distribution of street-involved youth across Winnipeg.

4.5.1 Neighborhoods and Places of Hangout and Shelter

Given the apparent existence of tight-knit groups by geography and place, the Fisher's Exact test was utilized to determine whether any particular neighborhood or type of place was associated with current infection status. As indicated in Table 1, the differences in infection status based on neighborhoods and types of places were non-significant.

As illustrated in Figure 4, the majority of participants in the study spend most of their time in downtown Winnipeg.

Figure 4. Dot density map of most frequent hangout and shelter locations of participants. Dots randomly distributed within the CCAs.



A total of 157 participants provided hangout and/or shelter intersection information that could be assigned to a CCA. CCA could be assigned to shelter location for 147 participants and hangout location for 137 participants. CCA of both shelter and hangout locations could be identified for 127 participants. Among the participants for whom information about types of places and locations were available, 50% (73/147) obtained shelter most often downtown and 58% (80/137) hangout most downtown. The CCA of shelter and residence was the same for 69% (88/127) of these participants. Fifty-five (62.5%) of these were the Downtown CCA. The rest included Fort Garry (2, 2.3%), Transcona (1, 1.1%), River East (1, 1.1%), Seven Oaks (6, 6.8%), Inkster (2, 2.3%), Point Douglas (19, 21.6%), and River Heights (2, 2.3%).

Among the 39 participants who hang out in a different CCA than their shelter, 51.3% hang out Downtown (20/39), 12.8% hang out in each of Seven Oaks (5/39) and Point Douglas (5/39), 10.3% in Inkster (4/39), 7.7% in River Heights (3/39), and 2.6% (1/39) each in Fort Garry and River East. The shelter locations that these participants were coming from were Point Douglas (13, 33.3%), Downtown (12, 30.8%), River East (4, 10.3%), St. James/Assiniboia (2, 5.1%), River Heights (2, 5.1%), Fort Garry (2, 5.1%), Inkster (2, 5.1%), Assiniboine South (1, 2.6%), and St. Vital (1, 2.6%).

Nearly 38% of participants obtain shelter at their friend's, boyfriend or girlfriend's, and relative's places (60/160) (Table 6). Fourteen percent (23/160) of participants experience unstable housing situations, with their most common places of shelter being foster homes, group homes, hotels, shelters, and jail. Sixteen percent (26/160) of participants live with their parents, while 32% live on their own.

Table 6. Types of places of most frequent shelter in the three months before the interview.

<i>Type of Place of Most Frequent Shelter</i>	<i>Number of Participants (%)</i>
Own Place	55 (32.5)
Friend's Place	27 (16.0)
Boy/Girlfriend's Place	19 (11.2)
Parent's Place	30 (17.8)
Relative's Place	14 (8.3)
Foster Home	2 (1.2)
Group Home	9 (5.3)
Hotel	4 (2.4)
Shelter	4 (2.4)
Jail	5 (3.0)
<i>Total</i>	<i>169</i>

Forty-two percent (67/160) of participants hang out most frequently in public settings such as schools, community drop-ins, malls, the street, and other similar locations (Table 7). The frequency distribution among particular places is presented in Table 8. Schools, community drop-in centres, and malls have been coded to protect the identity of these places.

Table 7. Types of places of most frequent hangout in the month before the interview.

<i>Type of Place of Most Frequent Hangout</i>	<i>Frequency (%)</i>
Own Place	24 (14.2)
Friend's Place	40 (23.7)
Boy/Girlfriend's Place	14 (8.3)
Parent's Place	7 (4.1)
Relative's Place	11 (6.5)
School *	6 (3.6)
Community Drop-In *	12 (7.1)
Mall *	14 (8.3)
Street *	21 (12.4)
Other *	17 (10.1)
Unsure	3 (1.8)
<i>Total</i>	<i>169</i>

* More details provided in Table 8.

Seventy individuals indicated that they most frequently hangout at a school, community drop-in centre, mall, street, or other type of place. All together, these seventy participants named 4 different schools, 3 community drop-in centres, 3 malls, 3 general street areas, and 6 other types of places as their most frequent hangout locations. Table 8 indicates the number of participants who listed each of these specific places as their most frequent hangout location.

Table 8. Specific schools, community drop-in centres, malls, streets, and other places of most frequent hangout in the month before the interview.

<i>Place of Most Frequent Hangout</i>	<i>Number of Participants</i>
School A	3
School B	1
School C	1
School D	1
Community Drop-in A	8
Community Drop-in B	3
Community Drop-in C	1
Mall A	12
Mall B	1
Mall C	1
Street – Downtown	8
Street - Point Douglas	5
Street – Unidentified	8
Other - Bar	8
Other - Pool Hall	2
Other - Hotel	2
Other - Library	1
Other - Basketball Court	2
Other - Jail	1
<i>Total</i>	<i>70</i>

In addition to listing place of most frequent hangout, participants were also asked to list all of the places that they typically hang out at. The frequency of types of places

named by the participants is listed in Table 9. With 985 places named, the average number of places per participant is approximately 6.

Table 9. Distribution and frequency of types of places where participants typically hangout.

<i>Type of Place of Typical Hangout</i>	<i>Frequency (% of Participants)</i>
Own Place	91 (53.8)
Friend's Place	154 (91.1)
Boy/Girlfriend's Place	88 (52.1)
Parent's Place	63 (37.3)
Relative's Place	78 (46.2)
School *	68 (40.2)
Community Drop-in *	85 (50.3)
Skate Park *	27 (16.0)
Park *	56 (33.1)
Mall *	119 (70.4)
Street *	83 (49.1)
Other *	76 (45.0)
<i>Total</i>	985

* More details provided in Table 10.

Table 10. Distribution and frequency of particular places where participants typically hangout.

<i>Typical Hangout – Distribution of Top-Named Places</i>	<i>Frequency</i>
School A	5
School B	10
School C	6
School D	4
School E	7
School F	5
School G	5
School H	4
Community Drop-in A	30
Community Drop-in B	15
Community Drop-in C	7
Community Drop-in D	10
Skate Park A	23
Park A – Central Park	14
Park B – Freight House Park	11
Mall A	104
Mall B	70
Mall C	1
Street – Downtown	37
Street – Point Douglas	10
Street – River Heights	10
Street – Seven Oaks	1
Street – Unidentified	24
Other – Pool Hall	25
Other – Bar	22
Other – Hotel	5
Other – Roller Rink	5
Other – Unspecified	5
Other - Jail	3
Other – Basketball Court	2
Other – library, pool, bowling alley, hockey arena, movie theatre	1 each

The frequency of which typical places of hangout were named is only presented in Table 10 for the most frequently named places or if they were identified in Table 8 as a place where a participant hangs out at most. In total there were 28 schools that were

named; the remaining 20 schools were only named 1 to 3 times. Thirty different community drop-in centres were named; 26 were named 1 to 5 times and are not presented. Six other skate parks were named, but each were listed fewer than 3 times. An additional 26 parks were named, but they were all named less than 6 times. Five other malls were named, but they were all only named fewer than 20 times. For the majority of the instances that a pool hall was named, the three different pool halls were listed – Pool Hall A was listed 12 times, Pool Hall B was listed 6 times, and Pool Hall C was listed five times.

Chapter 5

Discussion

5.1 Testing in Non-Clinical Venues

The results of this study indicate that there is an interest and demand for chlamydia and gonorrhea testing and treatment services for street-involved youth in non-clinical venues. Less than 4% of the sample refused to provide a urine specimen for testing, and among the individuals who were tested, most returned for a second appointment. The fact that obtaining the test result provided a motivation for return among 84% of the participants who were tested suggests that a service with similar time/place flexibility and trusted health practitioners would be utilized by Winnipeg street-involved youth, despite the fact that no honorarium would be offered when youth return for their results. Other studies have found that STI testing services designed for street-involved youth and offered in non-clinical venues are successful, with 99% of youth accepting testing and 94% of positives being treated in San Francisco (Auerswald et al, 2006), and 74% of youth tested in non-clinical venues in Denver never having been tested before (Van Leeuwen et al, 2002).

5.2 Use of Respondent Driven Sampling among Street-Involved Youth

This study was unusual because of the large number of seeds: 68 “seeds” and 101 individuals recruited into the study. The fact that 57 of the “seeds” had self-recruited suggests that word of mouth may be an effective mechanism to reach street-involved youth, provided the message is one that interests the individuals. Given the apparent interest in testing and treatment in non-clinical venues and the amount of self-recruitment, word of mouth spread of such services may be effective. Word of mouth has

previously been described as an important mechanism for information about sexual health outreach services to be spread, with a large proportion of clients who sought services at a drop-in clinic for young men under the age of 25 in London (Lewis et al, 2004) and a sexual health clinic for youth under the age of 20, also in London (Armitage et al, 2004) having heard about them via word of mouth.

The practice of allowing participants to enter the study without recruitment coupons resulted in a disproportionate quantity of resources being used to start new chains rather than expand existing chains over a longer study period. The result was that only two chains, containing a total of 43 participants, were able to attain six waves, described by Heckathorn (1997) to be the sufficient quantity of waves to ensure that an equilibrium sample is obtained. The result was that equilibrium was not achieved for gender, sexual orientation, past sexually transmitted infection, past STI testing, condom use, school problems, history of sex work, and incarceration, and therefore bias related to the selection of seeds, personal network sizes, and recruitment patterns was not eliminated for these variables. Therefore, any estimates based on these variables should be considered with this limitation in mind.

Importantly, rapport between study staff and street-involved youth was maintained by allowing self-recruitment, a trade-off for the fact that equilibrium was not reached for several variables. As the present study was a pilot study, the maintenance of rapport with the community will be invaluable to facilitate future work. Other studies have had 16 seeds recruit 236 injection drug users and Latino gay men in Chicago and San Francisco (Ramirez-Valles et al, 2005), 19 seeds to recruit 230 illicit stimulant drug users in rural Ohio (Wang et al, 2007), and 28 seeds recruit 374 ecstasy users in Ohio

(Wang et al, 2005). While the overall 68 seeds to 101 recruits in the present study is an unusually high ratio, if only the two chains that reached six waves and beyond are considered, the ratio is much lower, with 2 seeds resulting in the recruitment of 41 individuals. This suggests that, had the number of seeds been limited, the potential exists for seeds to produce the theoretically more desirable long chains of Winnipeg street-involved youth.

Many studies using RDS employ a dual-incentive system to ensure the growth of chains. The two incentives of this system are the study honoraria, which was used for this study, and additional money for each person that a participant recruits into the study using a coupon. In one study among injection drug users in Chicago, the incentive for recruitment was found to result in the commodification of coupons, coercive behavior towards potential recruits, and the distribution of coupons to individuals who are not a friend or family member of the recruiter (Scott, 2008). While the use of a dual incentive system in the present study may have resulted in more of the seeds being productive and deeper chains, the potential negative outcomes may have jeopardized the study results as well as the ability to continue working with this community.

The recruitment rate for all coupons distributed in this study was 22.5%, which is somewhat lower than other studies. For example, the coupon recruitment rate among ecstasy users in Ohio was 31% (Wang et al, 2005). Among IDUs and Latino gay men in Chicago and San Francisco, it was 39% (Ramirez-Valles et al, 2005) and among MSM in Bangladesh, it was 58% (Johnston et al, 2008). The low recruitment rate likely resulted from a combination of coupons not being distributed and individuals who received coupons not choosing to enter the study. Coupons may have been lost, forgotten about,

ignored, and some individuals who distributed coupons may not have properly described what they were for. Also, some individuals may not have had access to a telephone to call study staff.

Among the participants who were provided with coupons to distribute, 43% recruited at least one person. This means that 57% did not recruit anyone, comparable to the 49.9% who did not recruit anyone in the study among ecstasy users in Ohio (Wang et al, 2005) and the 42% who did not recruit anyone in the IDU and Latino gay male study (Ramirez-Valles et al, 2005). The probability that an individual would recruit at least one person increased with the number of coupons they were given to distribute, with only 15% of individuals given 2 coupons recruiting compared to 48% of those given 3 coupons, also consistent with the other studies. However, this observation may have also been due to the fact that most of the individuals given 2 coupons entered the study towards the end and therefore had the study gone on longer, they may have recruited more individuals. The majority of individuals returning for the second interview reported they had distributed recruitment coupons (85%), although only half of them recruited, suggesting that the major barrier to recruitment is not lack of coupon distribution. Only 26% of individuals who didn't return for the second interview recruited, suggesting that they may have not been as compliant in distributing coupons (or perhaps were friends with individuals less likely to choose to enter the study upon receipt of a coupon) in addition to their lack of compliance to return for the second interview. The fact that nearly one third (31.4%) of participants did not return for the second interview indicates that it is important to provide street-involved youth with information and services when contact is first made. This is the rationale behind the point-of-care test that is being

introduced for chlamydia and HIV, as studies in sexual health clinics have found that the rate of failure to return for treatment among individuals who tested positive is often unacceptably high - 20% at one clinic, for example (Schwebke, 1997), and would likely be higher among marginalized youth. For the 26% who didn't return for the second appointment and the 16% of the participants who returned for the second appointment that were motivated to return for reasons other than obtaining their test result, in the context of a testing service rather than a study with an honorarium, the use of a point-of-care test for chlamydia would have been beneficial, as those not motivated to return for their result would have had the opportunity to receive their result at the first appointment. A point-of-care test for chlamydia has been developed, but it is still in the research and evaluation stage (Mahilum-Tapay et al, 2007).

Representativeness was achieved for every variable except having tested positive for chlamydia and/or gonorrhea in the past. This indicates that there was little discrepancy between the sample proportions and the estimated population proportions for all of the variables except having tested positive in the past, meaning that the sample was representative of the target population.

5.3 Social Structure of Winnipeg Street-Involved Youth

Study participants characterized by particular demographics tend to associate more with themselves than with individuals in other groups. These characteristics include gender, ethnicity, age group, and being heterosexual. For application within Winnipeg street-involved youth, this means that seeds should be selected so that these groups are all represented, to ensure that a representative RDS sample is obtained.

Selection of seeds with diverse backgrounds has been suggested as leading to the success of RDS among illicit drug users (Wang et al, 2005).

The fact that individuals who have traveled to other parts of Manitoba recruit similar individuals indicates a potential for RDS to reach beyond the boundaries of an urban centre, to other parts of Manitoba. This pattern is not as apparent for travelers who had been outside of Manitoba in the 6 months prior to the interview. The fact that the study took place in the winter months may influence these results, as many street-involved youth may leave for warmer cities in winter. The youth that remain in the winter may be more likely to have family connections within Manitoba, including rural and First Nations reserve communities. Travel to other parts of Manitoba may reflect trips to visit family and friends in these communities, and would explain why travel did not extend outside of the province.

High homophilies among individuals who squeegee, panhandle, or flag, have dropped out or been kicked out of school, or have been charged with a crime, compared to individuals who have not had these experiences, suggest stronger social connections among highly street-involved youth. Participants reporting shelter in places suggestive of a higher degree of street-involvement, such as foster homes, group homes, hotels, shelters, and jail also showed relatively high homophily. Conversely, type of most frequent hangout did not show the same pattern, as individuals of both high and low degrees of street-involvement hangout in the same places. This may reflect the differences between more street-involved individuals who are physically close to each other for much of the day and need to support each other to survive, compared to individuals who are less street-involved, consistent with findings that length of time on

the street is correlated with increased social connectedness with a 'street family' (Taylor-Seehafer et al, 2007). These results suggest that RDS is an effective method to reach youth with a high degree of street-involvement, even if seeds have a lower degree of street-involvement.

Characteristics such as drug dealing and infection status appear to be randomly distributed among street-involved youth. Therefore, interventions related to drug dealing and sexually transmitted infections should be designed for street-involved youth in general, and not within particular pockets.

Sex workers in this sample did not form a close-knit group, possibly due to the fact that there were relatively few sex workers in the sample, or perhaps sex workers are somewhat isolated from the majority of street-involved youth, and have stronger connections to other sex workers, many of whom may be older and therefore ineligible for recruitment into this study. Also, competition between sex workers may potentially result in their not forming a close-knit group.

In general, in this study, RDS did not operate as an anonymous form of contact tracing, given the fact that participants tended to recruit their own gender, and those with same sex partners did not recruit others with same sex partners at a high rate (and thus were not recruiting their partners). Furthermore, the individuals who were infected with chlamydia and/or gonorrhea at the time of the study did not have a tendency to recruit other infected individuals; instead, infected individuals were randomly recruited. This is apparent by looking at the recruitment diagram, in which infected individuals, represented by black dots, appear to be randomly distributed and not connected to each other.

5.4 Associations with Infection among Winnipeg Street-Involved Youth

The fact that no social characteristics aside from gender correlated with infection status suggests the importance of designing STI-related interventions for diverse groups of street-involved youth. Although some studies have found chlamydia infection in street youth to be associated with being female and/or Aboriginal (Shields et al, 2004), sexual abuse, sex work, and infrequent condom use (Tyler et al, 2007), others have not found correlates of infection (Haley et al, 2002).

This sample of street youth had a high overall prevalence of 15% infected with chlamydia and/or gonorrhea. This is considerably higher than the average prevalence of 8.6% among street-involved youth across Canada in 1999 (Shields et al, 2004), 6.6% in Montreal (Haley et al, 2002), and 11.6% in Denver (Van Leeuwen et al, 2002).

Among female participants, 22% were infected with chlamydia and/or gonorrhea, despite the fact that 84% of the female participants had been tested in the past. This suggests that there is a need for frequent testing among females. As only 47% of males had been tested in the past, there is a clear need to encourage testing among males. This is consistent with testing habits of street youth identified in a California study, where 63% of females and 81% of males had not been tested for chlamydia in the previous year (Bauer et al, 2004).

5.5 Geographic Distribution of Street-Involved Youth in Winnipeg

The identification of locations that street-involved youth spend time in is useful because interventions designed specifically for street-involved youth would be most accessible if implemented in locations where they already spend time. Furthermore, as street-involved youth have been found to be resistant to entering clinical venues (Ristock

et al, 2005 and Begin et al, 1999), the implementation of health services in non-clinical venues where street-involved youth hang out would also increase the accessibility of the services. The chlamydia prevalence among participants in this study was high, but infected individuals did not cluster in particular neighborhoods and places, and instead were randomly distributed. Therefore, places where street-involved youth spend time, regardless of infection status, provide the best locations for services related to sexually transmitted infections, as the need for these services is widespread across the street-involved youth population and common hangout locations may be accessed by a large proportion of the population.

A large proportion of participants in this study live and/or hangout in the downtown area of Winnipeg. The downtown area also had the highest rate of being a participant's neighborhood of both shelter and hangout. The largest proportion of individuals who have different areas of hangout and shelter travel downtown to hangout. This suggests that the downtown area is a good location to implement services designed for street-involved youth, as it would be accessible to a large proportion of them.

Half of the study participants indicated that they obtain shelter most often at their own place or with their parents. The other half of the participants in this study indicated types of most frequent shelter locations that may indicate housing instability, such as friends and relatives' homes, foster and group homes, hostels, shelters, and jail (Auerswald et al, 2006). This is consistent with the finding in the federal street youth study that approximately 50% of respondents slept in the street, a park, at a shelter or hostel or at a boyfriend's or girlfriend's place (PHAC, 2006). One notable difference was that only 17% of respondents in the federal study slept at their own place (PHAC, 2006),

compared to approximately 32% in the present study. This difference is likely explained by the lower cost of rent in Winnipeg, particularly in the Downtown area, relative to most other Canadian cities. Winnipeg has been identified as having a “hidden homeless” population of street-involved youth who couch surf, live in inadequate or low quality housing and face potential eviction (Wilkie and Berdahl, 2007). The average monthly rent for a one bedroom apartment was \$568 in 2004 in Winnipeg, which is considerably lower than the \$950 average rent in Toronto, \$823 in Vancouver, and \$655 in Calgary (Canadian Mortgage and Housing Corporation, 2006). While only about 16% of the participants in this study obtain shelter most often at their parents’ place, this is not necessarily negative – as many studies have documented a history of family instability and violence among street-involved youth (Higgitt et al, 2003; Kidd, 2004), and some street-involved youth who have been under the care of the child protection system have indicated that the system failed them, Wingert 2003 and Miller 2004. A “street family” may provide emotional and financial support not available from other sources (Wingert, 2003).

A diversity in most frequent places of hangout is also apparent, with one fifth hanging out most often at their own or parents’ place and the rest equally split between friends’ or relatives’ places and public places such as schools, community centers, malls, and the street.

When participants were asked to list all of the places where they hangout, 62% listed Mall A, the location mentioned the most frequently by the study participants. Mall A would be an appropriate location for interventions designed for street-involved youth, as a large proportion of street-involved youth already spend time there. Furthermore, it is

located in the CCA where participants tended to congregate, increasing the chances that individuals who wouldn't typically go into Mall A would go there if they had a reason to, such as to access health services. Furthermore, a mall is an ideal location for a health service because it is a public place, typically with space available for lease, and they are inside buildings. A mall is also an effective location because they are typically on bus routes and individuals who weren't aware of the service may see it while they are there for other purposes. Also, as individuals may enter a mall for a variety of purposes, an individual going to a mall to seek health services will not be easily identified as going there specifically for health care. The service can be set up in such a way that the entrance is away from the main corridors, but in a location where a person could be accessing other, less potentially embarrassing or stigmatizing facilities or services. This site should be well connected to the network of other services offered for street-involved youth, and offer a variety of entry points (Woods et al, 2002), through other organizations and over the telephone and internet. Mall A would also be an ideal location for the provision of health information, in places such as the inside of the door of a washroom stall.

It was useful to have questionnaire items for most frequent place of hangout in addition to common hangout locations because the responses for most frequent place of hangout validated the most frequently named common hangout location as an ideal location for an intervention. Among the types of places that are publicly accessible, malls were one of the most frequently identified place of most frequent hangout. Mall A was identified as the most commonly named mall, both as a favorite hangout location and as a common hangout location, and therefore is a good location for a health service.

Interestingly, the community drop-in centres, several of which are specifically designed for street-involved youth, were listed as common hangout locations by only a handful of participants. Community Drop-in Centre A was named by 30 participants (18%) and Community Drop-in Centre C was only named 7 times (4% of participants). These centres are likely frequented routinely by a small group of street-involved youth, but may not be accessed by the majority. In all, half of the participants commonly spend time at these centres. It is important that street-involved youth be aware of these centres so that they can access them in circumstances where there is a need for these services. It would be useful to determine in a future study whether street-involved youth who do not typically access these centres are aware of them and what services they offer, and determine whether they ever access these services.

5.6 Study Limitations

The results of this study may not apply to street-involved youth in other cities. Also, the results may have been different had the study been run during the summer, as many street-involved youth leave Winnipeg in the winter for milder temperatures in other cities. The individuals who remain in Winnipeg during the winter may have different characteristics than those who leave, such as stronger ties to Winnipeg in the forms of more stable housing, family, and friends.

Another limitation of this study is the fact that many individuals were allowed to “self-recruit” into the study, resulting in a large proportion of seeds, many of which were non-productive. As a result, only two chains reached beyond the 6 waves thought to be required to achieve equilibrium, and consequently the results for the several variables that did not converge to equilibrium could therefore not be considered reliable.

With 20 variables in the univariate analyses, there may be one variable erroneously found to be significant, at the 5% significance level. Also, due to the personal nature of some of the questions in the questionnaire, accurate answers may not be provided by all participants. Recall bias may also have resulted in some inaccurate responses, though most questions were framed to capture behaviors and situations that occurred within recent months only.

The fact that street-involved youth had to actively contact study staff to become enrolled may have limited the sample to individuals who were able to access and use a telephone and who did not feel too shy or disinterested to enroll themselves. Furthermore, the use of RDS assumes that the population of interest forms one connected social network. It is possible that a subpopulation of street-involved youth that is not linked socially to the study sample exists in Winnipeg, and they were not represented in this study. Also, as a sampling frame does not exist, the sample obtained from RDS cannot be verified by comparison as being a true reflection of the population.

Finally, despite the high specificity ($\geq 95\%$) and sensitivity (80-93%) of the urine-based tests (Cook et al, 2005), some false positives and negatives will result. However, the false positive and negative rate should not differ from the rate among the general population, so this inaccuracy will not affect comparisons.

5.7 Conclusions and Recommendations

Street-involved youth in Winnipeg have a high prevalence of chlamydia and gonorrhea infection and many do not receive testing services and treatment. Participants were willing to obtain these services in non-clinical venues where they typically spend time and were eager to receive their test results. Services designed for street-involved

youth should be located in places where youth already spend time, particularly in Mall A, which is located in Downtown Winnipeg, a neighborhood where the largest proportion of participants spend time. A future study should be designed to assess the feasibility of a point-of-care test for chlamydia in these venues, as this would eliminate the need to return a week later for receipt of result and would therefore ensure that a larger proportion receive their result and treatment as necessary. Since very few correlates of current infection with chlamydia or gonorrhea were identified, community-based services should be designed for diverse groups of street youth.

RDS has great potential as a method for reaching Winnipeg street-involved youth who may not otherwise be connected to health services. Youth with a high degree of street involvement appear to form a tight social structure, but those with a lesser degree of street involvement make contact with and recruit them. These are the individuals that may be less likely to enter a clinic and therefore can be best “reached” using methods such as RDS and word of mouth. This indicates the value of RDS as a method to reach the most marginalized street-involved youth, as youth who are more accessible will recruit those who are more difficult to reach. In order for RDS to be more useful for providing population estimates, future applications should include fewer seeds and allow for the production of longer chains.

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Appendix A: Consent Form



Health
Healthy Living

Cadham Provincial Laboratory
Public Health Branch

P.O. Box 8450
750 William Avenue
Winnipeg MB R3C 3Y1
PH: (204) 945-6123
FAX: (204) 786-4770

Participant Information & Consent Form

Use of Respondent-Driven Sampling to Recruit Winnipeg Street-Involved Youth for the Purpose of Urine-Based Chlamydia and Gonorrhea Testing and Treatment in Non-Clinical Venues

Principal Investigator: John Wylie, Manitoba Health and University of Manitoba, 945-7473

Co-Investigators: Margaret Ormond, R.N., Ormond Consulting Inc.
John Schellenberg, Graduate Student, University of Manitoba
Laura Thompson, Graduate Student, University of Manitoba

Hello! You are being asked to participate in a research study. Please take your time to read or hear about the contents of this consent form and talk about any questions you may have with the study staff. You may take your time to make your decision about participating in this study and you may discuss it with your friends, family or your doctor before you make your decision. This consent form may contain words that you do not understand. Please ask the study staff to explain any words or information that you do not clearly understand.

Why we are doing this study:

The goal of this project is to determine if anonymous urine tests in locations other than clinics and doctors offices will be useful for decreasing chlamydia and gonorrhea infections among youth aged 14 to 24 in Winnipeg. In total, 200 people will be included in this study. Only those aged 14 to 24 will be eligible to participate. Participants will enrol themselves in the study, if they choose to, by calling the study phone number on a study card received from a friend.

What we plan to do in this study:

If you decide to take part in this study, you will be asked for the following things:

You will be asked to provide a urine sample at the first appointment. We will give you a urine collection bottle which will be taken to Cadham Provincial Laboratory for testing for chlamydia and gonorrhea.

You will also be asked to fill out a questionnaire about where you received the enrolment card, where you are from, where you sleep and hangout, how you get money, your involvement with social services, your personal style, your friendships, your health, and any past STDs.

At the first appointment you will also be given 3 enrolment cards to give to your friends that are aged 14 to 24.

A second appointment for one week later will be scheduled at the first appointment. At the second appointment you will be given your test results and asked to fill out a second questionnaire about your reaction to the test results and your experience in the study.

What we will do with the samples:

After the first appointment, we will take your urine sample to Cadham Provincial Laboratory to test for chlamydia and gonorrhea. Your name will not be on the sample or questionnaires. Instead, we will use a 3-digit code that cannot identify who you are. The code is used so that we know the test results and questionnaires are for the same person. When the test is finished, the sample will be destroyed.

How long is the study?

This project will continue for 5 months, from June 2006 to October 2006. During this time, we will be testing and interviewing 200 people. You will only be asked to come to two appointments, so your participation only lasts for one week.

Can I stop at any time?

You can stop participating in the study at any time.

Will I be compensated for my time?

For your participation, you will be offered \$20 at the first appointment and \$10 at the second appointment. This is intended to compensate for the extra time and trouble you have taken to participate in this study.

Risks and discomforts:

Some of the questions that you will be asked on this questionnaire are of a very personal nature. Some of the questions involve sexual activities, how you make money (including some questions on activities such as sex trade work and drug dealing) and your involvement with provincial agencies such as child and family services or being in foster care.

Also, if during the course of completing this questionnaire, you reveal information that suggests you have been the victim of abuse at some time in the past, the interviewers are obligated by mandatory regulations to obtain your name and phone number for additional follow-up

What about privacy?

All of the information you give us for the study will remain confidential. No information which can identify you or anyone else will be used in this study and your name will not be written on the questionnaire. All of the information that you give us will be put into the study using a number such as #23. For receiving your urine test results, the study interviewer will ask you for a first name, street name, or a made-up name that you will use to identify yourself when you come back for your second appointment. The study interviewer will keep a list of these names and code numbers so that (s)he can be sure (s)he is giving you the correct test results. The urine specimens that are sent for testing will only have the study code written on them. This list kept by the nurse will be destroyed as soon as the study is completed. This list will be kept separately from the questionnaire data. Because we have only a number for you and all responses will be grouped for analysis, no one will ever know how, you, as an individual, answered the questions

The results of this study may be written up and shown at science meetings and in science magazines. Also, a report for you and other participants will be made and handed out to Winnipeg youth after the end of the project. Nothing that could identify you will be included in these reports.

Questions

You are free to ask the study interviewer any questions that you may have about this study and your rights as a research participant. If you have any questions you can contact the study nurse, Margaret Ormond, anytime at

For questions about your rights as a research participant, you may contact The University of Manitoba, Bannatyne Campus Research Ethics Board Office at 789-3389.

Do not give consent unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

Statement of Consent

I have read or heard the reasons for this study and how it works. I have been able to talk about the study with the research nurse. All of my questions have been answered in words that I understand. I believe that no one is pressuring me to participate in this study. I understand that I will be given a copy of this consent form after signing it. I understand that it is my own decision to participate in this study and that I can stop any time.

By signing this consent form, I am not giving up any legal rights that I have as a participant in a research study.

**I freely agree to participate in this research study.
I know I can stop my participation at any time.**

Participant name: _____
(please print)

Participant Signature: _____

Date: _____
(day/month/year)

Note: If you want to take part in this study but do not want to sign your name, please tell the research nurse. If you want, you can just tell her that you want to take part and she can write that you said so.

Oral consent provided: Yes () No ()

Copy of consent form offered to client: Yes () No ()

Subject's name: _____

Witness/Study Staff

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given their consent.

Study staff name and role: _____

Study staff signature: _____

Date: _____
(day/month/year)

Appendix B: Questionnaire

Questionnaire #1: Prior to sample collection

Participant Code: _____

Date of Interview: (yyyy / mm / dd) _____ / _____ / _____

Place of Interview (nearest intersection): _____

For Cardholders:

Where were you when you were given this card? _____

Could you tell me the nearest intersection or if you can't, could you tell me the name of the neighborhood?

Neighborhoods: Point Douglas, Inkster, Downtown, Osborne Village, West Broadway

What is your relationship to the person who gave you this card? (circle the best choice)

Friend, Boy/girlfriend, Family member, Acquaintance, Stranger, Other: _____

Section A: PLACES

1. Home & Away

a) Where are you from? _____

b) In the past six months, have you lived in or traveled to another place in Manitoba?

Y N U R

If yes, where? (List 3 most recent places) _____

c) In the past six months, have you lived in or traveled to another place in Canada, the States, or elsewhere?

Y N U R

If yes, where? (List 3 most recent places) _____

2. Shelter

a) I am going to read you a list of places to sleep. For each place, could you please tell me whether you have slept in that type of place in the past three months?

- | | | | | |
|------------------------------------|-------|---|---|---|
| 1. At your own place? | Y | N | U | R |
| 2. At a friend's place? | Y | N | U | R |
| 3. At your boy/girlfriend's place? | Y | N | U | R |
| 4. At your parents' place? | Y | N | U | R |
| 5. At another relative's place? | Y | N | U | R |
| 6. At a foster home? | Y | N | U | R |
| 7. At a group home? | Y | N | U | R |
| 8. At a hotel? | Y | N | U | R |
| 9. At a shelter? | Y | N | U | R |
| 10. At a hostel? | Y | N | U | R |
| 11. Jail? | Y | N | U | R |
| 12. In a drunk tank? | Y | N | U | R |
| 13. In a park? | Y | N | U | R |
| 14. Under a bridge? | Y | N | U | R |
| 15. On a freight train? | Y | N | U | R |
| 66. Other: | _____ | | | |

b) In the past month, where did you sleep most often? _____
 Could you tell me the nearest intersection to this place or if you can't, could you tell me the name of the neighborhood?

Neighborhoods: Point Douglas, Inkster, Downtown, Osborne Village, West Broadway

c) Where did you sleep last night? _____
 Could you tell me the nearest intersection to this place or if you can't, could you tell me the name of the neighborhood?

Neighborhoods: Point Douglas, Inkster, Downtown, Osborne Village, West Broadway

3. Making a living

a) I am going to read you a list of ways to get money. Could you please tell me whether you have gotten money this way in the past six months?

- | | | | | |
|--------------------------------|-------|---|---|---|
| 1. Full-time or part-time job? | Y | N | U | R |
| 2. Social assistance? | Y | N | U | R |
| 3. Parents? | Y | N | U | R |
| 4. Other family members? | Y | N | U | R |
| 5. Friends? | Y | N | U | R |
| 6. Boy/girlfriend? | Y | N | U | R |
| 7. Child welfare system? | Y | N | U | R |
| 8. Squeegeeing? | Y | N | U | R |
| 9. Flagging/panhandling? | Y | N | U | R |
| 10. Hooking? | Y | N | U | R |
| 11. Escort services? | Y | N | U | R |
| 12. Drug dealing? | Y | N | U | R |
| 66. Other: | _____ | | | |

b) In the past month, where did you get most of your money? _____

4. Hangouts

a) Where do you usually hang out, for fun or to meet people?

- | | | | | |
|------------------------------------|---|---|---|---|
| 1. At your own place? | Y | N | U | R |
| 2. At friend's places? | Y | N | U | R |
| 3. At your boy/girlfriend's place? | Y | N | U | R |
| 4. At your parents' place? | Y | N | U | R |
| 5. At another relative's place? | Y | N | U | R |
| 6. At school? | Y | N | U | R |

If yes, which one(s)? (list top 3) _____

- | | | | | |
|------------------------------|---|---|---|---|
| 7. Drop-in/community center? | Y | N | U | R |
|------------------------------|---|---|---|---|

If yes, which one(s)? (list top 3) _____

- | | | | | |
|----------------|---|---|---|---|
| 8. Skate park? | Y | N | U | R |
|----------------|---|---|---|---|

If yes, which one(s)? (list top 3) _____

- | | | | | |
|---------------|---|---|---|---|
| 9. At a park? | Y | N | U | R |
|---------------|---|---|---|---|

If yes, which one(s)? (list top 3) _____

- | | | | | |
|------------------|---|---|---|---|
| 10. At the mall? | Y | N | U | R |
|------------------|---|---|---|---|

If yes, which one(s)? (list top 3) _____

- | | | | | |
|---|---|---|---|---|
| 11. A street location (ie. the Circle)? | Y | N | U | R |
|---|---|---|---|---|

Intersection or neighborhood: _____

66. Other: _____

b) In the past month, where did you hang out most often? _____

Could you tell me the nearest intersection to this place or the neighborhood?

5. Systems

a) Have you ever been...

1. In care of CFS?	Y	N	U	R
2. Been in foster care?	Y	N	U	R
3. Had a social worker?	Y	N	U	R
4. Been charged?	Y	N	U	R
5. On probation?	Y	N	U	R
6. In jail at a youth centre?	Y	N	U	R
7. In jail at an adult prison?	Y	N	U	R
8. In addictions treatment?	Y	N	U	R
9. On social assistance?	Y	N	U	R

b) Are you in school? Y N U R

c) Have you ever dropped out of school? Y N U R

d) Have you ever been kicked out of school? Y N U R

Section B: FRIENDS

1. Style

a) Would you say you have a personal style of your own? Y N U R

b) What do you call it? _____

c) What does it mean to you? _____

2. Social contacts

a) How many people do you consider to be close personal friends who are between the ages of 14 and 24? This is someone who you have spent time with in the last 6 months and who you would share a secret with. _____

b) How many of these friends spend a lot of their time on the street? _____

I want you to think of people you know that are between the ages of 14 to 24. These are people that you know well and would consider close to you – more than just casual acquaintances. I don't want you to tell me their names, just give them an initial so you can remember who they are. Thinking of Person 1...

Do you...	Person 1	Person 2	Person 3	Person 4	Person 5
c)... talk to this person (in general)?					
d)... talk to this person about something very private?					
e)... borrow money from this person?					
f)... lend money to this person?					
g)... have sex with this person?					
h)... get drunk with this person?					
i)... get high with this person? High can mean anything from smoking pot to injecting drugs.					
j) Which of these people are you closest to?					

If you are having sex with...	Person 1	Person 2	Person 3	Person 4	Person 5
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l) Do you use condoms with this person?					
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If not, why not? _____

You get drunk/high with...	Person 1	Person 2	Person 3	Person 4	Person 5
m) Do you inject drugs with this person?					
n) Have you ever shared needles with this person?					
o) Have you ever shared drug equipment with this person (cookers, spoons, water...)					

Section C: HOW ARE YOU?

1. General health

a) On a scale of 1 to 10, where one is feeling really sick and 10 is feeling really healthy....

1. How do you feel right now?

1 2 3 4 5 6 7 8 9 10

2. How would you rate your health generally in the past month?

1 2 3 4 5 6 7 8 9 10

3. How would you rate your physical health?

1 2 3 4 5 6 7 8 9 10

4. How would you rate your mental/emotional health?

1 2 3 4 5 6 7 8 9 10

2. STD

a) 1. Have you ever been tested for chlamydia or gonorrhea before?

Y N U R

2. When was the last time? (yyyy / mm / dd) _____ / _____ / _____

3. Was it a urine test? Y N U R

b) Why did you get tested?

1. Worried about it Y N U R

2. Symptoms (pain, discharge) Y N U R

3. Part of prenatal care Y N U R

4. Someone suggested it/told me to Y N U R

If yes, who? Sex partner Y N U R

Nurse/doctor Y N U R

Friend/Family Y N U R

Other: _____

5. Contact tracing Y N U R

c) 1. Have you ever tested positive for chlamydia or gonorrhea? Y N U R

If no, go to question 2 f).

2. If yes, did you get treatment (antibiotics, pills)? Y N U R

d) 1. Have you ever participated in contact tracing (where a nurse or someone else asks you who your sexual contacts are)? Y N U R

2. Did you tell them? Y N U R

Why/Why not? _____

- e) 1. Did you tell your sex partners about having chlamydia or gonorrhea? Y N U R
2. Why/why not? _____

3. What was their reaction? _____

- f) On a scale of 1 to 10, where 1 is not at all worried and 10 is very worried, how worried are you about:

1. Chlamydia/gonorrhea? 1 2 3 4 5 6 7 8 9 10

2. Genital herpes? 1 2 3 4 5 6 7 8 9 10

3. HIV? 1 2 3 4 5 6 7 8 9 10

- g) Having chlamydia, gonorrhea or genital herpes might make your body more open to getting infected with HIV.

1. Did you know this? Y N U R

2. **If no**, does this information change how worried you are about these STDs?
Y N U R

3. **If yes**, does that influence your concern about STDs?
Y N U R

- h) Of all the things you have to worry about, how much do you care about yourself, on a scale of 1 to 10, where one is not caring at all and 10 is caring a lot?

1 2 3 4 5 6 7 8 9 10

Comments:

Section D: DEMOGRAPHICS

Age _____ Gender _____

1.c) What ethnic origin do you consider yourself to have? (Check ALL that apply)

- ☐ First Nations, Metis, Inuit
- ☐ Caucasian
- ☐ Hispanic, Mexican, Central/South American
- ☐ African, African-Canadian, African-American, black
- ☐ Carribean, Haitian, Jamaican
- ☐ Chinese, Korean, Vietnamese, Cambodian, Indonesian, Japanese, Laotian
- ☐ Middle Eastern
- ☐ South Asian
- ☐ Other (specify) _____
- ☐ don't know
- ☐ refused to answer

d) What is the highest level of school you have completed?

- ☐ Public school, specify grade: _____
- ☐ Higher, specify type: _____
- ☐ Other, specify type: _____
- ☐ don't know
- ☐ refused to answer

e) Who do you have sex with?

Men Women Both Nobody

FINALLY....

Do you have any questions? (Note any questions asked) _____

Were there any questions that you think should have been asked in this survey? What are they?

Is there any other information that I can offer you?

Questionnaire #2: After providing test results

Participant Code: _____

Date of Interview: (yyyy / mm / dd) _____ / _____ / _____

Place of Interview (nearest intersection): _____

Informed Consent Provided: _____

1. What was your main reason for coming back to get your results?

2. Did your result surprise you? Y N U R

Why/why not? _____

3. Did you give out the cards you were given last week? Y N U R

How many? _____

If none, why not? _____

4. (If positive...) Will you try and tell your sex partners about your result so that they can get tested? Y N U R

Why/why not? _____

5. In future phases of this study, we might give you urine bottles to give to your friends so that they can be tested for gonorrhea and chlamydia. Once your friend has filled the bottle, they can call the phone number on the bottle to arrange to have the urine tested for these infections and to get their results. On a scale of 1 to 10 where 1 is very comfortable and 10 is very uncomfortable, how comfortable would you feel giving out urine bottles to...

friends: 1 2 3 4 5 6 7 8 9 10

sex partners: 1 2 3 4 5 6 7 8 9 10

6. Did you learn anything while participating in this study? Y N U R
If so, what? _____