AN EPIDEMIOLOGICAL SURVEY OF CHLAMYDIAL & GONOCOCCAL INFECTIONS IN A CANADIAN ARCTIC COMMUNITY: DETERMINANTS OF SEXUALLY TRANSMITTED INFECTIONS AMONG REMOTE INUIT POPULATIONS

by

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Abstract

Research Problem

Sexually transmitted infections (STIs) pose serious health problems for Canadian Inuit people. This is compounded by ineffective screening and disease prevention strategies. Programs will have little impact on reducing infection rates if they do not target accurate disease prevalence and key determinants of transmission.

Methods

A cross-sectional survey (Part A) was conducted among Inuit males and females (ages 15 - 65 years) in a Baffin community. Participants (n = 181; mean age = 29.6) were screened for chlamydia/gonorrhea and interviewed. The questionnaire, which followed the Theories of Reasoned Action and Planned Behaviour, was used to collect information on demographics, use of health services, sexual histories, STI and contraceptive knowledge, high-risk behaviours, perceived risk and barriers of condom use.

A random sample (n = 100) was selected from Part A for the longitudinal cohort. Individuals were followed every two months post baseline for four follow-up visits. At each visit, participants were screened for chlamydia/gonorrhea and questioned about their sexual/social networks and condom use. Networks were developed through "snowball"sampling.

Results

Overall, 35 cases of chlamydia were detected, with 21 detected at baseline and 14 during follow-up. The combined cases gave an overall prevalence of 15.6% in comparison with 2.7% that was previously estimated. No gonorrhea was detected. The strongest predictors for STIs included: female gender (OR 2.45, CI: 0.55, 10.89), recent STI (OR 9.82, CI: 2.70, 35.77) and a history of greater than 2 previous STIs (OR 1. 47, 0.92, 2.30). Chlamydia prevalence decreased by at least 22% post baseline screening and treatment intervention.

Major barriers to condom use included: embarrassed to purchase condoms, discussing condom use, and fear of giving a bad impression. There were no significant differences between males and females (p = 0.73) and between the age groups (p = 0.67) regarding condom use.

Conclusion

Consistent with the literature, the results support universal screening use in populations with greater then 10% chlamydia prevalence. Screening should especially target individuals with prior history of chlamydia and/or gonorrhea. Universal screening, prompt treatment and comprehensive contact tracing are strongly recommended for STI prevention in all Inuit communities.

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CHAPTER I

CHAPTER 1 Introduction

1.1 Overview

The health and socio-economic status of Canada's aboriginal population has been the subject of intense public scrutiny and dissension. Over the years, researchers have conducted several surveys that have repeatedly exposed the poor health indicators and impoverished economic conditions affecting the vast majority of aboriginal Canadians in an otherwise affluent society. In some cases, certain aboriginal populations like Inuit and First Nations people have been known to experience economic and health conditions (e.g. communicable diseases) that are comparable with those found in many disadvantaged countries (Waldram, Herring, and Young 1995).

Although the circumstances surrounding health and economic conditions of most societies are often unique to each society, it is widely held that the health of any given human population is simply, the product "...of a complex web of physiological, psychological, spiritual, historical, sociological, cultural, economic and environmental factors" (Waldram et al. 1995, 3). Some researchers argue that many aboriginal Canadians suffer from poor health as a result of poverty, social inequity and their historical position within the Canadian social realm. An example of how certain political, social and economic conditions have shaped the health status of Canadian aboriginal people, specifically remote Inuit populations, can be found in an analysis of sexually transmitted infections (STIs) among these communities.

Sexually transmitted infections, like chlamydia and gonorrhea, remain an ever-present threat to the general health, well-being and reproductive capacity of many aboriginal Canadians (Inuit, First Nations & Métis) (Patrick, Wong, and Jordan 2000; Steenbeek 2004). In Canada, reported rates of chlamydia and gonorrhea are highest among aboriginal people; in some regions (Nunavut, North West Territories), chlamydia and gonorrhea rates have been reported to be more than 10 times the national average (Health Canada 2001) (Table 1-A, Table 1-B, Graph 1-A and Graph 1-B; Appendix I)

In North America, chlamydia infections are known to be three to five times more prevalent than any other STI (Health & Welfare Canada 1999). After chlamydia, gonorrhea is the second most commonly reported bacterial STI (Alary, Jolly, and Poulin 1991) and if untreated, both chlamydia and gonorrhea may result in serious consequences especially for women; these include: pelvic inflammatory disease (PID), chronic pelvic pain, tubal infertility and ectopic pregnancies (Health & Welfare Canada 1999; Patrick 1992; Patrick, Wong, and Jordan 2000).

Clinical diagnosis of PID is often difficult since only 16% of all women who have acquired PID ever manifest symptoms. However, the consequences of both symptomatic and asymptomatic (silent) PID are often chronic and severe (Stamm 1999). Of those with PID, 20% may become infertile; 18% may experience debilitating, chronic pelvic pain; and 9% may develop life-threatening ectopic pregnancies (Centre of Disease Control 2001). Risk of ectopic pregnancy is 7-10% higher in women who have had PID as compared with those who have not (Orr and Brown 1998). Chlamydia infection during pregnancy can also lead to infant conjunctivitis which can result in blindness if untreated, pneumonia, sepsis with associated meningitis, endocarditis, arthritis and maternal postpartum endometritis (Stamm 1999). Among men, urethritis is the most common symptom resulting from chlamydia and/or gonorrhea infection. Complications like epididymitis generally affect a minority of infected men but rarely result in any serious sequela (Stamm 1999).

Over the past decade reported rates of chlamydia infections have risen dramatically (51-278 cases/100,000 persons) (Centre of Disease Control 2001; Kaufert and Kaufert 1998) making it the most prevalent sexually transmitted bacterial infection in North America and Europe. This reported increase in chlamydia may have been attributed to a combination of factors including: improvement in the sensitivity of diagnostic tests (urine nucleic acid testing) and continued high infection rates (Centre of Disease Control 2001). Despite this increase in chlamydia prevalence, surveillance and screening of chlamydia and similar diseases, remains inadequate.

In Canada, monitoring of reportable disease like chlamydia and gonorrhea is usually based on a passive disease-reporting system (i.e. cases are reported by laboratories, physicians and so forth). Passive surveillance is generally, the most economical means of surveillance. Unfortunately, the prevalence and incidence data captured by passive surveillance is often inaccurate and under-representative of the actual disease burden. It has been estimated that the percentage of reportable diseases that are not captured through passive surveillance ranges from 10% to 90%, in some cases (Laporte et al. 1996).

Understanding the transmission dynamics, determinants and networks associated with STIs is one method researchers can use to help overcome the limitations of current screening and surveillance programs in remote Inuit communities. This method can sharpen our understanding of the interplay between dominant variables that determine the typical course of infection within an individual and the variables that control the patterns of infection and associated disease epidemiology within communities (Anderson 1999). It is also essential that researchers identify behaviours and culturally based perspectives among others, which underlie some Inuit people's decisions to engage in high-risk behaviours that may predispose them to STIs (Sutton, McVey, and Glanz 1999).

It is evident that those who engage in high-risk behaviour run a greater risk of contracting and transmitting STIs than those who do not (Aral 2000; Bell and Trevino 1999; Ellen et al. 1996). There is abundant documentation to show that high–risk behaviour such as multiple partners, substance abuse and infrequent condom use, are typically seen among "core groups". Core groups are small groups of people that co-exist within large sexual networks. They are frequently infected with and transmit STIs and also, sustain the endemic and epidemic transmission of these infections (Cates, Rothenberg, and Blount 1996; Thomas and Tucker 1996). Little is known about the level of STI incidence and prevalence in isolated Inuit populations. In these situations, do the rates of STI infections differ between men and women? Do people in small and isolated communities engage differently in high-risk behaviours? Are there substantial differences in the age and gender, sexual networks and linkages among core groups in small isolated communities in comparison to those that exist in large southern communities?

Since linkages between core groups and other sexual networks are often necessary for the spread of STIs (Anderson et al. 1991), transmission of STIs beyond core groups may depend on individuals who are sexually active with members of core groups and with members of the general population (so called "bridging" persons). In other words, even though Person A may have a higher probability of being infected than Person B, Person B can be a much more efficient transmitter of infection if he or she has sex partners in socially distinct subpopulations, thereby providing a specific link or bridge for infection to spread between the two subpopulations. For example, in a Manitoba network analysis study, the investigators found numerous bridges between various First Nations communities. As a result, STIs like chlamydia and gonorrhea were continually entering many geographically isolated aboriginal areas (Wylie and Jolly 2001). Furthermore, since many individuals infected with chlamydia are asymptomatic, long periods of infectiousness would also ensure the persistent transmission of chlamydia among these individuals.

To prevent the spread of STIs in remote Inuit populations, it is necessary that researchers and public health officials develop effective screening initiatives and culturally appropriate prevention programs, (i.e. in line with Inuit views and beliefs), that can help individuals and communities eliminate or at least, reduce high-risk behaviours and risk factors that may lead to STIs. Essentially, maintenance and spread of STIs within populations reflects complex interactions between host susceptibility and pathogen virulence; availability and accessibility of health care; socio-behavioral parameters of sexual mixing; partnership formation and healthcare-seeking responses to (Anderson and May 1988; Garnett and Anderson 1993; Stoner et al. 2000).

Theories of behavioural prediction and behaviour change suggest that there are only a limited number of critical factors (or variables) underlying an individual's decision to perform or not perform a given behaviour. As such, the most effective interventions will be those directed at a specific behaviour (e.g. condom use). Most important, selection of a behaviour (or behaviours) to serve as the target of an STI risk-reduction intervention should be based on sound epidemiologic evidence and careful assessment (Fishbein, Wolitski, and Doll 1999).

To illustrate these concepts, one could consider a commonly used epidemiological model to demonstrate the determinants and dynamics behind STI transmission (Figure 1.2.1-A) (May and Anderson 1987; Aral 2002).

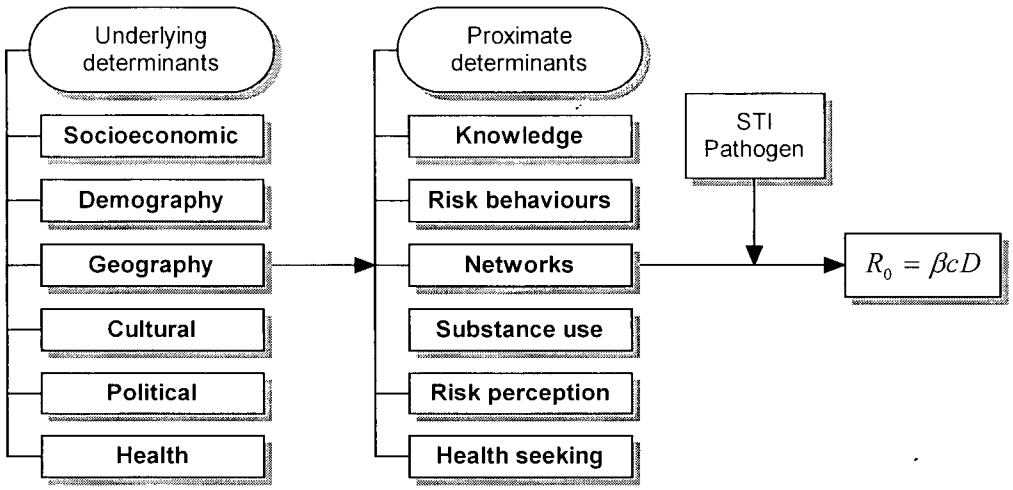


Figure 1.2.1-A
An Epidemiological Model of STI Transmission

In this formula ($R_0 = \beta cD$), R_0 represents the reproductive rate (i.e. the number of new infections produced by an infected individual), β is the average probability that an infected individual will infect a susceptible partner given exposure, c is the average number of new partners exposed by an infected individual per unit of time and D is a measure of duration of infectiousness of the specific infection. Since these determinants are heterogeneous across populations and social networks it is crucial that investigators identify these determinants and their subsequent effects on STI transmission (Cates, Rothenberg, and Blount 1996).

As noted in Table 1-C; Appendix I, public health interventions directed at preventing STIs among Inuit populations should be targeted at reducing the magnitude of β, c, or D by:

- Reducing the prevalence of disease
- Identifying partners of infected persons through contact tracing
- Reducing the duration of infectiousness by effective treatment

For example, transmissibility β can be lowered by increasing consistent and correct condom use or by delaying onset of sexual activity. Decreasing the rate of new partner acquisition will reduce the sexual interaction rate c. In the case of bacterial STIs, (i.e. chlamydia and gonorrhea), duration of infectiousness D can be reduced through better screening of asymptomatic individuals, by increasing health-seeking behaviour and adherence to medical treatment and by encouraging cooperation with contact tracing and partner notification.

The prevention of STIs and their negative health, social and economic consequences for Inuit people has recently become a central goal for many community-based health programs. The issue is however, not whether these programs should be provided but what type of interventions and health promotion strategies will be most effective to bring about the desired goals (Kaufert and Kaufert 1998). Structure and content of STI prevention programs are vital considerations in this regard, since even well-constructed and carefully implemented programs may have very little impact on the target group, if these programs do not target specific high-risk behaviours and determinants that may predispose Inuit people to STIs. To date, very little research has been conducted in the area of STIs and associated determinants and behaviours among remote Inuit populations nor, has there been any effort to determine a more accurate prevalence of disease burden especially, among communities in the Nunavut region.

Essentially, patterns of health and prevalence of disease (e.g. chlamydia and gonorrhea) and associated determinants and consequences in populations, are not independent factors but, are complex, intertwined and influenced by a number of factors (e.g. social economic status, education). As such, it is imperative that researchers develop more effective screening programs. They must understand the dynamics that encompass specific health conditions (i.e. communicable diseases) and their determinants, in order that they may develop more accurate and effective health promotion and disease prevention programs for Canadian aboriginal populations (Laporte et al. 1996).

1.2 Thesis Statement

The field of STI epidemiology has developed steadily during the past half century. As more data were collected, approaches to study design changed and subsequently, the nature of research hypotheses have reflected these changes. The multifactorial nature of STI epidemiology has increasingly necessitated a more multidisciplinary approach.

STI research has evolved from a descriptive form to an analytic one. At the initial stages, and throughout the 1950s, the focus was on careful clinical observations and case studies of microbial etiology, including descriptions of prevalence and distribution of morbidity based on surveillance data. In the early 1970s, research moved into a more analytic form with studies of risk factors associated with specific diseases and their complications in individuals. Later in the 1980s, the focus shifted to studies of population transmission dynamics and cost-effectiveness analysis. This led to prevention trials, including randomized controlled trials (RCTs) at the individual and later at the community level during the 1990s (Holmes and Aral 1999).

This thesis will be organized along the lines of this evolution of STI epidemiology and associated level of evidence. It will explore the trends in social and demographic correlates and examine the determinants of STI transmission patterns among remote Inuit communities.

1.2.1 Thesis Objective One

The primary objective of this dissertation was to determine a more accurate estimate of the prevalence of sexually acquired chlamydia and gonorrhea infections, among remote Inuit populations. Currently, Nunavut Health and Social Services uses a passive surveillance and selective screening process, which is typically seen in other regions of Canada. Passive surveillance relies on physicians, community health nurses and laboratories to report new cases of reportable diseases (i.e. chlamydia and gonorrhea) as they are discovered in the patient population. With regard to selective STI screening in the Nunavut region, this screening process would generally capture infection data from:

1. Well Women Clinics (yearly check-ups for women which includes: Papanicolaou smear (PAP); STI screening; family planning)
2. Initial pre-natal visits
3. Contact tracing and partner referral
4. Individuals who present to the health practitioner with symptoms (i.e. cervical discharge, pelvic pain, dysuria)

To date, no screening initiative similar to the one used in this study has been employed in any of the Inuit communities within the Baffin region.

Screening programs similar to the one used for this research project are organized efforts to detect infections among seemingly healthy persons in the community. Essentially, these programs are designed to target all individuals at risk in the community where the program is offered and not just a subgroup of those at highest risk of disease (i.e. women), those who are symptomatic, or those with the greatest likelihood of responding to the intervention.

Guidelines developed by Cadman and colleagues (Cadman et al. 1984) will be used to evaluate the efficacy of the study screening program. These guidelines will include the following queries:

1. Has the program effectively detected the disease burden?
2. Are efficacious treatments available for infected individuals?
3. Does the current burden of disease warrant treatment?
4. Is there a good screening test?
5. Does the program reach the appropriate individuals?
6. Can the health care system cope with the screening program?
7. Will those who tested positive comply with subsequent advice and interventions?

The population for this research project consisted of Inuit residents between the ages of 15 and 65 of a designated community in the Baffin Region, Nunavut. The study community was selected on the basis of logistical and financial considerations; familiarity with the region and community and finally, enthusiasm and support from the local Hamlet officials (including the Mayor) and community members.

1.2.2 Thesis Objective Two

The secondary objective of the study was to examine the determinants, behaviours and risk factors associated with chlamydia and gonorrhea transmission among the Test Community. This objective involved collecting data on: demographics, use of health care services, STI knowledge, sexual histories and behaviours that may influence the engagement of high-risk sexual activities (i.e. multiple partners, inconsistent condom use) and sexual decision making process. These behaviours were incorporated from the Theory of Reasoned Action (Fishbein 1980; Fishbein and Ajzen 1975) and the Theory of Planned Behaviour (Ajzen 1991) and include: Contraceptive Knowledge (i.e. current methods of contraception, their use and non-use); Risk Behaviour (i.e. perceived and actual risk); Behavioural Beliefs (i.e. condom self-efficacy); Normative Beliefs and Motivations to Comply (i.e. adherence to health care advice); Self Efficacy and Perceived

Control (i.e. negotiating condom use). The main determinants were then applied to the Anderson's model of disease transmission.

1.2.3 Thesis Objective Three

The third and final objective of this study was to identify whether the universal screening program (baseline visit) decreased the prevalence of STIs (follow-up visits) over time, and to develop a better understanding of the underlying sexual networks that occurred in the study community. Network analysis builds on the usual "contact tracing and partner referral" practices by defining reservoirs of infection, routes of transmission, and populations at risk of exposure (Anderson, Gupta, and Ng 1990; Ghani, Swinton, and Garnett 1997; Klovdahl 1985; Stoner et al. 2000). Furthermore, network analysis has the added benefit of using socio-grams (graphical representation of data) to help illustrate the sexual relationships of people within and outside the network. Sex-partner networks provide avenues by which STIs spread through populations at risk, linking core and bridge groups through sexual activity among network members. As such, enhancing our understanding of the role of sexual networks in STI transmission can guide the development of targeted intervention programs to reduce STIs among the most susceptible sectors of a community.

1.3 Rationale for Thesis Objectives

The results of this analysis may have significant implications for the prevention and overall management of STIs among isolated Inuit populations. By determining an accurate prevalence of disease burden (chlamydia and gonorrhea), characterizing individuals who are most vulnerable to STIs and by describing behaviours and determinants that are most amenable to change, specific interventions and health policies can be implemented that can improve outcomes. Furthermore, by analysing the nature of sexual networks we may gain insight into the transmission patterns and the epidemiology of STI (chlamydia and gonorrhea) infections.

The results of this study may also be used to assess the value of current STI screening programs in the Nunavut region with the aim of developing more appropriate and effective STI prevention strategies for Inuit populations.

1.4 Conceptual Framework

The Theory of Reasoned Action (Ajzen and Fishbein 1977; Ajzen and Fishbein 1980; Fishbein 1980) and the Theory of Planned Behaviour (Ajzen and Madden 1986; Ajzen 1988; Ajzen 1991;

Ajzen and Driver 1991) are conceptual models that have been widely used to predict and explain an extensive range of behaviours and health related intentions; they have also served as the framework for several STI prevention program specifically, in AIDS-related behaviours (Kamb et al. 1996; Kamb et al. 1998; Sutton, McVey, and Glanz 1999).

The Theories of Reasoned Action and Planned Behavior are comprehensive theories that specify several psychological variables that can influence a behavior, namely (a) intention; (b) attitude toward the behavior; (c) subjective norm; (d) perceived behavioural control; and (e) behavioural, normative and control beliefs. Both theories will be discussed in more detail in chapter two.

1.5 Hypotheses

Based on the literature review, personal experiences as a community health nurse in Inuit communities and conceptualizing issues in the Inuit context, the following hypotheses have been developed.

1.5.1 Disease Burden

This study postulates that previous chlamydia and gonorrhea counts in the Test Community were an under-representation of the true prevalence of disease. Study prevalence rates (2003-2004) will be compared with rates acquired in 2000 (i.e. through the routine protocol).

We also believe that there will be a decrease in STI prevalence post baseline screening and treatment intervention.

1.5.2 Gender and Age Related Issues

This study hypothesizes that there will be significant differences between males and females and between age groups, in some of the following categories:

1. Females will have higher odds ratio of contracting the study outcome than males. Similar findings will be evident among the different age categories, whereby more STIs will be found in the younger age group of study participants (i.e. younger participants will have higher odds ratio of contracting an STI).
2. Female participants will demonstrate a higher use of health services and more previous STI screening than male participants. There will be a positive association between use of heath services and the study outcome.

3. Female participants will score higher in STI and contraceptive knowledge scores than male participants. Similar findings will be seen among the different age groups, whereby the younger study population will demonstrate a lower STI and contraceptive knowledge score than the older study participants. Furthermore, STI and contraceptive knowledge will not be good predictors of STI acquisition.
4. There will be no differences in "age of first sex" between males and females.
5. There will be no differences in the area of "risk behaviour" (perceived and actual risk) between male and female participants. There will however, be a difference in the area of high-risk behaviours among the different age groups. Younger aged participants will be engaged in more high-risk activities than older participants. There will be an association between actual high-risk behaviour and the study outcome.
6. There will be differences noted in the areas of: behavioural beliefs, normative beliefs and motivations to comply, self-efficacy and perceived control between males and females. There will be an association between these behavioural beliefs and the study outcome.

1.5.3 Sexual Networks (Baseline & Follow-up)

Structures of sexual networks have implications for the spread of sexually transmitted disease. Individuals from one group can provide "bridges" for the spread of infection into another group. The study findings will explore whether some index participants (infected with either chlamydia and/or gonorrhea) will demonstrate "bridging" with larger communities (i.e. Iqaluit).

1.6 Thesis Organization

This thesis is organized into 6 chapters as follows:

1. Chapter 1 (Introduction) provides a background discussion that helps substantiate the research objectives, rationale and hypotheses
2. Chapter 2 (Literature review) will encompass an overview of the extensive literature review that was carried out for the preparation of this dissertation. The review will discuss issues pertaining to Inuit culture and beliefs around reproductive health; STI epidemiology (STI biology, transmission and sexual networks) and screening and surveillance (including diagnostic tests and treatment) of STIs. This chapter will conclude with a discussion of the conceptual framework pinning this study

3. Chapter 3 (Methods) discusses the methods that were employed for this study. This chapter will include a brief discussion of the questionnaire, an overview of the study protocol (cross-sectional and longitudinal), inclusion/exclusion criteria, data and specimen collection, sexual network building and ethical considerations (informed consent and confidentiality). This chapter will also have a section outlining the statistical component of the study, which includes: univariate and multivariate analysis, and model building (logistic regression) among others
4. Chapter 4 (Results) will provide an account of the main study findings. Some of the findings will be displayed in graph and table format
5. Chapter 5 (Discussion) will provide an overview of the objectives and hypotheses of the study, discuss the major research finding, evaluate the STI screening program, review the main determinants of STI acquisition and transmission within the context of the Anderson's model and provide the strengths and limitations of the study. This chapter will also include an overview of the conceptual framework
6. Chapter 6 (Thesis summary) will discuss the implications of the research findings in relation to STI prevention among remote Inuit populations. This chapter will conclude with suggestions for future areas of research

CHAPTER II

CHAPTER 2 Literature Review

This chapter provides a discussion about major health concerns attributed to STIs and on current issues and priorities for STI prevention among remote Inuit communities. The purpose of this chapter is to establish an in-depth and critical overview of both current and "classical" STI literature with the aim of providing a more insightful understanding and appreciation of the complex dilemma that Inuit people face when dealing with STIs. This chapter will be divided into four main sections including:

1. Inuit Culture And Reproductive Health: This section presents an overview of the impact of Western socialization on Inuit culture and reproductive health (e.g. pregnancy and STIs) and will focus on four themes: i) Inuit life prior to European contact; ii) the effects of European contact on Inuit culture and health; iii) Inuit beliefs on sexuality, reproduction and family planning and iv) Inuit sexual autonomy and freedom.
2. STI epidemiology: This section discusses some of the more common health consequences associated with chlamydia and gonorrhea infection and will focus on two themes: i) Chlamydia and gonorrhea physiology; ii) chlamydia and gonorrhea transmission.
3. Screening and surveillance: The section discusses the two most common types of surveillance: passive and active. There will also be a discussion on screening and current diagnostic tests for chlamydia and gonorrhea infection.
4. Risk Behaviour theory: This section will discuss the evolution of risk theory in the social sciences. The main theories that will be discussed include: Cultural Theory, Risk as Feelings Theory and Social Amplification of Risk Theory. This section will conclude with a discussion on the conceptual framework that was used for this study: The Theory of Reasoned Action and Planned Behaviour.

2.1 Inuit Culture and Reproductive Health

2.1.1 Introduction

The Arctic regions of Canada evoke images of a barren and inhospitable environment. It is a land in which extreme variations in temperature, sunlight and ice conditions exist. Despite these conditions, the Inuit have successfully inhabited the Arctic for thousands of years. They have adapted successfully to the barrenness and isolation, developed unique and diverse cultures and established strong kinship communities.

Contemporary Inuit people stand in significant contrast to the populations first encountered by explorers, whalers and missionaries: the sod house has since been replaced by modern housing (complete with central heating, running water, electricity), the traditional nomadic lifestyle has been substituted by permanent residence in centralized communities and, reliance upon migratory wildlife has been overtaken by a dependence upon store bought foods and various forms of wage employment (Condon 1983). More significant, Western socialization has also left a negative impact on traditional Inuit culture and health.

2.1.2 Inuit Life Prior to European Contact

Early explorers of the Canadian Arctic recount tales of a healthy and robust Inuit people who were well adapted to the harsh demands of Arctic living. The extreme cold of the region and the isolation shielded them from urban diseases and afflictions that historically burdened southern communities. For instance, minor colds and even potentially fatal diseases such as influenza, typhus, measles, tuberculosis and STIs (e.g. syphilis, gonorrhea) were unheard of in the pre-contact era. Premature death was generally attributed to injury or occasional starvation, and fertility rates were low due to irregular diet and prolonged lactation (up to 7 years) (Waldram, Herring, and Young 1995).

Living in small, isolated kin groups, Inuit youth learned from their parents and grandparents essential life skills like sewing, animal skin preparation, and subsistence hunting. They married and bore their children in tents and snow houses, assisted only by their husbands, mothers, or mothers-in-law. The basic social and economic unit was the nuclear family and cooperation was maintained through strong kinship ties and alliance mechanisms which were based in part on economic necessity (Condon 1987). Individual interventions, were often provided by the respected elder and were undertaken discreetly, to avoid hurtful gossip thereby preserving the integrity of the community (Gray 1996).

These social behaviours and norms created a society in which people tended to be tightly interdependent, socially responsible and highly sensitive to criticism (Briggs 1995). One can appreciate the difficulties that have occurred when these traditional Inuit norms were subjected to non-Inuit culture. Due to their traditional upbringing, Inuit people lacked the skills to meet the dynamics and demands of the Western social system with its emphasis for a rugged individualism. They were not prepared to meet the demands of a social imperative that would expect an individual to have strong interpersonal qualities, skills and necessary education to be self-assertive.

The encounter between these two divergent cultures posed a significant challenge to the world-view, traditions and social mores of many Inuit people. The Inuit had been traditionally brought up relying on strong family ties; now they were exposed to frequent, damaging criticism and stereotyping from foreign intruders. To make matters worse, those Inuit who embraced the Western ethos and chose to act in ways that conflicted with traditional Inuit values, drew criticism from the traditionally minded members of their community, such as their parents. This often resulted in a further decrease in self-esteem among the Inuit and led to behaviours that proved to be detrimental to their health and to their culture (e.g. substance abuse, violence) (Briggs 1995).

2.1.3 The Effects of European Contact on Inuit Culture and Health

During the early years of Arctic exploration, contact with Europeans and other foreigners was still relatively limited and rare for most Inuit (i.e. in the Baffin region). With the formation of the Hudson's Bay Company, local Inuit communities gradually became dependent upon the trading posts to supply them with food and material possessions that they had previously done without. The introduction of trapping as an economic pursuit, along with the formation of trading posts,

had a significant impact upon the social organization of Inuit communities. For example, families were now seeking or in some situations, forced, to take residence around various trading posts creating the first permanent settlements. By the 1930s, the transition from a traditional subsistence to a cash economy was established with far reaching consequences for many Inuit communities (Waldram, Herring, and Young 1995).

Settlement life not only promised a false sense of economic security for Inuit families, it also affected population growth. For example, the settlement provided youth with an expanded pool of potential sexual partners. Settlement life also brought the erosion of the traditional teachings of life, culture and values. No longer in daily contact with their children and grandchildren, the social contact that was necessary for elders to relay information to younger generations was lost. Furthermore, with the increasing attempts by the Canadian Federal Government to "civilize" the Inuit in the Western way of life, many children spent puberty in boarding schools, the time when this life cycle training would have been conducted. Consequently, many of these children found themselves unprepared to discuss issues like reproduction with their parents (Stern and Condon 1995).

Family distribution within the settlements was constrained by the availability of housing. As more houses became available, there was a tendency for extended families to divide into smaller units. Families were assigned housing units on the basis of need and family size. As a result, it was no longer possible for individuals to decide who their neighbours would be. This led to the fragmentation of the extended family (Condon 1987).

Another significant change was the transition from Inuktitut (the Inuit language) to English. During the formative years of settlement life, Inuktitut remained the primary language of interaction. With the introduction of Federal day schools in the 1960s, English instruction was mandated. Since the 1980s, the use of English has received additional reinforcement through television and radio. Today, the primary language of children, teenagers and young adults is English. Although middle-aged adults tend to be proficient in both languages, only the elderly and small children are monolingual Inuktitut speakers (Condon 1987).

Contact with Europeans also had a major impact on the general health of the Arctic populations. With new explorers, missionaries, whalers and traders came diseases that quickly took their toll among the Inuit population. During the 1920s, 1930s, and 1940s, tuberculosis, measles, influenza, and STI infections repeatedly ravaged Inuit populations. Canadian authorities responded to the tuberculosis crisis by administering annual TB surveys and evacuating patients to sanatoria in Southern Canada. During the 1950s and 1960s, the Federal Government began building nursing stations in the larger communities. However, due to a realistic fear of evacuation, many Inuit refused to seek treatment for illness, except in the most desperate of emergencies (Stern and Condon 1995).

A number of factors contributed to the deteriorating health status and diminishing culture of the Inuit in the post contact era. First and foremost, the Inuit were exposed to diseases (e.g. measles, influenza) to which they had no previous exposure and thus, no natural immunity. This lack of resistance was complicated by the extremely crowded and unsanitary housing conditions that became increasingly prevalent as more and more families were forced to move into established communities. A second contributing factor to impaired health was malnutrition. While starvation and famine were periodic facts of nomadic life, the traditional diet of fresh meat and fish provided all the essential nutrients, minerals and vitamins. The gradual depletion of game as a result of over hunting for furs and hides combined with an increased dependence upon "junk food", resulted in an increased incidence of malnutrition (Health Canada 2001). Thirdly, as the Inuit prolonged their contact with outsiders, they gradually abandoned traditional medical practices and beliefs in favour of Western practices. Most important however, many Inuit people suffer from poor health due to extreme poverty (i.e. high cost of living) and unequal opportunities for employment and education (i.e. due to limited employment available in the communities) (Health Canada 2001).

2.1.4 Inuit Beliefs on Sexuality, Reproduction and Family Planning

Today, Inuit elders are rarely involved in the dissemination of life skills and knowledge to younger generations. The majority of Inuit youth gain information about reproductive health (e.g. childbirth, family planning) under considerably different social conditions. Consequently their understanding regarding reproductive anatomy and physiology, pregnancy and family planning varies considerably. Most Inuit adolescent girls receive little information about menstruation or

reproductive physiology even after they had menstruated. Many adolescent girls state that their mothers simply told them that menses meant, "they were growing up" (Condon 1987).

With the abandonment of traditional medical practices the accumulated wisdom, knowledge and skills of the Inuit regarding the life cycle, reproductive health and family planning has in some cases, ceased to be shared by Inuit families. In some cases, Inuit families face challenges in instructing their children on health issues (Steenbeek 2004)

Until recent times, contraceptives were unknown to most Inuit people. Since infant mortality rates remained quite high, it was unlikely that women would have even considered limiting their fertility (Stern and Condon 1995). It is also believed that high infant mortality also played a role in encouraging women to accept Western medical advice regarding infant care such as the introduction of bottle-feeding. Unfortunately, since the promotion of bottle-feeding discourages lactation, infant malnutrition became quite prevalent and periods of infertility shorter. Moreover, since many young mothers were unemployed "sugar water" or canned milk was in some cases, substituted for the more expensive infant formula (Stern and Condon 1995).

By the 1970s, Inuit women had regular access to contraceptives, such as the "pill" and the intrauterine device (IUD) (Stern and Condon 1995). This accessibility resulted in longer spacing between births and lowering of fertility rates. Successful use of contraceptives as a goal for reducing unwanted pregnancies, however, was far from realized. An examination of medical records among Inuit women suggested that social and behavioural factors might have played a significant role in contraceptive failure. The medical records from as early as the 1970's (and even more modern times) are replete with notations regarding the difficulty Inuit women had in remembering to take their oral contraceptives. For example, it was not unusual for much of the community to become "turned around" during periods of winter darkness and summer light (Condon 1987).

Maintaining close ties to the land for the use of hunting and fishing practices also contributed to contraceptive failure. In a number of cases, Inuit women reported that they became pregnant because their IUDs fell out or more often, that they ran out of pills while on the land (Stern and Condon 1995). Similar contraceptive failures are repeatedly seen today despite the recent introduction of the injectable contraceptive method (e.g. Depo-Provera) (Steenbeek 2004).

Another deterrent for the use of birth control was the heavy cultural emphasis placed upon bearing children. With such cultural understandings about the meaning of reproduction, Inuit couples were unlikely to remain childless for long. It is also common practice for young people to begin having children before they established a separate household. Children born to single mothers are generally accepted within the community and are rarely stigmatized. This, in part, is due to the sheer numbers of those in the community who are born out of wedlock and, due to the marked tolerant attitude that community members have toward premarital sex (Waldram, Herring, and Young 1995)

2.1.5 Inuit Sexual Autonomy and Freedom

Although many Inuit do not regard themselves as sexually liberated, premarital and extramarital sexual liaisons were and, still are common. Even though the traditional practice of spouse exchange is no longer officially active, traditional attitudes toward sexuality persist (Condon 1987).

Both popular and scientific literature on the Inuit abounds with references to wife exchange. The traditional Inuit practice of spouse exchange had a sociological and functional purpose since it provided a means for establishing alliances with members of unrelated families. Furthermore, extramarital arrangements were often in the form of socially legitimate exchanges to which all parties involved gave their consent (Condon 1987).

Despite the disappearance of such ritualized exchanges and ironically largely due to the influence of missionaries, high-risk sexual behaviours (e.g. lack of condom use, multiple partners, early onset of sex) became very common, especially among adolescents. Rarely does early initiation of sexual behaviours by adolescents draw any disapproval from the parents or community, and adolescent sexual activity is generally initiated with little or no knowledge of reproductive physiology or understanding of the consequences that exist when engaging in high-risk sexual behaviours. Parents and grandparents, who in the past played a dominant role in educating their children and grandchildren on matters pertaining to reproductive health, no longer feel competent or inclined to teach their children about the importance of reproductive health issues (Steenbeek 2004).

Sexual autonomy and infrequent use of condoms has led to a significant increase in the incidence of STI infections and associated morbidity among Inuit adolescents. In some regions (Nunavut, North West Territories) chlamydia and gonorrhea rates were reported to be more than 10 times the national average. The STI issue has become a major health concern that is compounded by a lack of health care services.

The health status of modern Inuit populations is considerably lower in comparison to that of their ancestors. The introduction of previously unknown diseases (e.g. tuberculosis, STIs), substance abuse (alcohol, tobacco, solvents and recreational drugs) and Western customs and values has permanently altered a once relatively disease-free and self-reliant population.

2.2 STI Epidemiology

2.2.1 Introduction

In contrast to the human immunodeficiency virus (HIV) other STIs have received little publicity or attention in the media. In fact, much of the information that has filtered out to the public about these STIs (i.e. regarding transmission, health complications etc.) has been misconstrued. As a result, many individuals such as Inuit people perceive STIs as non-threatening infections that are easily treated and have relatively minor health consequences (Eng and Butler 1997; Steenbeek 2004).

Over the years many epidemiologic studies on STIs have suggested a strong association between HIV and non-HIV STIs (e.g. chlamydia, gonorrhea, chancroid, herpes, syphilis) (Anderson and May 1988; Brandt and Shumway Jones 1999; Curtis and Holmes 1999; Eng and Butler 1997). Several cancers, including cervical and liver among others, have also been linked with previous STI infection. It is likely that infections like chlamydia and gonorrhea, that induce ulceration or inflammation, may increase an individual's risk of acquiring HIV or, develop cancer (Boily and Anderson 1996). For instance, in Nunavut, there were approximately 75 cases of malignant and in situ cervical cancer (i.e. among Inuit women) reported in a 10-year period (1992-2001). This represents nearly 30% of all cancers reported in Nunavut (Nunavut Department of Health and Social Services 2003). Furthermore, the incidence rate for invasive cancer in Nunavut's female population is higher than the national rate (Graph 2.2.1-A.; Appendix II) (Health Canada. Population and Public Health Branch 2001; Nunavut Department of Health and Social Services 2003).

High rates of cervical cancer have also been reported in other aboriginal populations (Mao, Morrison, and Semenciw 1986; Nutting et al. 1993)The incidence of cervical cancer among Alaska's Native women for example, was also found to be four to five times higher than that among non-native women (Nutting et al. 1993). Similarly, the rates among Greenland Inuit were six times higher than among Danish women (Kjaer, De Villiers, and Haugarrd 1988).

Many of the severe and chronic health consequences associated with STIs however, (such as, infertility or cancer) manifest years after initial infection. As a result, the long term impact of STIs like chlamydia or gonorrhea often goes unnoticed. This phenomenon has contributed to the lack of understanding and knowledge that the general public and certain health professionals have regarding STI physiology and transmission (Eng and Butler 1997).

2.2.2 Gonorrhea

Gonorrhea is one of the oldest known diseases of which humans are the only known natural hosts. The pathogenesis of gonorrhea infections can be broken down into three basic steps: a) the attachment of the bacterium to epithelial cells; b) the penetration either through or between epithelial cells and c) the destruction of epithelial cells. Gonorrhea organisms have been known to attach to the epithelial cells lining the urethra, rectum, oropharynx and conjunctiva (Sparling 1999).

Knowledge of gonorrhea was scarce until near the end of the Dark Ages. For example, the term "clap", which is still commonly used to refer to gonorrhea, first appeared in print in 1378. Scientific description of gonorrhea was attributed to Albert Neisser in 1879 and Leistikow's and Loffler's cultivation of the organism in 1882 (Sparling 1999).

Gonorrhea can manifest itself very differently in men and women. In men, the most common presentation of gonococcal infection is an abrupt onset of urethritis (dysuria and discharge). Most men infected with gonorrhea have a spontaneous purulent discharge, while dysuria is present in 73-88% of males (Sparling 1999; Eng and Butler 1997).

Gonococcal infections in women are more complex and severe than in men. For instance, women have more anatomical sites that can be infected in comparison to men and the majority of infected women are asymptomatic. Secondly, due to inadequate screening and treatment, approximately 10-40% of infected women may develop pelvic inflammatory disease (PID). PID may progress to infertility or predispose women to ectopic pregnancies (Eng and Butler 1997). A retrospective review of all medical evacuations between 1987-1994 of Inuit women in the Canadian Central Arctic showed an annual incidence of 178/100,00 for ectopic pregnancy as compared with 118.3/100,000 in southern Canada (Orr and Brown 1996).

Pregnant women with gonococcal infections have a higher incidence of intrapartum complications and can transmit the disease to their babies. They are also at increased risk for spontaneous abortion and premature rupture of fetal membranes, and delayed or premature delivery (Sparling 1999). Some manifestations of gonorrhea can be found in Table 2.2.2-A.

Table 2.2.2-A

Common Symptoms of Uncomplicated and Complicated Gonorrhea

Population	Uncomplicated	Complicated
Men	Urethritis	Prostatitis
	Pharyngitis	Epididymitis lymphangitis
	Proctitis	Seminal vesiculitis
	Conjunctivitis	DGI*
Women	Cervicitis	PID
	Pharyngitis	Endometritis & Parametritis
	Proctitis	Salpingitis & oophoritis
	Bartholinitis	Pelvic peritonitis
	Urethritis	Bartholins gland abscess
	Conjunctivitis	Perihepatitis & Perisplenitis
		Periappendicitis
		DGI
Neonates	Oropharyngeal infection	Ophthalmia neonatorum
		Neonatal sepsis
		Neonatal arthritis

*DGI: disseminated gonococcal infection, which may include: arthritis-dermatitis syndrome, tenosynovitis, endocarditis, myocarditis, and meningitis. Source: (Sparling 1999)

A variety of tests have been developed to detect gonococcal antigen in genital secretions. Some of these include: Gram stain, enzyme immunoassays with polyclonal sera against gonococcal antigens and the Limulus (lipid A) test. Polymerase chain reaction (PCR) and the variant ligase chain reaction (LCR) tests have recently, become popular in detecting gonorrhea as they offer excellent sensitivity, specificity, and convenience. The culture technique however, still remains the gold standard for gonorrhea diagnosis (Eng and Butler 1997).

For epidemiologic purposes, it is also useful to differentiate one gonococcal strain from another. This procedure helps epidemiologists determine where specific strains originate during acute epidemics. One such technique is based on the ability of a particular gonococcal strain to grow on a chemically defined medium (auxotyping). Because of the complexity of preparing these chemically defined media, auxotyping is seldom used in clinical laboratories (Sparling 1999).

A second method to strain gonococci is based on antimicrobial susceptibilities. This method was once widely used and still may be considered as a useful adjunct to the auxotyping method. The ability of gonococci to transfer antibiotic resistance between strains, however, is a serious limitation of this procedure. As such, many scientists question its utility for long-term epidemiologic studies (Eng and Butler 1997).

A third method is genotyping, which determines differences in DNA sequences between strains. A related method, known as serotyping, is the most widely available technique used and can detect over 70 different gonococcal strains. This process is based on the detection of monoclonal antibodies that are specific for various outer membrane proteins of the organism (Sparling 1999).

With regard to treatment, gonococci are quite sensitive to antimicrobial agents in comparison to other gram-negative bacteria. However, over the past several decades there has been a gradual appearance of antibiotic-resistance in clinical practice. For example, isolates obtained in the 1940s were typically inhibited by minimal amounts of penicillin G. Over time, an increase in prevalence and extent of resistance to penicillin occurred due to over use of antibiotics (Sparling 1999).

2.2.3 Chlamydia

Chlamydia was first visualized in 1907 through the use of stained conjunctival scrapings (from orangutans) that were inoculated with human chlamydia material. The first isolate of genital tract chlamydia was found in 1959 by recovering specimens from the cervix of the mother of an infected infant with ophthalmia neonatorum (Schachter 1999).

Since the 1970's chlamydia has been recognized as a leading genital pathogen responsible for an increasing variety of clinical syndromes and manifestations (Eng and Butler 1997). Some of these manifestations (e.g. discharge, dysuria) are likely attributed to the combined effects of tissue damage from bacterial replication, inflammatory responses, and necrotic material that is produced from destroyed host cells (Schachter 1999). Chlamydia infections tend to follow a fairly self-limited acute course but can persist as a low-grade infection that may last for years (Eng and Butler 1997). A common pathologic end point of chlamydial infection is scarring of the affected mucous (Schachter, Stoner, and Moncada 1983).

Genital infections caused by chlamydia closely parallel those caused by gonorrhea. For instance, both organisms prefer to infect columnar or transitional epithelium of the urethra, with extension to the epididymis; the endocervix, with extension to the endometrium, salpinx, peritoneum and the rectum. Both organisms can produce extensive subepithelial inflammation, epithelial ulceration, and scarring (Stamm 1999). Similar clinical manifestations between genital infections caused by chlamydia and gonorrhea are shown in Table 2.2.3-A.

Chlamydia infections of the genital tract have a worldwide distribution and are prevalent in both industrialized countries and in the developing world (Eng and Butler 1997). The high prevalence of chlamydia infections in many parts of the world is due in part to: inadequate laboratory facilities, the asymptomatic nature of the disease, the lack of familiarity with chlamydia and the minimal resources that have been allocated toward the development of screening programs, contact tracing and treatment of infected partners (Stamm 1999; Eng and Butler 1997).

Chlamydia infections in women are often difficult to diagnose. In many situations infected women elude detection as they produce few or no symptoms, while those who do have symptoms are often non-specific. The most common site of infection in women is the endocervix (Schachter 1999). Many women with chlamydia of the endocervix have no signs or symptoms although, at least a third of the infected population may display local signs such as, mucopurulent discharge, dysuria and hypertrophic ectopy (area on the cervix that is edematous, congested, and bleeds easily).

Table 2.2.3-A

Clinical Symptoms of Gonorrhea and Chlamydia

Site of infection	Gonorrhea	Chlamydia
Men		
Urethra	Urethritis	NGU*
Epididymis	Epididymitis	Epididymitis
Rectum	Proctitis	Proctitis
Conjunctiva	Conjunctivitis	Conjunctivitis
Systemic	Disseminated gonococcal infection	Reiter's syndrome
Women		
Urethra	Acute urethral syndrome	Acute urethral syndrome
Bartholin's gland	Bartholinitis	Bartholinitis
Cervix	Cervicitis	Cervicitis, cervical metaplasia
Fallopian tube	Salpingitis	Salpingitis
Conjunctiva	Conjunctivitis	Conjunctivitis
Liver capsule	Perihepatitis	Perihepatitis
Systemic	Disseminated gonococcal infection	Reactive arthritis

*NGU: non-gonococcal urethritis. Source: (Stamm 1999)

Cervical ectopy is normally present in 60-80% of sexually active adolescents, which may account for the high prevalence of cervical chlamydia infections in this population. Oral contraceptives, which have been known to promote ectopy, have been associated with an increased risk of acquiring chlamydia (Stamm 1999; Eng and Butler 1997).

Frequent reinfection from STIs also promotes ectopy and cervical ulceration. This situation can increase the risk of contracting more STIs and cervical cancer. For example, during a ten-year period in Nunavut, higher rates of cervical cancer were seen among younger women (Nunavut Department of Health and Social Services 2003). Unlike some other major cancers, cervical cancer in this region seems to be primarily, a disease of younger adults (ages 20-39) (Graph 2.2.3-A.; Appendix II)

Approximately 8% of women with endocervical chlamydia will develop PID and subsequently produce salpingitis, pelvic peritonitis, periappendicitis, and perihepatitis (Eng and Butler 1997). Other infections that may manifest through chlamydia include urethritis, Bartholinitis, endometritis and histologic evidence of endometritis (Stamm 1999).

Infants exposed to chlamydia by passage through the infected birth canal may also acquire the infection. At least 60-70% of exposed infants acquire chlamydial infection and develop a number of manifestations (e.g. trachoma conjunctivitis, pneumonia) (Schachter 1999).

In men, chlamydia infections do not usually result in severe complications however, this group may represent a large reservoir of infection for women. Chlamydia urethral infections in men are more often asymptomatic than gonococcal urethral infection and when symptoms do occur they are generally milder. In rare instances, chlamydial urethritis can progress to prostatitis and epididymitis and can lead to male infertility (Eng and Butler 1997). About 70% of acute epididymitis in young sexually active men is attributed to chlamydia (Stamm 1999).

For years, cell culture has been considered the gold standard for the detection and diagnosis of chlamydia. However, the stringent requirements both in terms of technical expertise and specimen transport make cell culture impractical in many settings, especially, in remote communities. For this reason, non-culture tests like PCR and LCR are becoming more commonly used. These diagnostic tests have lower associated costs in comparison to culture and are easier to use in settings where transport of specimens is problematic (Eng and Butler 1997; Stamm 1999).

Unlike gonococci, there has been no emergence of antimicrobial resistance when treating chlamydia infections. Azithromycin, an antibiotic with excellent intracellular and tissue penetration is currently, considered the drug of choice for treating chlamydial infection. This drug has prolonged bioavailability and as such, permits single-dose administration. Single-dose therapy with azithromycin has been shown to be as effective as a weeklong course of doxycycline in treating chlamydial infection. Moreover, a single-dose therapy could result in much better compliance, especially among certain populations (Schachter 1999; Stamm 1999).

2.2.4 STI Transmission

Individual risk is a pivotal component of STI epidemiologic research. Individual risk is often defined as: the demographic and behavioural characteristics of individuals who are most likely to acquire or transmit infection in a given population (Eng and Butler 1997). Examples of individual risk, within the context of STI epidemiology, may include: number of sexual partners, age, gender and engagement in high-risk behaviours (e.g. substance abuse, lack of condom use, etc.) among others (Anderson and May 1991; Aral and Cates 1989; Beyth-Marom et al. 1993; Bryan, Aiken, and West 1996; Ellen et al. 1996; Eng and Butler 1997). In Canada, the highest rates of chlamydia and gonorrhea are seen among individuals between the ages of 15 and 24 (Health Canada 2003).

An individual's risk of acquiring or transmitting STIs is often influenced by the behaviours and infectious status of their sexual partners (Ford and Norris 1997; Jolly and Wylie 2001). As such, it is important to distinguish between individuals at risk for acquisition and those at risk for transmission. To appreciate this distinction it is imperative for STI researchers to understand the transmission dynamics of STIs, explore the networks within which these infections exist and identify the core groups (and bridging) of infectors (Ghani and Garnett 2000).

2.2.4.1 Transmission Dynamics of STIs

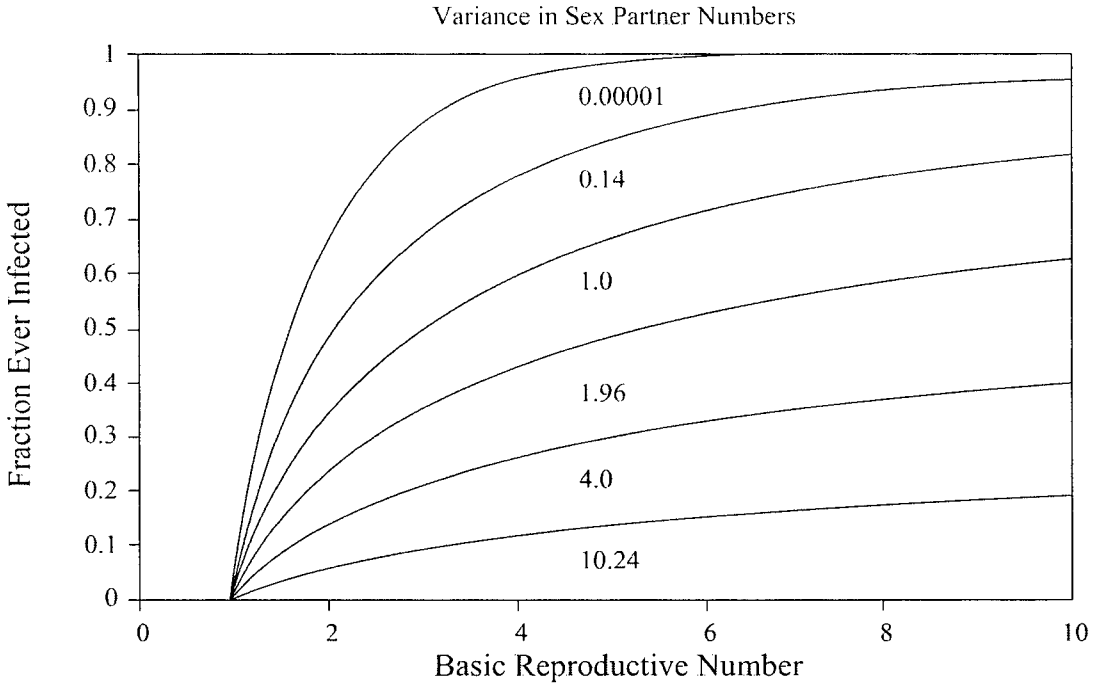
The most influential determinants of STI transmission ($R_0 = \beta cD$) can be grouped into three categories. Those that: a) influence the probability of exposure to an infectious person (e.g. host susceptibility, type and magnitude of sexual exposure and virulence of the pathogen); b) influence the mean efficiency of sexual transmission when such exposure occurs; c) influence the

mean duration of infectivity once infected (e.g. medical treatment, resistance to therapy) (Aral et al. 1999).

In the transmission formula ($R_0 = \beta cD$) R_0 is the average number of secondary cases generated by one primary case (index) in a defined population of sexually active individuals (Anderson 1999). It is important to note that for an infectious agent to spread and persist in a population, R_0 coefficient must be ≥ 1. Otherwise, after the generation of a few secondary cases the chain of infection will stop. On the right hand side of the formula, β denotes the average probability of STI transmission per sexual contact, D is the average duration of infectiousness of an infected person, and c is the average number of sexual partnerships formed per unit of time (Anderson 1999).

The most important measure of sexual behaviour is c, while other factors of importance include: a) frequency and types of sex acts within a partnership; b) frequency of concurrent partnerships and c) patterns of mixing between different segments of population. Although these determinants are important factors of transmission success, sex partner change rate (c) occupies a central position in determining the generation of secondary cases. Rates of sexual partner change vary greatly within and between societies. They are influenced by a wide range of demographic, socio-economic and cultural factors, such as age, gender, educational attainment, income and cultural views on sexuality (Anderson and May 1988; Anderson 1999).

Heterogeneity in sexual activity is another important factor that has a major influence on the endemic prevalence of an infection. For example, as illustrated in Graph 2.2.4.1-A, it is possible to calculate the fraction infected during an epidemic for various values of R_0, variance (heterogeneity) in sexual partner numbers, and basic reproductive number (c) (May and Anderson 1987).



Graph 2.2.4.1-A

Fraction Infected with Different Rates of Variance & Reproductive Number

Source: (May and Anderson 1987)

One can see that if the basic reproductive number is one (one new partner per year), the variance in sex partner numbers is high (e.g. 10.24) then, the "fraction ever infected" or secondary cases generated (R_0) will be low and vice versa. For instance, if an infected individual who belongs to a high sexual activity core (i.e. has many partners) chooses a new partner from a low sexual activity core (i.e. high variability; has few partners) then the number of secondary cases generated by the new partner will be low. If however, the same infected individual chooses a new partner from a similar high sexual activity core (i.e. low variability; has many partners) then the number of secondary cases generated by the new partner will be high. In this scenario, low variability enhances the likelihood that the sexually transmitted infectious agent will persist in the community (endemic) but the infection remains restricted to a small core of highly sexually active individuals within the network (Anderson 1999).

2.2.4.2 Sexual Networks

Some of the more recent developments in STI research have been in the area of network analysis (Anderson, Gupta, and Ng 1990; Garnett and Anderson 1993; Garnett et al. 1996; Ghani, Swinton, and Garnett 1997; Morris and Kretzschmar 1997). The role of sexual networks in STI transmission was recognized as early as 1981 (Jolly and Wylie 2001; Potterat et al. 1985). Network analysis can provide the means to more effective disease control by helping researchers understand disease transmission, and core transmitters (Boily, Poulin, and Masse 2000).

Network analysis is a technique that is used to study the relationships that exists among a group of people. More specifically, it can characterize the sociobehavioral and cultural attributes of relationships such as sexual activity. A key component of network analysis is the network interview (i.e. contact tracing). This procedure involves the naming of persons with whom the interviewee has had sexual contact and, the obtaining of information on behaviours engaged with these contacts. The contacts (first generation) and their contacts (second generation and so forth) are also interviewed to develop a diagram of how an entire network of persons relate to each other. One important feature of network analysis is the use of sociometric and graph theory (mathematical models to pictorially display the data) to aid in understanding the networks (Rosenberg et al. 1999).

Sexual network theory focuses on the importance of the "network" in defining reservoirs of infection, routes of transmission, and populations at risk of exposure (Anderson, Gupta, and Ng 1990; Ghani, Swinton, and Garnett 1997; Klovdahl 1985). Sex partner networks provide avenues by which STIs spread through populations at risk, linking core and bridge groups through sexual activity and mixing patterns among network members (Morris et al. 1996; Stoner et al. 2000; Thomas and Tucker 1996).

Mixing patterns are critical in determining what happens between high and low sexual activity groups. For example, if the mixing pattern is assortative (like with like), then an infectious person in the high activity group (core) is likely to have a sexual relationship with another high activity core member and this individual would have sufficient numbers of new sexual partners (second generation) to ensure that the chain of transmission continues. If however, the mixing pattern was disassortative (like with unlike), then the core group infector would likely be linked to an individual in a low sexual activity class. As such, this partnership is unlikely or at least, less likely to continue the chain of transmission (Anderson 1999).

In essence, for infection to persist, there must be sufficient levels of sexual mixing in the network. The determinants of sexual mixing and partnerships are often influenced by individual and cultural motivations, geography and social influences. Since the sexual partner network is undeniably the route of spread for STIs, it is important to note that all networks are embedded within a social and geographic space (Ghani and Garnett 2000).

2.2.4.3 Core Groups and Bridging

Rates of partner change and patterns of partner mixing greatly influence the spread of STIs. In many situations, the high rates of STIs are sustained by a relatively small group of people who are often referred to as the "core" transmitters. Core groups are central to STI transmission (Aral et al. 1999; Thomas et al. 2001). Not only do core groups help maintain the endemic and epidemic transmission of STIs, but mixing between members of the "core" and the "periphery" effects the extent to which STIs spread to the general population (Laumann and Youm 1999).

Geographic segregation (e.g. remote communities) may also promote a higher prevalence of STIs in certain sexual networks (Ellen et al. 1995). Numerous sexual bridges (individuals from one group who spread infection to another) could permit STIs to continually enter many geographically isolated areas. For example, in a Manitoba network analysis study, the investigators found numerous bridges between various, remote First Nations communities. As a result, STIs like chlamydia and gonorrhea, were continually entering many geographically isolated aboriginal areas (Wylie and Jolly 2001). Although network size within some of these communities may be too small to allow for the continual endemic persistence of STIs, ongoing entry of infection into these communities (bridging) could increase the likelihood of exposure for members of the network (Ford and Norris 1997; Wylie and Jolly 2001).

Preventing infections and transmission among the core group and bridge populations is a strategic way of limiting infection for the entire community. Since the product of R_0 must reach a critical threshold before STI transmission is possible, even a slight reduction in one or more of the determinants (β, D, c) could in theory, drop the reproductive rate of spread below that threshold and ultimately eliminate the pathogen from the population (Aral et al. 1999).

2.3 STI Surveillance

2.3.1 Introduction

Surveillance is a systematic process of collecting, analyzing and disseminating health related information (Buehler 1998). Surveillance is most often used to monitor the occurrence of disease (e.g. STIs, tuberculosis, cancer) over time within a specific population. At the community level, surveillance data can be used to assist health officials to identify individuals who may need medical treatment (i.e. due to a medical diagnosis), prophylaxis (i.e. due to exposure), or health education (i.e. due to high risk behaviours or as a preventative measure). At a national level, surveillance data may be used to help shape and direct public health policy and health initiatives. Periodic health surveys can also be used to monitor behaviours or trends that affect disease risk, knowledge/attitudes that influence health behaviours, and the use of healthcare services (Buehler 1998; Eng and Butler 1997).

There are two main types of surveillance:

1. Active surveillance: organizations (e.g. Health Canada) initiate and conduct a surveillance to obtain reports on a specific health problem. Active surveillance is often used during acute epidemics (e.g. influenza, meningitis outbreaks) or when a new disease pathogen enters the population (e.g. SARS) (Buehler 1998; Eng and Butler 1997)
2. Passive surveillance: organizations (e.g. Centres for Disease Control) rely on the initiatives of others (e.g. physicians, laboratories, registries) for reporting diseases. This is the most commonly used form of surveillance. (Buehler 1998; Eng and Butler 1997)

Laboratory surveillance can be highly effective for reporting communicable diseases. The main advantage of laboratory surveillance is the ability to identify many cases from different regions. The main disadvantages of this approach are that laboratory records alone may not be sufficient to provide epidemiologic or clinically relevant patient information. Secondly, individuals who receive diagnostic testing may not be representative of all persons with the disease (Buehler 1998).

In Canada, passive surveillance is predominantly used to monitor trends in disease (e.g. chlamydia, gonorrhea, cancer etc.) occurrence, at both the national, and community level. With regard to STIs however, passive surveillance can be problematic. For instance, passive surveillance does not always capture an adequate sample of infected individuals or individuals at risk for infection. Due to the asymptomatic nature of chlamydia and gonorrhea, many individuals may not seek health care and as such, remain infectious.

Under reporting of disease prevalence is a common problem in remote aboriginal communities, like those in Nunavut. Due to a lack of health care resources, isolation and the lack of initiative from community members to get screened, many cases of communicable diseases like chlamydia and gonorrhea go undetected or remain under-representative of the true burden of disease (Health Canada 2001; Health Canada 2003; Steenbeek 2004).

In Nunavut, early identification of STIs would not only portray a more accurate description of disease burden at the community level, but would also reduce morbidity and mortality at the population level. For instance, more active surveillance would result in early detection and treatment of existing infection. It would help guide risk-reduction programs to prevent further transmission of infections and help institute prophylactic measures for high-risk individuals (Anonymous 1989; Cadman et al. 1984; Eng and Butler 1997; Handsfield et al. 1986).

Another important consideration when selecting a surveillance program is program structure. It is vital that surveillance programs are designed appropriately for the specified need, and follow set criteria (Cadman et al. 1984; Eng and Butler 1997). These may include:

- Sensitivity: to what extent does the surveillance identify and capture all the specified events in the target population?
- Timeliness: this involves the entire cycle of information flow, from data collection to analysis and dissemination
- Representativeness: are events captured by the surveillance representative of the problem in the target population?
- Predictive value: to what extent are reported cases actual cases?
- Accuracy and completeness of descriptive information: how appropriate are the forms or questionnaires used for the surveillance program?

- Simplicity: are the forms used, easy to complete?
- Flexibility: can the surveillance system change to address new questions or concerns?
- Acceptability: does the surveillance data yield useful information? Are the tests acceptable by the target population?

Surveillance may provide a comparatively inexpensive means of assessing disease burden and evaluating the impact of intervention efforts in remote Inuit communities. In some instances the temporal association of changes in disease trends and interventions are so dramatic that only surveillance can provide documentation of the effect of an intervention (Buehler 1998).

Disease surveillance is the first step to identifying the true burden of illness among remote Inuit populations (Buehler 1998). For curable STIs, (e.g. chlamydia, gonorrhea) on-going surveillance, screening and treatment of infected cases can lead to secondary prevention of complications at the individual level, and primary prevention of transmission at the population level (Curtis and Holmes 1999).

2.3.2 Screening

Screening programs are designed to detect diseases and health disorders among seemingly healthy people in a given population. For instance, STI screening would allow for the detection of asymptomatic cases that would otherwise remain undetected. Screening would also prevent asymptomatic individuals from developing complications (e.g. PID) and transmitting infections within their sexual networks (Eng and Butler 1997).

In many communities, change in chlamydia prevalence is determined more by intensity of screening efforts than by race, socio-economic status, or individual risk behaviours (St.Louis and Holmes 1999). For example, Kretzschmar et al., (2001) investigated the effects of various screening programs on the prevalence and incidence of asymptomatic chlamydia infections among women. The authors used a stochastic simulation model for chlamydia transmission in an age-structured, heterosexual population with a highly sexually active core group. Different screening scenarios were implemented over a 10-year period. Screening men and women between the ages 15 and 24 years reduced the prevalence of asymptomatic infections in women from 4.2% to 1.4%. While increasing the age range of screening to 34 years led to an even greater decrease in prevalence (0.06%) after 10 years (Kretzschmar et al. 2001).

Since the majority of individuals infected with chlamydia and gonorrhea are asymptomatic, screening is necessary for the detections of cases and for the treatment of infected individuals and their partners. Expanded screening for STIs, (i.e. chlamydial infections) in regions with inadequate access to health services, will have a significant impact in preventing health consequences of STIs among women. Universal screening of all men and women, in areas of high STI prevalence (greater then 10 to 12%), would also be cost efficient (Stamm 1999). In other settings, where the overall prevalence of chlamydia and gonorrhea infection is less than 3.5 %, selective screening may be a more cost effective (Stamm 1999).

To develop accurate information on the prevalence of chlamydia and gonorrhea infections in Inuit communities, it is necessary to develop strategies that would ensure the screening of populations at risk. The quantitative effect of a more widespread screening effort in lowering prevalence or incidence of chlamydial and gonorrhea infections within this population, has not been estimated. The effective coverage of a prevention activity, like screening, is an important parameter that deserves more consideration.

2.3.2.1 Diagnostic Tests

Diagnostic tests are an essential component of the screening process. The first step in evaluating a diagnostic test is to determine its technical performance. For instance, does the test measure what it claims to measure? Is the test replicable? The four most commonly used measures of diagnostic test performance are sensitivity, specificity, predictive value, and likelihood ratio (Morse, Beck-Sague, and Mardh 1999).

- Sensitivity: Among individuals who have the disease, what percentage will have a positive test? Sensitivity is the ratio of subjects with a positive test result to all infected subjects (true positive fraction). A high sensitivity suggests that the diagnostic test is adequate for ruling out disease (Figure 2.3.2.1-A; Appendix II).
- Specificity: Among individuals who do not have the disease, what percentage will have a negative test? Specificity is the ratio of subjects with a negative test result to all uninfected subjects (true negative fraction) (Figure 2.3.2.1-B; Appendix II).

- Predictive value: If an individual has a positive test result, how likely is it that the individual has the disease? The predictive value of a positive test is PVP while the predictive value of a negative test is PVN. The PVP and PVN depend not only on the test sensitivity and specificity, but also on the prevalence of the disease in the population. Tests with high PVPs are desirable in situations were a false diagnosis can have profound consequences. Similarly, tests with high PVNs are desirable when it is essential not to miss any infections (Morse, Beck-Sague, and Mardh 1999) (Figure 2.3.2.1-A; Appendix II).
- Likelihood ratio: The likelihood ratio is the estimated probability of an individual having a given disease. This measure is based on the average prevalence of infection in the population and on other findings established before diagnostic testing. A positive likelihood ratio would demonstrate how much more likely a positive test is to occur in an individual with the disease in question than in an individual without the disease (Morse, Beck-Sague, and Mardh 1999).

Traditionally for chlamydia studies, tissue culture has been considered the gold standard for diagnostic techniques. Certain studies have however, raised questions about the acceptability of using culture as the gold standard especially, for chlamydia diagnosis (Kellog 1989; Morse, Beck-Sague, and Mardh 1999; Pate and Hook 1995). For instance, in one study the sensitivity of chlamydia tissue culture ranged from 33 to 86% (Kellog 1989) while in another study, the authors found high laboratory to laboratory variability between all chlamydia cultures (e.g. cervical and urethral) studied (Pate and Hook 1995).

Recently, there has been discussion around the development of an "extended gold standard" as the basis of comparison between diagnostic tests for chlamydia and gonorrhea (Kellog 1989; Morse, Beck-Sague, and Mardh 1999). Common criteria for extended gold standard include:

- One positive non-culture test, confirmed by culture
- One positive non-culture test, confirmed by one of the other non-culture techniques
- Positive PCR test confirmed by a different PCR method using different primers (Morse, Beck-Sague, and Mardh 1999)

2.3.2.2 Types of Diagnostic Tests

Canadian national guidelines for the diagnosis of STIs suggest dual testing for gonorrhea and chlamydia. These guidelines are intended for individuals who:

- Have symptoms suggestive of infection (e.g. discharge, dysuria, pelvic pain)
- Have another confirmed STI (e.g. Trichomonoas vaginalis)
- Are sexual contacts of confirmed cases (i.e. through contact tracing)
- Are cases of sexual assault or abuse
- Are sexually active individuals with significant risk factors for infection (i.e. adolescents, sex trade workers)(Orr and Brown 1996).

There are several diagnostic tests that are currently available for the detection and diagnosing of chlamydia and gonorrhea. The three most commonly used diagnostic tests are culture, antigen detection and nucleic acid detection.

As mentioned previously, culture testing for chlamydia and gonorrhea has been considered the gold standard. Cell culture for chlamydia involves inoculating a confluent monolayer of susceptible cells with an appropriately collected and transported specimen. After 48-72 hours of growth, infected cells develop characteristic intracytoplasmic inclusions that contain substantial numbers of chlamydia elementary and reticulate bodies. These unique inclusions are detected by staining with a fluorescein-conjugated monoclonal antibody that is specific for the major outer membrane protein (MOMP) of chlamydia (Anonymous 2003). The high specificity of cell culture and ability to retain the isolate make cell culture the first choice when the results will be used as evidence in legal investigations. The main disadvantages of culture include: relatively low sensitivity, long turnaround time, difficulties in standardization, labour intensity, technical complexity, stringent transport requirements and relatively high cost (Anonymous 2003).

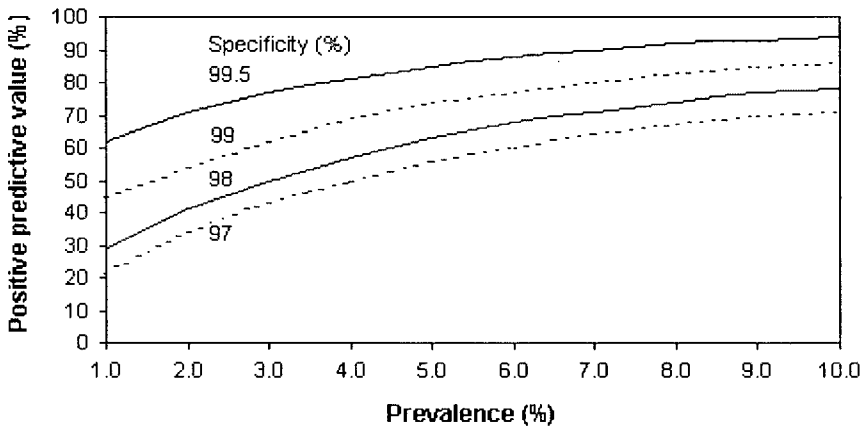
For gonorrhea, culture specimens are streaked on a selective (e.g., Thayer-Martin or Martin Lewis) or nonselective (e.g., chocolate agar) medium. Inoculated media are incubated at 35°C – 36.5°C in an atmosphere supplemented with 5% CO_2 and examined at 24-hour intervals for up to 72 hours (Anonymous 2003). The advantages of gonorrhea culture include: high sensitivity and specificity, low cost, suitability for use with different types of specimens and the ability to retain the isolate for additional testing (e.g. for antibiotic susceptibility). The major disadvantage of culture is that specimens must be transported under conditions adequate to maintain the organism viability. Another disadvantage is that a maximum of 24-72 hours is required from specimen collection to the report of presumptive culture result (Anonymous 2003).

The second type of diagnostic test is antigen detection. Antigen detection of genital swab material was one of the first laboratory methods available to clinical laboratories for the detection of chlamydia. In this technique, a sample is applied to a standard microscope slide, fixed with methanol and incubated with fluorescent-linked antibody directed against genus-specific cell wall proteins. The slide can then be viewed with a fluorescent microscope for the presence of elementary bodies. The main disadvantages of this method are that it requires an expert technologist and that it is labour intensive. This method is however, appropriate for confirmation of a positive test result by other assays (Morse, Beck-Sague, and Mardh 1999).

The third type of diagnostic test is the nucleic acid amplification tests (NAATS). NAATS are designed to amplify nucleic acid sequences that are specific for the organism being detected. Increased sensitivity of NAATS is attributed to its ability to produce a positive signal from as little as a single copy of the target DNA or RNA (Anonymous 2003).

Nucleic acid amplification tests, such as PCR and LCR are increasingly being utilized for diagnosis of many infections and will likely be considered the standard for chlamydia and gonorrhea diagnosis. Because these assays amplify genetic material from infectious organisms, their specificity can approach 100% if the proper genetic sequences are selected for the test. Nucleic acid amplification tests have been as sensitive as culture for several STIs, and the detection of some pathogens such as chlamydia and herpes virus has been improved by these tests. The sensitivity of these tests has enabled clinicians to use more easily collected specimens for diagnosis such as urine and vaginal swabs, rather than specimens obtained by more invasive sampling techniques. Furthermore, swabbing the male urethra is an uncomfortable procedure and has been a major limitation for screening males with possible asymptomatic infection. Lastly, the tests are not dependent on the presence of viable organisms in the specimens; therefore, handling and transport of specimens are relatively easy (Anonymous 2003; Orr and Brown 1996).

In summary, when selecting a diagnostic test it is important to consider clinical need, prevalence of the disease in the community, cost related issues and test performance. Test performance (sensitivity, specificity and predictive value) is critical when choosing a diagnostic test for both chlamydia and gonorrhea. For example, as illustrated in Graph 2.3.2.2-A, when a community has a 1% prevalence of gonorrhea, a test with a sensitivity of 90% and a specificity of 99% will only have a positive predictive value (PPV) of about 48%.



Graph 2.3.2.2-A

Positive predictive values for ranges of specificity & prevalence

Source: (Orr and Brown 1996)

As such, careful deliberations need to be made when choosing a diagnostic tool. An inappropriate test can significantly influence the whole integrity of the screening initiative (Orr and Brown 1996).

Furthermore, when the prevalence of STI infection is high (e.g. >10%), screening initiatives should be employed toward a greater proportion of the target population and include asymptomatic individuals and others who would not traditionally fall into a recommended screening category (e.g. men).

2.4 Risk Behaviour Theory

2.4.1 Introduction

Risk is defined as an action or a circumstance entailing some chance of loss, (Beyth-Marom et al. 1993) and is an important aspect of human behaviour. Under most circumstances it is the perceived risk of an event, rather than the actual risk that is most influential in an individuals' decision-making process.

Individuals are known to differ vastly in their perceptions of risks and risk preferences and as such make different choices (e.g. drinking and driving, unprotected sexual intercourse) (Lundborg and Lindgren 2002). For instance, some people may overestimate the small risks that they face (e.g. risks posed by tornadoes, floods), while others may underestimate larger and more plausible risks (e.g. risks of cancer, stroke or contracting an STI) (Lundborg and Lindgren 2002).

Traditionally, researchers and clinicians have viewed risky behaviour (e.g. unprotected sex, substance abuse) as the culprit for many health related problems (e.g. STIs, drug addiction) and as such have invested a great deal of energy and time in finding solutions that would help limit or eliminate these behaviours. Only recently have researchers begun to analyze the ways in which the public intuitively perceives risk and "risky behaviour" as a means of understanding why certain individuals make the choices that they do, (e.g. substance abuse, sexual risk taking), knowing the consequences (Gregory, Slovic, and Flynn 1996).

From a decision theory perspective, choosing a risky (or non-risky) action is rational if the choice reflects the relevant values and perceptions of the decision maker. When two individuals have different values and perceptions, they may choose different actions under the same conditions (Gregory, Slovic, and Flynn 1996). It is evident, that experts in public health and the general public often disagree on how to understand and interpret risk. In other words: how do you explain the fact that lay people often fail to follow the advice of experts in responding to the risks of modern life? How can we explain the unusual selection and prioritization of risks within a particular culture?(Krimsky 1992). This disagreement has been the source of many conflicts and communication failures, especially in STI prevention.

It is imperative that health service researchers, policy makers and clinicians be more attuned to the social and cultural differences in risk perception, not only to avoid conflicts and associated failures, but also to leverage these differences to achieve joint gains (e.g. STI prevention).

2.4.2 Evolution of Risk Theories

Early theories of decision making evolved with games of chance (Stigler 1986). Eighteenth century French nobility frequently asked their court mathematicians advice on gambling. Mathematicians developed the concept, "expected value", or the sum of the products of probabilities and outcomes, as a strategy for minimal risk gambling. In simple terms, if given a 1% chance to win 100 dollars versus 0 dollars, a player should offer no more than 1 dollar. This rule seemed reasonable at first, but decision makers soon realized the implications of maximizing expected values in order to avoid all gambles with negative expected values (i.e. lotteries and insurance) (Stigler 1986).

During the late 19th and early 20th centuries, economists became interested in measuring preferences over commodity bundles consisting of different items (Stigler 1986). The utility of a bundle is not simply the sum of the individual utilities because it was assumed that these items interact. In the middle of the 20th century, a mathematical breakthrough occurred that marked the beginning of the modern utility theory, namely, the "Expected Utility Theory". The expected utility theory permits the derivation of utilities for risky outcomes; rather than weighting each utility by the probability it actually occurs, people weighed each utility by their belief or perception that it will occur. This concept later developed into the "Subjective Expected Utility" theory, which remains the dominant approach to normative choice used in the psychology and social sciences (Edwards 1992).

Over time, conflicts and disagreements emerged that were not easily explained by subjective expected utility theory. Kahneman (Kahneman and Miller 1986), attempted to address these discrepancies with a theory called "Prospect Theory". Prospect theory was the first descriptive account of risky choice to introduce the status quo as a reference point in the value function, although the status quo is not the only reference point used to evaluate outcomes (Lommes and Sugden 1982; Lommes and Sugden 1986). Prospect theory was designed in part, to account for the fact that most people seem to prefer a risky option to a sure thing, when the choices are framed in a positive way. These individuals would shift their preferences when the same choices are framed in a negative way (Lommes and Sugden 1982; Lommes and Sugden 1986). These authors believed that most decision-makers would anticipate the disappointment they would feel if they received the best outcome and as such, choices were based on maximizing expected utilities (Lommes and Sugden 1982; Lommes and Sugden 1986). This theory later developed into what is now known as "Regret theory".

Regret theory suggests that decision makers would anticipate regret if the outcome was worse than that of another choice, while rejoicing if the outcome was better. Choices maximize expected utilities which in turn, are modified by anticipated regret and rejoicing (Bell 1982; Bell 1985; Lommes and Sugden 1987).

It has been demonstrated that choices vary with anticipated emotions such as disappointment and regret. Inferences about those emotions have often been indirect (Bell 1982). For example, decision makers are more likely to feel regret if the negative events that occur are under their control. In the same spirit, decision makers are more likely to feel regret from negative events that are the result of actions rather than inactions. Regret is usually greater in magnitude than disappointment, perhaps because the counterfactual comparison is under the decision maker's control (Bell 1982; Bell 1985; Lommes and Sugden 1982).

Along with regret theory, other theories of risk behaviour and decision-making emerged in the social sciences, such as: cultural risk theory, social amplification of risk, feelings theory, and theory of reasoned action and planned behaviour.

2.4.3 Cultural Risk Theory

Cultural theory is a social theory that emphasizes the relationships among human beings and their society (Rayner 1992). Cultural theory (Douglas and Wildavsky 1982) has been important

in the discussion on risk perception and risk interpretations (Dake 1991; Wildavsky and Dake 1990).

Cultural theory postulates that culture works as a social control mechanism for a given society, and influences individual behaviour and actions. For instance, strong-community minded people like the Inuit, have traditionally depended on each other for all aspects of life. This in turn promoted values of solidarity and community cohesiveness, rather than competitiveness.

Cultural theory argues that risks are defined, perceived, and managed according to the principles that adhere an individuals' social organization and cultural beliefs (Rayner 1992; Wildavsky and Dake 1990). Cultural theory aims at explaining how people perceive and act upon the world around them. More specifically the theory claims that social aspects and cultural adherence largely determine risk perception. According to Wildavsky and Dake (1990: 42) the cultural theory of risk is able to "predict and explain what kind of people will perceive which potential hazards to be dangerous". For instance, consider the case of an adolescent Inuit girl who values pregnancy. Although many observers (e.g. health care professionals) would argue that she has taken a risk when she engages in unprotected sex, the teenager and her community might argue that she has not. People perceive risks only when they are aware of the fact that they are taking risk (Byrnes 1998).

Although cultural theory has been used to explain risk taking within a cultural context, its applicability for STI risk research has not been well documented (Table 2.4.7-A). Some controversies regarding its usefulness in risk behavioural research have also arisen (Marris, Langford, and O'Riorden 1998; Sjoberg 1997). These include: a) cultural relativism (no absolute truth); b) stereotyping; c) deterministic (predictable); d) lacks attention to issues of power and self-interest and e) inherent conservatism (Rayner 1992).

2.4.4 Social Amplification of Risk

The social amplification of risk is a conceptual framework that describes how certain attributes (i.e. psychological, social, cultural, and political), influence an individuals' risk perception (Figure 2.3.2.1-B; Appendix II) (Slovic 1992). In this framework, "amplification" includes both intensifying and attenuating signals about risk.

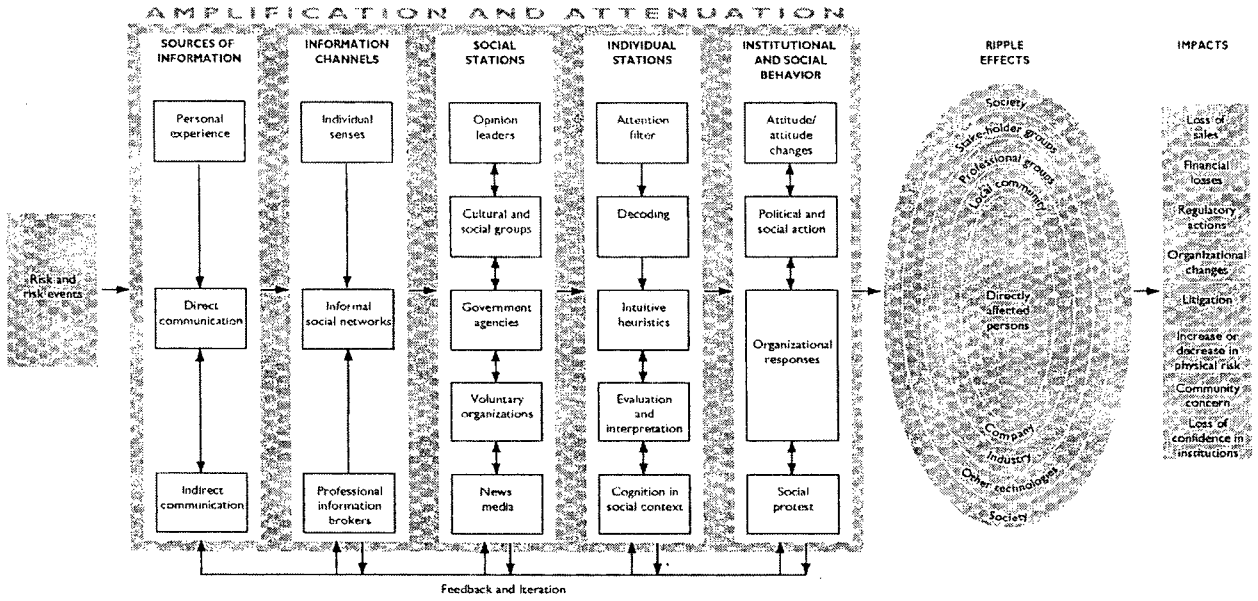


Figure 2.4.4-A

The Social Amplification of Risk Framework.

Source: (Pidgeon et al. 2003)

The experience of risk is both an experience of physical harm and the result of culture and social processes by which individuals or groups acquire or create interpretations of hazards (Kasperson 1992).

The social amplification of risk framework is based on the thesis that events pertaining to risks (e.g. not using condoms) interact with psychological, social, institutional, and cultural processes in ways that can heighten perceptions of risk and subsequently shape risk behaviour (Kasperson 1992). Behavioural responses or ripple effects in turn generate secondary social or economic impacts. They may include significant impacts such as liability, insurance costs, loss of confidence in institutions, or alienation from community affairs (Kasperson 1992).

What is considered "risk" is socially mediated and culturally determined. For instance, in an adolescent study conducted by Slovic (Slovic 1992), participants who engaged in high-risk activities (e.g. substance abuse, high-risk sexual activity) reported very similar cognitive and social perceptions. For instance, from a cognitive perspective, young people who engaged in risky activities reported: a) greater knowledge of associated risks; b) less fear of the risks; c) less personal risk and d) more personal control over risk; e) less ability to avoid the activity. From a social perspective, participants reported: a) greater peer influence; b) less desire for regulation of the activity by authorities and c) greater benefits relative to risks (Slovic 1992). It is conceivable that many of these high-risk activities were considered acceptable because they were not perceived to be true risks (or outliers) within the realm of possible adolescent behaviours.

According to the social amplification of risk framework, individuals or groups select specific characteristics of "risk" events and interpret them according to their perceptions (Pidgeon, Kasperson, and Slovic 2003). The individuals who collect and communicate information about risks act as "amplification stations" (Pidgeon, Kasperson, and Slovic 2003). These social groups can only amplify or attenuate signals by working in social aggregates and participating in social processes (Kasperson 1992). Individuals then process the information, locate the concerns and may even feel compelled to respond. Some may change their previously held beliefs, gain additional knowledge, or even be motivated to take action (Kasperson 1992).

In summary, the social amplification of risk framework purports that: information processing (cognition), personality, social factors, economic factors, and cultural factors, all influence an individuals' response to risk (Slovic 1992). The processing of risk events by the media, by cultural and social groups and by institutions and individuals profoundly shapes the societal experience with risk. This "processing" exercise also plays a crucial role in determining the societal impacts of a particular hazard events (Kasperson 1992). Although the framework has been used in hazards risk research (Frewer, Miles, and Marsh 2002; Ibitayo, Mushkatel, and Pijawka 2004; Slovic 1992) its applicability in STI behavioural research has not been well established (Table 2.4.7-A).

2.4.5 Risk as Feelings Theory

Many psychologists and economists who study risk adhere to what is known as the consequentialist perspective namely, people make decisions on the basis of an assessment of the

consequences of possible choice alternatives (Mellers et al. 1997; Mellers, Schwartz, and Ritov 1999).

The theory assumes that people assess the severity and likelihood of the possible outcomes of choice alternatives and integrate this information to arrive at a decision. This concept suggests that feelings triggered by the decision situation and imminent risky choices are not integral to the decision-making process (Figure 2.4.5-A) (Mellers et al. 1997; Mellers, Schwartz, and Ritov 1999).

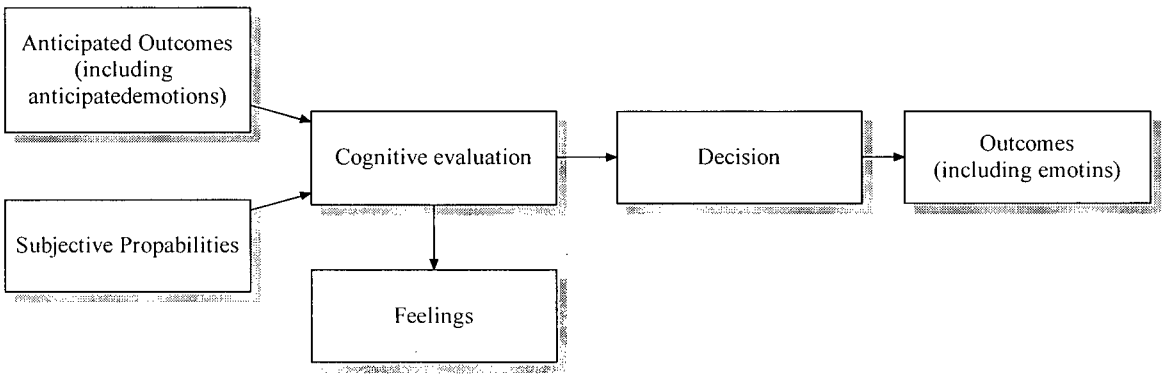


Figure 2.4.5-A
Consequentialist Perspective Without Anticipated Emotions.
Source: (Mellers et al. 1997; Mellers, Schwartz, and Ritov 1999)

Others, however, argue that feelings directly influence the decision process and in some situations, can conflict with cognitive evaluations (Loewenstein, Hsee, and Weber 2001). When such departures occur, the emotional reactions often exert a dominating influence on behaviour.

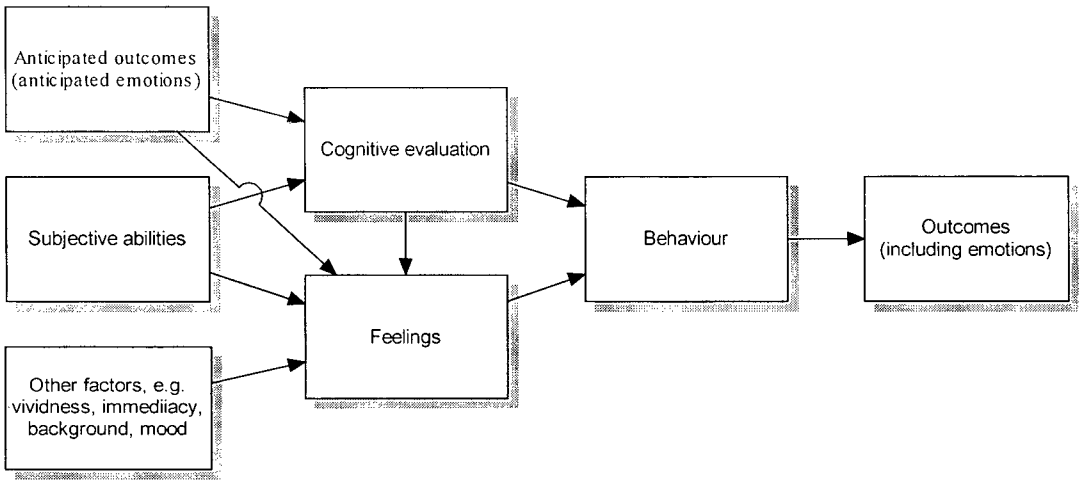


Figure 2.4.5-B
Consequentialist Perspective with Anticipated Emotions.
Source (Loewenstein, Hsee, and Weber 2001).

The risk as feeling theory (illustrated above), postulates that responses to risky situations result in part from direct emotional influences (e.g. worry, fear, dread, or anxiety) (Loewenstein, Hsee, and Weber 2001). People are assumed to evaluate risky alternatives at a cognitive level based largely on the probability and desirability of associated consequences(Loewenstein, Hsee, and Weber 2001). People's emotional reactions to risk depend on a variety of factors that influence cognitive evaluations. These include, the vividness with which consequences can be imagined, personal exposure to or experience with outcomes and past history of conditioning (Loewenstein et al. 2001; Mellers et al. 1997; Mellers, Schwartz, and Ritov 1999).

It is believed that anticipatory emotions play a critical role in risk aversion and farsighted decision-making. As such, individuals who do not have anticipatory emotions, (e.g. worry, dread), may display a profound disregard for future consequences (e.g. contracting an STI) (Loewenstein, Hsee, and Weber 2001). Thus, feelings may be more than just an important input into decision-making under uncertainty; they may be necessary and mediate the connection between cognitive evaluations of risk and risk-related behaviour (Loewenstein, Hsee, and Weber 2001). Although the "Risk as Feelings" theory has been widely studied in the social sciences (Johnson and Tversky 1983; Lerner and Keltner 2001; Saunders 1993) its applicability in STI risk behaviour research has not been well documented (Table 2.4.7-A).

2.4.6 Theory of Reasoned Action and Planned Behaviour

The theories of reasoned action and planned behaviour are comprehensive theories that were developed to explain how psychological variables can influence a behaviour, namely (a) intention, (b) attitude toward the behaviour, (c) subjective norm, (d) perceived behavioural control; and (e) behavioural, normative and control beliefs (Ajzen 1991; Fishbein 1980). These theories have been widely used for STI prevention (e.g. HIV) specifically in the area of condom use (Sutton, McVey, and Glanz 1999).

The theory of reasoned action asserts that one's intentions influence overt behaviour. For example: "How likely is it that you would feel embarrassed to buy condoms? (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III). Intentions, in turn are influenced by the attitude toward performing the behaviour and the subjective norm. Attitude is defined as the degree to which one has a positive versus a negative evaluation of the behaviour and is typically measured by differential scales (unpleasant-pleasant, unwise-wise, bad-good) (Fishbein 1980; Fishbein, Wolitski, and Doll 1999).

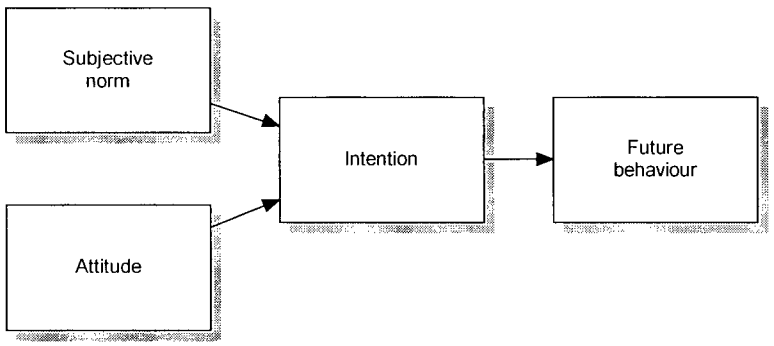


Figure 2.4.6-A
Theory of Reasoned Action.
Source: (Albarracin et al. 2001; Fishbein 1980)

The subjective norm is the perception of how important others think that one should or should not perform the behaviour in question. Subjective norm is typically measured by items such as: "My current partner thinks we should use condoms; My friends would approve if I used condoms" (Fishbein 1980; Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III).

The attitude toward the behaviour is assumed to be a function of one's beliefs such that performing the behaviour in question will lead to various outcomes and evaluative aspects of those beliefs (i.e. evaluation of an outcome). Thus one is more likely to have a positive attitude toward using condoms if one believes that using a condom will lead to a positive outcome (i.e. "Using condoms show that I am a caring person") (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III), and prevent a negative outcome (i.e. "using condoms would protect against being infected with HIV") (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III).

Outcome beliefs are typically measured by conditional "if" statements that link the behaviour to a set of outcomes: (i.e. "Would your partner get angry if you suggested using condoms? (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III). Outcome beliefs are critical components of the model. This is particularly evident when researchers are interested in modifying attitudes, (e.g. disliking using condoms), because it assumes that attitudes are based on beliefs (Fishbein 1980).

The subjective norm is also influenced by normative beliefs. For example, a man may perceive social pressure to use condoms if he believes that his partner thinks that he should use condoms and, is motivated to comply with him or her (i.e. "My current partner thinks we should use condoms") (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III). Motivations to comply however are measured by unipolar items (i.e. "I want to do what a new partner wants me to do") (Sutton, McVey, and Glanz 1999).

The predictive validity of the theory of reasoned action has been examined extensively (Sheppard, Hartwick, and Warshaw 1988; Sutton, McVey, and Glanz 1999). These analyses were important in establishing the predictive validity of the theory as a comprehensive model of behaviour in a Western society. Although the theory of reasoned action provides an effective account of deliberate behaviours, Ajzen (Ajzen 1991; Ajzen and Driver 1991) added perceived behavioural control to predict intentions and behaviours that are not completely under deliberate control.

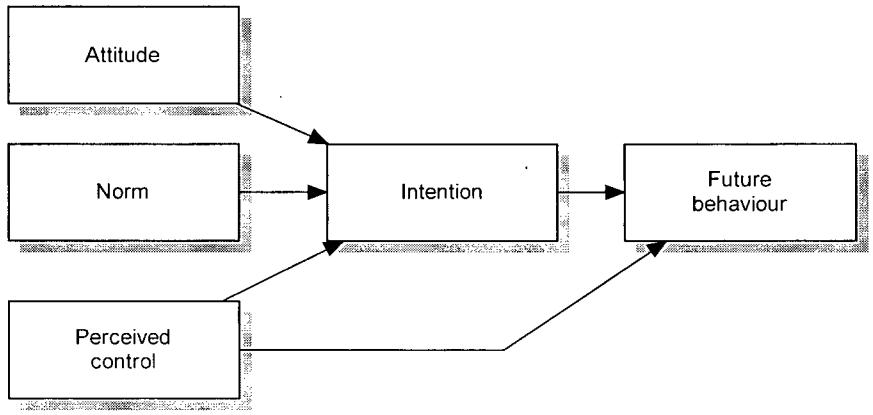


Figure 2.4.6-B
Theory of Planned Behaviour.
Source: (Ajzen 1991; Ajzen and Driver 1991)

Perceived behavioural control (theory of planned behaviour) refers to one's perception of control over the behaviour, and is assumed to reflect the obstacles that one encountered in past behavioural performance. With the inclusion of this new factor, perceived behavioural control could influence behaviour directly.

In addition to contributing to behavioural prediction, perceived behavioural control is assumed to influence a person's intention to use for example, condoms (i.e. "How much control do you have over using condoms?") (Sutton, McVey, and Glanz 1999) (Baseline questionnaire; Appendix III).

That is, people with higher perceived control are more likely to form intentions to perform a particular action than those who perceive that they have little or no control. In most situations, perceived behavioural control is measured as an aggregate of perceptions that: (a) one can or cannot perform the behaviour if one wants to, (b) performing the behaviour is or is not up to oneself, and (c) performing the behaviour is easy or difficult (Ajzen and Fishbein 1980; Ajzen and Madden 1986; Ajzen 1991). A summary of the major advantages and limitations of this conceptual framework can be found in Table 2.4.7-A.

2.4.7 Theory of Reasoned Action and Planned Behaviour and STI Prevention

Since condom use can considerably limit infection with HIV and other STIs, public health officials have instigated various behavioural theories for STI prevention. For example, the health belief model posits that increasing perceptions of vulnerability to STI infection should increase precautionary behaviour (Bandura A 1977; Bandura 1982). Yet chronic perceived vulnerability to STI infection in members of high-risk groups has shown to be insufficient to motivate these individuals to protective actions (Ajzen and Fishbein 1980; Ajzen 1991). This clearly suggests the need for other behavioural models of STI risk-related behaviour.

In the advent of HIV/AIDS it is has become imperative to talk about reducing the risk of HIV and other STI infections among remote Inuit populations. Young adults who have grown up during the age of AIDS often feel cheated. As they are beginning to understand and explore their sexuality they must also become proficient in understanding the risks of sexual involvement. The issue of behavioural change is complicated. It involves many forces including motivation, self-image, and family support. Information alone cannot eliminate the social and psychological pressures that often lead to risky behaviour. The fact is that changing one's behaviour is difficult for people of all ages. Yet, having access to life-saving information is an important prerequisite to healthy behavioural change.

To practice healthy sexual decision-making, Inuit people need to understand that safer sexual practices (e.g. using condoms) are supported and encouraged. Using behavioural models, (i.e. theory of reasoned action and planned behaviour), is one way that may help Inuit people understand the risks associated with STIs. It is also necessary to perform more research in the area of risk perception among different cultures to elicit more information on risk behaviours, existing levels of STI-risk-reduction knowledge, and factors that determine the population's motivation to reduce STI risk (Fisher and Fisher 1992).

In conclusion, the uses for risk and behavioural theory are vast (Table 2.4.7-A) The question, however, is whether we are ready to depart with the traditional paternalistic approach of health care, ("we know best", attitude) and adopt a more empathetic and culturally sensitive approach. Before we can claim to help our disadvantaged neighbours we need to first understand their perspectives on health and risk and be more understanding with their issues around poverty, and inequality. Only then can we begin to comprehend the complexities that surround "risk behaviour."

Table 2.4.7-A

Summary of Risk & Behavioural Conceptual Frameworks

Description	Main Advantages	Main Limitations	Use in Risk Research
Cultural Theory of Risk			
Perceived risk is closely tied to cultural adherence and social learning	Basics of the theory is easily comprehendible	Does not measure the relevant aspects of culture	Culturally based male concerns predict higher rates of HIV/STD in India. (Schensul et al., 2002-2007) in progress
	Intuitively appealing	Concept of culture needs to be clarified.	Compared cultural theory with psychometric no significant findings
		Limited previous use in STI risk behaviour research	Compared judgments of risk between a Swedish & Brazilian sample (Sjoberg 1997) two groups judged risks in a similar fashion no significant differences
Social Amplification of Risk			
Risk interacts with psychological, social, institutional and culture to heighten perception and behaviours	Well used in hazards and environmental risk research	Difficult to determine changes in risk perception	Efficacy of PEPCON explosion in amplifying risk perception (Ibitayo, Mushkatel, and Pijawka 2004) amplified public safety issues-not effective to trigger policy initiatives
	Useful framework to begin to explain impact of risk perception on a risk event	Media influence not always reliable	Media & genetically modified foods (Frewer, Miles, and Marsh 2002) perceptions did increase /decrease in line with amplification /attenuation
		Limited previous use in STI risk behaviour research	Adolescent study of high-risk activities (Slovic 1992)-participants who engaged in high-risk activities shared similar cognitive & social perceptions
		Difficult to predict when	

Description	Main Advantages	Main Limitations	Use in Risk Research
		amplification effects occur	
Risk as Feelings Theory			
Emotions directly influence responses to risky situations	Effects of emotions on behaviour is well researched	Emotions are influenced by past experiences	Relationship between "weather-effect" and stock returns (Saunders 1993)- weather variables effected mood-predisposing people to particular behaviours
	Connections from emotions to cognitive process are stronger then vice versa	Emotions tend to be situational and difficult to measure	Studied the effects of emotion on risk perception (Lerner and Keltner 2001)– fearful people made relatively risk-averse choices while angry people made more risk-seeking choices
	Feelings about risk are insensitive to changes in probability	Limited previous use in STI risk behaviour research	Studied the effects of emotion on risk perception (Johnson and Tversky 1983)- people who read sad newspapers gave higher risk estimates for certain causes of death
Theory of Reasoned Action & Planned Behaviour			
Developed to how certain psychological variables can influence a behaviour	Well researched and validated theory	Conceptual model has only been researched among Western populations	Using the TRA/TPB for predictors of condom use (Sutton et al., 1999)-Measures of past behaviours were the best predictors
	Widely used in STI prevention and risk behaviour research	Most studies have been based on student samples	Meta-analysis of psycho-social correlates of hetero-sexual condom use (Sheeran, Abraham, and Orbell 1999) behavioural intentions and communications about condoms were best predictors
	Useful for developing communication strategies	Factors like personality and demographics are not taken into account	Studied the psychological determinants of AIDS-preventive behaviours (Fisher and Fisher 1992) behavioural

Description	Main Advantages	Main Limitations	Use in Risk Research
			intentions predicted AIDS preventive behaviours
		Defining perceived behavioural control can be problematic (measurement issues)	

CHAPTER III

CHAPTER 3 Methods

Chapter 3 provides an overview of the research methods that were used throughout this project. A description of the following will be included:

- Research setting
- Ethical considerations
- Conceptual Framework
- Study population (inclusion and exclusion criteria)
- Study procedures (cross-sectional and longitudinal, urine screening)
- Baseline and follow-up questionnaire
- Data collection and organization
- Creating scores and values
- Contact tracing and partner referral
- Social and sexual networks (network development and analysis)
- Statistical analyses (cross-sectional and longitudinal)

3.1 Research Setting

Nunavut has an Inuit population of about 23,000 living in the regions of Baffin (eastern region), Kivalliq (central region), and the Kitikmeot (western region). Nunavut was created on April 1, 1999 and encompasses one-fifth of Canada's landmass. Each of the territory's twenty-six communities have populations of around 1,000 inhabitants. The regional administrative centres of Cambridge Bay, in Kitikmeot and Rankin Inlet, in Kivalliq have populations of 1,300 and 2,700 respectively. The territorial capital of Iqaluit, is the largest community in Nunavut with a population of over 5,250 (Anonymous 2005).

The Baffin region (Figure 3.1-A) is 1500 Km long with an area of 507,451 sq Km. Baffin has 12 communities and with a few exceptions, most of the communities are isolated from one another and only accessible by airplane. Many of the communities share similarities in physical layout, age distribution, infrastructure, health conditions and availability of health services.

Figure 3.1-A

Nunavut- Baffin Region.

Source: (Natural Resources Canada 2000)

3.1.1 Test Community

The community that was selected for this research project is located in the Baffin region. The community was selected on the basis of logistical feasibility, familiarity with the community by the researcher and support from the community council and local community members. The community was well representative of other communities in the Baffin region with respect to age distribution, demographics, isolation, access to health care services and rates of STIs (chlamydia and gonorrhea) (Table 3.1.1-A; Appendix IV). To maintain confidentiality and to respect the community members, the community will not be named throughout this dissertation. From this point on, the community will be referred to as "Test Community".

3.2 Ethical Considerations

Over the years, certain health-research initiatives (e.g. genetic testing) have acquired a bad reputation among aboriginal people (Castellano 2004; Weijer, Goldsand, and Emanuel 1999). In these situations, the research objectives were often alien to the researched population and in some cases, the outcomes were regarded as misguided and harmful (Castellano 2004).

Furthermore, research that seeks objectivity (i.e. maintaining distance between the investigator and research participants), often violates aboriginal beliefs of reciprocal relationships and collective validation (Castellano 2004). It is perceived that if the researcher assumes complete control of the research process, the dialogical relationship between the researcher and the research participants is disrupted. With such a research approach, any attempts to gain an understanding of aboriginal life may produce results that aboriginal people reject as distortions of their reality (Castellano 2004).

Some aboriginal groups (e.g. First Nations) have also expressed concern about the use of census and population health data. Despite the removal of personal identifiers, census and population health research (e.g. National Population Health Survey) are not governed by standard ethical regulations. Many First Nations people feel that they have no control over such information that may be used for unauthorized surveillance, or that may reinforce negative stereotypes of them as communities (Weijer, Goldsand, and Emanuel 1999).

In accordance with these and other ethical concerns and to respect the confidentiality of the Test Community, the following considerations were applied throughout this research process:

1. Consultation with the community when developing the research protocol and during the implementation: The Hamlet office, local council and Community Health Representative (CHR) were consulted during the whole research process to provide feedback on the questionnaire, recruitment strategies, interviewing techniques and the research methods.
2. Informed consent was obtained from community leaders prior to approaching individuals. Project goals and objectives, maintenance of anonymity and confidentiality, terms of data usage and storage and intellectual property rights were all discussed with the local council prior to initiating the study. Clinical ethics approval from the University of British Columbia and research licensure from the Nunavut Research Institute were also obtained. The consent form was provided in both English and Inuktitut and was developed in accordance to the Ethical Guidelines for Research prepared by the Royal Commission on Aboriginal Peoples.
3. The community will have access to the results upon completion of the thesis and the community will not be named in any reports, publications or presentations.

3.3 Conceptual Framework

The theories of reasoned action and planned behaviour are two theories that have been previously used to help predict condom use among research participants. Although the conceptual framework's usefulness in predicting STIs in an Inuit population has not been previously researched, the theories have however, been used to predict and explain high-risk sexual behaviours and condom use in many other settings (Ajzen and Madden 1986; Ajzen 1991; Sutton, McVey, and Glanz 1999).

In summary, both theories support the notion that perceptions of STI risk are only minimally linked to preventive behaviour. Essentially, people are more likely to use condoms for example, if they have previously formed these intentions. Intention is defined as the subjective likelihood that one will perform the behaviour in question (Fishbein, Wolitski, and Doll 1999). The intention to perform a given behaviour (e.g. using a condom) is in turn viewed as a function of two basic factors: the person's attitude toward performing the behaviour (positive or negative feeling) and/or the person's subjective norm concerning the behaviour (perception that others think that he or she should or should not perform the behaviour) (Ajzen and Madden 1986; Ajzen 1991; Fishbein 1980; Fishbein, Wolitski, and Doll 1999).

Attitudes are viewed as a function of behavioural beliefs (i.e. beliefs that performing the behaviour will lead to certain outcomes, e.g. preventing an STI). Subjective norms are viewed as a function of normative beliefs (beliefs that one should or should not perform the behaviour in question), and motivations to comply (the degree to which, one wants or does not want to do that the referent thinks one should do) (Ajzen and Madden 1986; Ajzen 1991; Sutton, McVey, and Glanz 1999).

Essentially, to change an existing behaviour an individual needs motivation, personal skills and interpersonal resources (i.e. interpersonal communication, negotiating skills and self-efficacy) (Eng and Butler 1997). The more one believes that performing the behaviour will lead to positive outcomes, (or prevent negative outcomes), the more favourable one's attitude will be toward performing the behaviour.

Self-efficacy can also greatly influence an individual's ability to practice protective sexual behaviour (e.g. discusses condom use with a partner, uses condoms during intercourse, and refuse to have intercourse if condoms are not to be used) (Cecil and Pinkerton 1998). Reports in the literature provide support for the utility of self-efficacy, as a predictor of intending to use condoms (Jemmott et al. 1992; Mahoney, Thombs, and Ford 1995); frequency with which condoms and other contraceptives are used (Brien et al. 1994); talking to partners about contraception (Joffe and Radius 1993); and refusing intercourse unless contraception is used (Kasen, Vaughan, and Walter 1992; Zimmerman et al. 1995).

For the purpose of this study, the main components of the theory of reasoned action and planned behaviour (discussed in paragraphs 2.4.6 and 2.4.7) were incorporated into the baseline questionnaire (Appendix II). The aim, was to determine if these two theories would be effective in predicting an STI outcome among the study participants.

3.4 Study Population (Inclusion & Exclusion Criteria)

Sample selection for the cross-sectional group was open to all Inuit males and females between the ages of 15 and 65 who resided in the Test Community. Participants were required to be physically present in the Test Community between the dates of August 1st and September 30th, 2003. This requirement excluded all community members who resided in the surrounding outpost camps, were visiting other communities, or were working on the fishing vessels.

All the study participants were approached and recruited by the investigator, health centre staff, CHR and by word of mouth. Posters advertising the study were placed at the local store, school, Hamlet office and Health Centre and announcements were made on the local radio station.

For the longitudinal cohort a random sample of participants from the cross-sectional study group was selected and followed every two months post baseline visit for an additional four visits. As in the case of the cross-sectional requirement, participants were required to be present in the Test Community for each follow-up visit. Table 3.4-A is a summary of the inclusion and exclusion criteria for participating in this research project.

Table 3.4-A

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Inuit ethnicity	Individuals that were living in outpost camps
Between the ages of 15-65	Individuals that were visiting other communities
Able to give written informed consent	Individuals working on fishing vessels
Permanent residents of the Test Community	
May or may not be sexually active	

3.5 Study Procedures: Baseline Visit

During the baseline visit all study participants were interviewed and screened for gonorrhea and chlamydia. The baseline questionnaire (Appendix II) was used to collect information on demographics, use of health services, sexual histories, knowledge of STIs and contraceptives and predictors of STI transmission. Chart reviews were also completed for all the participants in order to obtain more detailed information on use of health services, previous STI results and health histories.

All urine specimens that were used for the STI screening were collected and packaged at the Health Centre by the investigator. Samples were flown to Baffin Regional Hospital (Iqaluit) laboratory on a weekly basis. All positive and/or symptomatic individuals were treated according to Nunavut Health and Social Services Medical Policies. This included the administration of one gram of oral Azithromycin for confirmed chlamydia infections, symptomatic individuals and for all contacts of infected individuals. In the case of confirmed or suspected gonorrhea cases, individuals were treated with 400 mg of oral Cefexime. Contact tracing and partner notification were completed for all confirmed chlamydia and gonorrhea cases as per routine clinical practice.

3.5.1 Follow-up Visits

During each visit, the participants were given a short interview to collect information on social and sexual networks and were screened for chlamydia and gonorrhea. Similar procedures as discussed previously were applied with regard to treatment of index and suspect cases and contact tracing.

3.5.2 Chlamydia and Gonorrhea Screening

Baffin Regional Hospital uses a urine based, Nucleic Acid Amplification test (NAAT) for the screening of chlamydia and gonorrhea. At the start of the study (August 1st, 2003) the laboratory was using the Ligase Chain Reaction (LCR) diagnostic test by ABBOTT. ABBOTT discontinued the reagents for the LCR screening method and as of October 2003, the laboratory switched to the Polymerase Chain Reaction (PCR) screening method by Roche.

3.5.2.1 LCR Screening Method for Gonorrhea

The LCR™ amplification technology is designed to detect a specific nucleic acid sequence in the Opa gene of gonorrhea. This process can be applied to specimens from both symptomatic and asymptomatic males and females (Abbott Laboratories 2001). During the screening process the first 15-20 ml of voided urine was collected in a plastic, preservative-free, urine specimen container. Participants were instructed to avoid voiding for at least one hour prior to collection. After collection, specimens were labeled and stored in a -20°C freezer at the Test Community health centre. Batches of frozen urine samples were flown to Baffin Regional Hospital Laboratory on a weekly basis.

During the DNA amplification phase, the prepared urine sample is added to the LCR reaction mixture. This mixture consists of four oligonucleotide probes, thermostable ligase and polymerase and individual nucleotides in buffer solution. The four oligonucleotide probes are designed to hybridize to complementary single-stranded gonorrhea target sequences exposed in the sample preparation (Abbott Laboratories 2001). The 48 base pair sequence is usually selected as the target DNA as it is most specific to gonorrhea. Up to 11 copies of the Opa gene are found per gonorrhea cell (Meyer, Gibbs, and Hass 1990).

In the LCx Analyzer a sample of the amplification product is transferred to an incubation well where they bind with the amplification product (Abbott Laboratories 2001). The presence or absence of gonorrhea is determined by relating the LCx Assay results of the specimen to the Cutoff value. Although the predictive value of an assay will depend on the disease prevalence of a particular population, the overall sensitivity of the LCR screening test is reported to be 97.5%, while the specificity is 98.3% (Abbott Laboratories 2001).

3.5.2.2 LCR Screening Method for Chlamydia

Similar to the gonorrhea testing, the LCR™ amplification technology can detect chlamydia DNA in urine specimens from both symptomatic and asymptomatic males and females (Abbott Laboratories 2001).

As previously mentioned, the LCR Assay uses the nucleic acid amplification method to detect the presence of chlamydia DNA in clinical specimens. In addition to its chromosomal DNA, chlamydia harbours a cryptic plasmid, which is unique to chlamydia. The LCR target is located within this plasmid (Abbott Laboratories 2001).

The presence or absence of chlamydia is determined by relating the LCx Assay results to the Cut-off value. The diagnostic test has an overall sensitivity of about 93.1%, while the specificity is about 97.1%(Abbott Laboratories 2001).

3.5.2.3 PCR Amplification Method for Chlamydia

Baffin Regional Hospital currently uses the PCR method for the detection of both chlamydia and gonorrhea in urine samples. This method is based on four major processes; specimen preparation; PCR amplification of target DNA; hybridization of the amplified products to oligonucleotide probes and detection of the probe-bound amplified products (Roche Diagnostic Systems 1996). Specimen collection and transport are similar to the urine collection method explained in the LCR gonorrhea section. The diagnostic test has an overall sensitivity of about 93.1%, while the specificity is about 97.1%(Abbott Laboratories 2001).

3.5.2.4 PCR Amplification Method for Gonorrhea

The PCR amplification method for urine gonorrhea screening uses the primers SS01 and SS02 to define a sequence of nucleotides within the cytosine DNA methyltransferase gene of gonorrhea (Roche Diagnostic Systems 1996).

Gonorrhea urine PCR screening follows the same procedures in urine collection, sample preparation, amplification and detection as discussed previously. The diagnostic test has an overall sensitivity of about 90%, while the specificity is about 97% (Roche Diagnostic Systems 1996).

3.6 Baseline Interview/Questionnaire

The baseline interview and questionnaire were given to all cross-sectional study participants. Interviews were conducted at the Test Community health centre in either English or Inuktitut and took approximately 30 minutes to complete. The Community Health Representative (CHR) from the Test Community was trained and hired to administer the Inuktitut questionnaires. Interviewer training consisted of two-1hour sessions that included instruction on interviewer techniques, introductions, probing, following instructions, and recording of information. Respondents were paid a small honorarium of 20 dollars for their participation.

The baseline questionnaire was developed in a three stage process:

1. Consultation over the structure, content and development of the questionnaire with key informants in the Test Community. These included: CHR, members of the community council, Inuit teachers and other prominent community members
2. Translation of the final draft by professional Inuit translators. The questionnaire was available in both English and Inuktitut
3. Piloting the final questionnaire with a convenience sample of Inuit people (n = 40)

A summary of the variable categories that were included in the baseline questionnaire can be found in Table 3.6-A. A detailed description of each variable and response options can be found in (Legend A; Appendix IV).

Table 3.6-A

Summary of Variable Categories in the Baseline Questionnaire

Category	# Variables	Variable Type
Demographic	10	Continuous & Categorical
Health & Health Services	9	Categorical
STI knowledge	12	Categorical
STI Study result	1	Dichotomous (Outcome)
Sexual history	7	Categorical & Continuous
Contraceptive knowledge	7	Categorical
Risk behaviours	11	Categorical & Continuous
Behavioural beliefs	12	Categorical
Normative beliefs	3	Categorical
Motivations to comply	5	Categorical
Self-efficacy	7	Categorical
Perceived behavioural control	1	Categorical

3.6.1 Description of Variable Categories (Baseline Questionnaire)

The following section provides a brief description and rationale for selected variable categories that were used in the baseline questionnaire. All other variables in the baseline questionnaire, (e.g. behavioural and normative beliefs, motivations to comply, self-efficacy and perceived behavioural control), were components of the Theory of Reasoned Action and Planned Behaviour. These variables were discussed in chapter two.

1. Demographics (gender, age, income range):
   Gender and age are known to influence sexual behaviours and are strong predictors of STIs (e.g. females are more susceptible to STIs) (Bolan, Ehrhardt, and Wasserheit 1999). Gender differences in sexual behaviour may change with increasing age, social contacts and cultural norms (Bolan, Ehrhardt, and Wasserheit 1999)

2. Health and health care services (use of health services, previous STI screening):
   Health and health care behaviours are known risk factors for STI exposure, infection following exposure and for STI related complications (Aral et al. 1999). Poor health care behaviour (e.g., failure to seek testing and treatment for symptomatic STIs) is a common determinant of STI transmission among sexual partners and a good indicator of treatment compliance (Eng and Butler 1997)
3. Knowledge (i.e. STI and contraceptive):
   Research on the effects of knowledge about STIs and STI risk are conflicting—some support a protective effect on sexual behaviour (Yacobi et al. 1999) whereas others point to no benefit (Sekirime et al. 2001). Although awareness of AIDS has reached virtually universal levels among men and women of reproductive age, knowledge of non-HIV STIs and contraceptives remains less widespread. Since large knowledge gaps persist by gender and across social/cultural groups (Bessinger, Katende, and Gupta 2004) it would be worthwhile to see if similar findings exist in Inuit populations
4. Risk Behaviours (i.e. age of first sex, number of partners, use of condoms, previous STIs):
   a. One of the most frequently used risk markers in STI research is age of first sex. This has two epidemiological functions: first as a true risk factor related to disease outcome and second as an indicator of other aspects of sexual activity (Sanchez et al. 1996). Age at first sex has been independently associated with the development of cervical cancer, chlamydia prevalence and with HIV infection (Sanchez et al. 1996). Age of first sex is often correlated with factors like ethnicity, socio-economic status, and number of sex partners (Aral et al. 1999)

b. The greater the number of partners an individual has is indirectly related to a greater risk of exposure to STIs. Lifetime number of sex partners is associated with the risk of cervical and other genital cancers (Aral et al. 1999). The number of sex partners within a specific time period (e.g. 3 months), has also been shown to be a risk factor for contracting gonorrhea, chlamydia, genital herpes, and human papillomavirus infection (D'Costa et al. 1985; Handsfield et al. 1986; Schachter, Stoner, and Moncada 1983; Syrjanen et al. 1984)

3.6.2 Follow- up Interview

A follow-up interview was done with all participants in the longitudinal cohort during each of the four visits. The interview was designed to extract information on the participant's social and sexual networks (e.g. number of sexual partners since last visit), type and strength of relationships and location of social gatherings.

3.7 Data Collection and Organization

All the data collected from the baseline questionnaires, follow-up questionnaires, chart reviews and STI results were coded and entered into an excel spreadsheet by the investigator. All personal identifiers (e.g. name and date of birth) were removed from the data. Upon completion of the data entry all hardcopies were shredded. STI laboratory results from both the baseline and follow-up visits were considered personal health documents and were kept in the participant's Health Centre chart in the Test Community.

3.8 Grouping Variables into Summed Scores

To minimize the number of variables in the data set, selected variables were grouped together to form scores. A common approach used in developing scores is to simply add participants' (Figure 3.8-A and Figure 3.8-B) responses to each item thus creating a summed score (Pietrobon et al. 2004). These scores can then be used to determine significant predictors in a regression model without loosing any valuable information (Pietrobon et al. 2004). In this case the scores were developed to help deal with the small sample size and to allow for meaningful results during the analysis. Summed scores were only computed for selected variables in the baseline questionnaire.

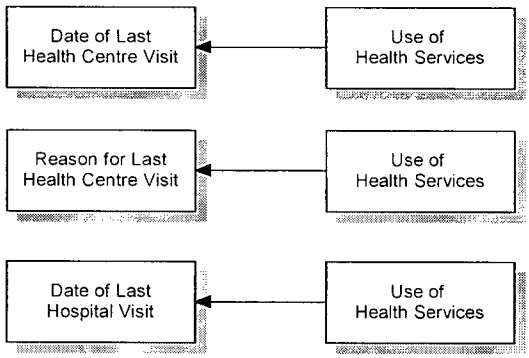


Figure 3.8-A

An Example of Individual Variables

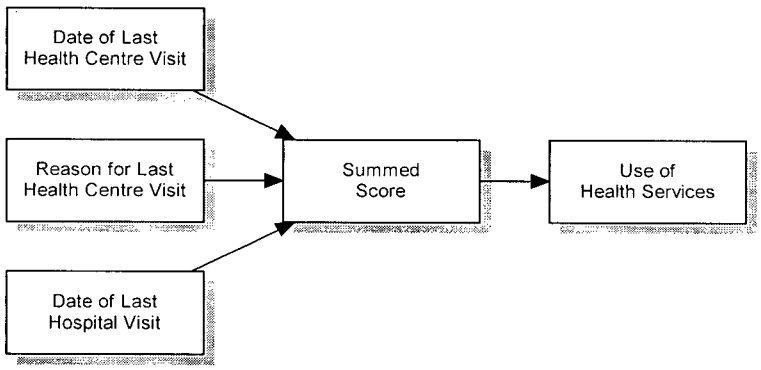


Figure 3.8-B

An Example of A Summed Score

All the variables that were collapsed into scores belonged to a specific theme (e.g. use of health services) and contained either a Likert scale or qualitative responses. Scores were based on the most correct response and were summed up to produce the highest attainable score (i.e. adding up all the correct numbers) for a given category. For example, if a yes response was the correct answer for a specific question (e.g. do condom help prevent STIs – yes, no or not sure) then a value of 1 would be given to an answer of yes and a value of 0 be given to the answers no or not sure. Table 3.8-A contains the variables that were formed into scores along with the highest attainable score.

Table 3.8-A

Baseline Score Values and Highest Attainable Scores

Category	# Variables	Highest Attainable Score
Use of health services score	3	10
Impression of STI/HIV score	3	6
Contraceptive knowledge score	7	28
Perceived risk belief score	2	6
Actual risk behaviour score	5	18
Condom self-efficacy score	7	16
Normative belief & motivation to comply score	8	32
Negotiation condom use & perceived control score	8	9

After the "highest attainable scores" were calculated (i.e. adding up all the correct answers), some of the variable scores were grouped into values (Legend B; Appendix IV). Values were assigned to help limit the number of categories within each variable score. For example, if a score had a "highest attainable score" of 10, then for this specific score there could potentially be 11different categories (i.e. scores of 0-10). Having too many categories can be problematic during the analysis especially, when dealing with the issue of small sample size. SPLUS statistical software was used to help determine which variable scores would be assigned values through the use of summaries and density plots.

Summary statistics and density plots are useful tools for exploring the data and for looking at the data distribution. For example, if the summaries and density plot indicate that certain scores (e.g. scores of 4, 5, 6) can be grouped together without disrupting the data distribution or loosing information, then a value (e.g. 1) can be assigned for the given scores. Assigning values would in turn, help limit the number of levels within each variable category, reduce the standard error during analyses and improve the statistical power (Pietrobon et al. 2004). An illustration of how values were assigned for the variable "Use of Health Services Score" is given below:

- **Step 1:** Summary Statistics for Use of Health Services Score.
  The summary statistics gives us an overview of how many individuals belong to a certain score. For example, there were 12 individuals that had a score of 10 (Figure 3.8-C).
- **Step 2**: Density Plots for Use of Health Services Score (Original/Grouped Scores).
  The density plots help us examine the distribution of the data and as such, help us determine were the cutoff areas would be. In this case the cut off areas would be were the individual scores would be grouped together.

By analyzing the summaries and density plots (original & grouped) it was apparent that the scores can be grouped into 3 categories: 1 = scores: 4,5,6; 2 = scores: 7,8; 3= scores: 9, 10. In this case a value of one would be regarded as low score, value of 2 = moderate score and value of 3 = high score. Values such as low, moderate or high were based according to the overall responses by the study participants.

Use of Health Services Score:	
Score of 10:	12 (individuals)
Score of 9:	44
Score of 8:	68
Score of 7:	24
Score of 6:	17
Score of 5:	7
Score of 4:	9
Total	**181**

Figure 3.8-C
Use of health services score

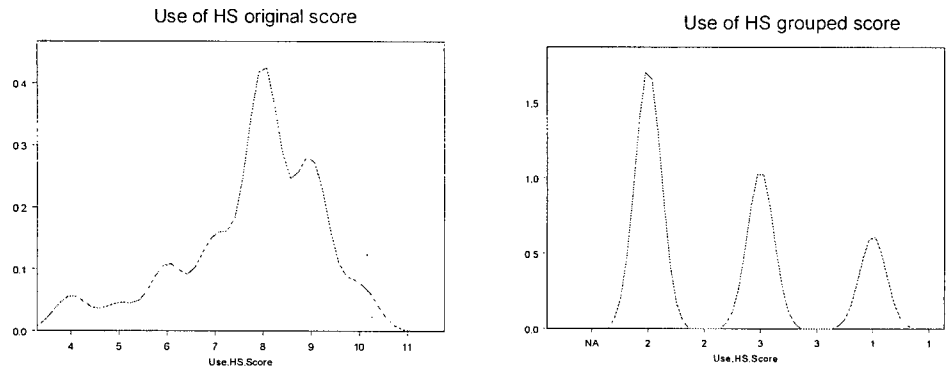


Figure 3.8-D

Use of health services density plots (original/grouped)

3.9 Contact Tracing and Partner Referral

Since both chlamydia and gonorrhea are reportable diseases, chains of infection were followed through contact tracing and partner referral. Information on all sexual partners, within a three-month period was collected through the "snowball" sampling technique. Snowball sampling starts with the index case and adds all the sexual partners to the network as soon as they are traced. This stage forms the first generation of index cases. Partners of the first generation of index cases become the second generation of index cases and so on (Ellen et al. 1996).

For the purpose of this study, the investigator contacted only named contacts that resided in the Test Community. For all other cases (partners that resided in other communities in the Nunavut region), the usual protocol for contact tracing was applied: contact information was elicited from the infected individuals and then given to the appropriate health centres or public health clinics where testing and treatment was carried out. In most cases, public health or community health nurses interview these contacts and encourage them to get tested and treated.

3.10 Social and Sexual Networks

A social network is a map of the relationships between individuals. Social networks also illustrate the ways in which individuals are connected through various social contacts ranging from casual acquaintance to close familial bonds (Klovdahl 1985). A sexual network is a type of social network that is defined by the sexual relationships between a set of individuals (Kretzschmar 2000)

Social network theory views relationships in terms of nodes and ties. Nodes are the individual actors within the networks and ties are the relationships between the actors. There can be many kinds of ties between the nodes depending on the relationships being studied (Klovdahl 1985).

Social factors are heavily implicated in STI related behaviour (Anderson, Gupta, and Ng 1990; Aral 1999; Bessinger, Katende, and Gupta 2004; Ghani, Swinton, and Garnett 1997; Klovdahl 1985). For instance, it is important to understand how social factors shape norms and influence the selection of sexual partners. This type of information provides an important body of knowledge on the behavioural dynamics of disease spread. It is also important to find the linkages between social and sexual networks, how linkages change over time, how they differ by gender, developmental period (adolescence vs. early adulthood vs. middle age), ethnic background, and culture (Klovdahl 2001).

For this research project, information on both social and sexual networks were obtained through contact tracing. During the follow-up interviews, information was collected on sexual partners, social contacts, strength and type of relationships (for both sexual and social) and location of social interactions. The investigator did not interview any of the social contacts (excluding those who were also study participants) listed by the participants.

3.10.1 Network Development and Analyses

The networks generated from this research project are based on an "ego-centric" method. This method concentrates on the individual, rather than on the network as a whole. Such information can be useful for understanding how networks affect individuals.

Sexual network size was defined as the number of sexual contacts of an index case during the three-month period before screening. Global network-size, was developed by calculating the individual network size for each participant enrolled in the study, and summing these sizes across study participants. For each index case (i.e. infected with an STI), the network size (N_t) was computed as follows: $N_t = N_0 + N_1 + N_2 + \ldots + N_k$, where N_0 represents the index case, N_1 represents the total number of first-generation partners named by the index case, N_2 represents the total number of second generation partners within the same 3-month period and so forth to N_k (i.e. third generation partners and so on) (Choi and Noseworthy 1992).

Network analysis uses a graphic display (sociogram) that consists of points (or nodes) to represent actors and lines (or edges) to represent ties or relations. A graph may represent a single type of relationship among the actors (simplex), or more than one kind of relation (multiplex) (Hanneman 2001). Each tie or relation may be directed (i.e. originates with a source actor and reaches a target actor), or it may be a tie that represents a bonded-tie between the pair of actors (Hanneman 2001). Directed ties are represented with arrows and may be reciprocated (A chooses B and B chooses A).

The actors' position (power) in a network is also very important and it can be defined by the numbers and lengths of pathways to other actors. For instance, actors who have several pathways to other actors may be considered central figures (e.g. star shape) with a great deal of power. The number and lengths of pathways in a network are also, very important in understanding an individual's constraints and opportunities, and for understanding the behavior of the network as a whole (Hanneman 2001). In some analysis, the lengths can be made to represent the strength of relationship between two nodes (e.g. a short length would represent a strong relationship such as marriage). This attribute however, was not included in this study.

Some network properties that will be used in this study include:

- Density: size of a network is critical, for the structure and maintenance of social relations. As a network gets bigger, the proportion of all the ties (density) that could be present will fall
- Transitivity: a measure that examines the connections between triadic relations (i.e. 3 individuals). The transitivity principle holds that, if A is tied to B, and B is tied to C, then A should be tied to C
- Reciprocity: a measure that examines the relationships between dyads (i.e. 2 individuals). A dyad has reciprocity when both individuals name each other. For instance A names person B as a sexual partner then person B should also name person A. In network analysis reciprocity is measured as a ratio
- Bridging: occurs when individuals from a network have contacts from outside the network. Bridging is important to networks as they can act as a liaison with other networks and can either bring in or take out infections
- Centrality Measures.

Centrality Measures

Centrality is a measure of the structural position and attributes of the nodes within the network. Centrality also measures the contribution of network position to the importance, influence, and prominence of an actor in a network. Centralization refers to the extent to which a network revolves around a single node. More specifically, centrality is measured as a share of all centrality possessed by the most central node. In a star network for example, the central point has complete centrality, and all other points have minimum centrality. The four measures of centrality that will be discussed include: degree, closeness, betweenness and power (Hanneman 2001). Correlation statistics of the four measures of centrality will also be completed.

- **Degree:** the number of ties that a given node has. More precisely, the degree of node i is given by $d_i = \sum_j a_{ij}$ (Freeman 1978). The degree of an actor is simply the number of people they had sex with
- **Closeness:** the total graph-theoretic distance of a given node from all other nodes. More precisely, $c_i = \sum_j d_{ij}$ where d_{ij} is the number of links in the shortest path from actor i to actor j. Closeness is an inverse measure of centrality in that a larger value indicates a less central actor while a smaller value indicates a more central actor (Freeman 1978)
- **Betweenness:** the number of times that a node needs a given node to reach another node. More precisely, it is the number of shortest paths (between all pairs of nodes) that pass through a given node. It is exactly defined as: $\boldsymbol{b_k} = \sum_{ij} \frac{\boldsymbol{g_{ikj}}}{\boldsymbol{g_{ij}}}$ where g_{ij} is the number of shortest paths from node i to node j, and g_{ikj} is the number of shortest paths from i to j that pass through k (Freeman 1978). Betweenness indexes the extent to which a node's presence facilitates the flow of a communicable disease for example. If a node that is high on betweenness centrality is removed from the network, the speed and certainty of transmission from one arbitrary point to another are more damaged than if a node low on betweenness is removed (Freeman 1978)

- **Power:** power is a product of relationship patterns (i.e. one individual influences others, disease transmission) and, the amount of power in social structures can vary. For instance, if a system is very loosely coupled (low density) not much power can be exerted; in high-density systems there is the potential for greater power. Furthermore, actors that face fewer constraints, and have more opportunities (i.e. more sexual partners) that others, are in favourable positions and so, have more power (Freeman 1978).

3.11 Statistical Analyses (Cross-Sectional)

All data collected during the Baseline visit underwent an exploratory analysis such as: looking at the distribution of the data within the study population; cross-tabulations and correlations between covariates of interest; plot variable against variable (e.g. age & sex) and plotting response variable with covariates of interest (e:g. gender). The t-test and Chi-square tests were used to determine if any differences existed between males and females, and between younger and older age groups. Pearson's R Correlations were computed for all the continuous variables. Since the study outcome was dichotomous, it was changed to numeric for the purpose of conducting the correlations variable. The correlations were done using SPSS.

The Pearson's correlation (r) is a measure, of how well the association between two variables (i.e. X and Y) are measured on the same individual. In other words, correlations measure the strength of the relationship between two variables and are used to predict the value of one variable, given the value of the other. The end products of correlations are expressed on a scale from -1.0 (as one variable increases the other decreases) to +1.0 (as one variable increases the other also increases), the strongest correlations are at both extremes and provide the best predictions (Shavelson 1996). Correlation statistics can also be used to check for multi-colinearity between variables.

Multi-colinearity results when the columns of X for instance, have significant interdependence on each other. This condition can produce numerically unstable estimates of the regression coefficients. A strong correlation between two variables may be indicative of colinearity and as such, these variables should not be included together in a regression model.

All categorical variables were analyzed independently with the outcome variable through cross-tabulations. Cross-tabulations is a method of analyzing data. This method allows the analyst to look at the responses to one question in relation to the responses to other questions. Cross-tabulations produce two-way and multiway tables, provide a variety of tests and measures of association, offer tests of independence and measures of association for nominal and ordinal data (Venables and Ripley 2001).

Multivariate analysis using the logistic regression method was used to look at the strength of associations between the response variable and covariates of main interest. The output of the logistic regression models are presented with the odds ratios and respected 95% confidence intervals for each covariate of interest in this analysis. The statistical software that was used includes: SPSS and S-PLUS version 6.2.

The odds ratio (OR) is a measure of association which approximates how much more likely (or unlikely) it is for the outcome to be present among those with the disease than among those without. For example, if y denotes the presence or absence of an STI and x denotes whether a person is female or not, then $\hat{\psi} = 2$ indicates that STIs occurs twice as often among females than among males in the study population (Hosmer and Lemeshow 1989).

3.11.1 Logistic Regression

The logistic regression method is an important component of data analysis. There are three main reasons for choosing a logistic regression: it is an extremely flexible and an easily used statistical method, it lends itself to a clinically meaningful interpretation and it can be used with dichotomous outcome variables (Hosmer and Lemeshow 1989).

The first objective in developing a logistic regression model was to find the most parsimonious and best fitting model, while controlling for confounders. Selecting confounders can be problematic especially, in small sample size data sets. On the one hand, it is very important to control for known confounders, such as age and gender. On the other hand, controlling all measured variables is impractical and, can lead to inefficient estimates (Maldonado and Greenland 1993).

There are several methods that can be used to select confounders. Some of these methods are as follows:

1. Change-in-estimate of the beta coefficient: select a variable for control only if its control makes an "important difference" in the exposure estimate (i.e. more than 10 or 20% change). This method examines a relevant method of confounding but may be criticized because it takes no account of statistical variability (Greenland S 1989).
2. Significance testing: select a variable for control only if its association with the outcome of interest (i.e. its coefficient in a multiple logistic-regression model) is statistically significant at some preset level (Robins and Greenland 1986). A backward stepwise regression method is often used to implement this strategy. The significance testing method has been criticized because it takes no direct account of the actual degree of confounding produced by the variable (Robins and Greenland 1986).
3. Significance testing the change in estimate: select a variable for control only if the change in the exposure-effect estimate produced by control of the variable is statistically significant. This method modifies the change-in-estimate rule to take into account statistical variability, and modifies the significance test rule to test a relevant parameter. The procedure may be criticized because a significance test is still not a measure of the degree of confounding (Maldonado and Greenland 1993).
4. Equivalence testing the change in estimate: select a variable unless the change in the exposure-effect estimate produced by control of the variable is statistically equivalent to zero (Maldonado and Greenland 1993).
5. Select variables based on the literature and clinical appropriateness (Maldonado and Greenland 1993).

For this project, two methods of confounder selection were used. The first method used a stepped logistic regression model that added variables in a forward fashion. Since the sample size was too small to accommodate all the variables at the same time (i.e. backwards elimination), the forward method was the best option. The script used for generating the model was developed to select variables based on the Akaike information criterion (AIC). This generic function calculates the AIC for one or several fitted model objects for which a log-likelihood value can be obtained. This calculation is based on the formula –2*log-likelihood + 2*npar, where npar represents the number of parameters in the fitted model. When comparing fitted objects, the smaller the AIC, the better the fit (Sakamoto, Ishiguro, and Kitagawa 1986).

The second method that was used involved developing separate logistic regression models to test each hypothesis that were discussed in Chapter 1. Variable selection was based on clinical relevance and on the appropriateness of testing the hypothesis. For both methods, a script was developed for SPLUS version 2000 statistical software.

To test the model's fit, we used the ROC curve. The ROC curve is a good diagnostic tool that tests the appropriateness of a model by measuring the area under the curve. Essentially the larger the area, the better the fit.

3.11.2 Statistical Analyses (Follow-up Visits)

The data that were collected during the follow-up visits were tested using the McNemar's test of correlated proportions. McNemar's test is often used with dichotomous variables in a pretest-posttest design (i.e. to evaluate change) or, in a matched-pair design (i.e. to assess the effectiveness of an intervention) (Levin and Serlin 2000).

For this analysis two time periods will be used: baseline and longitudinal (visits 1-4). The data set was set up to indicate whether the participant had a positive/negative baseline study STI outcome and, whether the same participant had a positive/negative longitudinal study STI outcome during each of the four visits. The data were then arrayed in a 2 × 2 table in which one margin represented the two Time 1 categories (i.e. positive, negative) and the other margin represented the two Time 2 categories (i.e. positive, negative) (Levin and Serlin 2000).

Consider Table 3.11.2-A, which depicts the number of participants who had a positive STI during the baseline visit (Time 1) and during the follow-up visit 1 (Time 2). If we let n_{ij} denote the frequency of observations falling in the i th Time 1 and j th Time 2 categories $(i, j = 1,2)$, and with common "dot" notation to represent summation, the total sample size is given by $n...$ The n_{ij} follow a multinomial distribution, and the null hypothesis can be written in terms of the marginal probabilities of interest, p_i and $p_{.i}$, as: $H_0 : pi = p.i$ (Levin and Serlin 2000).

Table 3.11.2-A

STI Cases for Follow-up Visit 1

		Follow-up Visit 1		
		Negative	Positive	Totals
Baseline	Negative	86	0	86
	Positive	9	4	13
	Totals	95	4	99

Let the effective sample size be $N' = n9 + n0$, (number of observations in the two "change" cells). The chi-square distribution is then used to provide a reasonable approximation of the probability associated with the McNemar test statistic $X2 = (n9 - n0) \times 2/(n9 + n0)$. If this test statistic exceeds the alpha-level critical chi-square value, then it is concluded that the two marginal probabilities, $p_{i.}$ and $p_{.i}$ are not equal or in this case, the probability of acquiring a STI was not the same on the two occasions (Levin and Serlin 2000).

The second calculation that was done on the follow-up data was to compare the chlamydia point prevalence at baseline with the period prevalence during the follow-up visits. To calculate this difference we used a crude measure: P = ID were P = prevalence, I = incidence density and D = duration. So in this case, 99 people were followed for four visits. We assumed that each participant had equal follow-up of about 240 days (i.e. approximately 30 days x 8 months). This accounts to 23760 person days of follow-up (i.e. 240 days x 99 people), or 65 person years (i.e. 23760 person days/365 calendar days). The number of combined chlamydia that were detected during follow-up will then be multiplied by the person years of follow-up to give us the incidence of cases per person per year. We assumed that the average duration of disease (D) was a conservative estimate of 150 days (0.4 years) (Brunham and Plummer 1990), and from this we were able to calculate the follow-up prevalence.

3.11.3 Sample Size Calculations (Longitudinal)

Sample size calculations for the longitudinal survey were done using S-Plus 2000 statistical software. A script was developed based on the formula for a Binary Response variable that was based on the following assumptions:

$\Pr(Y_{ij} = 1\{ \begin{matrix} PA\ ingroupA \\ PB\ ingropuB \end{matrix} j = 1,...n; i = 1,....m$. Also assuming that $Corr(Y_{ij}, Y_{ik}) = p$ for all $j \neq k$

The number of subjects needed per group was:

$$m = \frac{\left[z_\alpha \{2\overline{pq}(1=(n-1)\rho\}^{1/2} + z\vartheta\{(1+(n-1-\rho)(PAqA+PBqB)\}^{1/2} \right]^2}{nd^2}$$

Where $\overline{p} = (pA + pB)/2$ and $\overline{q} = 1 - \overline{p}$ [25]. For $\alpha = 0.05$, rho (range of 0.2-0.6), n = 4 (number of repeated measures). The null prevalence rate (PA) for the Test Community was calculated using the number of cases that were reported in 2000 (Table 3.1.1-A; Appendix III), while the p-alternate (PB) was calculated using a range of prevalences between (0.05 to 0.2). It was assumed that all observations between subjects were independent with a medium correlation of (rho 0.4) between each repeated measure. For instance, the probability that an individual with a positive Chlamydia case during baseline will have a subsequent positive case during the follow-up visits was 0.4. A plot demonstrating the sample size calculations for the Test Community can be found in Figure 3.11.3-A, Appendix IV.

CHAPTER IV

CHAPTER 4 Results

Chapter 4 presents the major study findings under the following headings:

1. Exploratory analysis includes findings on socio-demographics, use of health services, STI/contraceptive knowledge, components of the Theory of Reasoned Action and Planned Behaviour Conceptual Framework, STI study outcome and explanation of the summed score variables
2. Univariate and multivariate analysis of baseline data includes correlations and cross-tabulations of the baseline data and logistic regression models
3. Follow-up analysis includes the McNemar's test of correlated proportions for the follow-up data and comparing the baseline prevalence with follow-up
4. Network analysis includes the baseline and follow-up network sociograms and accompanying data

4.1 Baseline Socio-Demographic Information

The baseline socio-economic data are shown in Table 4.1-A. One hundred and eighty-one participants from the Test Community's "eligible" population (n = 224) were interviewed and screened for chlamydia and gonorrhea infection. This yielded an overall response rate of 81%. There were 72 males (40%) and 109 females (61%). The mean age of the respondents was 29.6 years (S.D ± 10.0).

The age data were normally distributed as noted in the QQ- plot (Figure 4.1-A, Appendix V), reflecting the age structure of the Test Community's population overall. Thirty-two (18%) of the participants were between the ages of 15-19 years, 38 (21%) were between 20-24 years, 99 (55%) were between 25-44 years, 10 (6%) were between 45-54 and 2 (1%) were between 55-65 years. The mean age (M = 30) for females was similar to males (M = 29). The younger age distribution is characteristic of Inuit communities in the Baffin region (Statistics Canada 2001).

Another common socio-demographic variable is education. In this study, 181 participants (30%) had less than grade 9 education, 62% had some years of high school education, while 12 female participants (7%) completed high-school. One female participant had a college diploma. Post secondary education is still relatively rare for most Inuit people especially since most of these individuals would have to leave their home communities to attend academic institutes.

With regard to employment status, 103 or (57%) of the study participants were unemployed of whom, 11% reported no annual income (including adolescent participants), while 85 (47%), reported that they were on unemployment insurance (i.e. receiving approximately $10,000/per year). For the participants who were employed, 13% reported working on a part-time basis, while the remaining 30% worked full-time. Of the employed participants, 30% reported an annual income of $10-30,000/per year and 23 (13%) reported an annual income of $30-50,000+. Overall, the high unemployment status and low income that was reported is representative of the economic situation in similar communities in this region (Statistics Canada 2001).

With regard to living arrangements, 41% lived with their partner (i.e. sexual relationship), 23% lived with relatives (i.e. other than parents), 23% lived with their parents (i.e. biological or adoptive), 11% lived alone and 2% lived with a roommate (i.e. not considered a sexual relationship). It is still common to see families cohabiting with extended family members such as aunts, uncles, cousins and grandparents. This may be due to cultural preferences (i.e. living amongst family members) and/or due to a lack of available housing.

Table 4.1-A

Summary of Baseline Socio-Demographic Data

Demographic Variables	**Males**	**Females**	**Total**
Total in sample	72	109	181
Mean Age (Median)	29.1(27.5)	30 (28. 0)	29.6 (28.0)
(S.D)	8.9	10.7	10.0
Age distribution	**N (%)**	**N (%)**	**N (%)**
15-19	8 (11)	24 (22)	32 (18)
20-24	25 (35)	13 (12)	38 (21)
25-44	34 (47)	65 (60)	99 (55)
45-54	5 (7)	5 (5)	10 (5)
55-65	0	2 (2)	2 (1)
Highest Attained Education			
Less then grade 9	22 (31)	33 (30)	55 (30)
Grade 9-11	50 (69)	63 (58)	113 (63)

Demographic Variables	Males	Females	Total
Grade 12+	0	13 (12)	13 (7)
Employment Status			
Unemployed	48 (67)	55 (51)	103 (57)
Part-time	11 (15)	12 (11)	23 (13)
Full-time	13 (18)	42 (39)	55 (30)
Income Range			
None	5 (7)	14 (13)	19 (10)
Less then 10,000	44 (61)	41 (38)	85 (47)
10-30,000	18 (25)	36 (33)	54 (30)
31-50,000+	5 (7)	18 (17)	23 (13)
Living Arrangements			
With Partner	25 (35)	49 (45)	74 (41)
With relatives	17 (24)	25 (23)	42 (23)
With Parents	19 (26)	23 (21)	42 (23)
Lives Alone	10 (14)	10 (9)	20 (11)
With roommate	1 (2)	2 (2)	3 (2)

4.1.1 Baseline Use of Health Care Services

The baseline use of health care services data are shown in Table 4.1.1-A. The "Use of health care services" questions were used to evaluate a participant's past use of the Community Health Centre and hospital services (i.e. Baffin Regional Hospital and southern hospitals). More specifically, it looked at the frequency of health services use and reasons for past use. Use of health services is an important determinant of STI acquisition as it can indicate if an individual has access to screening, treatment, contraceptives and health teaching. The "use of health services" data were cross-referenced with individual health centre chart reviews.

Among all the participants, 169 (93%) reported that they last used the community health centre within the same year of the study (i.e. 2003). From the remaining participants, only 11 (6%) reported that they last used the health centre between 1-5 years ago, while one participant's last visit was 10 years ago. Frequency of health centre use included: 13 (7%) who seldom used the health centre, 154 (85%) who used the health centre several times per year, 10 (6%) reported monthly use, while 4 (2%) went on a daily to weekly basis.

When questioned about the reason for their last health centre visit, the participant's responses were grouped into four themes. These include: 99 (55%) medical (illness other than STI related such as injury or mental health); 57 (32%) prevention (e.g. immunization, well women's clinic, prenatal, TB screening); 22 (12%) STI (e.g. contact tracing and STI related symptoms); 3 (2%) dental (e.g. dental carries, dental abscess, dental pain).

Participants were also queried about previous STI screening (i.e. for chlamydia and gonorrhea). Previous STI testing is also an important determinant of STI acquisition and transmission. As indicated in (Chapter II, section 3), screening is essential for detecting disease, ensuring appropriate treatment for infected individuals and contact tracing to avoid further transmission. The responses included: 19 (11%) were never tested, 58 (32%) had 1-4 tests, 48 (27%) had 5-10 tests, 38 (21%) had 11-15 tests, and 18 (10%) had 16 or more previous STI tests. The mean number of previous STI tests was 7.5 (SD: ± 6.5). Female participants had significantly more STI testing than males indicating a higher use of health services.

Participants were also questioned about previous hospital use (i.e. Baffin Regional Hospital, southern hospital). The responses included: 14% have never been to a hospital as a patient, 22% were seen at the hospital less then a year ago, 46% were seen within 1 to 5 years ago, 12% were seen within 6 to 10 years ago, and 7% were seen greater than 11 years ago. Reasons for the last hospital visit were grouped into 4 categories. The responses included: 44% medical/surgical (e.g. seeing a physician for medical/mental health illness, surgery); 22% specialist clinic (e.g. neurology, cardiology); 19% labour and delivery; 2% dental.

A summed score for "use of health services" (Legend B; Appendix IV) was developed for use with the logistic regression models. A description of how the scores were calculated was given in (Chapter III). For this score, three variables were grouped together and included date of last health centre visit and reason for last health centre visit and date of last hospital visit. The highest attainable score was 10, and three score ranges or values were available (i.e. low = scores 4-6; moderate = scores 7-9; high = 10). Thirty-three (18%) participants scored a low use score, 92 (51%) scored a moderate use score and 56 (31%) scored a high use score. As shown in Table (4.1.1.A), male participants had lower "use of health services" scores than female participants.

Table 4.1.1-A

Summary of Baseline Socio-Demographic & Use of Health Services Data

Use of Health Care Services	Males N (%)	Females N (%)	Total N (%)
Last Use of Health Care Services			
< One year ago	61 (85)	108 (99)	169 (93)
Between 1-5 years ago	10 (14)	1 (1)	11 (6)
Between 6-10 years ago	1 (1)	0	1 (1)
> 11 years ago	0	0	0
Reason For Last Use of Health Services			
Medical	41 (57)	58 (53)	99 (55)
Prevention	17 (24)	40 (37)	57 (31)
STI	12 (17)	10 (9)	22 (12)
Dental	2 (3)	1 (1)	3 (2)
Frequency of Health Centre Use			
Seldom	12 (17)	1 (1)	13 (7)
Few times per year	54 (75)	100 (92)	154 (85)
Monthly	4 (6)	6 (6)	10 (6)
Daily/weekly	2 (3)	2 (2)	4 (2)
Previous # STI Tests Pre-Study			
Never been tested	16 (22)	3 (3)	19 (10)
1-4 tests	33 (46)	25 (23)	58 (32)
5-10 tests	19 (26)	29 (27)	48 (27)

Use of Health Care Services	Males N (%)	Females N (%)	Total N (%)
11-15 test	3 (4)	35 (32)	38 (21)
16+ tests	1 (1)	17 (16)	18 (10)
Mean value (SD)	**3.7 (4.1)**	**10.0 (6.6)**	**7.5 (6.5)**
Last Hospital Use			
Never been	13 (18)	12 (11)	25 (14)
< 1 year	13 (18)	26 (24)	39 (22)
1-5 years	27 (38)	57 (52)	84 (46)
6-10 years	10 (14)	11 (10)	21 (12)
11 years+	9 (13)	3 (3)	12 (7)
Reason For Last Hospital Use			
Medical/surgical	38 (53)	41 (38)	79 (44)
Specialist clinic	19 (26)	20 (18)	39 (21)
Labour/delivery	0	34 (31)	35 (19)
Never been	13 (18.1)	12 (11)	25 (14)
Dental	2 (3)	2 (2)	4 (2)
Use of Health Services Score (UHSS)			
Low Use Score (scores 4-6)	22 (31)	11 (10)	33 (18)
Moderate Use (scores 7-9)	36 (51)	56 (51)	92 (51)
High Use (score of 10)	14 (19)	42 (39)	56 (31)

4.1.2 Baseline STI Knowledge

The baseline STI knowledge data are shown in Table (4.1.2.A). One hundred and thirty-three (73%) of the participants had never heard of the terms chlamydia and/or gonorrhea prior to the study despite the fact, that many of these participants had a previous history of either a chlamydia and/or gonorrhea infection. Among the participants that knew the terms, 28 (16%) reported that they learned about chlamydia and gonorrhea from a community health nurse and/or physician, 13 (7%) from school and 7 (4%) from the media (e.g. magazines, television, radio). When questioned about prior knowledge of the term "STI" (or STD), 168 (93%) reported that

they had heard of the term prior to the study. Furthermore, only 4 (2%) heard of syphilis and 58 (32%) heard of herpes.

In spite of the high percentage (74%) of participants who reported knowing about HIV, only 5% knew that HIV was also considered an STI. Some participants (31%) believed that HIV and STI were completely different diseases. When asked about how one can acquire HIV, only four participants (2%) knew that HIV could be transmitted through unprotected sexual intercourse, sharing infected needles and through blood/body fluid contact. One individual knew that HIV could be passed vertically (mother to baby) and through breast milk. By contrast, 41% did not know how an individual gets HIV despite having previously heard of the term.

A summed score for STI knowledge was developed. The score was a combination of three variables (i.e. is HIV an STI?, how does an individual get HIV? and how does an individual get a non-HIV STI like chlamydia?). The highest attainable score was 6 and there were three score options: low knowledge (scores 0-2), moderate knowledge (scores 3-4) and high knowledge (scores 5-6). From the three available scores, 75 (41%) scored a low knowledge score, 86 (48%) scored a moderate knowledge score and 20 (11%) scored a high knowledge score. Similar to the use of health services score, the STI knowledge scoring system (i.e. low, moderate and high) was based on the overall performance of the participants.

The mean age for the low STI knowledge score (M = 27.4) was lower in comparison to the mean age of the higher scores (M = 31.3 and M= 31.1). The age differences between the three scores were significant (p = 0.04). The differences in scores between males and females however, were not significant (p = 0.89).

Table 4.1.2-A

Baseline STI Knowledge Data

STI Knowledge	Males	Females	Total
Ever Heard Of Chlamydia/Gonorrhea	**N (%)**	**N (%)**	**N (%)**
No	61 (85)	72 (66)	133 (73)
Yes	11 (15)	37 (34)	48 (27)
How did You Hear about Chlamydia/Gonorrhea			
Never heard of them	61 (85)	72 (66)	133 (73)
Nurse/MD	4 (6)	24 (22)	28 (16)

STI Knowledge	Males	Females	Total
School	4 (6)	9 (8)	13 (7)
Media	3 (4)	4 (4)	7 (4)
Ever Heard About HIV/AIDS			
Yes	58 (81)	76 (70)	134 (74)
No	14 (19)	33 (30)	47 (26)
Ever Heard About Syphilis			
No	72 (100)	105 (96)	177 (98)
Yes	0	4 (4)	4 (2)
Ever Heard About Herpes			
No	53 (74)	70 (64)	123 (69)
Yes	19 (26)	39 (36)	58 (32)
Ever Heard Of STI (or STD/ VD)			
Yes	68 (94)	100 (92)	168 (93)
No	4 (6)	9 (8)	13 (7)
Is HIV A Type of STI (or STD)			
No	49 (69)	60 (55)	109 (60)
Not sure	20 (28)	43 (40)	63 (35)
Yes	3 (4)	6 (6)	9 (5)
How Does Someone Get HIV			
Not sure	23 (32)	52 (48)	75 (42)
Sex & sharing needles	23 (32)	30 (28)	53 (29)
Sex	18 (25)	16 (15)	34 (19)
Sex & blood/other body fluid exposure	4 (6)	4 (4)	8 (4)
Sharing needles	2 (3)	2 (9)	4 (2)
Sex & sharing needles & blood/other body fluid exposure	0	4 (4)	4 (2)
Blood or other body fluid exposure	1 (1)	1 (1)	2 (1)
Sharing needles & blood/other body fluid exposure	1 (1)	0	1 (1)
How Does Someone Get An STI			
Unsafe Sex	44 (61)	59 (54)	103 (57)

STI Knowledge	Males	Females	Total
Having multiple partners & cheating on your partner	12 (17)	25 (23)	37 (20)
Not sure	6 (8)	17 (16)	23 (13)
Unsafe Sex & having multiple partners	10 (14)	6 (6)	16 (9)
Needles	0	2 (2)	2 (1)
STI Knowledge Score			
Low STI knowledge (scores 0-2)	23 (32)	52 (48)	75 (41)
Medium STI knowledge (scores 3-4)	41 (57)	45 (41)	86 (48)
High STI knowledge (scores 5-6)	8 (11)	12 (11)	20 (11)

4.1.3 Baseline Contraceptive Knowledge

The baseline contraceptive knowledge data are shown in Table (4.1.3.A). The majority of participants (54%) reported that condoms were effective in preventing the transmission of STIs in comparison to other contraceptives. One individual did not know what a condom was or what it was used for. This same individual however, was also not sexually active. When questioned about the birth control pill (BCP), 32% of the participants believed that the BCP was also very effective in preventing STIs; the majority of these participants were women. By contrast, only 3% believed that the BCP was not effective in preventing STIs; the remaining participants were unsure.

Participants were also questioned about other forms of contraceptives (i.e. female condom, diaphragm, spermicidal foam and abstinence). The majority of participants reported that they never heard of these contraceptives and as such, were not sure if they were effective in preventing STIs. These included: female condom (96%; not sure), diaphragm (92%; not sure) and spermicidal foam (98%; not sure). Only 73 (40%) of the participants reported that asking someone about their STI status before engaging in sexual activity was effective in preventing STIs; 47 (26%) believed that it was not effective at all. With regard to abstaining from sex (i.e. as a form of contraceptive and preventing STIs), only 41% believed that it was an effective means of preventing STIs while, 23% felt that abstinence was not effective at all. These results are not surprising since contraceptives like the diaphragm or spermicidal foam are not available at the health centre, and as a result, very few individuals in these communities are familiar with these products.

A contraceptive knowledge score was developed for use with the logistic regression. The score contained seven variables, which included:

- How effective are condoms in preventing STIs?
- How effective is the BCP in preventing STIs?
- How effective is the female condom in preventing STIs?
- How effective is the diaphragm in preventing STIs?
- How effective is spermicidal foam in preventing STIs?
- How effective is asking your partner if they have an STI?
- How effective is abstaining from sex in preventing an STI?

The highest attainable contraceptive knowledge score was 28 (i.e. answering all the questions correctly). The overall mean score was 10.5 (SD ± 3.43). The age distribution (i.e. scores between younger and older age groups) between the scores was not significant ($p = 0.052$). However, the difference in score values (i.e. comparing means/ANOVA) between male ($M = 8.8$) and female scores ($M = 11.6$) was significant ($p < 0.05$). As indicated in Table 4.1.3-A, female participants had higher scores than males.

Table 4.1.3-A

Baseline Contraceptive Knowledge Data

Contraceptive Knowledge	Males N (%)	Females N (%)	Total N (%)
How effective are Condoms in preventing STIs			
Not sure	0	1 (1)	1 (1)
None	3 (4)	4 (4)	7 (4)
Somewhat	6 (8)	17 (16)	23 (13)
Effective	45 (63)	53 (49)	98 (54)
Very effective	18 (25)	34 (31)	52 (28)
How effective is the BCP in preventing STIs			
Not sure	49 (68)	26 (24)	75 (41)
None	2 (3)	4 (4)	6 (3)
Somewhat	9 (13)	6 (6)	15 (8)
Effective	6 (8)	21 (19)	27 (14)
Very effective	6 (8)	52 (48)	58 (32)
How effective is the female condom in preventing STIs			
Not sure	70 (97)	104 (95)	174 (96)
None	1 (1)	3 (3)	4 (2)
Somewhat	0	0	0
Effective	0	1 (2)	1 (1)
Very effective	1 (1)	0	1 (1)
How effective is the diaphragm in preventing STIs			
Not sure	70 (97)	97(89)	167 (93)
None	0	0	0
Somewhat	1 (1)	1 (1)	2 (1)
Effective	1 (1)	5 (5)	6 (3)
Very effective	0	6 (6)	6 (3)
How effective is spermicidal foam in preventing STIs			
Not sure	71 (99)	106 (97)	177 (98)
None	0	0	0
Somewhat	0	0	0

Contraceptive Knowledge	Males N (%)	Females N (%)	Total N (%)
Effective	0	0	0
Very effective	1 (1)	3 (3)	4 (2)
How effective is asking if someone has an STI			
Not sure	3 (4)	2 (2)	5 (3)
None	23 (32)	24 (22)	47 (26)
Somewhat	6 (8)	13 (12)	19 (11)
Effective	32 (44)	41 (38)	73 (40)
Very effective	8 (11)	29 (27)	37 (20)
How effective is no sex in preventing an STI			
Not sure	1 (1)	4 (4)	5 (3)
None	22 (31)	19 (17)	41 (23)
Somewhat	10 (14)	10 (9)	20 (11)
Effective	29 (40)	46 (42)	75 (41)
Very effective	10 (14)	30 (28)	40 (22)
Contraceptive knowledge score (max. score of 28)			
Mean (Median)	8.8 (9.0)	11.6 (12.0)	10.5 (10.0)
(SD)	2.5	3.5	3.4

4.1.4 Baseline STI Related Risk Behaviours

The baseline STI related risk behaviour data are shown in Table 4.1.4-B. One hundred and four (58%) participants reported having at least one prior STI before the study. The majority of previous STIs were chlamydia. As previously mentioned, having a previous history of an STI is a determinant for subsequent infections. Female participants had more previous STIs (M = 1.4) than males (M = 0.8) and this difference was significant with the Chi-square test ($X2 = 23.2$, df = 6, $p = 0.006$). When comparing the number of previous STIs between the different age groups however, the between groups differences were not significant.

For the study outcome, 21 cases of chlamydia were detected among the study participants by urine PCR. From the 21 cases, 6 cases were males and 15 cases were females. The Chi-square test for the association between gender and STI study result was not significant ($X^2 = 1.25$, df = 1, $p = 0.26$). The mean age of individuals who had a positive STI was 22.1 compared with 30.6 for those not infected and this difference was significant ($p < 0.01$).

For age of first sex (i.e. another common determinant for STI acquisition), the overall mean age for all the participants was 15.2 (SD ± 2.2). Age of first sex for female participants (M = 15.3) was marginally higher than male participants (M = 14.9). With regard to other STI-related risk behaviours, 90 (50%) reported that they did not use any form of contraceptives during their first sexual encounter, while 38 (21%) reported using a male condom. Similarly, 76 participants (42%) reported that they had between 3-5 sexual partners in their lifetime and 88% reported having had 1-2 partners in the last 3 months (pre- baseline interview). For the last STI test result (i.e. for all participants), 18 (10%) had a positive test (i.e. any type of STI) with the majority being female participants. There were no significant differences between males and females for any of the STI-related risk behaviours.

Two scores were developed for STI- related risk behaviours: perceived risk behaviour score and actual risk behaviour score. For the perceived risk behaviour score, two variables were used: perceived risk for contracting an STI and perceived risk for contracting HIV. The summed score had three score options (no risk-minimal risk, low to medium risk and medium to high risk). From the whole study population, 72 (40%) reported no risk- minimal risk), 53 (29%) reported low- medium risk and 56 (31%) reported medium to high risk. The differences in score values between males and females were not significant ($p = 0.29$). However the differences in mean age (Table 4.1.4-A) between each of the three scores were significant ($p = 0.001$). Similar to the other calculated scores, the scoring (i.e. no risk-minimal, low-medium, medium – high) were based on the overall responses of the participants.

Table 4.1.4-A

Mean Age Per Perceived Risk Behaviour Score

Perceived Risk Belief Scores	Mean Age	N	Std.
No risk to minimal risk	34.2	72	10.3
Low to medium risk	27.3	53	9.0
Medium to high risk	25.8	56	8.0
Total	29.6	181	10.0

The other score developed was the actual risk behaviour score. This score consisted of five variables, which included:

- What kind of contraceptive was used during your first sex?
- Number of sexual partners ever?
- What relationship did you have with your last sexual partner?
- Did you use alcohol or drugs during your first sex?
- How often do use condoms?

The highest attainable score was eighteen and for the purpose of this study, was considered a "high-risk" score. Overall, the mean score was 10.9. The mean score for males (M = 11) was slighter higher than the score for females (10.8). The scores between the different age groups (i.e. younger aged participants vs. older aged participants) were not significant (p = 0.17).

Table 4.1.4-B

Baseline STI Related Risk Behaviours

STI Related Risk Behaviours	Males	Females	Total
Number of STIs ever pre study	**N (%)**	**N (%)**	**N (%)**
None	43 (60)	34 (28)	77 (43)
1-2	21 (29)	57 (52)	78 (43)
3-5	7 (10)	17 (16)	24 (13)
6-10	1 (1)	1 (1)	2 (1)

STI Related Risk Behaviours	Males	Females	Total
Mean (SD)	**0.8 (1.4)**	**1.4 (1.3)**	**1 (1.4)**
Last STI test result pre-study			
Negative	67 (93)	96 (88)	163 (90)
Positive	5 (7)	13 (12)	18 (10)
STI study result			
Negative	66 (92)	94 (86)	160 (88)
Positive	6 (8)	15 (14)	21 (12)
Age of first sex			
Never had sex	0	1 (1)	1 (1)
< 15 years	27 (38)	34 (31)	61 (33)
15-19 years	44 (61)	71 (65)	115 (63)
20-24 years	1 (1)	2 (2)	3 (2)
25+ years	0	1 (1)	1 (1)
Mean (SD)	**14.9 (0.2)**	**15.3 (0.2)**	**15.2 (2.2)**
Contraceptive used at first sex			
None	30 (42)	60 (55)	90 (50)
Male condom	23 (32)	15 (14)	38 (21)
Not sure	19 (26)	16 (15)	35 (19)
BCP/hormone injection	0	18 (17)	18 (10)
Presently at risk for STI			
None	24 (33)	49 (45)	73 (40)
Not very much	26 (36)	28 (26)	54 (30)
Quite a lot	9 (13)	15 (14)	24 (13)
Greatly	13 (18)	17 (16)	30 (17)
Presently at risk for HIV			
None	65 (90)	102 (94)	167 (92)
Not very much	7 (10)	7 (6)	14 (8)
Number of sexual partners ever			
None	0	1 (1)	1 (1)
1-2	10 (14)	25 (23)	35 (19)

STI Related Risk Behaviours	Males	Females	Total
3-5	22 (31)	54 (50)	76(42)
6-10	16 (22)	18 (17)	34 (19)
11-20	18 (25)	9 (8)	27 (15)
21+	6 (8)	2 (2)	8 (4)
Number of sexual partners in last 3 months			
None	0	1 (1)	1 (1)
1-2	60 (83)	100 (92)	160 (88)
3-5	11 (15)	8 (7)	19 (10)
6-10	1 (1)	0	1 (1)
Perceived risk belief score			
No risk to minimal risk	24 (33)	48 (44)	72 (40)
Low risk to medium risk	25 (35)	28 (26)	53 (29)
Medium to high risk	23 (32)	33 (30)	56 (31)
Actual risk belief score (Out of 18)			
Mean score (SD)	11.0 (0.3)	10.8 (0.3)	10.9 (2.6)

4.1.5 Condom Self-Efficacy

The condom self-efficacy data are shown in Table 4.1.5-B. As this table indicates, all the condom-related questions were asked independently and required an answer of either, yes, no or not sure. Sixty-one percent of the study participants reported that using condoms decreased sexual enjoyment; 91% also believed that using condoms was a sign of caring for the welfare of others. Similarly, 97% believed that condoms prevented pregnancy, 77% believed that condoms prevented HIV and 89% believed that condoms prevented other non –HIV STIs. On a negative side, 58% believed that using condoms would offend their sexual partner(s), suggest an STI (64%) and are difficult to plan ahead for (43%). These are common barriers to condom use.

Table 4.1.5-A

Mean Age Per Condom Self-Efficacy Score (CSES)

CSES	Mean Age	N	Std.
Low	24.6	25	10.4
Moderate	31.1	102	10.4
High	29.2	54	8.4
Total	29.6	181	10.0

The condom self-efficacy score was developed to evaluate an individual's ability to negotiate condom use. The score incorporated eight variables which, included:

- Do condoms make sex less enjoyable?
- Do condoms prevent pregnancy?
- Do condoms prevent HIV infection?
- Do condoms prevent non-HIV STIs?
- Do using condoms show that you care?
- Would using condoms offend your partner?
- Would using condoms suggest that you have an STI?
- Are using condoms difficult to plan ahead for?

The highest attainable score was sixteen (i.e. a score of 2 was given for each correct answer) and all the participant's scores were grouped into three scores (i.e. low, moderate, high). A score of low included all values between (0 – 10), a score of moderate included all values between (11 – 13) and a score of high included all values between (14 – 16). The score values (i.e. low, moderate, high) were assigned according to how each individual scored in comparison to the other participants. For the condom self-efficacy score, the scores appeared to be quite consistent between males and females and as such, were not significant ($X^2 = 0.76$, df = 2, p = 0.68). With regard to age differences, younger participants tended to score lower than older participants (Table 4.1.5-A). The differences in age (i.e. comparing means/ANOVA) between the scores were significant (p = 0.01).

Table 4.1.5-B

Condom Self Efficacy (Cross Sectional)

Condom Self Efficacy Variables	Males	Females	Total
Do condoms make sex less enjoyable	**N (%)**	**N (%)**	**N (%)**
Yes	53 (74)	58 (53)	111 (61)
No	19 (26)	50 (46)	69 (38)
Not sure	0	1 (1)	1 (1)
Do condoms prevent pregnancy			
Yes	68 (94)	107 (98)	175 (97)
No	4 (6)	2 (2)	6 (3)
Not sure	0	0	0
Do condoms prevent HIV			
Yes	58 (81)	81 (74)	139 (77)
Not sure	9 (13)	20 (18)	29 (16)
No	5 (7)	8 (7)	13 (7)
Do condoms prevent other STIs			
Yes	64 (9)	97 (89)	161 (89)
No	4 (6)	7 (6)	11 (6)
Not sure	4 (6)	5 (5)	9 (5)
Do condoms show you care			
Yes	64 (89)	100 (92)	164 (90)
No	8 (11)	8 (7)	16 (9)
Not sure	0	1 (1)	1 (1)
Would condoms offend your partner			
Yes	27 (38)	77 (71)	104 (57)
No	45 (63)	32 (29)	77 (43)
Not sure	0	0	0
Would using condoms suggest an STI			
Yes	42 (58)	73 (67)	115 (63)
No	30 (42)	36 (33)	66 (37)
Not sure	0	0	0

Condom Self Efficacy Variables	Males	Females	Total
Are condoms difficult to plan ahead for			
No	40 (56)	63 (58)	103 (57)
Yes	32 (44)	45 (41)	77 (42)
Not sure	0	1 (1)	1 (1)
Condom self-efficacy score			
Low efficacy	10 (14)	15 (14)	25 (14)
Moderate efficacy	38 (53)	64 (60)	102 (56)
High efficacy	24 (33)	30 (28)	54 (30)

4.1.6 Baseline Normative Beliefs and Motivations to Comply

The data on baseline normative beliefs and motivations to comply are shown in Table 4.1.6-A. The normative beliefs and motivations to comply category, was comprised of variables that measured an individual's beliefs or views about condom use and how easily they complied to or, were affected by other people's (i.e. partners, friends, medical staff) suggestions regarding contraceptive use.

Of all the participants, 109 (60%) believed that their current partner would not want them to use a condom during sex, while 160 (88%) felt that a new partner would want them to use a condom. In this situation, "current partner" may be a more long term relationship such as marriage, common law or steady relationship, while "new partner" may be an individual they just had a sexual encounter with or the so called, "one-night stand". Similarly, 96% of the participants stated that their close friends (non-sexual) would have encouraged them to use condoms. The responses to the other variables can be found in Table 4.1.6-A.

A normative beliefs and motivations to comply summed score was also developed. The score was comprised of eight variables which, included:

- My current partner wants me to use condoms?
- A new partner would want me to use condoms?
- My friends would want me to use condoms?
- I do what my current partner wants me to do regarding my health?

- I would do what a new partner would want regarding my health?
- I do what my friends want me to do regarding my health?
- I do what the nurse/doctor wants me to do regarding my health?
- I do what the government wants me to do regarding my health.

The highest attainable score was 32 and all the scores were categorized into three values: low score included values 0-17, moderate score included values 18 - 22 and high score included values 23 – 32. A high score indicated that an individual had strong beliefs about condom use and was easily persuaded by another individual's (e.g. partners, friends) suggestions regarding condom use.

The score values varied between males and females especially, with regard to the high score. Males had higher scores than females and this difference was significant ($p = 0.001$). With regard to the score values between the different age distributions, the mean age of the low score was $M = 24.6$; the mean age of the moderate score was $M = 31.1$ and the mean age of the high score was $M = 29.2$. The difference in scores between the different age groups (i.e. younger age vs. older aged participants) was also significant ($p = 0.01$). This suggests that older participants held stronger beliefs about condom use than younger participants and, were more likely to comply with their partner's wishes regarding contraceptive use.

Table 4.1.6-A

Baseline Normative Beliefs and Motivations to Comply

Normative Beliefs & Motivations To Comply	Males N (%)	Females N (%)	Total N (%)
My Current Partner Wants To Use Condoms			
Strongly disagree	0	2 (2)	2 (1)
Disagree	30 (42)	79 (73)	109 (60)
Agree	42 (58)	28 (26)	70 (39)
Strongly agree	0	0	0
A New Partner Would Want To Use A Condom			
Strongly disagree	0	0	0
Disagree	8 (11)	13 (12)	21 (12)
Agree	64 (89)	96 (88)	160 (88)

Strongly agree	0	0	0
My Friends Want Me To Use Condoms			
Strongly disagree	0	0	0
Disagree	1 (1)	7 (6)	8 (4)
Agree	71 (99)	102 (94)	173 (96)
Strongly agree	0	0	0
I Do What My Current Partner Wants			
Strongly disagree	0	1 (1)	1 (1)
Disagree	36 (50)	63 (58)	99 (55)
Agree	35 (49)	44 (40)	79 (43)
Strongly agree	1 (1)	1 (1)	2 (1)
I Do What A New Partner Wants			
Strongly disagree	0	3 (3)	3 (2)
Disagree	34 (47)	76 (70)	110 (60)
Agree	38 (53)	29 (27)	67 (37)
Strongly agree	0	1 (1)	1 (1)
I Do What My Friends Want			
Strongly disagree	0	3 (3)	3 (2)
Disagree	43 (60)	56 (51)	99 (55)
Agree	29 (40)	50 (46)	79 (43)
Strongly agree	0	0	0
I Do What The Nurse/MD Wants			
Strongly disagree	0	0	0
Disagree	10 (14)	12 (11)	22 (12)
Agree	62 (86)	96 (88)	158 (88)
Strongly agree	0	0	0
I Do What The Government Wants			
Strongly disagree	2 (3)	3 (3)	5 (3)
Disagree	36 (50)	56 (51)	92 (51)
Agree	34 (48)	50 (46)	84 (46)
Strongly agree	0	0	0

Normative Beliefs & Motivations To Comply Score			
Low beliefs/compliance	17 (24)	37 (34)	54 (30)
Moderate beliefs/compliance	33 (46)	64 (59)	97 (53)
High beliefs/compliance	22 (31)	8 (7)	30 (17)

4.1.7 Negotiating Condom Use and Perceived Control Score

Table 4.1.7-A identifies respondent views about the major barriers to condom use (i.e. another well known determinant for STIs). These include:

- 102 (56%) participants were too "embarrassed" to buy condoms
- 70 (39%) participants felt that they would "forget" to use condoms
- 46 (25%) participants would get too "carried away" during sex to use condoms
- 58 (32%) participants would have difficulty discussing condom use with their partners
- 85 (47%) participants reported that their partner would get angry if they suggested using a condom
- 79 (44%) participants feared giving a bad impression if they suggested using a condom (i.e. giving the perception that they may have an STI).

Table 4.1.7-A

Mean Age - Negotiating Condom Use & Perceived Control Score (NCUPCS)

NCUPCS	Mean Age	N
Low score	28.9	60
Moderate score	30.3	86
High score	29.2	60
Total	29.6	181

Only 55 participants (30%) reported that they had total control over condom use. A "negotiating condom use and perceived control" score was also developed. The score was composed of 8 different variables:

- Would you be embarrassed to buy condoms at the store?
- Would you forget to use condoms?
- Is it difficult to get condoms at the health centre?
- Is it easy to get carried away during sex and forget to use condoms
- Is it difficult to discuss condom use with your partner(s)
- Would your partner get angry if you suggested using a condom?
- Would you fear giving a bad impression if you suggested using a condom
- How much control do you have over condom use.

The highest attainable score was nine and all the scores were grouped into three values: low score = values (0–4), moderate score = values (5-7) and high score = values (8-9); the higher the score the higher one's ability to negotiate condom use.

For the negotiating condom use and perceived control score 60 (33%) had a low score, 86 (48%) had a moderate score while 35 (19%) scored high. The reported values were very similar between males and females and the differences were not significant ($p = 0.73$). The mean age distribution within the three score values Table 4.1.7-B were also not significant ($p = 0.67$).

Table 4.1.7-B

Negotiating Condom Use & Perceived Control (Cross-Sectional)

Negotiating Condom Use & Perceived Control Score	Males	Females	Total
Would you be embarrassed to buy condoms	**N (%)**	**N (%)**	**N (%)**
Likely	28 (39)	74 (68)	102 (56)
Unlikely	44(61)	35 (32)	79 (44)
Would you forget to use condoms			
Unlikely	40 (56)	71(65)	111 (61)
Likely	32 (44)	38 (35)	70 (39)
Is it difficult for you to get condoms at the HC			
Unlikely	51 (71)	85 (78)	136 (75)
Likely	21 (29)	24 (22)	45 (25)
Do you get carried away and not use condoms			
Unlikely	49 (68)	86 (79)	135 (75)
Likely	23 (32)	23 (21)	46 (25)
Is it difficult to discuss condoms with partner			
Unlikely	54 (75)	69 (63)	123 (68)
Likely	18 (25)	40 (37)	58 (32)
Would your partner get angry if you suggested condoms			
Unlikely	50 (69)	46 (42)	96 (53)
Likely	22 (31)	63 (58)	85 (47)
Would you fear giving a bad impression with using condoms			
Unlikely	36 (50)	66 (61)	102 (56)
Likely	36 (50)	43 (40)	79 (44)
How much control do you have over condom use			
No control	15 (21)	30 (28)	45 (25)
Some control	38 (53)	43 (40)	81(45)
Total control	19 (26)	36 (33)	55 (30)
Negotiating Condom Use & Perceived Control Score			
Low score (score values 0-4)	23 (32)	37 (34)	60 (33)

Negotiating Condom Use & Perceived Control Score	Males	Females	Total
Moderate score (score values 5-7)	33 (46)	53 (49)	86 (48)
High score (score values 8-9)	16 (22)	19 (17)	35 (19)

4.1.8 Summary of Baseline Results

Overall, 181 participants were screened for genital chlamydia and gonorrhea and interviewed. The mean age of the respondents was 29.6 and this was consistent for both male and female participants, although there were more female participants than males. The majority of participants were unemployed with less than a high school education.

Male participants used health services less frequently than female participants. This was evident in both the use of health services score and in previous STI testing. Younger aged participants also had lower use of health services than older participants.

With regard to STI knowledge, the majority of participants reported that they never heard of the terms "chlamydia" and/or "gonorrhea" prior to the study. Similarly, although the majority of participants reported knowing the terms "HIV/AIDS" many of the participants were unsure of how HIV was transmitted among people. For the STI knowledge score, the majority of participants scored between low to moderate scores. There were no differences in scores between males and females.

For contraceptive knowledge, most participants were only familiar with two types of contraceptives: the male condom and the BCP. These two types of contraceptives are commonly available at the community health centre. With regard to the other forms of contraceptives (i.e. female condom, diaphragm, spermicidal foam), most of the participants were unsure of their efficacy in preventing STIs and unwanted pregnancy. Female participants did score higher than male participants on the contraceptive knowledge score and this difference was significant. There were no significant differences in score values between the age groups.

With regard to risk behaviours, females had more previous STIs than males. For the study outcome, there were 21 cases of chlamydia and 0 cases of gonorrhea detected during the baseline visit. Although female participants had more chlamydia cases than males, this difference was not significant. The difference between age groups (i.e. participants with the study outcome were younger than those without) was significant. For other risk behaviours there were no significant differences between males and females.

For condom self-efficacy, participants reported both positive and negative aspects about condom use. For the condom self-efficacy score, there were no significant differences between males and females. There were however, significant differences in scores between the age groups.

The normative beliefs and motivations to comply questions were used to measure an individual's beliefs and compliance about condom use. For the summed score, males scored higher than females and there were significant differences between the age groups.

The major barriers to condom use that were reported by the participants included: being embarrassed to purchase condoms at the store, discussing condom use with their partner(s) and the fear of giving a bad impression (i.e. suggesting that the individual has an STI). For the negotiating condom use and perceived control score, there were no significant differences between males and females and between age groups.

4.2 Baseline Univariate Analyses

Univariate analyses were completed on all baseline variables (Table 4.2-A). The analyses were done to examine the strength of association between covariates and the study outcome, establish if co-linearity existed between the variables and determine if variables were significant univariately before being added to the logistic regression models

Table 4.2-A

Cross-Sectional Variables

Variable Name	Variable Type
Age	Continuous
Gender	Categorical
Use of health services score	Categorical
Income range	Categorical
HIV/STI knowledge score	Categorical
Number of STI tests ever pre study	Continuous
Number of STIs ever pre study	Continuous
STI study result	Categorical (outcome variable)
Contraceptive knowledge score	Continuous
Last STI test result before study	Categorical
Age of first sex	Continuous
Perceived risk beliefs score	Categorical
Actual risk behaviour score	Continuous
Condom self efficacy score	Categorical
Normative beliefs and motivations to comply score	Categorical
Negotiating condom use and perceived control score	Categorical

4.2.1 Univariate Analyses of Baseline Continuous Variables

All continuous variables were analyzed with the outcome variable (STI study result) through the use of box plots (Figure 4.2.1-A) and, with each other through the use of Pearson's R correlations (Table 4.2.1-A). A description of these tests were given in (Chapter III). The interpretations of the box plots can be found following Figure 4.2.1-A.

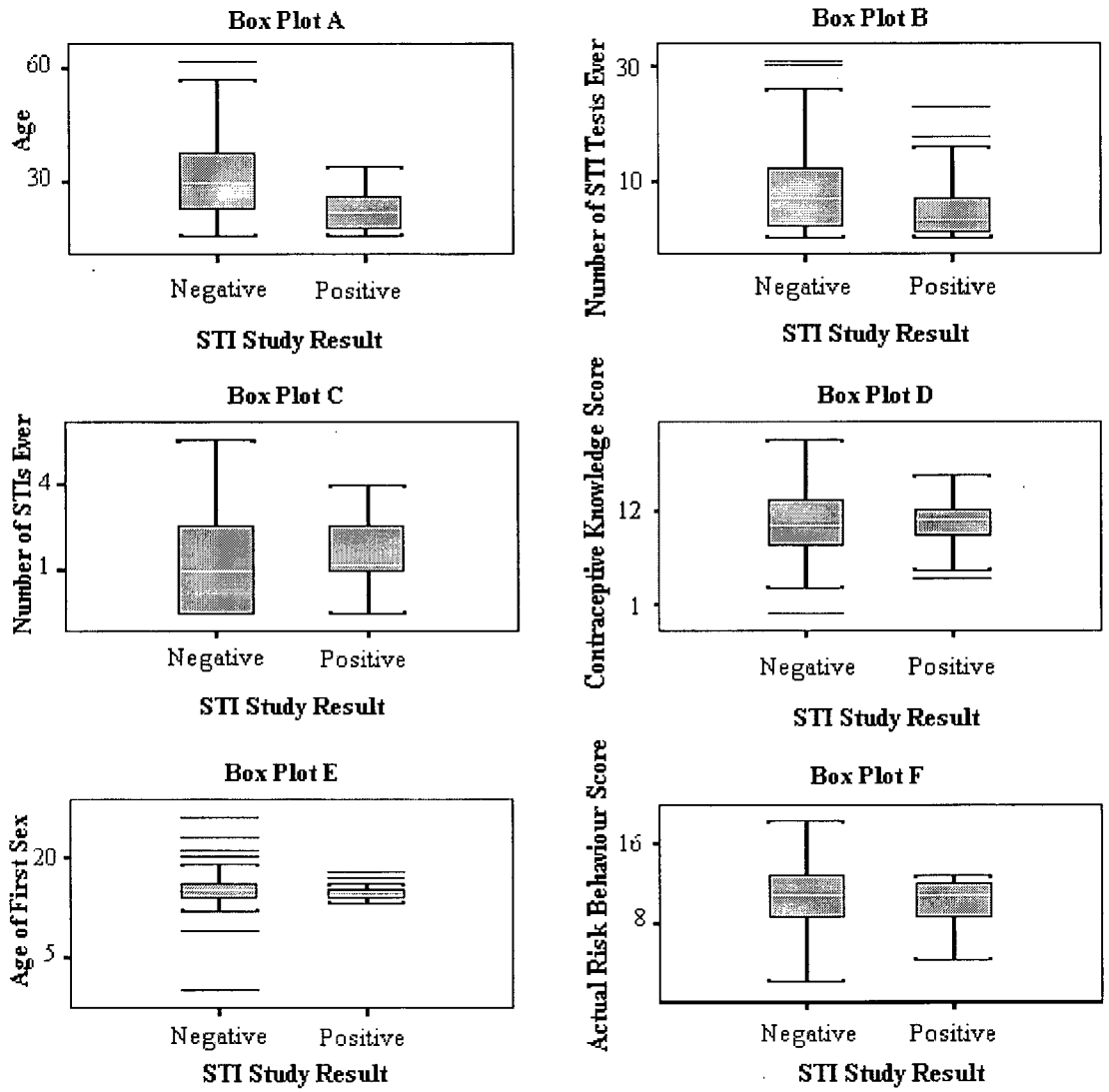


Figure 4.2.1-A

Box Plots of Continuous Variables and Study Outcome

The interpretations of the box plots (Figure 4.2.1-A) are as follows:

1. In box plot A (Age & STI study result), the graph is asymmetrical and skewed to the left (i.e. toward younger age groups). This is particularly evident in the diseased category (STI Study Result = positive), which has a median age of 21. The box plot for no disease (STI Study Result = negative) has a median age of 29.

2. In box plot B (Number of previous STI tests & STI study result), the graph is also asymmetrical and skewed to the left (i.e. toward the lower range of STI tests). This is particularly evident in the positive category, which had a median value of 3 STI tests. The negative category has a median of 7 STI tests. Both the positive and negative categories have outliers (extreme values).
3. In box plot C (Number of previous STIs & STI study result), the graph is also asymmetrical and skewed to the left. Both categories have a median of 1 previous STI test. The non-diseased category also had a wider range of previous STIs values than the diseased category.
4. In box plot D (Contraceptive knowledge score & STI study result) the graph indicates that the non-diseased participants were heterogeneous and with low to high scores. The score spread is skewed but symmetrical around the median. The median score for diseased participants appears slightly higher than the non-diseased participants.
5. Box plot E (Age of first sex & STI study result) shows that the non-diseased participants had a wider "age of first sex" distribution then the diseased participants. Both groups had a median "age of first sex" of 15 and outliers.
6. Box plot F (Actual risk behaviour score & STI study result) does not show much variation between the diseased and non-diseased individuals. The non-diseased individuals had a wider distribution of scores ranging from 0 to >15. It is also a possibility that these individuals were older and as such, may have had more high-risk behaviours over time then the younger diseased participants.

Pearson's R Correlations were also computed on all the continuous variables. Table 4.2.1-A lists all the correlation coefficients for the continuous variables and the study outcome. As noted, no strong correlations existed among the variables though some of the correlations were significant. Since no strong correlations existed between the variables, it was assumed that colinearity was not an issue between the covariates and study outcome.

Table 4.2.1-A

Correlations of Continuous Variables and Study Outcome

		Age	#STIs Ever	#STI Tests Ever	CKS	AFS	ARBS	STI Study Outcome
Age	Pearson Correlation	1	.119	**.304***	.073	**.258***	**.182***	**-.272***
	Sig. (2-tailed)		.110	.000	.329	.000	.014	.000
#STIs Ever	Pearson Correlation	.119	1	**.535***	.077	.063	**.190***	.091
	Sig. (2-tailed)	.110		.000	.304	.398	.011	.222
#STI Tests Ever	Pearson Correlation	**.304***	**.535***	1	**.197***	**.181***	.018	-.108
	Sig. (2-tailed)	.000	.000		.008	.015	.815	.149
CKS	Pearson Correlation	.073	.077	**.197***	1	**.215***	.007	-.024
	Sig. (2-tailed)	.329	.304	.008		.004	.926	.749
AFS	Pearson Correlation	**.258***	.063	**.181***	**.215***	1	-.090	-0.65
	Sig. (2-tailed)	.000	.398	.015	.004		.229	.387
ARBS	Pearson Correlation	**.182***	**.190***	.018	.007	-.090	1	-.040
	Sig. (2-tailed)	.014	.011	.815	.926	.229		.592
STI Study Outcome	Pearson Correlation	**-.272***	.091	-.108	-.024	-.065	-.040	1
	Sig. (2-tailed)	.000	.222	.149	.749	.387	.592	

* Significant at the 0.05 level (2-tailed)

CKS: Contraceptive Knowledge Score

AFS: Age of First Sex

ARBS: Actual Risk Behaviour Score

4.2.2 Baseline Categorical Variables

All categorical variables were analyzed independently with the outcome variable through cross-tabulations. The cross-tabulations for the categorical data and the study outcome are provided in Table 4.2-A. Variables with statistically significant p-values (i.e. $p < 0.05$) are bolded in the "Significance" column. As noted in Table 4.2-A, only three variables were significant. This may be due in part to the small sample size.

Table 4.2-A

Cross-Tabulations for STI Study Outcome & Categorical Variables

Variables	STI Result		Pearson Chi-Square	Significance
	Negative (N)	Positive (N)	(df)	(2-sided)
Gender			1.25 (1)	0.345
Males	66	6		
Females	94	15		
Income Range			10.51 (3)	**0.015**
0 (no income)	13	6		
1 (< 10,000)	76	9		
2 (10-30,000)	48	6		
3 (31-50,000+)	23	0		
Use of Health Services			5.68 (2)	0.058
1 (low use)	62	13		
2 (medium use)	80	6		
3 (high use)	18	2		
STI Knowledge Score			4.25 (2)	0.12
1 (low score)	62	13		
2 (medium score)	80	6		
3 (high score)	18	2		
Last STI Test Pre Study			28.73 (1)	**0.000**
Negative	151	12		
Positive	9	9		
Perceived Risk Belief Score			7.65 (2)	**0.022**
0 (none)	67	5		
1 (low)	49	4		
2 (moderate - high)	44	12		
Condom Self-Efficacy Score			3.23 (2)	0.199
1 (low)	21	4		
2 (medium)	94	8		

Variables	STI Result		Pearson Chi-Square	Significance
	Negative	Positive		
	(N)	(N)	(df)	(2-sided)
3 (high)	45	9		
Normative Beliefs & Motivation To Comply			2.982 (2)	0.225
1 (low)	51	3		
2 (medium)	84	13		
3 (high)	25	5		
Negotiating Condom Use & Perceived Control			0.001 (2)	0.999
1 (low)	53	7		
2 (medium)	76	10		
3 (high)	31	4		

4.2.3 Baseline Logistic Regression (Method One)

Two methods of variable selection and logistic regression model building were used. The first method used a stepped model that added variables in a forward fashion. The aim of the first method was to build the most parsimonious and best fitting model that could best test the strength of association between the outcome variable and main covariates.

In the second method individual logistic regression models were developed to test each hypotheses that were discussed in (Chapter I). For this method, variable selection was based on clinical relevance and its appropriateness in testing the hypotheses. Similar to method one, these models were used to test the strength of association between the outcome variable (STI study result) and covariates of main interest.

As previously mentioned, the first model was developed using a stepped model that added variables in a forward fashion. The script used for generating the model was developed to select variables based on the Akaike information criterion (AIC). The final model that was generated was as follows:

STI.Study.Result ~ Age + Gender + LSTBS* + NSE + PRBS

* LSTBS = last STI test result before study; NSE = number of STIs ever; PRBS = perceived risk belief score

The results of the first model are presented in Table 4.2.3-A with the Odds Ratio and 95% confidence intervals.

Table 4.2.3-A

Results for Logistic Regression Model (Method 1)

Variables	Individuals with STI (N)	Odds Ratio	P-value	95% C.I for OR	
				Lower	Upper
Age	NA	0.89	**0.012**	0.82	0.98
Gender* (females)	15	2.45	0.24	0.55	10.89
Last STI** Test Result Pre-Study (positive)	9	9.82	**0.001**	2.70	35.77
Number Of Previous STIs	NA	1.47	0.11	0.92	2.30
Perceived*** Risk Behaviour Score					
Score value = 1 (low)	4	0.40	0.27	0.08	2.05
Score value = 2 (moderate-high)	12	1.48	0.57	0.39	5.68

* Gender: Male was reference category

** Last STI Test Result Pre-Study: Negative result was reference category

*** Perceived Risk Behaviour Score: Score value = 0 (no perceived risk) was the reference category

To test the fit of the model an ROC curve was used (Figure 4.2.3-A). In logistic regression, ROC curves are very useful for evaluating the predictive accuracy of a chosen model (Swets 1988). As illustrated in the curve Figure 4.2.3-A, the diagonal line represents chance. A curve that is well above the diagonal line means that an indicator is accurate. Another measure of accuracy given by the ROC curve is the area under the curve (Table 4.2.3-B). This measure will vary between 0.5 and 1. An area of 0.5 represents the diagonal, attained when no discrimination exists or by chance alone. An area of 1 represents the perfect indicator (Swets 1988). In this case, the area under the curve was 0.889 indicating a good fit.

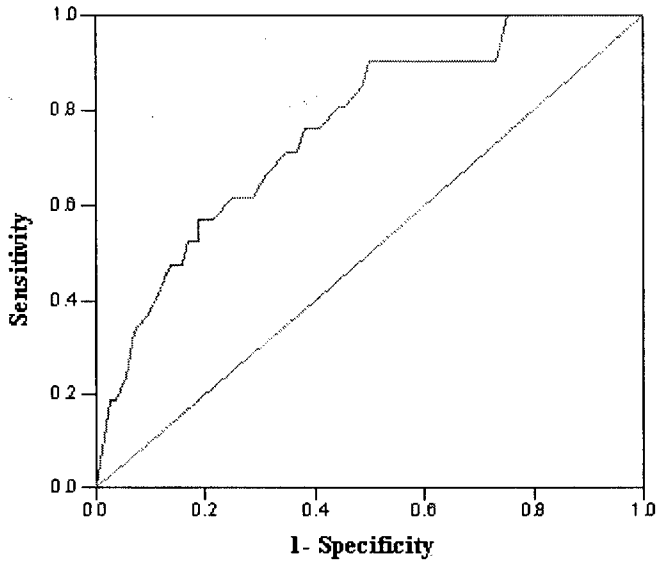


Figure 4.2.3-A

ROC Curve to Test Fit for Model 1 (Method 1)

Table 4.2.3-B

Area Under the Curve for Model 1 (Method 1)

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.889	.027	.000	.837	.942

* under the nonparametric assumption

** Null hypothesis: true area = 0.5

In summary, the first model was developed using a stepped forward addition of variables. The final model that was selected (i.e. based on the AIC criteria) included the following variables: age, gender, last STI test result pre-study, number of previous STIs and perceived risk behaviour score.

The results generated in Table 4.2.3-A indicated:

- As age increased the odds of contracting an STI decreased (i.e. protective effect)
- Females had more than double the odds of contracting an STI than males
- Individuals who tested positive in their last STI testing pre-study increased their odds of contracting an STI by more than nine times
- Individuals who scored a moderate-high score in the perceived risk behaviour score had higher odds of contracting an STI than those who had a lower score

The variables that were statistically significant were age and last STI test result pre-study.

4.2.3.1 Baseline Logistic Regression (Method Two)

The second method that was used, involved selecting variables that were considered clinically relevant in testing the hypotheses (Chapter I). Each model was designed to test specific criteria (e.g. gender or age differences in contracting an STI) within a specified question or hypothesis. In the next section, the logistic regression models will be listed following the hypothesis they were developed to test.

Hypothesis 1

Females will have higher odds of contracting the study outcome than males. Similar findings will be evident among the different age categories, whereby more STIs will be found in the younger age group of study participants (i.e. younger participants will have higher odds of contracting a STI). To test this hypothesis, age and gender variables were added to the model.

Table 4.2.3.1-A

Results For Logistic Regression Model 1

Variables	**Individuals with STI (N)**	**Odds Ratio**	**P-value**	**95% C.I for OR**	
				Lower	**Upper**
Age	NA	0.91	**0.000**	0.88	0.94
Gender (females)	15	2.13	0.124	0.81	5.61

As indicated in Table 4.2.3.1-A, females had more than twice the odds of contracting an STI than male participants. Similar findings were noted in model 1, method 1(4.2.3.A). With regard to age, it appears that as age increases (i.e. older participants) the odds of contracting an STI decreases. This findings was also consistent with model 1, method 1 (Table 4.2.3-A). The only variable that was significant was age.

To determine the fit of the model an ROC curve was used. As indicated in Table 4.2.3.1-B the area under the curve was 0.761 indicating a moderate to good fit.

Table 4.2.3.1-B

Area Under the Curve For Model 1

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.761	.053	.000	.658	.865

* Under the nonparametric assumption

** Null hypothesis: true area = 0.5

Hypothesis 2

Female participants will demonstrate a higher use of health services and more previous STI screening than male participants. There will be a positive association between use of health services and the study outcome.

To test this hypothesis, age, gender, use of health services score and previous STI tests pre-study were used in the model. The reference category included males, younger age, low previous STI testing and use of health services score value = high. The results of the model can be found in Table 4.2.3.1-C.

Table 4.2.3.1-C

Results for Logistic Regression Model 2

Variables	Individuals with STI (N)	Odds Ratio	P-value	95% C.I for OR	
				Lower	Upper
Age	NA	0.93	**0.000**	0.89	0.97
Gender (females)	15	2.97	0.05	0.99	8.90
Use of Health Services Score					
Score value = 1 (low use)	13	1.11	0.88	0.28	4.48
Score value = 2 (moderate use)	6	0.38	0.14	0.11	1.38
Number of STI Tests Pre-Study	NA	0.946	0.30	0.85	1.05

As indicated in Table 4.2.3.1-C, age and gender had similar results to the previous two models. With regard to the use of health services score, individuals who scored a low health services score had higher odds ratio of contracting an STI then individuals who scored higher. For the "number of STI tests pre-study" variable, it seems that as the number of previous tests gets higher, the lower the odds of contracting an STI. It is conceivable that these individuals (i.e. scored high on health services use score and had many previous STI tests) may have accessed health services more frequently and as such, were more likely to get screened for an STI than other participants. Hence, more screening may indicate a less chance of contracting an STI.

In this model, the only variable that had a significant p-value was age. To test the fit of the model an ROC curve was used. As indicated in Table 4.2.3.1-D, the area under the curve was 0.79 indicating a moderate to good fit.

Table 4.2.3.1-D

Area Under the Curve For Model 2

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.790	.047	.000	.883	.865

* Under the nonparametric assumption

** Null hypothesis: true area = 0.5

Hypothesis 3

Female participants will score higher in STI and contraceptive knowledge scores then male participants. Similar findings will be seen among the different age groups, whereby the younger study population will demonstrate a lower STI and contraceptive knowledge score than the older study participants. Furthermore, STI and contraceptive knowledge will not be good predictors of STI acquisition.

To test this hypothesis the variables gender, age, STI knowledge scores and contraceptive knowledge score were used in model 3. The reference categories include: males, younger age, lower contraceptive knowledge score and HIV/STI knowledge scores = low knowledge.

Table 4.2.3.1-E

Results for Logistic Regression Model 3

Variables	Individuals with STI (N)	Odds Ratio	P-value	95% C.I for OR	
				Lower	Upper
Age	NA	0.91	**0.00**	0.86	0.96
Gender (females)	15	1.74	0.33	0.57	5.34
STI Knowledge Score					
Score value = high knowledge	2	0.73	0.72	0.13	4.03
Score value = med. knowledge	6	0.56	0.33	0.18	1.77
Contraceptive Knowledge Score	NA	1.04	0.61	0.90	1.19

As indicated in Table (4.2.3.1-E), age and gender had similar odds as previous models. Female participants had slightly higher scores in both STI knowledge and contraceptive knowledge than male participants. The differences in scores were not significant ($p = 0.89$). Younger participants had lower scores than older participants. The age differences between the three scores were significant ($p = 0.04$).

With regard to the STI knowledge score, individuals who scored a high knowledge score or a moderate knowledge score had lower odds of contracting an STI than individuals who scored lower. For the contraceptive knowledge score however, an opposite scenario occurs. In this case, individuals who scored higher scores (i.e. score was out of 28) had higher odds of contracting an STI than individuals who scored lower.

In this model, the only variable that had a significant p-value was age. To test the fit of the model an ROC curve was used. As indicated in Table (4.2.3.1-F), the area under the curve was 0.77 indicating a moderate to good fit.

Table 4.2.3.1-F

Area Under the Curve for Model 3

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.768	.056	.000	.658	.877

* Under the nonparametric assumption

** Null hypothesis: true area = 0.5

Hypothesis 4

There will be no differences in age of first sex between males and females.

The mean age for "first sex" for all the participants was M = 15.15 (SD: 2.21). The mean age for females (M = 15.29) was slighter higher than the mean age for males (M = 14.94). The difference between females and males was not significant (p = 0.27;CI: -0.97, 0.27). A logistic regression model was not fitted for this hypothesis.

Hypothesis 5

There will be no differences in the area of "risk behaviour" (perceived and actual risk) between male and female participants. There will however, be difference in the area of high-risk behaviours among the different age groups. Younger aged participants will be engaged in more high-risk activities than older participants. There will be an association between actual high-risk behaviour and the study outcome.

To test this hypothesis the following variables were included in the model: age, gender, age of first sex, number of STIs ever, perceived risk behaviour score, actual risk behaviour score and last STI test result pre- study. The reference categories in this model included: males, younger age, younger age of first sex, perceived risk behaviour score = high risk and last STI test result pre-study (negative result).

Table 4.2.3.1-G

Results for Logistic Regression Model 4

Variables	(N) Individuals with STI	Odds Ratio	P-value	95% C.I for OR	
				Lower	Upper
Age	NA	0.88	**0.005**	0.80	0.96
Gender (females)	15	1.09	0.88	0.35	3.38
Age of First Sex	NA	1.04	0.68	0.88	1.24
Number of STIs Ever	NA	1.23	0.24	0.85	1.95
Perceived Risk Behaviour Score					
Score value = 1 (low risk)	4	0.40	0.26	0.08	1.99
Score value = 2 (moderate risk)	12	1.33	0.66	0.37	4.82
Actual Risk Behaviour Score	NA	0.92	0.46	0.75	1.14
Last STI Test Result Pre-Study					
Positive Test result	9	8.04	**0.001**	2.27	28.48

As indicated in Table 4.2.3.1-G, age and gender had similar odds ratio as previous models. Female participants had more previous STIs (M: 1.36) than male participants (M: 0.79). When comparing the number of previous STIs among the different age groups (i.e. younger participants vs. older participants), the differences were not significant ($p = 0.43$). As noted in (Table 4.2.3.4.A), individuals with higher numbers of previous STIs had an OR of 1.28 of contracting an STI over individuals with fewer to none, previous STIs.

Two scores were developed for STI- related risk behaviours, perceived risk behaviour score and actual risk behaviour score. When assessing the perceived risk behaviour scores between males and females, the differences were minimal and not significant ($p = 0.28$). With regard to age differences, as the age decreased the scores increased and the differences between the age groups were significant ($p = 0.001$). As noted in Table 4.2.3.1-G, individuals who scored higher on the perceived risk behaviour score had an OR of 1.33 over individuals who scored lower.

For the actual risk behaviour score, the mean score for males (M: 11.01) was slighter higher then the score for females (M: 10.75). With regard to the OR, as the actual risk behaviour score increased the value of the OR was approaching 1.

The most dramatic risk factor noted in Table 4.2.3.1-G was the last STI test result pre study. Individuals with a positive test result had an OR of 8.04 over individuals who had a negative test result. This finding was similar to that found in model 1, method 1.

In model 4, the only significant variables were age and last STI test result pre-study. To test the fit of the model an ROC curve was used. As indicated in Table 4.2.3.1-H, the area under the curve was 0.86 indicating a good fit.

Table 4.2.3.1-H

Area Under the Curve for Model 4

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.858	.043	.000	.775	.942

* Under the nonparametric assumption

** Null hypothesis: true area = 0.5

Hypothesis 6

There will be no differences noted in the areas of: behavioural beliefs, normative beliefs and motivations to comply, self-efficacy and perceived control between males and females. There will be an association between these behavioural beliefs and the study outcome.

To test this hypothesis the following variables will be included in the model: age, gender, normative beliefs and motivations to comply score, condom self-efficacy score and negotiating condom use perceived control score. The reference categories that were used in this model include: males, younger age, normative beliefs and motivation to comply score = low compliance, condom self-efficacy score = high self-efficacy and negotiating condom use and perceived control score = high control.

Table 4.2.3.1-I

Results for Logistic Regression Model 5

Variables	(N) Individuals with STI	Odds Ratio	P-value	95% C.I for OR	
				Lower	Upper
Age	NA	0.86	**0.000**	0.81	0.92
Gender (females)	15	3.09	0.06	0.98	0.78
Normative Beliefs & Motivations To Comply Score					
Score value = 3 (high compliance)	5	10.80	**0.006**	2.97	59.02
Score value = 2 (mod. compliance)	13	4.23	**0.04**	1.11	16.16
Condom Self-Efficacy Score					
Score value = 2 (moderate)	8	0.42	0.15	0.13	1.36
Score value = 1 (low)	4	0.58	0.50	0.12	2.89
Negotiating Condom Use & Perceived Control Score					
Score value = 2 (mod. control)	10	1.21	0.78	0.32	4.58
Score value = 1 (low control)	7	1.30	0.74	0.28	6.11

For the normative beliefs and motivations to comply score, the scores varied among males and females especially with regard to the high score. The difference in score values between males and females was significant ($p = 0.001$). With regard to the score values between the different age distributions, the difference in scores between the different age groups was also significant ($p = 0.01$). As noted in Table 4.2.3.1-I, individuals who scored high (i.e. were more likely to comply with, or be pressured by others) had an OR of 10.8, in comparison to individuals who scored low (i.e. where not likely to be pressured or influenced by others). This finding may suggest that individuals who scored high in this score may be more likely to be affected by peer pressure or, by their partner's beliefs around contraceptive use and as such, may be more prone to STIs.

For the condom self-efficacy score, the scores appeared to be quite consistent between males and females. With regard to age differences between the scores (i.e. younger age groups vs. older ages), the differences were significant ($p = 0.01$). In Table 4.2.3.1-I, the OR for individuals who scored low to medium was not high when compared to individuals who scored a high score. This finding may indicate, that individuals who scored high on the score may not necessarily consider using condoms as an impediment to safer sexual practice but rather, choose not to use them.

For the negotiating condom use and perceived control score, the score values were very similar between males and females and the differences were not significant. The age distribution between the three score values were also not significant. As indicated in Table 4.2.3.1-I, individuals who scored lower in the negotiating condom use and perceived control score had slightly higher OR then individuals who scored high. In model 5 the only variables that were significant include: age, normative beliefs and motivation to comply scores.

To test the fit of the model an ROC curve was used. As indicated in Table 4.2.3.1-J, the area under the curve was 0.82 indicating a good fit.

Table 4.2.3.1-J

Area Under the Curve For Model 5

Area	Std. Error*	Asymptotic Sig.**	Asymptotic 95% Confidence	
			Lower Bound	Upper Bound
.815	.054	.000	.710	.921

* Under the nonparametric assumption

** Null hypothesis: true area = 0.5

4.3 Longitudinal Data

From the 99 follow-up participants, 30 (30%) were males and 69 (70%) were females. The mean age of the respondents was 27.8 years (S.D 8.7). The age breakdown for the participants can be found in Table 4.3-A.

Table 4.3-A

Summary of the Demographic Characteristics (Longitudinal)

Demographic Variables	**Males**	**Females**	**Total**
Total in sample	30	69	99
Mean Age (Median)	**29.0 (30.0)**	**27.3 (26.0)**	**27.8 (26.0)**
(S.D)	8.4	8.8	8.7
Age distribution	**N (%)**	**N (%)**	**N (%)**
15-19	7 (23)	11 (16)	18 (18)
20-24	7 (23)	14 (20)	21 (21)
25-44	14 (47)	42 (61)	56 (57)
45-54	2 (7)	2 (3)	4 (4)
55-65	0	0	0

For the longitudinal study outcome, 14 cases of chlamydia were detected by urine PCR. From the 14 cases, 3 cases were males and 11 cases were females. Two of the female participants had repeat infections and one female case was not a study participant (i.e. sexual contact of a study participant). The association between gender and longitudinal STI study result was not significant ($p = 0.54$). The overall mean age of individuals who had a positive follow-up STI was $M = 22.4$ while, for individuals not infected, the mean age was $M = 28.7$. The difference in age between positive and negative STI participants was significant ($p = 0.008$).

4.3.1 Analyses of Longitudinal Data

The longitudinal data were analyzed with the McNemar's test of correlated proportions. A description of the test was given in Chapter 3.

For these analyses, two time periods were used: baseline and follow-up (i.e. visits 1-4). The data set was organized to indicate whether the participants had a positive/negative baseline study STI outcome, and whether the same participant had a positive/negative longitudinal study STI outcome during any of the four follow-up visits. The first part of the analysis will used to determine if prevalence decreased after the baseline screening for each of the 4 follow-up visits. The second part of the analysis will involve comparing the prevalence that was calculated during baseline (point prevalence) with the follow-up prevalence (period prevalence). The follow-up prevalence was calculated with the formula P = ID were P = prevalence, I = incidence density and D = duration.

4.3.1.1 Determining Change in Prevalence (Part 1)

The McNemar test focuses on change from one condition to another (i.e. baseline to follow –up). In this example, the null hypothesis was that the baseline screening would have no affect on the prevalence of STIs during the follow-up visits.

From the 99 individuals who participated in the longitudinal survey, 13 individuals had a positive STI during the baseline visit. As noted in Table 4.3.1.1-A, 4 of these individuals also had a positive STI during follow-up visit 1; 2 individuals had STIs during visit 2; 1 individual had a STI during visit 4. Visit 3 and Visit 4 are unique because they have individuals that did not have a baseline STI however; they developed a STI during the follow-up visit. For instance 4 individuals developed a STI during visit 3 and 3 individuals developed a STI during visit 4. The McNemar chi-square test is then computed on the two cells where participants developed an STI before and/or after the Baseline screening. The results for the McNemar tests can be found on Table 4.3.1.1-B.

Table 4.3.1.1-A

Number of New Infections Per Follow-Up Visit

Baseline Visit	**Visit 1**		**Visit 2**		**Visit 3**		**Visit 4**	
	Neg.	**Pos.**	**Neg.**	**Pos.**	**Neg.**	**Pos.**	**Neg.**	**Pos.**
Negative	86	0	86	0	82	**4**	82	**3**
Positive	9	**4**	11	**2**	13	0	12	**1**

Table 4.3.1.1-B

McNemar Test Results for Each Visit

	Visit 1	Visit 2	Visit 3	Visit 4
N	99	99	99	99
Chi-square	7.11	9.09	0.63	0.51
P-Value	**0.008**	**0.003**	0.05	**0.04**

As indicated in Table 4.3.1.1-B, the McNemar test yielded significant values for visit 1, 2 and 4. During these three visits the "before and after" effect was significant meaning that the baseline screening and intervention had a positive effect on the participants (i.e. fewer infections). During visit 3 however, the McNemar test yield a non- significant value and as such the intervention was not successful.

4.3.1.2 Determining Change in Prevalence (Part 2)

In the second part of the analyses, the baseline prevalence will be compared with the follow-up prevalence.

In this case, 99 people were followed for four visits. We assumed that each participant had equal follow-up of about 240 days (i.e. 30 days x 8 months). This accounts to 23760 person days of follow-up (i.e. 240 x 99), or 65 person years (i.e. 23760/365). Then we had 14 cases of chlamydia in 65 person years of follow-up, which gave an incidence of 0.22 cases per person per year or 22% per year. Assuming that the average duration of disease (D) is 150 days (0.4 years) (Brunham and Plummer 1990) then the follow-up prevalence was 9% (i.e. 0.22 x 0.4). It is important to note that the assumed duration of "150 days" was a very conservative estimate. In reality, the duration was much shorter (i.e. participants were screened every two months and test of cure was performed after each treatment) and as such, the follow-up prevalence was likely, lower than 9%.

The calculated prevalence (point prevalence) for just the baseline participants was 11.6% (21/181), while the prevalence (period prevalence) for the follow-up visits was calculated to be 9%. This is a 22% relative decrease in STIs from baseline to follow-up.

4.4 Baseline Network Analyses

As previously mentioned, 181 individuals participated in the baseline visit. All the participants who tested positive were questioned about their sexual partners through the "snowball" sampling method. For all other participants (i.e. those that did not test positive), only names of the first generation partners (i.e. first level partners) were collected.

Snowball sampling begins with a focal actor, which in this case, was the infected participant. Each of these actors was asked to name all of their sexual ties to other actors. Then, all the actors named were tracked down and asked for all of their sexual ties. The process continued until no new actors were identified, or until it was no longer feasible to track down the partners (i.e. partners were living in different communities) (Hanneman 2001).

From all the participants, there were 21 confirmed chlamydia cases of which, 12 were index cases (initial cases), 5 were first generation (i.e. partners of the index cases), 2 were second generation (i.e. partners of first generation contacts) and 2 were fourth generation (i.e. partners of third generation contacts). There were no third generation partners that were infected. A summary and visual display (i.e. sociograms) of the baseline sexual network can be found in Table 4.4-A and Figure 4.4-B, and Figure 4.4-A, Appendix V).

Table 4.4-A

Baseline Chlamydia Sexual Network

Chlamydia Network	Enrolled (Traced)	Confirmed Infections	All Sexual Contacts Named	Mean # of Contacts
Other Participants	125	0	125	1.0
Index cases	12	12	30	2.55
1st generation	17	5	29	1.71
2nd generation	9	2	16	1.78
3rd generation	7	0	12	1.71
4th generation	9	2	10	1.11
5th generation	2	0	2	1
Total	**181**	**21**	**224**	**1.55**

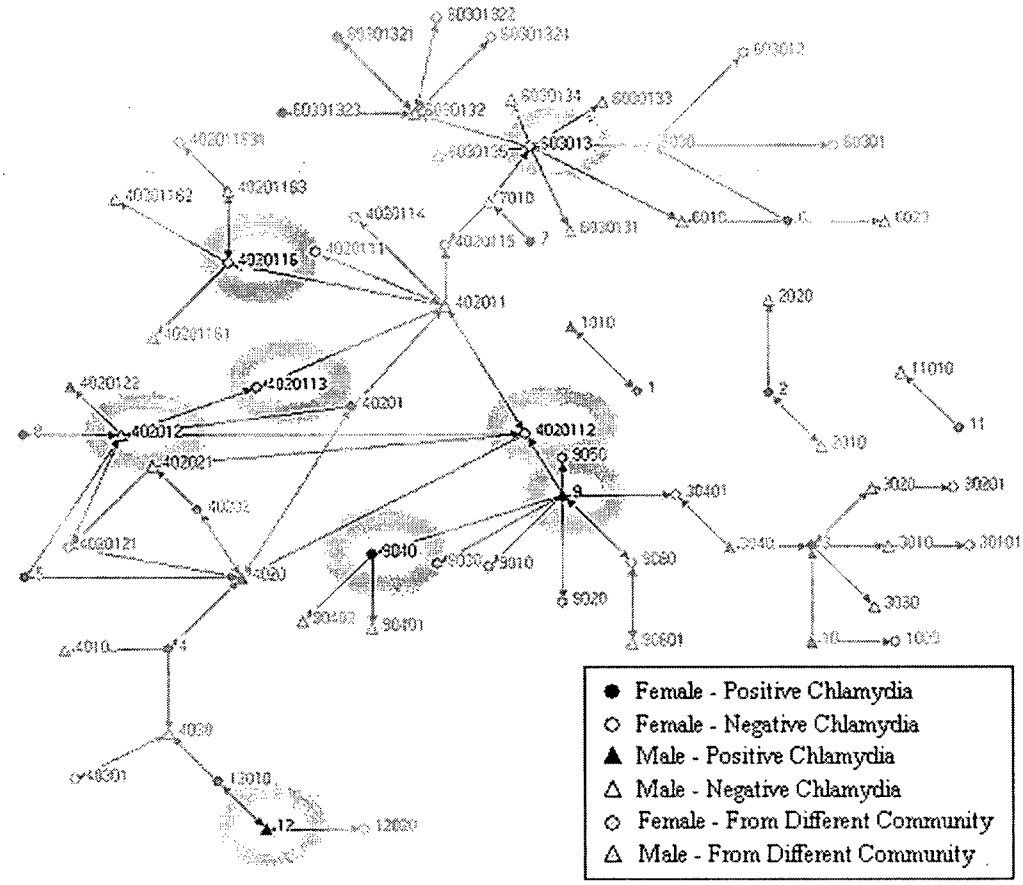


Figure 4.4-B

Baseline Sexual Network

The next section will provide some of the basic properties of both the sexual and complete networks. The information that will be provided includes: transitivity, reciprocity, density and the centrality measures (i.e. closeness, betweenness, power, degree) and bridging.

4.4.1 Baseline Sexual Network Properties

Transitivity

Transitivity is a measure that examines the connections between triadic relations (i.e. 3-person relationship). For transitivity to occur, all individuals in the triadic relationship would need to name each other as sexual partners. For instance, if a male participant had two female contacts, each of these female contacts would need to name each other as a sexual partner (i.e. bi-sexual relationship). In the baseline sexual network, there were no transitive ordered triadic relationships reported.

Reciprocity:

Reciprocity is a measure that examines the relationships between dyadic relationships (i.e. 2-person relationships). A dyadic relationship has reciprocity when both individuals name each other (i.e. if A mentions B then B mentions A). In the baseline sexual network, the reciprocity was 0.29. This means that for every reciprocal relationship there are approximately, four dyadic relationships that are not: $(\frac{x}{y} = 1 \rightarrow y = \frac{1}{x} = \frac{1}{0.2857} = 3.5)$.

As noted in Figure 4.4-B, there are different types of reciprocity. For instance, some actors (i.e. #603013, #4020116 and #9) name more partners than being named themselves. These types of actors are often called "sources". Some actors (i.e. #402012, #4020113) are more often named as partners than they name themselves. These type of actors are often called "sinks". Other actors (i.e. # 9040) may be "transmitters" and as such, are named by different actors than they name themselves. While others have mutual or reciprocated relationships. For instance, actors #12 and #9060 have "symmetric" or balanced relationships with other actors. For the network as a whole, we note that a only a small proportion of the relationships are reciprocated.

Density:

Density measures the size of the network. The baseline sexual network had 72 actors with 5112 possible relationships. The density of ties (i.e. proportion of all ties that could be present that actually are) was 0.0188 indicating a small network.

Bridging

Bridging occurs when individuals from a network have contacts from outside the network. In the baseline sexual network, bridging contacts would have been from outside the Test Community. From the 72 nodes, 17 were from outside the Test Community.

Centrality Measures

The four measures of centrality that will be discussed include: degree, closeness, betweenness and power (refer to chapter III for a description of each of these measures). In some network analysis, the length of ties (i.e. component of degree) can be used to represent the strength of relationship between nodes. This feature was not applied to any of the networks.

Correlation statistics of the four measures were also completed and the results can be found in Table 4.4.1-A. A summary of all the network properties can be found in Table 4.4.2-A.

1. **Degree:** The degree centrality is the number of ties an individual node has. For the baseline sexual network the mean degree was 2.1 (SD: 1.7). This result indicates that the baseline sexual network was a connected component in which, on "average" each participant had slightly over 2 sexual contacts. This would be considered a moderate to highly connected group
2. **Closeness:** Closeness centrality is the total graph-theoretic distance of a given node from all other nodes. The mean closeness for the network was 1.5 (SD: 0.14), which in this case means that people were close to each other, and easily reachable
3. **Betweenness:** Betweenness centrality is a measure of how often a given node lies on the geodesic between any other two nodes. In this case mean betweenness was 14.4 (SD: 30.5). This indicates that many people lie between two people who are connected. This is evidence of cohesion.
4. **Power**: Power is a measure of the centrality of persons you are connected to. If positive, it indicates increased centrality because the persons you are connected to are central themselves. Negative values are the opposite. In this case the power was 1.4 (SD. 1.6). Since it was a positive power measure it would indicate that people are in general connected to central persons, indicating again an interactive network with high network centrality

Table 4.4.1-A

Correlations of Baseline Sexual Network Centrality Measure

	Betweenness	**Closeness**	**Degree**	**Power**
Betweenness	1.00	0.31	**0.81**	**0.69**
Closeness	0.31	1.00	0.19	0
Degree	0.81	0.19	1.0	0.88
Power	0.69	0	**0.88**	1.0

4.4.2 Baseline Complete Network Properties

The baseline complete network (Figure 4.4-A, Appendix V) was comprised of all the baseline participants. This included the infected participants and their partners, and the non-infected participants and partners. As illustrated in Figure 4.4-A, Appendix V, the complete network had 320 nodes of which, the majority of participants were in dyad relationships and a few in triads. The sexual network is located in centre of the network. Because the network as a whole was too fragmented the only feasible calculations that were possible included: mean and variance of the degree, reciprocity and bridging. A summary of both the sexual network and complete network properties can be found in Table 4.4.2-A.

- **Degree:** The mean degree was 1.3 (SD: 1.0). This indicates that on "average" each participant in the complete network had slightly over 1 sexual contact
- **Reciprocity:** The reciprocity was 0.18. In other words, for every reciprocal relationship, there were approximately 6 relationships that were not
- **Bridging:** In the baseline complete network, 29 participants (including the sexual network participants) had contacts from different communities

Table 4.4.2-A

Summary of Baseline Sexual and Complete Network Properties

Network	Transitivity	Reciprocity	Density	Degree (Mean)	Closeness (Mean)	Betweenness (Mean)	Power (Mean)
Sexual	0	0.29	72	2.1	1.5	14.4	1.4
Complete	NA	0.18	320	1.3	NA	NA	NA

4.4.3 Follow-up Networks Analyses

Ninety-nine participants were followed every two months post baseline visit for an additional 4 visits. During each of the visits, participants were asked about both their sexual and social contacts. Each follow-up visit will be presented individually with a summary table (i.e. describing the number of contacts) and sociogram (i.e. sexual network). The only calculations that will be presented include: degree, reciprocity and bridging.

4.4.3.1 Follow-up Visit 1

During the first follow-up visit, four individuals had a positive chlamydia test. All four individuals also had a positive STI during the baseline visit.

- **Degree:** The mean degree centrality was 1.17 (Std: 0.49). The maximum degree was 4 while the minimum was 1. This states that on "average" each participant had a little over one sexual contact
- **Reciprocity:** The reciprocity for the first visit was 0.13. This indicates that for every reciprocal relationship there were approximately 8 relationships that were not
- **Bridging:** There were 13 participants that had sexual contacts from outside the community

A summary of the follow-up visit can be found in Table 4.4.3.1-A, and the sociogram of the sexual network in Figure 4.4.3.1-A.

Table 4.4.3.1-A

Summary Of Sexual and Social Network for Follow-up Visit 1

	Participants Non-Part ( )	**Infected**	**All Sexual Contacts Named**	**All Social Contacts Named**	**Mean Sexual Contacts**	**Mean Social Contacts**
Non-infected	92	0	92	477	1.0	5.18
Index	3	3	3	14	1.0	4.67
1st generation	3	1	4	10	1.33	3.33
2nd generation	1	0	1	4	1.0	4.0
Total	99	**4**	100	505	1.08	4.3

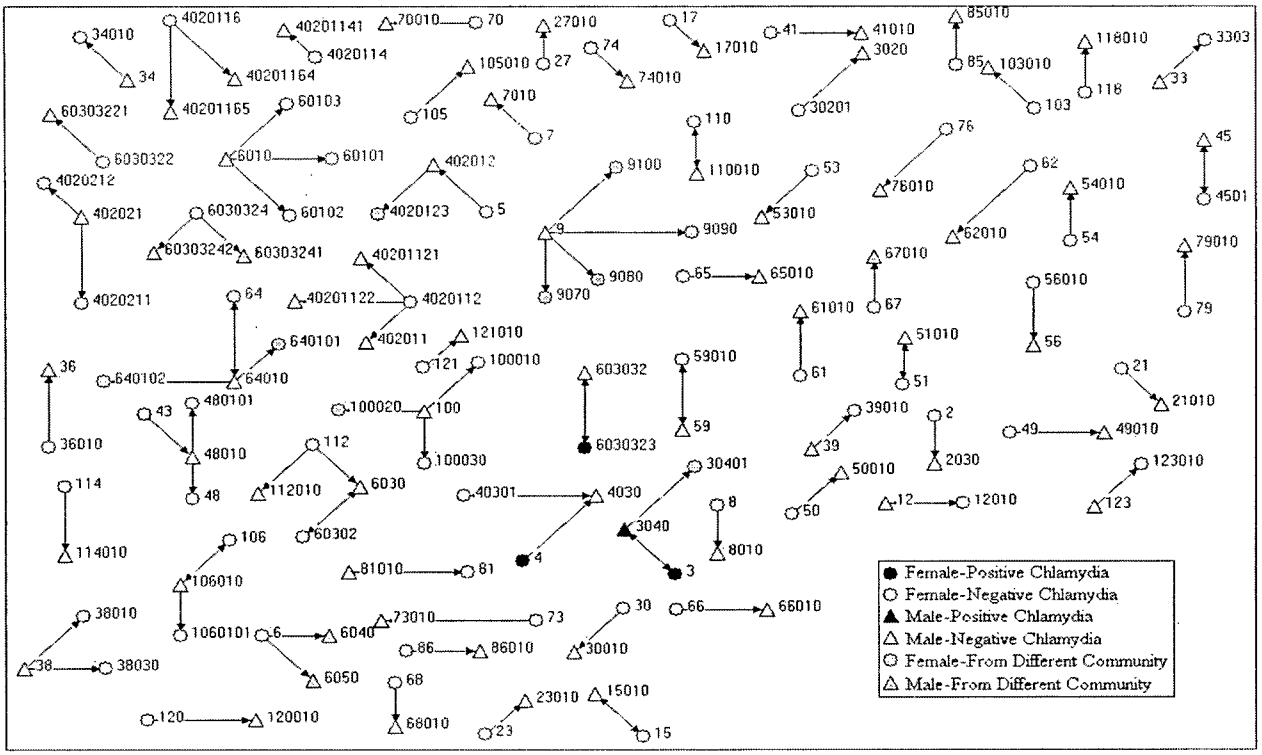


Figure 4.4.3.1-A
Follow-up Visit 1

4.4.3.2 Follow-up Visit 2

During the second follow-up visit, two individuals had a positive chlamydia test. Both of these individuals had a positive STI during the baseline visit.

- **Degree:** The mean degree centrality was 1.08 (SD: 0.28). The maximum degree was 2 while the minimum was 1. This states that on "average" each participant had about 1 sexual contact
- **Reciprocity:** The reciprocity for the first visit was 0.2. This indicates that for every reciprocal relationship there were approximately 5 relationships that were not
- **Bridging:** There were 9 participants who had sexual contacts from outside the community

A summary of the follow-up visit can be found in Table 4.4.3.2-A, and the sociogram of the sexual network in Figure 4.4.3.2-A.

Table 4.4.3.2-A

Summary of Sexual and Social Network for Follow-up Visit 2

	Participants Non-Part ( )	Infected	All Sexual Contacts Named	All Social Contacts Named	Mean Sexual Contacts	Mean Social Contacts
Non-infected	95	0	81	481	0.85	5.06
Index	2	2	2	9	1.0	4.5
1st generation	1(1)	0	2	3	2.0	3.0
2nd generation	1	0	1	2	1.0	2.0
Total	99	**2**	86	505	1.21	3.64

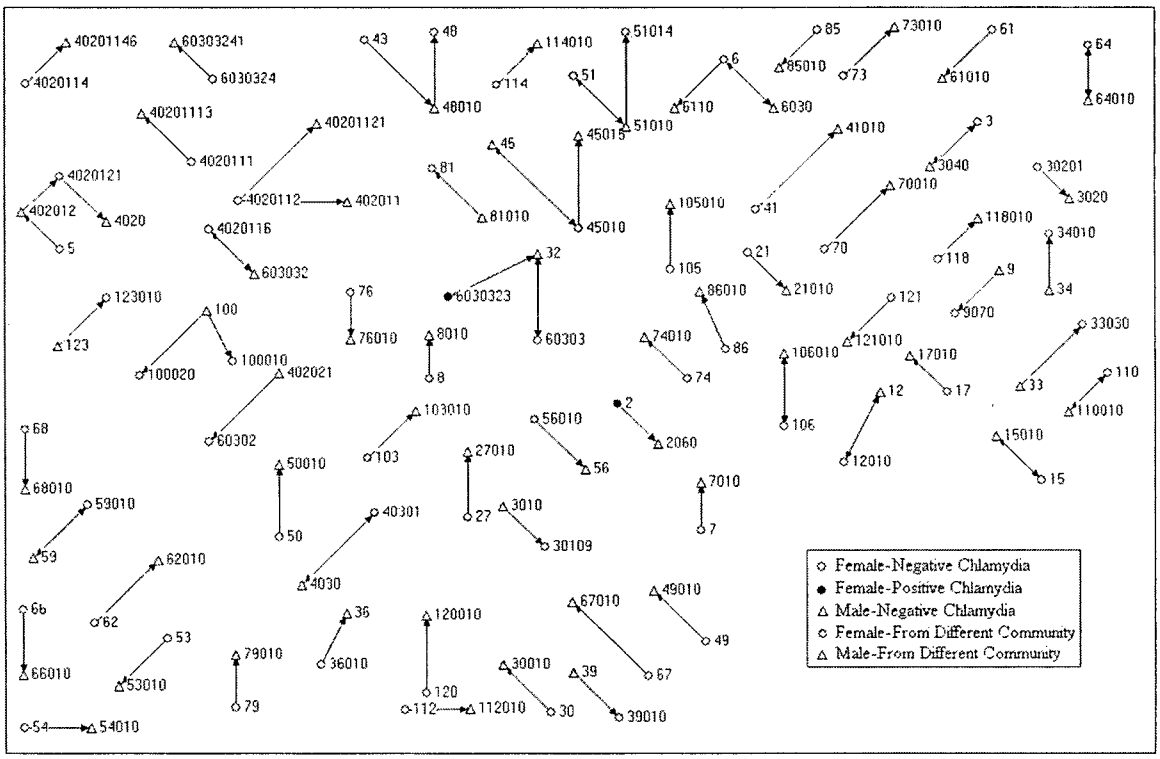


Figure 4.4.3.2-A

Follow-Up Visit 2

4.4.3.3 Follow-Up Visit 3

During the third follow-up visit, four individuals had a positive chlamydia test. None of these individuals had a positive STI during the baseline visit.

- **Degree:** The mean degree centrality was 1.12 (SD: 0.44). The maximum degree was 4 while the minimum was 1. This indicates that on "average" each participant had about one sexual contact
- **Reciprocity:** The reciprocity for the first visit was 0.21. This indicates that for every reciprocal relationship there were approximately 5 relationships that were not
- **Bridging:** There were 4 participants who had sexual contacts from outside the community

A summary of the follow-up visit can be found in Table 4.4.3.3-A, and the sociogram of the sexual network in. Figure 4.4.3.3-A.

Table 4.4.3.3-A

Summary of Sexual and Social Network for Follow-up Visit 3

	Participants Non-Part ( )	Infected	All Sexual Contacts Named	All Social Contacts Named	Mean Sexual Contacts	Mean Social Contacts
Non-infected	92	0	74	486	0.80	5.28
Index	1	1	3	4	3.0	4
1st generation	3	2	6	17	2.0	5.67
2nd generation	3(2)	1	8	14	1.6	4.67
3rd generation	(3)	0	1	0	0.33	NA
4th generation	(1)	0	1	0	1.0	NA
Total	99	**4**	93	521	1.46	4.9

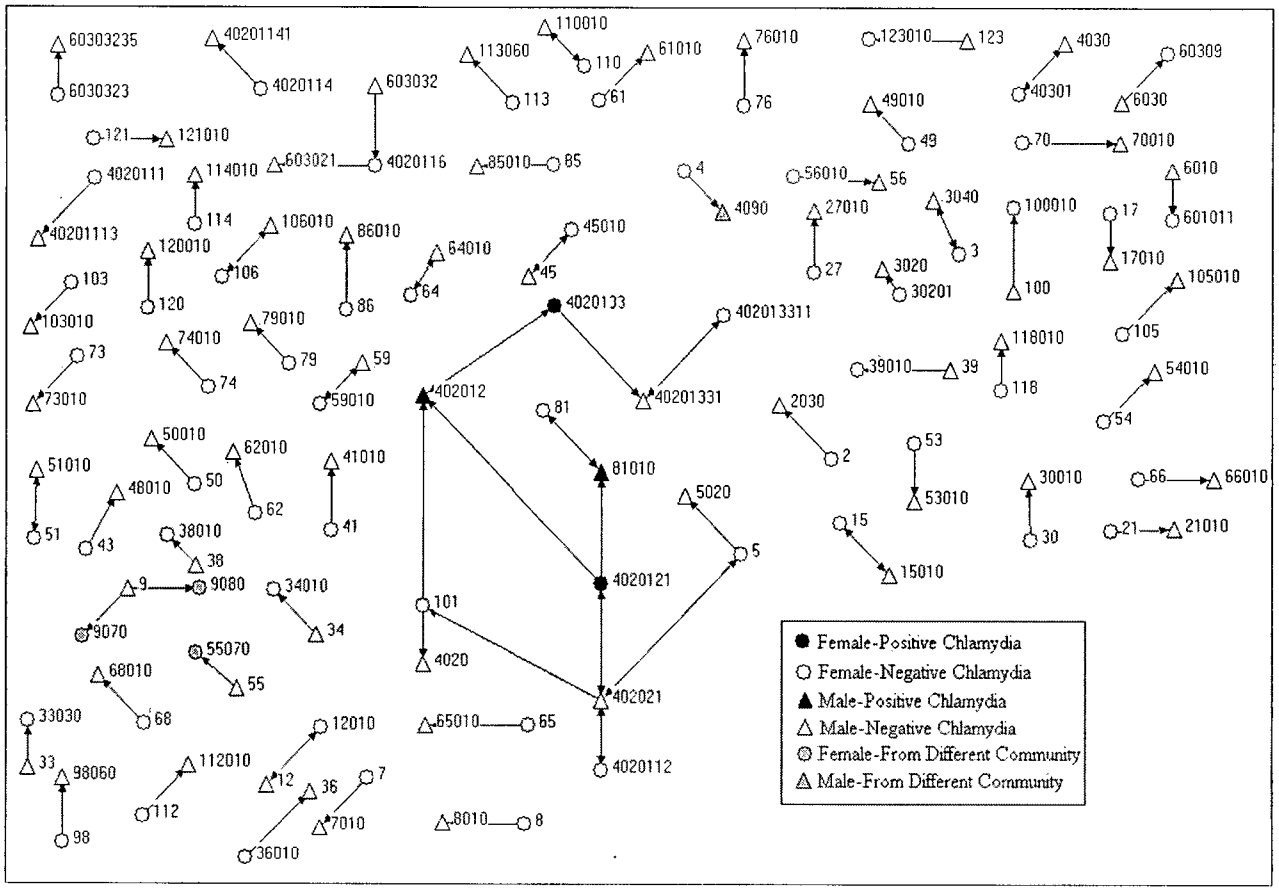


Figure 4.4.3.3-A

Follow-Up Visit 3

4.4.3.4 Follow-Up Visit 4

During the fourth and final follow-up visit, four individuals had a positive chlamydia test. One of these individuals also had a positive STI during the baseline visit.

- **Degree:** The mean degree centrality was 1.06 (SD: 0.33). The maximum degree was 4 while the minimum was 1. This states that on "average" each participant had about one sexual contact
- **Reciprocity:** The reciprocity for the first visit was 0.2. This indicates that for every reciprocal relationship there were approximately 5 relationships that were not
- **Bridging:** There was only one participant that had sexual contact from outside the community

A summary of visit 4 can be found in Table 4.4.3.4-A, and the sociogram in Figure 4.4.3.4-A

Table 4.4.3.4-A

Summary of Sexual and Social Network for Follow-up Visit 4

	Participants Non-Part ( )	**Infected**	**All Sexual Contacts Named**	**All Social Contacts Named**	**Mean Sexual Contacts**	**Mean Social Contacts**
Non-infected	94	0	65	482	0.69	5.13
Index	3	3	3	13	1.0	4.33
1st generation	1	0	3	7	3.0	7.0
2nd generation	1(1)	(1)	1	5	1.0	5.0
Total	99	**4**	72	507	1.42	5.34

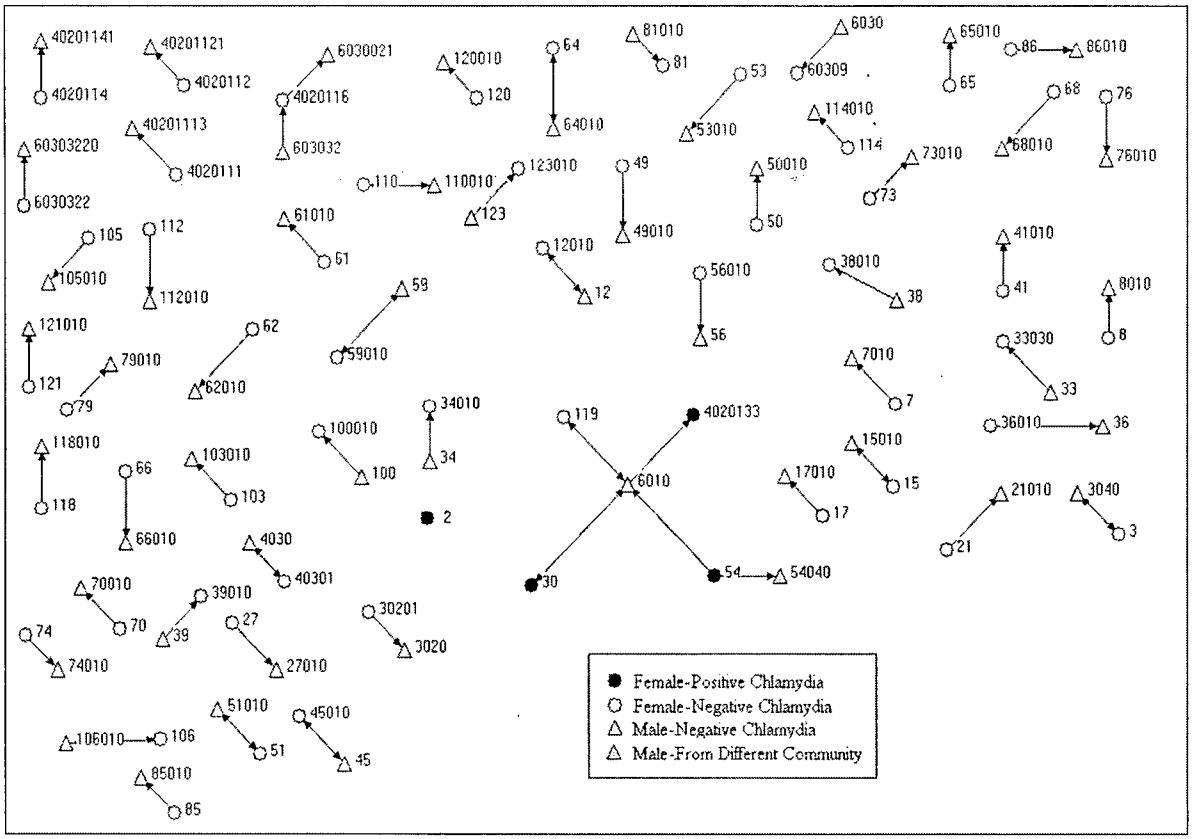


Figure 4.4.3.4-A

Follow-Up Visit 4

Table 4.4.3.4-B

Summary of Network Characteristics for Follow-Up Visits

	Visit 1	Visit 2	Visit 3	Visit 4
Degree	1.17	1.08	1.12	1.06
Reciprocity	0.13	0.2	0.21	0.2
Bridging	13	9	4	1

CHAPTER V

CHAPTER 5 Discussion

In chapter 5 we revisit the objectives of the study, discuss and compare the major research findings with existing literature, and provide an overview of the Anderson model of disease transmission and the conceptual model (i.e. Theory of Reasoned Action & Planned Behaviour). A discussion of the longitudinal data and underlying sexual networks for both the baseline and follow-up visits will conclude the chapter.

5.1 Overview of Study Objectives

The primary objective of this study was to determine a more accurate prevalence of sexually acquired, chlamydia and gonorrhea infections among remote Inuit populations and to evaluate the effectiveness of a universal screening program among these populations. An Inuit community from the Baffin region was selected as the Test Community. The Test Community was representative of other Inuit communities in the Nunavut region (i.e. Baffin, Kivalliq and Kitikmeot) with regard to isolation, demographics, access to health care services and STI prevalence.

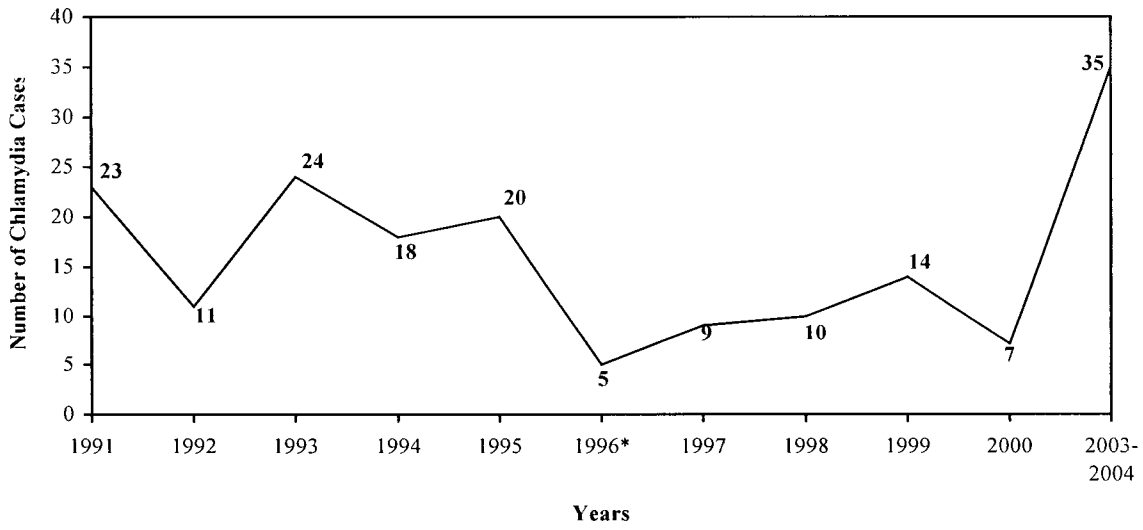
The second objective of the study was to examine key determinants, behaviours and risk factors associated with STI transmission among the study population. This involved collecting data on demographics, use of health care services, STI/contraceptive knowledge, high risk behaviours and beliefs that may influence the engagement of high-risk sexual activities. The behaviours and normative beliefs (i.e. regarding condom use and STI risk) that were used for this study were incorporated from the Theory of Reasoned Action (Fishbein 1980; Fishbein, Wolitski, and Doll 1999) and the Theory of Planned Behaviour (Ajzen 1991).

The third and final objective of this study was to determine whether the baseline-screening program decreased rates of STIs during the four follow-up visits and to develop a better understanding of the underlying sexual networks and "bridging" that occurred among the study participants.

5.2 Objective One (Chlamydia and Gonorrhea Prevalence)

Thirty-five cases of sexually acquired chlamydia infections were detected during the study period (August 1st, 2003- June 30th, 2004). From these 35 cases, 21 infections were detected during the baseline visit (August 1st – September 30th, 2003) and 14 infections were detected during the 4 follow-up visits combined (October 1st, 2003 – June 30th, 2004). The 35 cases of chlamydia gave the Test Community an overall prevalence of 15.6% in comparison to the 2.7 % that was computed for 2000. This is an 83% relative difference in prevalence. As illustrated in Graph 5.2-A, the number of cases detected during the study period (2003-2004) was considerably higher than the cases detected in the previous years (1991-2000). For instance, in the year 2000 only 7 cases of chlamydia were detected in the Test Community through the usual screening and surveillance programs (Saxton 2003).

Since undercounting is a known limitation of passive surveillance (Laporte et al. 1996) (discussed in Chapter II; section 3) it is conceivable that over the past years there has been an undercount of chlamydia cases in the Test Community. This finding supports our hypothesis that selective screening and passive surveillance has underestimated the true prevalence of chlamydia.

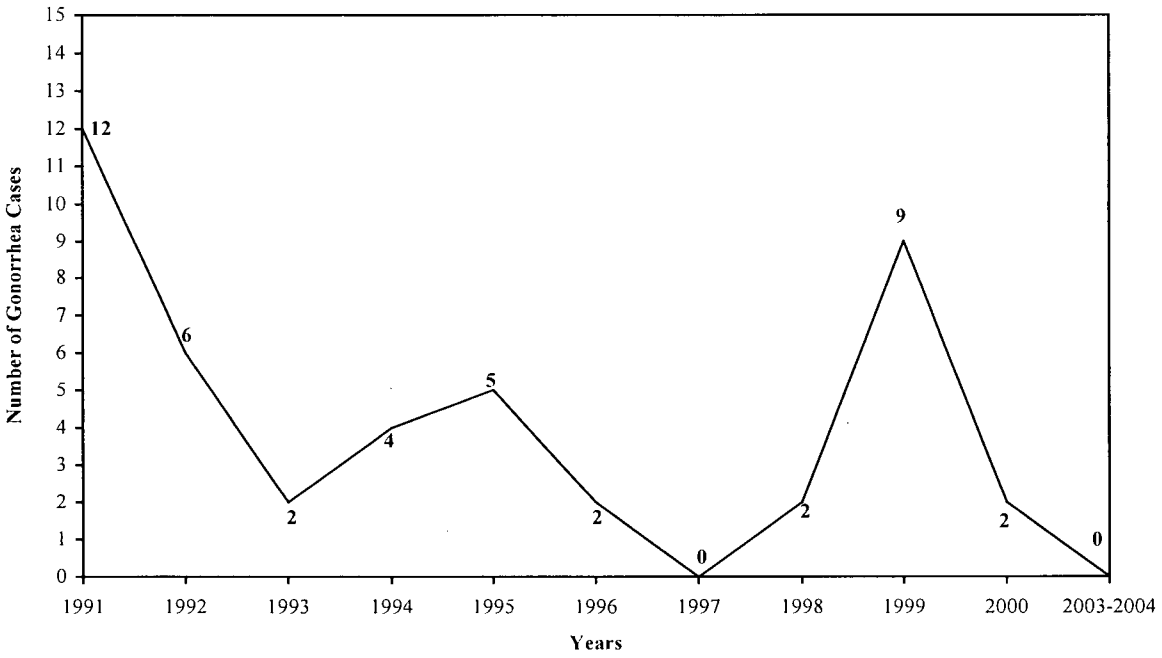


Graph 5.2-A

Chlamydia Cases Among 15-65 year olds in Test Community (1991-2000)

* Urine PCR for chlamydia and gonorrhea screening was introduced in the Baffin region Source: (Osborne 2003)

With regard to gonorrhea (Graph 5.2-B), no cases were detected during the study period. This finding was consistent with the results of a recent study that was conducted by Baffin Regional Hospital laboratory personnel (Saxton 2003). In this study, the investigators found that gonorrhea prevalence dropped to 1.0% in the Baffin region and to 1.7% in the Kivalliq region.



Graph 5.2-B

Gonorrhea Cases Among 15-65 year olds in Test Community (1991- 2000)

Source: (Osborne 2003)

Passive surveillance and selective screening are commonly used to monitor and detect chlamydia and gonorrhea cases among the general population. In the Baffin Region, for instance, Nunavut Health and Social Services also relies on passive surveillance (e.g. community health nurses, physicians, laboratories) for the reporting of communicable diseases.

Since the majority of individuals infected with chlamydia and gonorrhea are asymptomatic, routine screening of all susceptible individuals in high disease prevalent areas is necessary for the detection of cases and for the treatment of infected individuals and their partners (Eng and Butler 1997). It is well documented that universal screening programs have led to the treatment of large numbers of asymptomatic individuals which, in turn, dramatically decreased the prevalence of chlamydia infections (Kretzschmar et al. 2001).

In a meta-analysis conducted by Sloan et al., (Sloan et al. 2000), the investigators reviewed 32 studies that looked at various selective screening algorithms to detect chlamydia and gonorrhea among women in different settings (e.g. urban, rural, STI clinics). The various criteria for screening included both individual risk factors and signs and symptoms (Table 5.2.A).

Table 5.2-A

Criteria For Selective Screening of Chlamydia and Gonorrhea Among Women.

Source: (Sloan et al. 2000)

Individual Risk Behaviours	**Signs and Symptoms**
Young age	Vaginal discharge/itch
Not married	Yellow-green vaginal discharge
One partner in a specified period	Clumpy, thick or frothy vaginal discharge
Partner is symptomatic	Abdominal/lower abdominal pain
No condom use	Mucous
Oral contraceptive use	Cervical friability
IUD use	Cervical ectopy

The studies that were reviewed included four categories of algorithms: (1) simple tools using signs and symptoms (individually or in combination); (2) tools using speculum exams (i.e. to assess signs like cervical friability and vaginal discharge); (3) tools that used a combination of individual risk factors and signs and symptoms; (4) risk scores based on individual risk factors and signs and symptoms.

The results of the meta-analysis found little differences in the usefulness of simple screening criteria and algorithms or risk scores in the detection of chlamydia and/or gonorrhea among women. These strategies consistently identified women incorrectly rather than correctly, and many had test efficiencies that were roughly equivalent to, or worse than chance (Sloan et al. 2000). Other authors also found that the universal screening approach was more effective in detecting chlamydia infections than using diagnostic criteria (Marrazzo et al. 1997; Mosure et al. 1997; Paavonen et al. 1998; Quinlivan, Petersen, and Gurrin 1998; Weinstock et al. 1992). Universal screening of all men and women in areas of high STI prevalence (greater than 10 to 12%), would also be cost effective in terms of treatment and prevention of more serious health consequences (Stamm 1999).

Some authors, however, found that selective screening was more cost-effective in both low and high prevalent populations. Some of the screening criteria suggested included: women on oral contraceptives (Guerreiro et al. 1996) and age-based screening (Howell et al. 1998; Miller et al. 2000).

5.2.1 Screening Program Evaluation

In Nunavut, a selective screening method is currently used to detect chlamydia and gonorrhea. The screening selection is focused on specified criteria as follows:

1. Well women's clinic: yearly check-ups for women which includes a PAP smear, physical examination, family planning and chlamydia and gonorrhea screening;
2. Initial pre-natal check: visit is usually done at the completion of the first trimester. Patients are given a PAP smear, physical examination, pre-natal blood tests (including syphilis and HIV) and chlamydia and gonorrhea screening;
3. Symptomatic individuals: all individuals who present with symptoms that may be indicative of a chlamydia or gonorrhea infections. These may include: vaginal or urethral discharge, dysuria and lower abdominal pain among others for women and urethral discharge and dysuria for men;
4. Contact tracing: sexual contacts of laboratory confirmed chlamydia and gonorrhea patients (Osborne 2003).

A universal type-screening program was used during the cross-sectional study. Universal screening programs, typically, do not have any pre-set criteria (e.g. age, symptoms, gender, etc) but rather are designed to screen all individuals who are sexually active and generally asymptomatic. This method captures not only the so-called "high-risk" category (i.e. females, under the age of 25) but also the "low-risk" individuals who would otherwise not be captured (i.e. men). This method is especially relevant in populations with high disease prevalence (i.e. greater than 10%), and in closed populations were the risks of having an infected partner are high (Anonymous 2003; Eng and Butler 1997; Kraut-Becher et al. 2004). To evaluate the study screening program (i.e. universal) the screening program criteria developed by Cadman et al., (Cadman et al. 1984) were used.

5.2.1.1 Evaluating the Baseline Screening Program Using Cadman's Criteria

In this section, we used Cadman's criteria to evaluate the universal screening program that was implemented during the baseline visit. The seven criteria, responses and study strengths and limitations are listed below.

1. Has the program effectively detected the disease burden?

A major strength of the study was that the screening program captured a more accurate prevalence of chlamydia than the conventional method. Determining a more accurate disease prevalence could help identify the extent of disease burden in the community which, in turn, would facilitate more efficient treatment and prevention strategies (Stamm 1999).

Capturing an accurate prevalence of an infection can also play an important role in determining the cost-effectiveness of a screening program. Although selective screening is less costly than universal screening, it is also less effective; the cost savings vs. the consequences of missing infections need to be weighed carefully, especially in high prevalent settings (Kretzschmar et al. 2001; Sellors et al. 1992; Sloan et al. 2000).

In a study by Kraut-Becher (Kraut-Becher et al. 2004), the investigators found that universal screening for STIs on intake in jails was the most cost effective strategy to decrease morbidity in inmates and to reduce transmission risk in communities, after release.

With regard to gonorrhea, since no cases were detected during the study, we can assume that the overall prevalence in the Test Community was very low. As a result, the positive predictive value and sensitivity of the screening program to detect gonorrhea cases was much lower than that for chlamydia. Despite the low prevalence of gonorrhea, it is still recommended to simultaneously test for chlamydia and gonorrhea (Stamm 1999) since both tests can be done on a single urine sample.

2. Are efficacious treatments available for infected individuals?

There are several very safe, effective and inexpensive treatments for chlamydia. Antibiotics may include doxycycline, azithromycin, ofloxacin, or erythromycin. Up to 95 percent of people with chlamydia are effectively cured with one course of antibiotics (Sparling 1999).

Unlike gonorrhea, there has been no emergence of antimicrobial resistance to treating chlamydia. In Nunavut, azithromycin is currently considered the drug of choice for treating chlamydial infection. This drug has prolonged bioavailability and as such, permits single-dose administration. Single-dose therapy with azithromycin has been shown to be as effective as a weeklong course of doxycycline in treating chlamydial infection (Lea and Lamb 1997). Moreover, a single-dose therapy results in much better compliance, especially among certain populations (Schachter 1999; Stamm 1999). The drawbacks with using azithromycin include: adverse reactions like stomach irritation and vomiting and higher cost (Stamm 1999).

With regard to gonorrhea, several antibiotics can successfully cure gonorrhea. However, drug-resistant strains of gonorrhea are increasing in many areas of the world, and treatment of gonorrhea is becoming more difficult (Sparling 1999). In Nunavut, gonorrhea cases are typically treated with a single dose of Cefixime. Since many people with gonorrhea are also infected with chlamydia, antibiotics for both infections (i.e. azithromycin and cefexime) are usually given together.

3. Does the current burden of disease warrant treatment?

Chlamydia is one of the most prevalent STIs in the Nunavut region and as such, warrants immediate treatment. Without treatment, some women will develop pelvic inflammatory disease (PID), ectopic pregnancy and infertility among others. Chlamydia is also a frequent cause of prostate infections and, is the most common cause of sterility in men.

Gonorrhea is a bacterial infection that often co-exists with chlamydia. These bacteria can also cause PID, ectopic pregnancy and infertility in women and prostate infections in men. Since gonorrhea in the Nunavut region is not as prevalent as chlamydia, it is recommended to treat only individuals who have a confirmed positive result or are symptomatic. By contrast, with suspect chlamydia cases, all individuals should be treated immediately (i.e. before receiving laboratory confirmation) to avoid any delays.

4. Is there a good screening test?

Nucleic acid amplification tests (NAAT), offer an efficient and non-invasive means of screening and diagnosing genital chlamydia and gonorrhea infections. This screening test offers the ease of urine collection in both men and women, with the added benefit of sensitivities and specificities equal to those obtained from urethral or endocervical samples. NAATs also make it possible to screen large groups of people in settings may be problematic (Anonymous 2003; Orr and Brown 1996).

One disadvantage of these NAATs is the inability to determine antibiotic sensitivities. Another is occasional false-positive results from dead organisms, which can occur if test of cures are performed too soon after treatment (less than 3 weeks) (Anonymous 2003; Orr and Brown 1996).

5. Does the program reach the appropriate individuals?

The screening program that is proposed would not only target the "high-risk" individuals (e.g. women, adolescents) but would also screen individuals who would otherwise be missed or excluded (e.g. men). When the target population has a combined prevalence of greater than 10% it is recommended to screen all sexually active individuals regardless of whether or not they fall into the high-risk category. This is especially important in closed, isolated communities like those in Nunavut. In these communities, all sexually active individuals who are not in monogamous relationships should be considered high-risk.

6. Can the health care system cope with the screening program?

Since Nunavut Health and Social Services already uses NAATs to screen genital chlamydia and gonorrhea infections, the proposed screening program would not be difficult to implement. Urine screening tests are easy to collect, non-invasive and much easier tolerated by asymptomatic

individuals. Community health nurses currently collect specimens and provide treatment as per Nunavut Health and Social Services Protocol.

The main limitations of maintaining a universal screening program in the Nunavut region include timeliness of specimen results and subsequent treatment of infected individuals. Timeliness looks at the overall cycle of information flow - from sample collection to analysis and dissemination of results to the health centers. In most cases, the turn around period can vary greatly. Since samples need to be flown to the laboratory in Iqaluit for analysis, some samples may sit for long periods of time in the health centre freezer. This was a major limitation of the study, especially, since it can potentially delay treatment and contact tracing. Another limitation is the logistical support available for transport of specimens. Transportation of specimens is a major limitation of screening programs in communities that rely on air transport. As such it is imperative that a better and more efficient system be developed that can handle the logistical challenges that are often common in the north. For example, establishing a set protocol for dealing with specimens that are delayed in airports would be helpful.

7. Will those who tested positive comply with subsequent advice and interventions?

The investigators are confident that infected individuals will be compliant with the treatment regime. Since azithromycin and cefixime (i.e. single dose antibiotic treatments) are used for the treatment of chlamydia and gonorrhea, patient compliance is high. The efficacy of using single dose azithromycin for chlamydia infection (Schachter, Stoner, and Moncada 1983; Skerk et al. 2004; Stamm 1999; Tobin, Harindra, and Mani 2004) and cefixime for gonorrhea infections (Ison et al. 2004) has been well documented.

With regard to behaviour modifications (i.e. high-risk sexual behaviours), it is believed that with more effective education on chlamydia, gonorrhea and associated health consequences and, with the provision of more appropriate disease prevention strategies, some Inuit people may feel empowered to make healthy lifestyle choices.

5.2.2 Summary

For objective one, we used a universal type-screening program to capture chlamydia and gonorrhea cases from men and women ages 15 – 65. The main purpose of this screening method was to detect infections from otherwise asymptomatic people and as such, determine a more accurate prevalence of infection. The only criterion that was used was age and in hindsight,

participants under the age of 15 could also have been screened, since many Inuit adolescents are sexually active (Steenbeek 2004).

Thirty-five cases of genital chlamydia were detected during the study period, giving the Test Community an overall prevalence of 15.6%, compared to the 2.7% that was calculated for 2000. This finding supports our hypothesis that the current screening program used in the Baffin region has severely undercounted the prevalence of chlamydia. Although our findings were restricted to the Test Community, we believe that similar findings would have been seen in other communities within the Baffin region, should a comparable program been implemented. With regard to gonorrhea, no cases were detected. Although this finding does not support our hypothesis it can be accounted for by the general decrease in prevalence in the Baffin region.

Nunavut Health and Social Services currently uses a selective screening program that focuses on women. Although it is well documented that women are affected disproportionately with STIs in contrast to men (Bolan, Ehrhardt, and Wasserheit 1999; Centre of Disease Control 2001; Eng and Butler 1997; Gunn, Fitzgerald, and Aral 2000; Handsfield et al. 1986), men are often the source of primary infection. To decrease the prevalence of chlamydia, it is therefore important to include men in any screening initiative.

The results of this study can be generalized to similar Inuit communities (i.e. Nunavut, North West Territories, Keewatin Region) in Canada. They would, however, have limited applicability to other aboriginal populations and ethnic communities (i.e. First Nations, Métis). Although many aboriginal communities have similar health related problems Inuit populations are very unique in terms of isolation, culture and access to health care services, among others. Inuit people need health care initiatives that account for this diversity.

5.3 Objective Two (Determinants of STI Transmission)

This section contains a discussion on the key finding pertaining to demographics, use of health care services, STI/contraceptive knowledge, risk behaviours and beliefs associated with condom use and STIs. A summary of the application of the Anderson model and conceptual model will conclude this section.

5.3.1 Demographics

During the baseline visit, 181 people from the target population were screened and interviewed. For the follow-up visits, 99 participants were followed to completion. Only one participant from

the original 100 was lost to follow-up as a result of suicide. The overall mean age for all participants was 29.6 years for the baseline group and 27.8 years for the longitudinal cohort.

Although the study had an overall response rate of 81%, more participants could potentially have been enrolled if the baseline visit was conducted during the fall or winter months. A portion of the "eligible" population was not present in the community (i.e. living in outpost camps, working on fishing vessels and engaged in eco-tourism) during the baseline study period. Small sample size was a limitation of the study and contributed to the limited number of statistically significant variables in both the univariate and multivariate analysis and to the generalizability of these results (i.e. external validity).

There were substantially more female participants than males. The higher female ratio for both the baseline and follow-up visits was not anticipated. Despite the numerous attempts to advertise the study through the local radio, posters and word of mouth, the majority of recruitment occurred through the health centre, accounting for the larger female ratio. Since females used the health centre more frequently than males during the course of the study, they were recruited more easily.

Female participants had an odds ratio of 2.45 compared to males for contracting an STI, which in this case was chlamydia. This result supported our hypothesis that females will have higher STI prevalence than males. This finding was consistently found in the literature (Anderson 1999; Aral 2002; Bolan, Ehrhardt, and Wasserheit 1999; Eng and Butler 1997; Guerreiro et al. 1996; Hillis et al. 1994).

The mean age of participants with an STI was 22.1 years in comparison to 30.6 years for participants without an STI. The difference between the two age groups was highly significant ($p = 0.001$). Age was also significantly correlated with the study outcome, number of STI tests ever, age of first sex and the actual risk behaviour score.

In the multivariate analysis, age was highly associated with the study outcome ($p = 0.01$). It appeared that as age increased the odds ratio of contracting an STI decreased creating a protective effect against STIs. This finding was consistent with our hypothesis that younger age was a strong predictor for the study outcome. Similar findings have been noted in the literature (Weijer, Goldsand, and Emanuel 1999; Welte et al. 2000).

5.3.2 Use of Health Services

Female participants used health services more frequently than males and reported more previous STI screening. The mean number of previous STI screening tests for females was 10 in comparison to 3.7 tests for males. This findings further supports our hypothesis that women were more frequently screened for STIs than males.

Although, number of previous STI tests was not significant univariately ($p = 0.11$) and multivariately ($p = 0.30$), individuals who had a greater number of previous tests had a lower odds ratio for the study outcome (OR = 0.95) over those that had fewer tests. This suggests that, as the number of previous STI tests increases, the odds ratio for contracting the study outcome decreases. In other words, individuals who had more previous testing were screened more regularly and, as such, were less likely to develop a STI.

For the "use of health services score", 51% of the participants scored a "moderate" use of health services score. Female participants did score higher than males in the use of health services score and the differences were borderline significant ($p = 0.05$). Furthermore, individuals who had low scores did have an OR of 1.11 for the study outcome in comparison to individuals who had higher scores. This further supports the argument that individuals who have demonstrated limited use of health care services may be at greater risk for STIs. One explanation for this is that these individuals would have less access to condoms, less access to health teaching and less access to screening. A similar finding was found in a study by Wong et al (Wong et al. 2005).

5.3.3 STI/Contraceptive Knowledge

Seventy-three percent of participants had never heard of chlamydia, gonorrhea, herpes and syphilis prior to the study. Many of the participants had, however, heard of the term STI (or STD). A large portion of the participants believed that "STI" was the actual name of the disease; many were unaware that STI was simply an acronym for sexually transmitted infections.

This confusion may be attributed to hearing the term "STI" or "STD" from their health care providers when having an infection rather, than being told the actual name of the disease (e.g. having a diagnosis of chlamydia).

Similar confusion was apparent for HIV. Despite the fact that 74% of participants reported hearing of the term HIV/AIDS, many of these same participants were unable to explain how HIV was contracted and/or transmitted. Similarly, many of these participants were unaware that HIV was also an STI, believing that they were two separate diseases, of which, HIV was the worst.

Perhaps, the fear about HIV stems from a lack of knowledge and familiarity with the disease. It is not uncommon for aboriginals (i.e. First Nations and Inuit) infected with HIV to be stigmatized and ostracized by their communities and families (Steenbeek 2004). Similar observations have been noted among other culturally distinct populations (Campbell et al. 2005; Chen et al. 2005; Duffy 2005).

With regard to contraceptive knowledge, many of the participants were only knowledgeable about the male condom and the birth control pill (BCP). Minimal knowledge was reported on other forms of contraceptives (i.e. female condom, diaphragm, spermicidal foam and abstinence). This lack of knowledge may be due to the fact that these other contraceptives are not readily available in the community and so, there is very little familiarity with these products. There was also some confusion about the BCP. Thirty-two percent of the participants believed that the pill was effective in preventing STIs. The majority of these participants were female.

For both the STI and contraceptive knowledge score, the majority of participants scored moderately (i.e. they had an average level of knowledge). For the STI knowledge score, participants who scored low also had a lower mean age ($M = 27$ years) than those who scored higher ($M = 31$). For contraceptive knowledge, however, there was no significant difference between age and score values. There was, however, a significant difference between male and female scores ($p < 0.05$).

There was no strong association between both STI and contraceptive knowledge and study outcome. STI knowledge was not a strong indicator for STI acquisition. Sekirime, (Sekirime et al. 2001) investigated the association between STI knowledge and STI risk behaviour among university students in Kampala. The investigators found no correlation between STI knowledge and high risk sexual behaviours. Other investigators however, (Larsen et al. 2004; Minichiello, Marino, and Browne 2001) did find a positive correlation between high levels of STI knowledge and health seeking behaviours.

For the contraceptive knowledge score, individuals who scored higher had a higher odds ratio of developing the study outcome (OR = 1.04) over those who had lower score values. There are two possible explanations for the effect of contraceptive knowledge on the study outcome. First, it may indicate that our measure of contraceptive knowledge was inadequate in some way. A second possible explanation for the observed relationship is gender related. We did see a significant difference between male and female scores whereby, female participants had higher scores. We also know that females had more study outcomes than males and, as such, could account for this observation (i.e. higher scores = higher OR). In other research that used TRA and TPB, they found that contraceptive knowledge was not a significant predictor of condom use, and so was often excluded in the multivariate analysis (Sutton, McVey, and Glanz 1999).

5.3.4 High-Risk Sexual Behaviours (Baseline)

More than half of the participants reported a previous STI, with the majority of infections being chlamydia. Female participants had more previous infections than males and this difference was highly significant ($p = 0.006$). It is important to note that although females had more previous STIs they also were screened more frequently than males. Despite the protective effect of screening that was seen earlier (i.e. individuals who were not screened more had an even higher odds of contracting an STI than those who were screened) females still had more STIs. One possible explanation is that these women are being re-infected by the less screened males. Another explanation is that since women are screened more frequently we identify more STIs.

Although having a previous STI was not significant in univariate ($p = 0.09$) or multivariate ($p = 0.11$) analysis, the odds ratio of developing the study outcome for individuals with a history of STIs was 1.47 higher than in individuals with no history. Having a previous history of an STI is a well known risk factor for both chlamydia and gonorrhea acquisition (Miller et al. 2001; Vall and Escriba 2003).

The mean age of first sex for all participants (i.e. males and females) was 15 years. This supports our hypothesis that age of first sex was similar for both male and female participants ($p = 0.27$). Age of first sex was not significant univariately ($p = 0.07$), multivariately ($p = 0.07$) and was not a strong predictor of the study outcome. One possible explanation can be that early age of first sex (i.e. 15 years or less) was reported by most of the participants. Since this is was a main characteristic of the study group (as discussed in Chapter II; section 2), its overall effect as a risk factor may have been diluted. Although "age of first sex" has often been documented as a risk factor for STI acquisition(Anderson 1999; Anonymous 2003; Eng and Butler 1997), other research has found similar results as those in this study (Edgardh 2000).

For the other risk behaviours, there were no significant differences between males and females and these include: no contraceptive use during first intercourse, number of life-time partners, number of partners in the last 3 months and last STI result pre-study. The lack of significant variables may likely be due in part to the small sample size of the study.

The variable "last STI test result pre-study" was, however, a strong predictor for the study outcome. Furthermore, individuals with a positive STI in the last screening had an odds ratio of 8 of developing a subsequent STI than those participants that tested negative. It appears that the more frequently a person acquired a STI, the more likely they will continue to do so in the future. This study may also suggest that much of the risk of subsequent GC/CT infections stems from having sex with partners who also have a high likelihood of having GC/CT.

A similar finding was noted in a study by Gunn et al., (Gunn, Fitzgerald, and Aral 2000). The investigators looked at clients attending an STI clinic and found that the strongest predictor for subsequent STIs was a recent history of having either a chlamydia or gonorrhea infection. These individuals had a relative risk of 5.6.

For the perceived risk behaviour score, 40% of the participants reported having no risk or a minimal risk of contracting either HIV or a non-HIV STI (e.g. chlamydia). Perceived risk was not a strong predictor of the study outcome though individuals with higher scores did have higher odds of contracting a STI than individuals who had lower scores. In a study Sutton et al., (Sutton, McVey, and Glanz 1999), it was found that perceived risk of contracting an STI had a significant effect on condom use (i.e. condom self-efficacy).

There were no significant differences in the perceived risk behaviour scores between males and females, though there were differences between the age groups ($p = 0.001$). For instance, the mean age for a higher score value (i.e. perceiving oneself to be at a moderate- to-high risk) was lower than those who perceived themselves at low risk. In other words, younger aged participants perceived themselves at a higher risk for contracting STIs than older participants. One possible explanation for such a finding is that younger participants perceived themselves at highest risk because they have had previous exposure to STIs and, as such, are familiar with the diseases. As a result of this familiarity, they may not feel threatened by the risk of contracting an STI and continue to engage in behaviours that predispose them to reinfection.

This observation contradicts other research findings. For instance, Mbizvo et al., (Mbizvo et al. 2003) studied knowledge and perceived risk of STIs among a group of urban women in Zimbabwe and found that women aged 15–19 had the least perceived risk of infection.

For the actual risk behaviour score, the mean score for the whole study group was 10.9 (moderate risk). There was no significant difference between male and female scores and between the age groups. The score was not highly correlated with the outcome variable ($p = 0.59$) nor was it significant multivariately ($p = 0.46$).

One reason that may explain why the score had no effect on the study outcome are the "risk behaviours" that were measured. As previously mentioned, the actual risk behaviour score contained five separate variables: contraceptives used during first sex, number of sexual partners ever, number of sexual partners in the last 3 months, alcohol or drugs used during first sex and frequency of condom use. It is possible that these behaviours were similar between all participants (i.e. with and without the study outcome) and as such, had no effect on the study outcome. Another possibility is that the sample size was too small to produce any significant association.

5.3.5 Condom Self-Efficacy

Overall, most of the participants correctly believed that condoms were effective in preventing pregnancy (97%), other non-HIV STIs (89%) and preventing HIV (79%). These responses, however, must be viewed with some scepticism, since many of the participants were uncertain how HIV and other STIs were transmitted and/or acquired. As such, it is difficult to ascertain if they responded to these questions from knowledge or by guessing.

With regard to the other aspects of condom self-efficacy, many of the participants felt that condoms decreased sexual pleasure (91%), suggest an STI to their partner(s) (64%), would offend their partners (58%) and are difficult to plan ahead for (43%). These are common cited barriers to condom use (Bryan, Aiken, and West 1996; Jemmott et al. 1992; Sutton, McVey, and Glanz 1999).

For the condom self-efficacy score, there were no significant differences between males and females. Contrary to these findings, Sutton et al., (Sutton, McVey, and Glanz 1999) found that male participants had higher condom self-efficacy than females and as such, were more likely to have used a condom on the most recent occasion of sex.

For the different age groups, there was a significant difference. It seemed that younger participants had lower scores than older participants. The score was not significant univariately, multivariately and was also not a strong predictor for the study outcome. By contract, a study conducted by Svenson (Svenson et al. 2002), on 493 university students attending a Swedish university, found that consistent condom use was found among students who had high condom self-efficacy.

5.3.6 Normative Beliefs and Motivation to Comply

For normative beliefs and motivations to comply score, male participants scored higher scores than females overall, and the difference was significant ($p = 0.001$). The difference in scores between the different age groups was also significant ($p = 0.01$). Younger participants tended to have lower scores than older participants. This finding may signify that younger participants were less likely to comply with using condoms. (Rotheram-Borus et al. 1991; Zimmerman et al. 1995).

In the logistic regression analysis, individuals who scored the highest had an odds ratio of greater than 10 of contracting an STI than did individuals who scored lower. Such a finding is difficult to interpret. It is either that the score was not a valid measure or individuals who were more compliant with their partners' wishes regarding using/ or not using condoms, were more likely to contract an STI.

5.3.7 Negotiating Condom Use and Perceived Control Score

The three main barriers to condom use included: being embarrassed to buy condoms at the store, making their partners angry by suggesting using condoms, and fear of giving the wrong message

by suggesting the use of a condom. In the study by Sutton et al., (Sutton, McVey, and Glanz 1999), the investigators found that "decreasing sexual pleasure" as the most common reported barrier to condom use.

For the negotiation condom use and perceived control score, the majority of participants (48%) had moderate scores. Male and female participants had similar scores. Similar findings were found by Sutton et al., (Sutton, McVey, and Glanz 1999). The investigators interviewed 949 people (16-24 years) from a national survey conducted in England. They found that men and women did not differ significantly in their attitude toward condom use, perceived control over condom use and condom self-efficacy.

There were also no significant differences between the age groups ($p = 0.67$) in terms of score values. Essentially, there were no differences in the odds ratio between individuals who scored high or low. In the study by Sutton et al., (Sutton, McVey, and Glanz 1999) the researchers found that condom use was seen as a behaviour that was largely under volitional control. They found that the best predictors of condom use, were measures of past behaviours such as: frequency of condom use in the previous 12 months and condom use on the most recent occasion of intercourse.

5.3.8 Summary

For objective two we set out to find the main determinants of STI transmission among Inuit populations. As such, we collected information on demographics, use of health services, STI/contraceptive knowledge, risk behaviours and beliefs associated with condom use and STIs. As shown in Figure 5.3.8-A, these determinants were then applied to the Anderson model of disease transmission. To recap, the Anderson model is designed to demonstrate the factors that influence the reproductive rate ($R_0 = \beta cD$) and the dynamics behind disease transmission in a given population (May and Anderson 1987; Aral 2002).

In Anderson's model, for the formula ($R_0 = \beta cD$), R_0 represents the reproductive rate (i.e., the number of new infections), β is the average probability that an infected individual will infect a susceptible partner, given exposure, c is the average number of new partners exposed by an infected individual per unit of time (i.e. sexual network) and D is a measure of duration of infectiousness of the specific infection.

The main objective of using this model was to illustrate the many facets that influence the reproductive rate ($R_0 = \beta cD$) of STIs among Inuit people. As shown in Figure 5.3.8-A, there are several main determinants that can potentially influence disease (i.e. chlamydia and/or gonorrhea) transmission: for example, an underlying determinant like socio-economics. As discussed in Chapter IV, many of the participants were unemployed, with less than a complete high school education and with an income of less than 10,000/year. Unemployment and low income have been shown to be risk factors for STIs (Aral et al. 2003). Other key determinants that were also discussed in previous chapters include: young age distribution, gender, isolation, cultural diversity, limited access to health care services and inadequate screening initiatives.

One of the more important findings was in relation to gender. Female participants used health services more regularly than males, were screened more frequently for STIs yet, also had a history of more STIs. All these findings supported our hypotheses that were discussed in (Chapter I). The main predictors for the study outcome were: young age, being female and having a recent, positive STI test result before the study.

The other important factors are the proximate determinants such as knowledge. Although knowledge was not a strong predictor of the study outcome, it may influence other factors like health education, avoiding high risk activities and using contraceptives effectively. Other key determinants that were incorporated from the theory of reasoned action and planned behaviour include: high-risk behaviours (i.e. previous STIs), differing perceptions of risk and normative beliefs.

The Theory of Reasoned Action (Ajzen and Fishbein 1977; Ajzen and Fishbein 1980; Fishbein 1980) and the Theory of Planned Behaviour (Ajzen and Madden 1986; Ajzen 1988; Ajzen 1991; Ajzen and Driver 1991) are theories that have been widely used to predict and explain individual behaviours and health related intentions. They have been used as a tool to predict condom use among study participants and have served as the framework for several STI prevention programs (Kamb et al. 1996; Kamb et al. 1998; Sutton, McVey, and Glanz 1999). The Theories of Reasoned Action and Planned Behavior are comprehensive theories that specify psychological variables that can influence a behaviour, namely (a) intention; (b) attitude toward the behavior; (c) subjective norm; (d) perceived behavioural control; and (e) behavioural, normative and control beliefs.

To the best of our knowledge, this framework has not been applied among Inuit or similar indigenous populations, prior to this study. As such, its reliance in predicting STI related behaviours among this population has not been well researched. The results of this study can only be compared with similar research (i.e. using the same theoretical model) carried out in other populations, namely Western societies. The fact that the theory was developed by Westerners for Western societies and for the main purpose of evaluating condom use are limitations for this study. To overcome some of these limitations the questionnaire was translated in Inuktitut and piloted on a convenience sample. Some of the terminology was also changed to avoid confusion. Although the theory of reasoned action and planned behaviour has proved to be a valid tool for predicting condom use in Western societies its applicability on predicting STIs among Inuit populations has not been validated with these study findings.

Overall, the two main limitations for Objective Two were small sample size and recall. Working with an Inuit population, it was inevitable that we would have a small sample size. Despite recognizing this limitation at the start of the study we still have to acknowledge that the sample size limited our statistical power and as such, presented us with few results that had high variability (i.e. low precision). To overcome this limitation we created summed scores. Summed scores are an acceptable method of condensing data to increase statistical power. These scores must however be interpreted with caution. Although scores similar to the ones used for this study have been cited in the literature (Pietrobon et al. 2004; Sutton, McVey, and Glanz 1999), these specific scores (i.e. use of health services, STI /contraceptive score, perceived/actual risk behaviour score, condom self-efficacy score and the normative beliefs and motivation to comply score) have only been used with this study group and as such, may not be generalizable to other populations. It would, however, be worthwhile to confirm these results with larger samples.

The second limitation is self-reporting. Self-reporting of sensitive information like STIs is subject to underreporting biases arising from personal concerns about social stigma, failure of recall, and even lack of knowledge that the respondent had a particular STI (i.e. it was clinically asymptomatic or never diagnosed). Considerable effort was expanded in minimizing underreporting by devising an interview protocol that gave a maximum sense of privacy and confidentiality in a health care environment and provided memory aids to facilitate respondent recall. Secondly, certain questions (i.e. number of previous STIs and STI testing) were cross-referenced with chart reviews. Even if these procedures were effective, we must still acknowledge that the self-reports understate the prevalence of STIs to an unknown extent. Also, there may be systematic biases in underreporting related to particular attributes of the respondents.

Despite these limitation, we feel that the data that were collected helped to explain some of the key determinants behind STI transmission in remote Inuit populations.

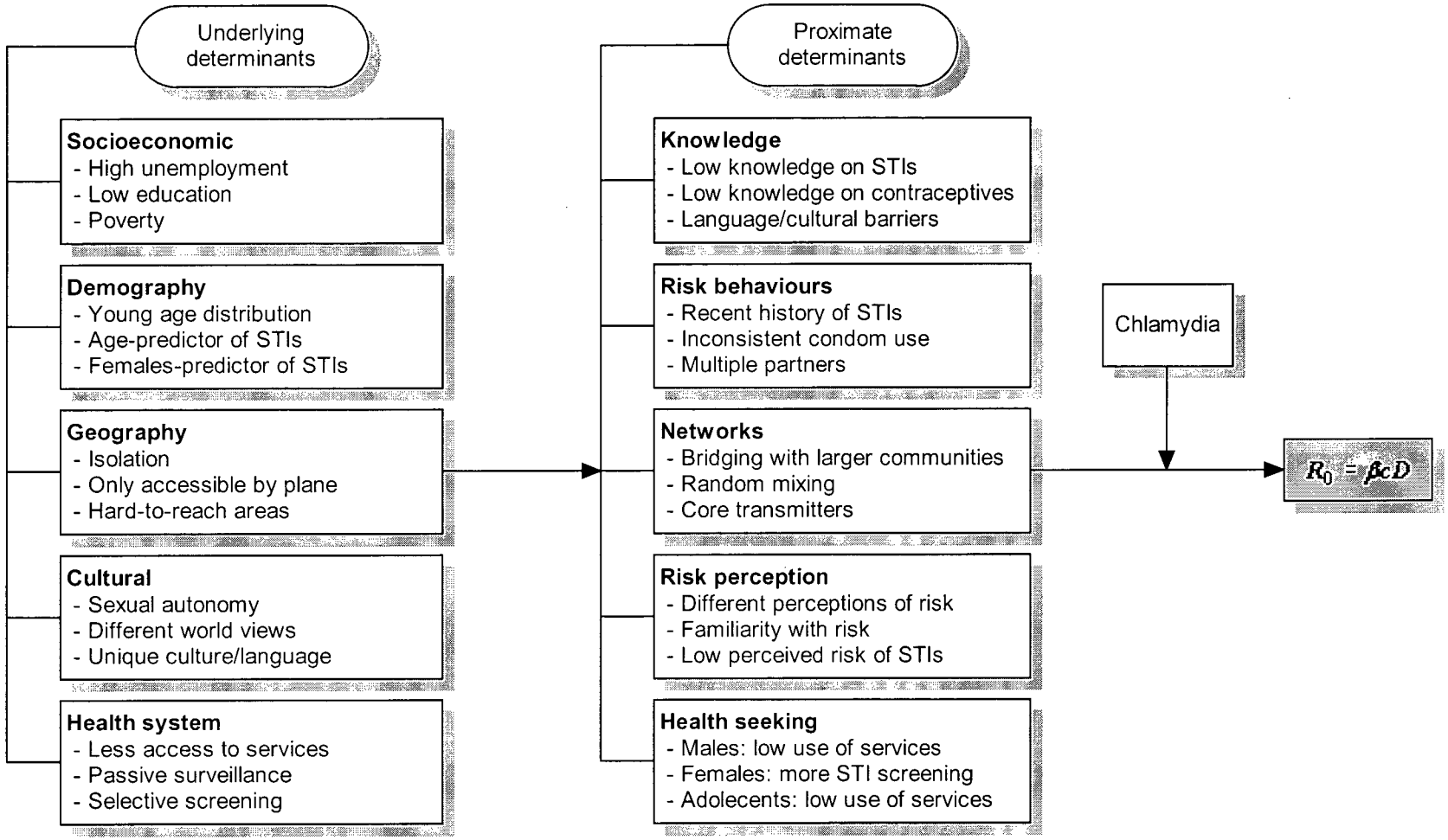


Figure 5.3.8-A

Determinants of STI Transmission Among Inuit Populations

5.4 Objective Three (Longitudinal Data and Sexual Networks)

In this section we will discuss the findings as they pertain to the third objective. This will include information on the longitudinal data, change in chlamydia prevalence (i.e. baseline to follow-up visits) and the underlying sexual networks (baseline and follow-up visits).

5.4.1 Longitudinal Data

As previously mentioned, 100 randomly selected participants were followed every two months post baseline visit for an additional 4 visits. Only one participants was lost to follow-up after the first visit. The remaining 99 participants were followed until study completion. During each visit, the participants were screened for chlamydia and gonorrhea and questioned about their sexual and social networks. Fourteen cases of chlamydia were detected during the combined 4 follow-up visits. No gonorrhea cases were detected.

To analyze the longitudinal data we used the McNemar's test of correlated proportions. McNemar's test is often used with dichotomous dependent variables in a pretest-posttest design. In this case, the test was used to determine if prevalence decreased after the baseline screening. We then calculated the incidence rate from the follow-up visits, calculated a period prevalence for the four follow-up visits and compared it with the baseline prevalence. Ideally, we would have liked to conduct a survival analysis or longitudinal analysis. However, we did not have enough events (STIs) during the 4 visits to warrant these tests. Given the small sample size and relatively few events we were limited with the statistical test options.

The results of the first part of the analysis showed that the prevalence rate changed significantly from baseline to follow-up visits 1, 2 and 4 (Chapter IV). During the first visit (2 months post baseline visit), four individuals that had a positive study outcome during the baseline visit, developed an STI during follow-up visit one. In this case the difference between baseline and visit one was highly significant ($p = 0.008$). During visit two (4 months post baseline visit), two individuals that had a positive STI during the baseline developed an STI during follow-up visit two. The difference between baseline and visit two was also highly significant (0.003).

In the third visit (6 months post baseline visit), four individuals who did not have an STI during the baseline visit developed an STI during follow-up visit three. In this case the difference between baseline and visit three was not significant ($p = 0.05$). One explanation for this finding is that there was no "before and after" effect. In other words, the baseline intervention effect (i.e. treating 21 infected individuals) that we saw during visit one and two had no effect on visit three because these individuals did not belong to the original infected group. A second explanation is that the source of infection originated from another community (bridging) and so was not eradicated during the baseline treatment.

In the fourth and final visit (8 months post baseline visit) one individual, who had a positive STI during the baseline visit, and three with no baseline STI, developed an infection. In this case, the difference between baseline and visit 4 was significant ($p = 0.04$). Overall, the baseline screening and treatment intervention did have a significant effect on three of the four follow-up visits. This supports our hypothesis that baseline screening would decrease the prevalence and incidence of STIs (i.e. chlamydia) in the Test Community.

In the second part of the analyses we wanted to compare the baseline point prevalence with the period prevalence that was calculated for the follow-up visits. For example, 99 people were followed for four visits. We assumed that each participant had equal follow-up of 240 days (30 days x 8 months). This accounts to 23,760 person days of follow-up (240 x 99) , or 65 person years (23760/365). We had 14 cases of chlamydia in 65 years of follow-up which gave us an incidence of 0.22 cases per person per year or 22% per year. Assuming that the average duration of disease (D) is 150 days (0.4 years) (Brunham and Plummer 1990), then the follow-up prevalence was 9% (0.22 x 0.4).

The calculated prevalence for just the baseline visit was 11.6% (21/181), while the prevalence for the follow-up visits was calculated to be 9%. This is a 22% relative decrease in STIs from baseline to follow-up. So, in theory, if the baseline screening program continues, the R_0 (reproductive rate) of the disease would drop to below 1 and subsequently die out (Anderson 1999). Ideally, screening programs, similar to the one used in this study should be used consistently among high prevalent populations (i.e. aboriginal populations) in order to maintain low prevalence rates. Failure to do so may result in a resurgence of high STI prevalence rates (Eng and Butler 1997).

5.4.2 Sexual Networks

In this section we will discuss the sexual networks that were developed for the baseline visit and for each of the follow-up visits.

5.4.2.1 Baseline Sexual Network

All the participants who tested positive during the baseline visit were questioned about their sexual partners through the "snowball" sampling method. For all other participants, (i.e. those that did not test positive), only the names of the first generation partners (i.e. first level partners) were collected.

From all the participants, there were 21 confirmed chlamydia cases of which, 12 were index cases (initial cases), 5 were first generation (i.e. partners of the index cases), 2 were second generation (i.e. partners of first generation contacts) and 2 were fourth generation (i.e. partners of third generation contacts). There were no infected third generation contacts. Seven from the infected baseline group had partners from outside the Test Community (bridgers). All the bridgers came from larger communities (e.g. Iqaluit). Two sexual network sociograms were then developed; one was for the "sexual network" and the other was for the "complete network" (i.e. sexual network and remaining participants).

As illustrated in (Chapter IV), the sexual network contained 72 actors with 5112 possible relationships (density). From the 72 actors, 17 individuals were from outside the Test Community (bridgers). The density of ties (i.e. proportion of all ties potentially present that actually are present) was 0.0188, while the reciprocity (i.e. when both individuals name each other) was 0.29. These results indicate that the network was relatively small with few reciprocal relationships. There were also no transitive ordered triads (i.e. if a male actor named three female contacts, the contacts would not name each other). This finding was expected since all the relationships were heterosexual.

The centrality measures were also calculated for the baseline sexual network. Centrality is a measure of the structural position and attributes of the nodes within the network. The four measures of centrality that were calculated included: degree, closeness, betweenness and power.

The most important measure of centrality is degree, or the number of ties that a given node has. In this case the degree mean was 2.1 (SD. 1.7). When looking at the correlation statistics (Chapter IV), degree was highly correlated with betweenness (i.e. number of times a node needs a given node to reach another node) and power (i.e. an actor's position in the network). Simply, the more ties an actor has (degree) the more power or influence they exert on the network, and the more contact they have (betweenness) with other actors.

When assessing the baseline sexual network it appears that the network was very cohesive and well connected. This may explain why infection may spread so rapidly among network participants. There were also some individuals who may have been core transmitters. To recap, core groups of individuals can sustain reservoirs of infection. These reservoirs push the R_0 in the core above 1, allowing infection to remain endemic in a population. Consequently, among core transmitters, treatment at one time (i.e. baseline) may fail to prevent re-infection at a later time, hence the endemic pool of infection. This may have been responsible for some of the infections that were seen in the follow-up visits. Examples of potential core transmitters include: actors 3 and 9 (Chapter IV). Both these "core transmitters" were females under the age of 25. These individuals also had strong central positions (star shaped design), with several ties to different nodes or actors.

In the baseline complete network (Appendix V), there were 320 nodes of which the majority of participants were in dyad relationships and a few in triads. Twenty-nine individuals had partners from outside the Test community (bridgers). The network was very fragmented with a mean density ties of 1.3 (SD 1.0) and a reciprocity of 0.18.

5.4.2.2 Follow-up Networks

As previously mentioned, 14 cases of chlamydia were registered during the follow-up visits. As noted in Table 5.4.2.2-A, the network components were very similar for all four visits. Similarities were also seen in the four sociograms that were presented in chapter IV.

Table 5.4.2.2-A

Summary of Follow-up Networks

	Visit 1	Visit 2	Visit 3	Visit 4
Degree	1.17	1.08	1.12	1.06
Reciprocity	0.13	0.2	0.21	0.2
Bridging	13	9	4	1

It appears that the sexual networks for the follow-up visits were very fragmented, with the majority of relationships being dyads and the occasional triad. There were marked differences in structure and size from the baseline sexual network. There are two possible explanations for this observation. First, participants may have been more reluctant to name all their sexual contacts during the follow-up visits especially when they did not have a positive STI. Secondly, participants were not naming the same partners that were named during the baseline visit. This again appears that the partner selection was very random and differed with every visit. Monogamous relationships tended to remain consistent throughout but, beyond that, the relationships were very sporadic. Such a pattern may represent participants who were avoiding certain partners especially if these partners had an STI during the baseline or follow-up visits.

5.4.3 Summary

For objective three, we wanted to determine if the baseline screening and treatment intervention changed the prevalence of chlamydia in the follow-up visits and examine the underlying sexual networks.

For the first part of the objective we examined the results of McNemar's test of correlated proportions. The result of the analysis showed that there were significant differences between the baseline visit and visits one, two and four. Visit three was unique as all four positive chlamydia cases were from individuals that did not have a positive study outcome during the baseline visit. In this case, the screening intervention had no effect.

In the second part of the analysis we compared the baseline chlamydia point prevalence with the follow-up period prevalence which was calculated with the P = ID formula. There was a 22% relative decrease in prevalence in just one year of screening intervention. It is important to note that we did not do a point prevalence survey at the end of the intervention, so the baseline prevalence of 11% was compared with a period prevalence of 9%, and thus the actual decrease in prevalence is even greater.

So in theory, if the program were to continue every two months for example, then the disease prevalence would be less than one and would subsequently, be eradicated.

The main limitation for the first part of objective one was that there were few events and as such, statistical analysis was limited. Ideally, with longitudinal data it would have been ideal to calculate a survival analysis or conduct a longitudinal analysis. Considering the data that we had, the McNemar's test was most appropriate.

For the second part of the analysis we collected data through the "snowball" sampling method to generate our networks. Initially, we collected data on both sexual and social networks. The social networks, however, were too fragmented and did not provide any significant information and as such, were not included in the results and discussion. The sexual networks (c) developed were for the baseline visit and the four follow-up visits. In the baseline visit we saw more ties between nodes, cohesion and bridging than during the follow-up visits. For instance, the average **degree centrality** for the participants was slightly over two contacts per participant, which indicates a moderately to highly connected sexual network. The baseline network also had a relatively high **closeness centrality** measure, which indicates that network members were close to each other and easily reachable. With regard to the "bridgers", these individuals may have on occasion, been responsible for bringing in the infections into the community. However, since we were unable to test individuals from outside the Test Community, we were unable to determine if the bridgers were infected at all.

In the baseline visit, the sexual network was quite cohesive with a higher density, more ties and higher centrality measures than what was seen in the follow-up visits. The follow-up visits also had relatively simple sexual networks with a random mixing. This fragmentation may have been due to sampling especially, since many of the participants did not name the same partners consecutively throughout all the visits. This could be due to poor recall, random mixing of partners, or avoiding to mention all their partners.

In some cases, random mixing produces a "S" shaped diffusion curve in the network sociograms. The "S" shaped structure however was not visible in any of the follow-up networks. One explanation for this is that the disease may have been in the community for some time, and so we did not see the "epidemic effect". An other explanation is that the networks were too small to see any distinct patterns.

There are two major limitations and weaknesses of snowball sampling. First, actors who are not connected (i.e. "isolates") are not easily located by this method. The presence and numbers of isolates can be a very important feature of populations for some analytic purposes. Second, there is no guaranteed way of finding all of the connected individuals in the population. For instance, where does one start the snowball rolling? If we start in the wrong place or places, we may miss whole sub-sets of actors who are connected but not attached to our starting points. Snowball approaches can be strengthened by giving some thought to how to select the initial nodes. In many studies, there may be a natural starting point. In this case, the sampling started with any infection that appeared through the screening process.

For example, if person A and person B were sexual partners and were both infected with chlamydia, the index person would be the individual who was screened first. So if person A was screened before person B then they would be the index case. In reality however, person A may not have necessarily been the index case, but simply a first generation partner of person B and so forth. Furthermore, the fact that the study was limited to partners of infected persons limited our ability to draw conclusions about the behaviour of persons who were within the sexual networks but who did not contract the disease.

Another issue that concerns partner data collection is that of partner recall. "Partner recall" refers to the extent to which a participant is able to name all the persons in his/her network accurately. Research has shown that individuals frequently do not name all the eligible partners in their networks thus providing an incomplete network description. Estimates of reliability of partner recall, measured as the percentage of names that recur over time, varies considerably between individuals (Bell, Montoya, and Atkinson 2000). Despite these limitations, we feel that we were able to demonstrate the effect of the baseline screening on the prevalence, and visualize the underlying sexual networks.

CHAPTER VI

CHAPTER 6 Thesis Summary

6.1 Introduction

Although sexually transmitted infections like chlamydia and gonorrhea have a worldwide distribution, they are often insidiously hidden behind the walls of ignorance, poverty, inequality and discrimination.

Research shows that in Canada, STIs are problems among certain communities of the First Nations and Inuit people. For many aboriginal peoples, the STI problem is further compounded by a lack of adequate disease surveillance and screening programs, and by the absence of effective health promotion and disease prevention strategies.

To address the STI problem existing among Canada's Inuit people, the author of this dissertation has set out to accomplish three main objectives: acquire a more accurate account of chlamydia and gonorrhea prevalence in a remote Inuit community in the Baffin region, demonstrate the efficacy of using a universal screening program and treatment intervention in reducing disease prevalence, and identify the main determinants, risk factors and underlying networks that are associated with STIs in this population.

6.2 Research Findings and Implications with STI Prevention

The intent of STI prevention is to reduce the incidence of new STIs. To accomplish this goal, prevention programs need to assist individuals in developing skills, behaviour patterns and practices that help them decrease their risk of contracting and transmitting these diseases.

The first step towards designing an STI prevention program is to assess the prevalence and incidence of a disease among a given population (Eng and Butler 1997). As discussed in the previous chapters, incidence and prevalence are important data that contribute to the determination of a community's health needs and, as such, must be captured carefully. For instance, underestimating the true prevalence of a disease could seriously undermine prevention programs, affect adversely financial and resource allocation and, most importantly, would allow for infection to spread.

The second step in this process involves initiating and maintaining a universal screening approach especially in areas with high disease prevalence (i.e. greater than 10%). Early detection and treatment of individuals with STIs would not only provide secondary prevention at the individual level, but would also assist in the primary prevention, at the population level, by blocking further transmission (Eng and Butler 1997).

The third step would require the identification of the determinants of STI prevalence and incidence. To achieve this, it is important to study the social relationships, characteristics and dynamics of a particular community, examine the underlying sexual networks and identify risk factors that are pertinent to the specific society. Identifying key risk factors is an important element for any STI prevention program.

In summary, to lower the prevalence of disease in a community, there must be a reduction in the reproductive rate of infection (R_0) and to achieve this, certain behaviours need to be changed, while others are facilitated. The results from this study can be used to reduce the reproductive rate of infection among Inuit communities as follows:

1. **Shortening duration of infectivity (D):** this can be accomplished by active surveillance and universal screening for asymptomatic infections; prompt diagnosis and treatment of infected individuals and comprehensive contact tracing of all index cases and partners. In this study, we saw a decrease in prevalence from 11% at baseline to 9% during the follow-up visits combined. This constituted a 22% relative decrease in prevalence in just eight months;

2. **Reducing exposure to STIs (c):** this can be accomplished by finding the key determinants of sexual behaviour; analyzing the underlying sexual networks to identify core transmitters and transmission patterns, and recognize the sexual decision-making behaviours that are inherent within the community. It is also important to promote delayed initiation of sexual intercourse among young adolescents (e.g. through school education, peer educators); encouraging abstinence and monogamy (i.e. letting adolescents know that it is their right to refuse sex) and reduced rates of sex partner change and, avoiding concurrent sexual partnerships. In this study we found that many participants experienced their first sexual encounter at an early age (mean of 15 years); had a higher odds ratio for contracting an STI if they were female (OR: 2.45); had a positive result on their last STI screening pre-study (OR: 9.82) and had a history of previous STIs (OR: 1.47). We also found a unique sexual network that was well connected and had bridging with larger communities;
3. **Decreasing efficiency of STI transmission (β):** this can be achieved by increasing consistent and correct use of barrier contraceptives like condoms; making condoms more accessible to community members; encouraging positive attitudes toward condom use and empowering individuals to assert their intent to use condoms with sexual partners. The three main barriers to condom use that were detected through the study include: being embarrassed to buy condoms at the store, difficult to discuss condom use with partners and fear of giving a bad impression if suggesting using condoms. Measures (i.e. open communication, role playing, group discussions) could be implemented that could focus on these three barriers.

6.3 Future Research Recommendations

Because STIs are complex diseases that are associated with a variety of social issues (i.e. poverty, education, gender issues, economics) and involve a wide spectrum of stakeholders in the community, a collaborative, multifaceted approach to STI prevention is essential. Furthermore, population-based surveys and studies of STI-related health behaviours are critical for monitoring population trends in health behaviours, developing effective interventions and evaluating program effectiveness (Eng and Butler 1997).

Community interventions, especially among remote Inuit communities, are rare in the field of STI control and prevention. As a result, little work has been done toward the development of community collaboration with local health units. Given the tremendous economic burden of STIs, the current level of resources allocated for behavioural research in STI prevention is extremely low. Ideally, prevention-related research that should be emphasized would include: determinants of sexual behaviour; age of first sex among adolescents; influence of social and other community-related factors on risk of STIs; interventions to encourage abstinence, improve condom use and reduce high-risk behaviours (Eng and Butler 1997).

More qualitative studies are also needed to gather richer data on the lived experience of aboriginal people infected with STIs, the potential role of traditional medicine and the role of elders in the community setting. Cultural practices that affect the design and delivery of interventions also need to be investigated. This is particularly important in the areas of sexual behaviours like age of first sex. As previously mentioned in (Chapter II), some Inuit people may view sexuality (e.g. sexual intercourse) as a natural and acceptable behaviour between two individuals. For instance, it is not uncommon for adolescents to engage in sexual relationships with the approval of their parents or guardians. With the increasing rates of chlamydia however, female adolescents are at a greater risk for contracting HIV or viruses that may predispose them to cervical cancer among others. In such a case, cultural beliefs (i.e. such as initiating sex early) may need to be modified to prevent serious health related consequence. It would also be important to involve Inuit community members (i.e. CHRs) in the surveillance and screening process, health teaching to prevent STI reoccurrence to help empower their fellow community members to engage in healthier sexual behaviours.

There is also a need to strengthen the capacity of primary care practitioners to engage in research in the community setting. It is important to setup fellowship programs that allow practicing physicians and community health nurses to develop research skills and to help practitioners evaluate interventions. This will enable them to become more efficient knowledge utilizers and innovators.

In light of all these recommendations, however, it is increasingly obvious that in evaluating behavioural interventions to prevent STIs, tools and interventions must be deployed on the basis of a clear understanding of the underlying disease epidemiology. Realistic projections about any future STI interventions must also be tempered by the awareness of the powerful underlying socioeconomic forces like poverty, discrimination, gender relations and social inequality among others, that drive STIs in many parts of the world (Aral et al. 1999).

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APPENDIX I

Appendix I Supplementary Material for Chapter I

Table 1-A

Chlamydia Cases & Rates in Canada by Province/Territory and Sex (2000-2002)

Source: (Health Canada 2003)

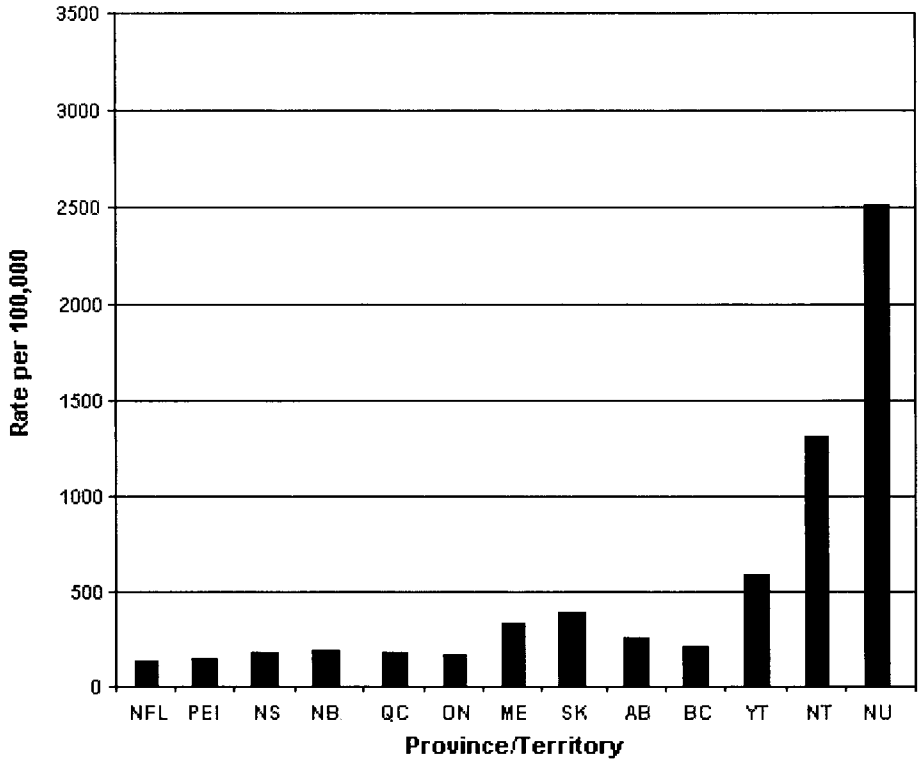
Year			Total	Province/Territory												
				NF	PEI	NS	NB	QU	ON	MB	SK	AL	BC	YT	NWT	NU
2000	**Cases**	**Male**	13539	103	69	298	327	2199	4799	967	968	1705	1691	45	140	228
		Female	32868	451	162	1103	916	6461	9796	2296	1968	4296	4498	101	344	476
		Total	46439	554	231	1405	1243	8678	14603	3263	2936	6001	6191	146	484	**704**
	Rate	**Male**	88.9	38.7	101.8	64.6	87.5	60.4	83.3	170.2	190.8	112.3	83.9	285.3	662.6	1591.2
		Female	211.6	166.4	230.4	229.7	240.2	172.9	165.5	397.4	382.4	288.2	220.1	682.1	1739.4	3636.4
		Total	150.9	103.1	167.3	149.3	164.6	117.6	125.0	284.7	287.3	199.4	152.5	477.4	1183.2	**2567.6**
2001	**Cases**	**Male**	15216	130	41	368	312	2881	5434	928	1060	1950	1702	39	163	208
		Female	34618	463	109	1232	889	7306	10776	2326	2041	4513	4108	92	370	393
		Total	49944	593	150	1603	1202	10210	16221	3254	3169	6463	5813	132	533	**601**
	Rate	**Male**	98.9	49.2	60.4	79.7	83.2	78.8	92.7	162.8	210.4	126.1	83.7	254.5	773.3	1421.5
		Female	220.6	171.8	154.4	256.1	232.5	194.6	179.2	401.1	398.7	297.3	199.1	631.8	1870.4	2905.3
		Total	160.7	111.1	108.3	170.0	158.8	137.8	136.6	282.9	312.0	210.9	141.9	441.7	1304.5	**2134.3**
2002	**Cases**	**Male**	17383	104	42	330	369	3077	6143	966	1280	2234	2319	48	195	276
		Female	38628	418	103	1241	944	8009	11768	2360	2333	5102	5301	93	402	554
		Total	56055	522	145	1574	1313	11113	17919	3331	3613	7336	7621	141	597	**830**
	Rate	**Male**	112.1	39.5	61.7	71.3	98.4	84.0	103.5	169.1	253.8	143.2	112.7	315.4	920.4	1863.1
		Female	244.1	155.5	145.4	257.6	246.7	212.8	193.2	406.3	455.1	332.7	253.3	637.6	2014.4	4025.0
		Total	178.9	98.1	104.3	166.6	173.3	149.6	149.0	289.1	355.3	237.1	183.6	473.1	1451.0	**2904.3**

Table 1-B

Gonorrhea Cases & Rates in Canada by Province/Territory and Sex (2000-2002)

Source: (Health Canada 2003)

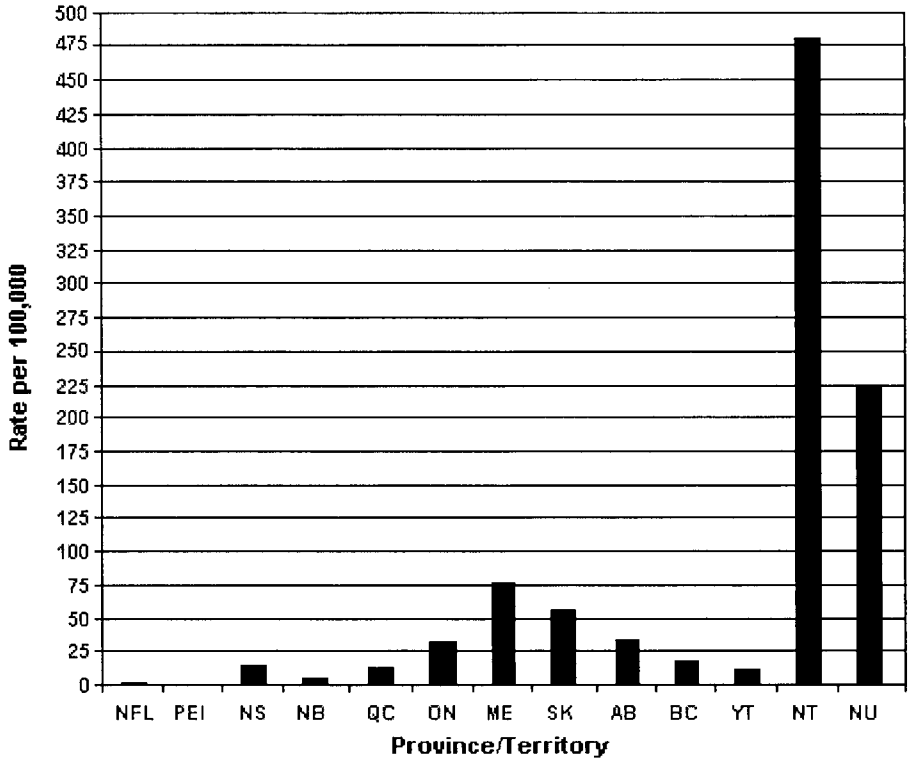
Year			Total	Province/Territory												
				NF	PEI	NS	NB	QU	ON	MB	SK	AL	BC	YT	NWT	NU
2000	**Cases**	**Male**	3829	4	0	32	10	538	1674	353	235	343	528	3	63	46
		Female	2353	1	0	25	1	126	1120	305	230	243	179	2	72	49
		Total	6189	5	0	57	11	670	2794	658	465	586	708	5	135	**95**
	Rate	**Male**	25.1	1.5	0.0	6.9	2.7	14.8	29.0	62.1	46.3	22.6	26.2	19.0	298.2	321.0
		Female	15.1	0.4	0.0	5.2	0.3	3.4	18.9	52.8	44.7	16.3	8.8	13.5	364.1	374.3
		Total	20.1	0.9	0.0	6.1	1.5	9.1	23.9	57.4	45.5	19.5	17.4	16.3	330.0	**346.5**
2001	**Cases**	**Male**	4156	0	0	46	7	664	1798	361	252	473	442	2	72	39
		Female	2558	0	0	39	5	162	1145	339	276	328	147	1	79	37
		Total	6727	0	0	86	12	830	2943	700	531	801	594	3	151	**76**
	Rate	**Male**	27.0	0.0	0.0	10.0	1.9	18.2	30.7	63.3	50.0	30.6	21.7	13.1	341.6	266.5
		Female	16.3	0.0	0.0	8.1	1.3	4.3	19.0	58.5	53.9	21.6	7.1	6.9	399.4	273.5
		Total	21.6	0.0	0.0	9.1	1.6	11.2	24.8	60.9	52.3	26.1	14.5	10.0	369.6	**269.9**
2002	**Cases**	**Male**	4454	5	0	92	13	669	1842	310	268	567	582	8	65	33
		Female	2720	4	0	107	17	205	1156	309	291	413	112	3	58	45
		Total	7185	9	0	199	30	878	3000	623	559	980	695	11	123	**78**
	Rate	**Male**	28.7	1.9	0.0	19.9	3.5	18.3	31.0	54.3	53.1	36.3	28.3	52.6	306.8	222.8
		Female	17.2	1.5	0.0	22.2	4.4	5.4	19.0	53.2	56.8	26.9	5.4	20.6	290.6	326.9
		Total	22.9	1.7	0.0	21.1	4.0	11.8	25.0	54.1	55.0	31.7	16.7	36.9	299.0	**272.9**



Graph 1-A

Reported Rates of Genital Chlamydia Per Province/Territory in 2003

Source: (Health Canada 2003)



Graph 1-B

Reported Rates of Gonorrhea Per Province/Territory in 2003

Source: (Health Canada 2003)

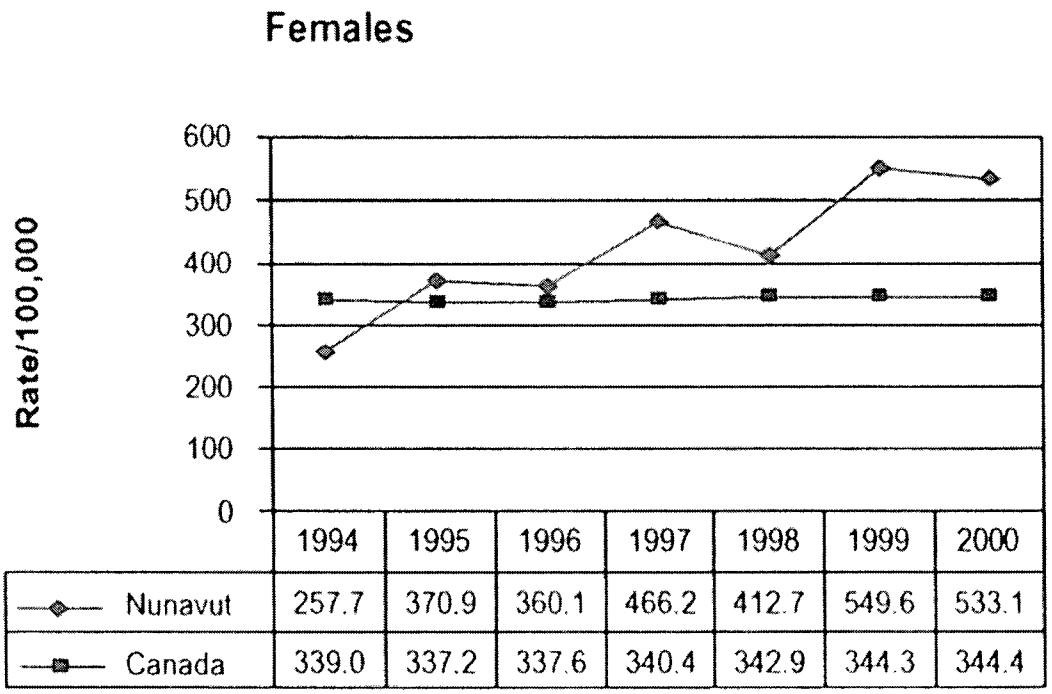
Table 1-C

Examples of Behaviours that Influence the Spread of STIs.

Source: (Fishbein, Wolitski, and Doll 1999)

Behaviour that reduce interaction between susceptibles and infection
Delayed onset of sexual debut
Infrequent acquisition of new partners
Avoiding concurrent partnerships
Avoiding unprotected sex while symptomatic with an STD
Behaviours that reduce acquisition, if exposed
Using safer sex practices
Use of barrier prophylactic
Use of topical or systemic prophylactic treatment
Use of vaccines
Delayed onset of sexual intercourse (young females most susceptible)
Obtaining early treatment for STD (to decrease HIV transmission)
Behaviours that reduce duration of infectivity
Early health care seeking if experiencing STD symptoms
Undergoing routing STD screening
Adherence to therapy
Compliance with partner notification

APPENDIX II

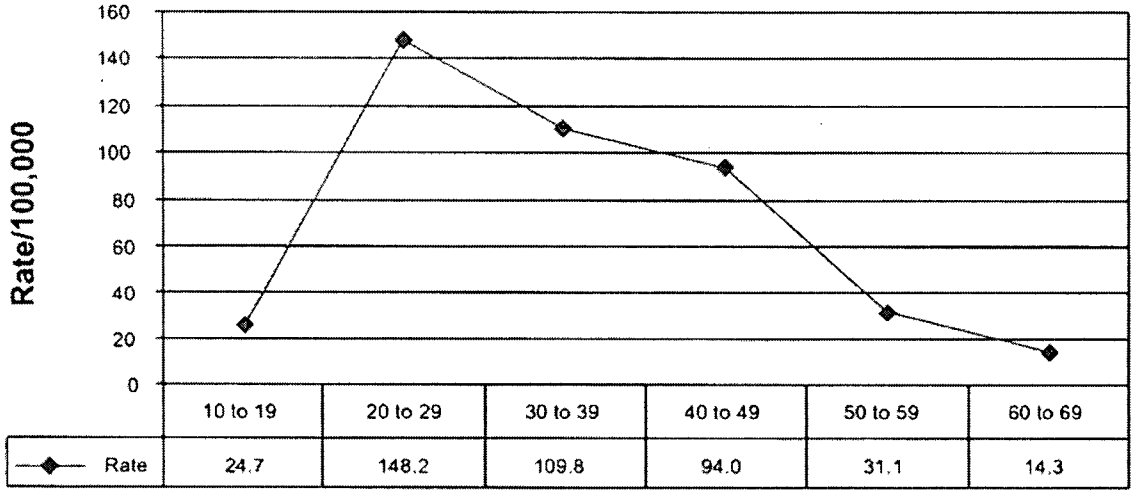


	1994	1995	1996	1997	1998	1999	2000
Nunavut	257.7	370.9	360.1	466.2	412.7	549.6	533.1
Canada	339.0	337.2	337.6	340.4	342.9	344.3	344.4

Graph 2.2.1-A

Rates of Invasive Cancer, Nunavut vs. Canada, Females

Source: (Nunavut Department of Health and Social Services 2003)



Graph 2.2.3-A

Age-Specific Incidence Rates of Cervical Cancer in Nunavut, Malignant and In Situ. (Nunavut Department of Health and Social Services 2003)

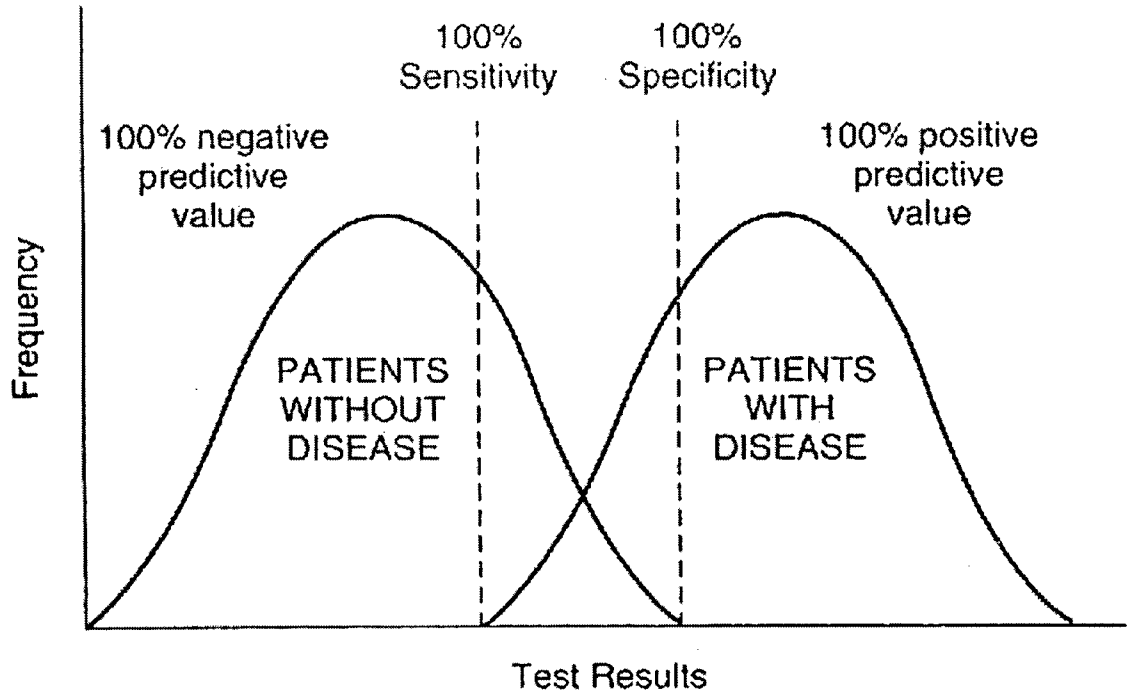


Figure 2.3.2.1-A

Relationship of Cut-off Value to Selected Test Parameters.

Source: (Albritton, Vittinghoff, and Padian 1996)

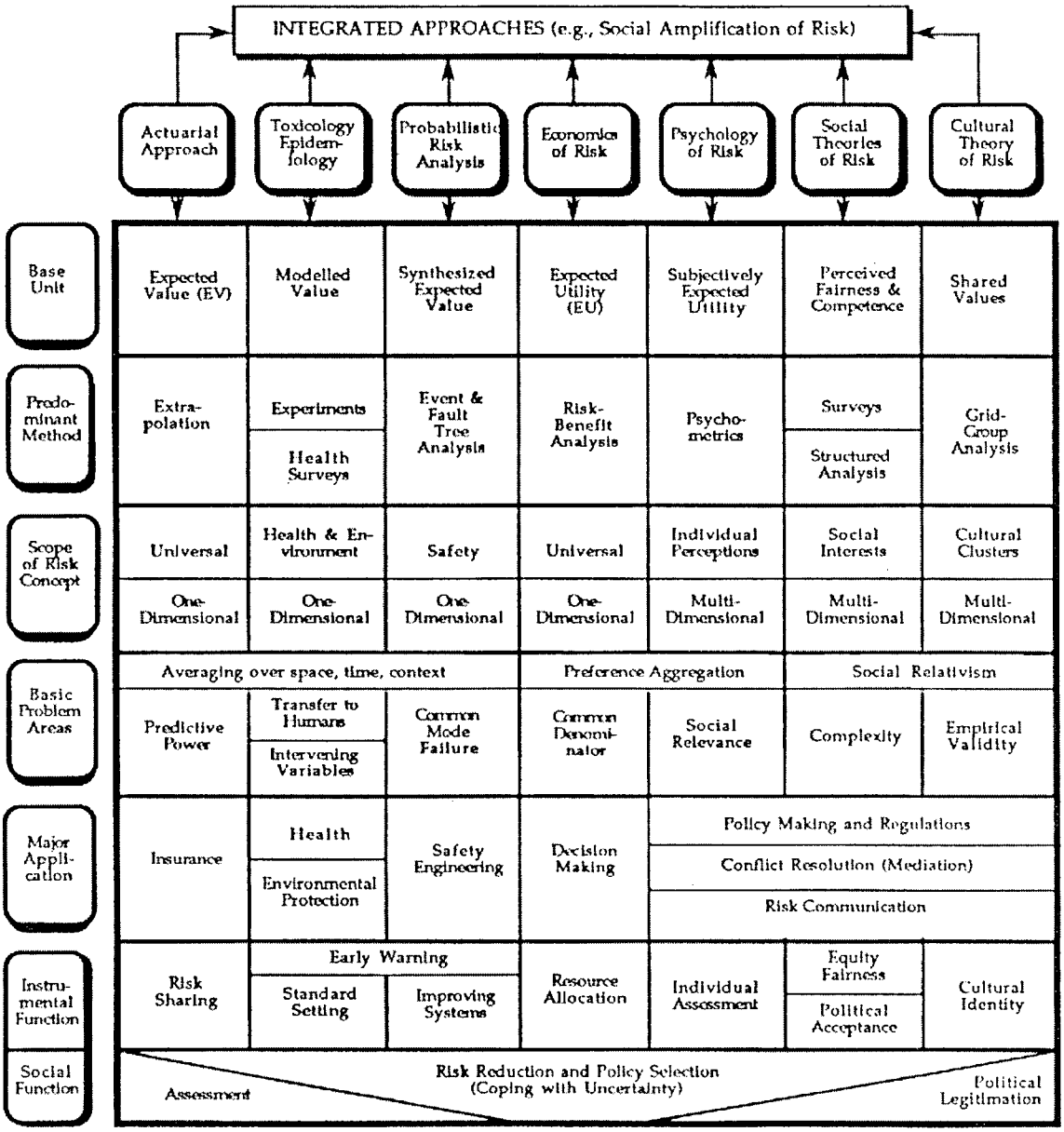


Figure 2.3.2.1-B

Systematic Classification of Risk Perception.

Source: (Renn 1992)

APPENDIX III

Study ID#

BASELINE QUESTIONNAIRE
(CONFIDENTIAL)

Interviewer's Initials: _____Location of interview: _____

Today's date: ____/____/____ (dd/mm/yy)

Please do not put the participant's name on any part of this questionnaire.

SECTION A – DEMOGRAPHICS

1. Age in years: _____ Gender: _____

2. What is the last education or highest grade you have completed *(check one)*?
   - ☐ I'm currently in high school
   - ☐ Completed elementary school or some high school
   - ☐ Completed high school
   - ☐ I'm currently in Technical/vocational School
   - ☐ Completed technical/vocational schooling
   - ☐ I'm currently in college/university
   - ☐ Completed college/university degree
   - ☐ Other (*specify grade*) 2.1: _____

3. How would you describe your current employment status *(check all that apply)*?
   - ☐ Unemployed
   - ☐ Employed fulltime
   - ☐ Employed part-time
   - ☐ Disability
   - ☐ Social assistance (welfare)
   - ☐ (*specify occupation)* 3.1: _____

4. Do you have any other income?
   - ☐ None
   - ☐ EI/disability

5. What is your personal yearly income before taxes (*check one*)?
   - ☐ No income
   - ☐ Less than $10,000
   - ☐ $10,000 – under $30,000
   - ☐ $30,000 – under $50,000
   - ☐ $50,000 or greater

6. How would you describe your living status *(check all that are applicable)*?

- ☐ I live with my parent(s)
- ☐ I live with other relatives (e.g., aunts, uncles, grandparents, older siblings, etc.)
- ☐ I live alone (with or without children)
- ☐ I live with a room-mate(s)
- ☐ I live with my partner (i.e., sexual or romantic partner)
- ☐ Other *(describe)* 6.1: _____

7. Do you leave your community on a regular basis?

- ☐ No (Go to question 9)
- ☐ Yes (Number of times you leave per year) 7.1: _____

8. If you do leave your community on a regular basis where do you usually go?

- ☐ Iqaluit
- ☐ Other communities *(Please specify)* 8.1: _____
- ☐ Out on the land
- ☐ South (Please specify) 8.2: _____

SECTION B – HEALTH

This section asks some questions about your health and your opinions regarding health use of health services and health practices. We realize that some of these questions are very personal but your answers are very important to this research project. Please remember that all of your answers will remain completely confidential.

9. In general, would you say that your health is *(check one)*?

- ☐ Excellent
- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Poor

10. Have you **ever** had an appointment with the nurse at the community health centre?

- ☐ No (Go to question 12)
- ☐ Yes 10.1: Please indicate date of last visit: _____(dd/mm/yy)
  10.2: Please indicate reason of last visit: _____

11. How often do you have appointments with the nurse at the community health centre?

- ☐ Daily/weekly
- ☐ Monthly
- ☐ Few times a year
- ☐ Seldom

12. Have you **ever** received treatment or had an appointment at the Baffin Regional Hospital in Iqaluit or any hospital in the South?

- ☐ No
- ☐ Yes
  - 12.1 Please indicate date of last visit: _____(dd/mm/yy)
  - 12.2 Reason of last appointment: _____

13. Before you heard about this research project, had you **ever** heard of chlamydia /gonorrhea?

- ☐ No
- ☐ Yes ⟶ 13.1 Where did you hear about it first *(check one)?*
  - ☐ School
  - ☐ Media (e.g., TV, radio, magazine, newspaper, etc.)
  - ☐ Community health nurse or doctor

14. Have you ever heard of HIV before?

- ☐ No
- ☐ Yes

15. Have you ever heard of Syphilis before?

- ☐ No
- ☐ Yes

16. Have you ever heard of Herpes before?

- ☐ No
- ☐ Yes

17. Have you ever heard of STI before?

- ☐ No
- ☐ Yes

18. Is HIV a STI?

- ☐ Not sure
- ☐ No
- ☐ Yes

19. Is HIV or STI worse?

- ☐ Not sure
- ☐ HIV
- ☐ STI
- ☐ Same

20. Why is HIV or STI Worse? *(Check one)*

- ☐ Not sure
- ☐ Heard it was
- ☐ Death/ no cure
- ☐ Very sick
- ☐ No difference

21. How does someone get HIV? *(check all that apply)*

- ☐ Not sure
- ☐ Sex
- ☐ Needles
- ☐ Blood/body fluid

22. How does someone get a STI? *(check all that apply)*

- ☐ Not sure
- ☐ Needles
- ☐ Many partners/cheating
- ☐ Unsafe sex

23. In your opinion, what would be the best way to give you information about chlamydia, gonorrhea or other STIs *(check one)*?

- ☐ Education sessions in school
- ☐ Community health nurse or doctor
- ☐ Media
- ☐ I am not interested in getting information

24. Have you **ever** been tested for chlamydia and/or gonorrhea before?

- ☐ No (Go to question 27)
- ☐ Yes ⟶ **When were you last tested (check one)?**
  - ☐ Within the past 6 months
  - ☐ Within the past 6-12 months
  - ☐ Over 12 months ago
  - ☐ Not sure

24.1 **How many times were you ever tested?**
(Please specify) _____
☐ Not sure

24.2 **How many positive STIs have you had (GC/CT)?**
(Please specify) _____

24.3 Did you receive treatment after your last test?
- ☐ NA
- ☐ No
- ☐ Yes *(specify)* _____

25. Have you ever had any complications because of a chlamydia or gonorrhea infection?

- ☐ No
- ☐ Yes *(specify)* 25.1: _____

26. What was the result of your last STI test before the study?

- ☐ Negative
- ☐ Positive CT and/or positive GC

27. Where would you most prefer to be tested for chlamydia, gonorrhea or other types of STIs if you had to *(check one)*?

- ☐ Community Health Centre
- ☐ Hospital or Public health unit (Iqaluit)
- ☐ I have no preference

28. Study STI result: (Check all that apply)

- ☐ Negative
- ☐ Positive CT
- ☐ Positive GC

29. In you opinion, how effective do you think the following are in preventing chlamydia, gonorrhea or other STIs *(check one for each item)*?

	Not sure	**None**	**Somewhat effective**	**Effective**	**Very effective**
29.1 Condoms	☐	☐	☐	☐	☐
29.2 BC Pills	☐	☐	☐	☐	☐
29.3 Female condom	☐	☐	☐	☐	☐
29.4 Diaphragm or sponge	☐	☐	☐	☐	☐
29.5 Spermicidal foam	☐	☐	☐	☐	☐
29.6 Asking a partner if they have an STI	☐	☐	☐	☐	☐
29.7 Not having sex	☐	☐	☐	☐	☐

SECTION C – SEXUALITY & RISK BEHAVIOURS

The next section asks questions about sexual activity and risk behaviours, and your opinions and feelings about sexuality issues. We realize that some of these questions are very personal but your answers are very important to this research project. Please remember that all of your answers are confidential and you have the right to refuse to answer any of these questions.

30. How old were you when you had vaginal intercourse for the **first** time?

- ☐ Never had sex

  Age in years: _____

31. Did you or your partner use any form of contraception or take any precautions that **first** time, or not *(tick all the boxes that apply)*?

- ☐ Condom
- ☐ BCP/Depo injection
- ☐ Withdrawal
- ☐ None
- ☐ Not sure

32. With your present sexual lifestyle, how much at risk do you personally feel of becoming infected with chlamydia and/or gonorrhea *(tick one box only)*?

- ☐ Greatly at risk
- ☐ Quite a lot at risk
- ☐ Not very much at risk
- ☐ None

33. During your life, how many people have you had vaginal intercourse with *(check one)?*

- ☐ None
- ☐ 1to 2 people
- ☐ 3 to 5 people
- ☐ 6 to 10 people
- ☐ 11 to 20 people
- ☐ 21+

34. In the last 3 months, how many people have you had vaginal intercourse with *(check one)*?

- ☐ None
- ☐ 1- 2
- ☐ 3-5
- ☐ 6-10
- ☐ 11- 20
- ☐ 21+

35. When you **last** had vaginal intercourse, what kind of relationship did you have with your partner *(check one)*?

- ☐ Married to each other
- ☐ Common
- ☐ Steady partners (not living together)
- ☐ Not steady partners at the time
- ☐ Never had sex

36. With your present lifestyle of much at risk are you for getting HIV?

- ☐ Greatly
- ☐ Quite a lot
- ☐ Not very much
- ☐ None

37. Did you drink alcohol or use drugs before the first time you vaginal intercourse?

- ☐ No
- ☐ Yes *(specify)* 37.1: _____

38. The last time you had vaginal intercourse, what method(s) did you or your partner use to prevent pregnancy *(check all that apply)*?

- ☐ Male condom
- ☐ Female condom
- ☐ BCP/Depo Provera
- ☐ Diaphragm
- ☐ Withdrawal
- ☐ None

39. When you have vaginal intercourse, how often would you say you use condoms *(check one)?*

- ☐ Always
- ☐ Most of the time
- ☐ About half of the time
- ☐ Occasionally
- ☐ Never

40. Please indicate how you would feel with the following statements. **Using condoms would:** ***(tick one for each)***

	Not sure	Yes	No
40.1 Make sex less enjoyable for me	☐	☐	☐
40.2 Protect against unwanted pregnancy	☐	☐	☐
40.3 Protect against being infected with HIV	☐	☐	☐
40.4 Protect against other STIs	☐	☐	☐
40.5 Show that I was a caring person	☐	☐	☐
40.6 Make sex less spontaneous	☐	☐	☐
40.7 Cause offence to my partner	☐	☐	☐
40.8 Make my partner think I might be infected with an STI	☐	☐	☐
40.9 Make sex messy	☐	☐	☐
40.9a Reduce my partner's sexual pleasure	☐	☐	☐
40.9b Be an annoying interruption to sex	☐	☐	☐
40.9c May be difficult to plan ahead for	☐	☐	☐

SECTION E – NORMATIVE BELIEFS

Listed below are some statements about the views and behaviour of other people. Again, thinking of your own beliefs, please tick a box to indicate how much you agree or disagree with each statement.

41. **Tick one for each**

	Strongly disagree	Disagree	Agree	Strongly agree	N/A
41.1 My current partner thinks we should use condoms	☐	☐	☐	☐	☐
41.2 A new partner would want me to use condoms	☐	☐	☐	☐	☐
41.3 My friends would approve if I used condoms	☐	☐	☐	☐	☐

42. **Tick one for each**

	Strongly disagree	Disagree	Agree	Strongly agree
42.1 I want to do what my current partner wants me to do	☐	☐	☐	☐
42.2 I want to do what a new partner wants me to do	☐	☐	☐	☐
42.3 I want to do what my friends want me to do	☐	☐	☐	☐
42.4 I want to do what the doctor/nurse wants me to do	☐	☐	☐	☐
42.5 I want to do what Government health campaigns recommend me to do	☐	☐	☐	☐

43. The following are some common barriers to condom use. Please indicate how likely each of the listed barriers would stop you from using condoms? ***Tick one for each***

	Likely	Unlikely
43.1 Feeling embarrassed to buy condoms	☐	☐
43.2 Forgetting to carry them with you	☐	☐
43.3 Difficulty in obtaining condoms	☐	☐
43.4 Getting carried away in the heat of the moment	☐	☐
43.5 Difficulty in talking about using condoms	☐	☐
43.6 Your partner getting angry if you suggested using condoms	☐	☐
43.7 Fear of giving a bad impression about your own sexual behaviour if you suggested using condoms	☐	☐

44 How much control do you have over whether or not you use condoms? ***Tick one only***

- ☐ Total control
- ☐ Some control
- ☐ No control at all

This is the end of the questionnaire. Thank you for participating in this study.

APPENDIX IV

Appendix IV Supplementary Material for Chapter III

Table 3.1.1-A

Chlamydia /Gonorrhea Prevalence in the Baffin Region (Year 2000)

Source: (Osborne 2003)

Community	Chlamydia Cases	Chlamydia Prevalence	Gonorrhea Cases	Gonorrhea Prevalence
Community 1	18	0.0450	2	0.0050
Community 2	27	0.0394	0	0
Community 3	3	0.0068	0	0
Community 4	1	0.0118	0	0
Community 5	8	0.0235	1	0.0029
Community 6	32	0.0454	3	0.0043
Community 7	137	0.0374	46	0.0126
Community 8	18	0.0692	0	0
Community 9	31	0.0411	3	0.004
Community 10	33	0.0471	5	0.0071
Test Community	7	**0.027**	**2**	**0.007**
Community 12	11	0.0733	0	0

Legend A

* (Variable category)

1. **Age** (Demographic)*
2. **Gender** (Demographic)
3. **Highest grade** (Demographic):
   Highest grade achieved up to the time of interview:
   Options: 1= < grade 9; 2= grades 9-11; 3= grade 12+ (including University & College)
4. **Employment status** (Demographic):
   Paid, regular work at the time of interview
   Options: 1= unemployed; 2= part time; 3= full time
5. **Job description** (Demographic):
   Options: 0= none (unemployed); 1= trades; 2 = sales/services; 3= art/recreation (carving, fishing, hunting); 4= education/government; 5= administration
6. **Other forms of income** (Demographic):
   Income other than from paid regular work, seasonal work (fishing, hunting) or self-employment (carving)
   Options: 0= none; 1= employment insurance (EI) or disability
7. **Income Range** (Demographic):
   Individual annual income from all sources (paid regular work, seasonal, self-employment, EI/disability)
   Options: 0= none; 1= <10,000; 2= 10-30,000; 3= 30-50,000+
8. **Living Arrangements** (Demographic):
   Living arrangements at time of interview
   Options: 1= alone; 2= roommate (non-sexual); 3= relatives (other then parents); 4= parents (natural or adoptive); 5= sexual partner (marriage or common law)
9. **Leave Community Per Year** (Demographic):
   Number of times the individual leaves the community per year (includes going out on the land, Iqaluit, other communities and south)
   Options: actual number given

10. **Places Visited when leaving Community** (Demographic):

    Options: Iqaluit; other communities (in Nunavut); on the land (i.e. out post camp); south

11. **Rate Health** (Health & Health Services):

    Individuals were asked to rate their own health

    Options: 1= poor; 2= fair; 3= good; 4= very good; 5= excellent

12. **Last Health Centre (HC) Use** (Health & Health Services):

    Date of last health centre visit prior to interview

    Options: 1= < 1 year; 2= 1-5 years; 3= 6-10+ years

13. **Reason Last HC Use** (Health & Health Services)

    Reason for last health centre visit prior to interview

    Options: 4= prevention (health teaching, family planning, prenatal, screening); 3= medical (physical or mental illness); 2= dental; 1=STD related (contact tracing, STD testing)

14. **Frequency of HC Use** (Health & Health Services):

    How often individuals use the HC per year

    Options: 1= seldom; 2= few times a year; 3= monthly; 4= daily/weekly

15. **Ever Been to the Hospital** (Health & Health Services):

    Any visit to the hospital (Iqaluit or south) prior to the study

    Options: 0= no; 1=yes

16. **Last Hospital Use** (Health & Health Services):

    Last use of a hospital prior to the study

    Options: 3= never been; 2= 6+; 1= 1-5, 0= <1 year

17. **Reason for Last Hospital Use** (Health & Health Services):

    Options: 4=prevention, 3= medical, 2= dental, 1= STD

18. **Date of Last STI Test** (Health & Health Services):

    The last STI test prior to the study screening:

    Options: 0= never been tested; 1= 12+ months ago; 2= 6-12 months ago; 3= less then 6 months ago

19. **Number of STI Tests Ever Excluding the Study Test** (Health & Health Services):

    Options: actual number given.

20. **Ever Heard of Chlamydia (CT) and/or Gonorrhea (GC) before the study** (STI Knowledge):

    Options:0= no; 1= yes

21. **How Did You Ever Hear About CT and/or GC?** (STI Knowledge):

    Options: 0= never heard of them; 1= media (pamphlets, TV, radio); 2= nurse/doctor, 3= school

22. **Ever Heard of HIV?** (STI Knowledge):

    Options: 0= no; 1=yes

23. **Ever Heard of Syphilis?** (STI Knowledge):

    Options: 0= no; 1= yes

24. **Ever Heard of Herpes?** (STI Knowledge):

    Options: 0= no; 1=yes

25. **Ever Heard of the Term STI Before?** (STI Knowledge):

    Options: 0=no; 1=yes

26. **Is HIV an STI?** (STI Knowledge):

    Individuals were asked if they thought HIV was also a STI

    Options: 0= not sure; 1= no; 2= yes

27. **Is HIV or STI worse?** (STI Knowledge):

    Individuals were asked if they thought that HIV was worse than a non-HIV STI

    Options: 0= not sure, 1= HIV; 2= STI; 3= same.

28. **Why is HIV or STD worse?** (STI Knowledge):

    Here individuals were asked to explain why they thought there was a difference between the two terms and hence, one worse than the other: the explanations were categorized into the most common themes

    Options: 0= not sure; 1= heard it was; 2= death/no cure; 3= very sick; 4= no difference

29. **How is HIV Transmitted?** (STI Knowledge):

    The explanations were categorized into the most common themes

    Options: not sure, sex, needles, blood/body fluids – 0= not sure, 1= one of the methods mentioned, 2 = two methods mentioned, 3= all methods mentioned

30. **How Does Someone Get a Non-HIV STI?** (STI Knowledge):

    The explanations were categorized into the most common themes

    Options: not sure, needles, many partners/cheating on your partner, unsafe sex (no condom)- 0 = not sure and needles, 1 = either many partners/cheating or unsafe sex, 2= both correct responses

31. **Method of Disseminating Information on STIs** (STI Knowledge):

    Options: 0= not interested in getting information; 1= media; 2= nurse/doctor; school

32. **Study STI Result** (Outcome variable)

    Options: 0= negative, 1= positive (CT or GC)

33. **Number of Confirmed STIs Excluding the Study Result** (Sexual History):

    Options: actual number given

34. **Reasons for All Previous STI Testing** (Sexual History):

    The explanations were categorized into the most common themes:

    Options: 0= never been tested; 1= symptoms (i.e. urethritis, discharge, abdominal pain etc); 2= screening (prenatal, well woman clinics etc); 3= named as a contact; 4= symptoms & screening; 5= symptoms & named as a contact; 6= screening & named as a contact; 7= symptoms/screening/named as a contact

35. **Location of Last STI test Excluding Study Test** (Sexual History):

    Options: 0= never been tested, 1= Health Centre, 2= hospital/public health (in Iqaluit)

36. **Treatment Received After Last STI Test** (Sexual History):

    Options: 0= never been tested; none; 1= Azithromax (treatment for chlamydia); 2= Cefexime (treatment for GC); 3= Azithromax & Cefexime

37. **STI Related Complications Ever** (Sexual History):

    Options: 0= never tested; 1= none; 2= yes

38. **List of STI Related Complications** (Sexual History):

    Options: 0= none, 1= PID (pelvic inflammatory disease); 2= premature delivery; 3= infertility; 4= urethritis

39. **Preferred Location for STI Testing** (Sexual History):

    Options: 0= no preference; 1= health centre; 2= hospital/public health unit

40. **How Effective are Condoms in Preventing STIs** (Contraceptive knowledge):

    Options: 0= not sure; 1= none; 2= somewhat; 3= effective; 4= very effective

41. **How Effective are Birth Control Pills (BCP) in Preventing STIs**. (Contraceptive Knowledge):

    Options: 0= not sure; 1= very effective; 2= effective;3= somewhat; 4= none

42. **How Effective is the Female Condom in Preventing STIs**. (Contraceptive Knowledge):

    Options: 0= not sure; 1= none; 2= somewhat; 3= effective; 4= very effective

43. **How Effective is a Diaphragm in Preventing STIs.** (Contraceptive Knowledge):

    Options: 0= not sure; 1= very effective; 2= effective; 3= somewhat; 4= none

44. **How Effective is Spermicidal Foam in Preventing STIs**. (Contraceptive Knowledge):

    Options: 0= not sure; 1= very effective; 2= effective; 3= somewhat; 4= none

45. **How Effective is Asking a Person if They Have an STI Before Having Sex with them** (Contraceptive Knowledge):

    Options: 0= not sure; none; 1= somewhat; 2= effective; 3= very effective

46. **How Effective is Not Having Sex in Preventing STIs** (Contraceptive Knowledge):

    Options: 0= not sure; 1= none; 2= somewhat; 3= effective; 4= very effective

47. **Age in Years at First Consented Vaginal Intercourse** (Risk Behaviours):

    Options: actual age given.

48. **Type of Birth Control Used During First Vaginal Sex** (Risk Behaviours):

    Options: 0= not sure; 1= none; 2= withdrawal; 3= BCP/Depo-Provera;4= male condom

49. **Presently at Risk for Contracting a STI** (Risk Behaviours):

    Options: 0= none; 1= not very much; 2= quite a lot; 3= greatly

50. **Number of Sexual Partners Ever** (Risk Behaviours):

    Options were categorized: 0= none; 1= 1-2; 2= 3-5; 3= 6-10; 4= 11-20; 5= 21+

51. **Number of Sexual Partners in the Last 3 Months Prior to Interview** (Risk Behaviours):

    Options were categorized: 0= none; 1= 1-2; 2= 3-5; 3= 6-10; 4= 11-20; 5= 21+

52. **Relationship with Last Sexual Partner** (Risk Behaviours):

    Options: 0= never had sex; 1= not steady; 2= steady; 3= living together; 4= married

53. **Present Risk for Contracting HIV** (Risk Behaviours):

    Options: 0= none; 1= not very much; 2= quite a lot; 3= greatly

54. **Did You Use Alcohol and/or Drugs the First Time You had Vaginal Sex** (Risk Behaviour):

    Options: 0= no; 1= yes

55. **Specify Type of Substance(s) Used the First Time you had Vaginal Sex** (Risk Behaviour):

    Options: 0= none; 1= alcohol; 2= pot; 3= alcohol/pot

56. **Type of Birth Control Used the Last Time You Had Vaginal Sex** (Risk Behaviour):

    Options: 0= none; 1= withdrawal; 2= diaphragm; 3= BCP/depo; 4= female condom; 5= male condom

57. **How Frequent Do You Use Male Condoms When Having Vaginal Sex** (Risk Behaviour):

    Options: 0= never; 1= occasionally; 2= half the time; 3= most of the time; 4= always

58. **Do Male Condoms Make Vaginal Sex Less Enjoyable For You** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

59. **Do Male Condoms Prevent Unwanted Pregnancy** (Behavioural Beliefs):

    Options:0=not sure; 1= no;2= yes

60. **Do Male Condoms Prevent HIV Infection** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2=yes

61. **Do Male Condoms Prevent STD Infections** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

62. **Do Male Condoms Show You Care** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

63. **Do Male Condoms Make Sex Less Spontaneous** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

64. **Would Using or Suggesting the Use of a Male Condom Offend Your Partner** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

65. **Would Using or Suggesting the Use of a Male Condom Suggest an STI Infection** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

66. **Do Male Condoms Make Sex Messy** (Behavioural Beliefs):

    Options: 0= not sure;1= no; 2= yes

67. **Do Male Condoms Reduce Sexual Pleasure For Your Partner** (Behavioural Beliefs):

    Options: 0= not sure; 1= no; 2= yes

68. **Are Male Condoms an Annoying Interruption to Sex** (Behavioural Beliefs):

    Options: 1= not sure; 2= no; 3= yes

69. **Are Using Male Condoms Difficult to Plan Ahead for** (Behavioural Beliefs):

    Options: 1= not sure; 2= no;3= yes

70. **My Current Partner Wants Us to Use Condoms.** (Normative Beliefs):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly agree

71. **A New Partner Would Want Us To Use Condoms.** (Normative Beliefs):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly agree

72. **My Friends Think it is a Good Idea to Use Male Condoms When Having Sex.** (Normative Beliefs):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly; 5= agree

73. **I Do What My Current Partner Wants Me To Do.** (Motivations to Comply):

    Options: 1= disagree; 2= strongly 3= disagree; 4= agree; 5= strongly agree

74. **I Do What a New Partner Would Want Me to Do.** (Motivations to Comply):

    Options: 1= disagree; 2= strongly 3= disagree; 4= agree; 5= strongly agree

75. **I do What My Friends Want Me to Do.** (Motivations to Comply):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly disagree

76. **I do What The Nurse/Doctor Want Me To Do**. (Motivations to Comply):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly agree

77. **I Do What The Government Tells Me To Do**. (Motivations to Comply):

    Options: 1= disagree; 2= strongly disagree; 3= agree; 4= strongly agree

78. **Would You Be Embarrassed To Buy Condoms At The Store** (Self Efficacy):

    Options: 1= unlikely; 2= likely

79. **Would You Be Someone That Forgets To Use a Condom** (Self Efficacy):

    Options: 1= unlikely; 2= likely

80. **Is It Difficult To Get Condoms At The Health Centre** (Self Efficacy):

    Options: 1= unlikely; 2= likely

81. **Is It Easy To Get Carried Away During Sex And Not Use A Male Condom** (Self Efficacy):

    Options: 1= unlikely; 2= likely

82. **Is It Difficult To Discuss Condom Use with Your Partner (heterosexual)** (Self Efficacy):

    Options: unlikely; likely

83. **Would Your Partner Get Angry If You Suggested Using A Male Condom** (Self Efficacy):

    Options: 1= unlikely; 2= likely

84. **Would You Fear Giving a Bad Impression if You Suggested Using A Male Condom** (Self Efficacy).

    Options: 1= unlikely; 2= likely

85. **How Much Control Do You Have Over Condom Use** (Perceived Behavioural Control):

    Options: 0= no control; 1= some control; 3= total control

Legend B (Grouping variables into scores)

The following variables were either kept as independent variables or grouped together to form scores. The remaining variables were not used for this study.

1. **Age:** (Single variable; Demographic) Actual age given.
2. **Gender:** (Single variable; Demographic): **Options:** 0= male, 1= female.
3. **Highest grade:** (Single variable; Demographic)**: Options:** 1=< gr. 9, 2= gr. 9-11, 3= gr. 12+
4. **Income Range:** (Single variable; Demographic): **Options:** 0= nothing, 1= <10,000, 2= 10-30,000, 3= 30-50,000+
5. **Use of Health Services Score:(score out of 10)** (3 variables combined; Health & Health Services):
    a. Date of last HC visit: 3= < 1 yr, 2= 1-5 yrs, 1= 6 yrs +, 0= never been
    b. Reason for last HC visit: 4= prevention, 3= medical, 2= dental, 1= STI
    c. Last Hosp Visit: 3= <1, 2= 1-5 yrs, 1= 6yrs +, 0= never been

Once final scores were computed, the scores were grouped into values: value = 1 contained scores 4,5,6; value = 2 contained scores 7,8,9; value = 3 contained score 10

6. **STI Knowledge Score: (score out of 6):** (3 variables combined; STI knowledge)
    a. Is HIV a STI: 0=not sure, 0= no, 1 =yes
    b. How does someone get HIV: 0= not sure; sex, sharing needles or blood/body fluids (reporting one answer gives a score of 1, two answers gives a score of 2 & three answers gives a score of 3)
    c. How does someone get an STI: 0= not sure, 0= needles; many partners/cheating, unsafe sex (reporting one answer gives a score of 1, two answers gives a score of 2)

Once final scores were computed, the scores were grouped into values: value = 1 (low scores) contained scores 0-2, value = 2 (moderate score) contained scores 3-4, value = 3 (high score) contained scores 5-6

7. **Number of STI tests ever before study:** (Single variable; Sexual History).
8. **Number of STIs ever before study:** (Single variable; Sexual History)
9. **Study STI result:** (Outcome Variable): **Options:** 0= negative, 1= positive

10. **Last STI result prior to study**: (Single variable; Sexual History): **Options:** 0= never tested or negative, 1= positive
11. **Contraceptive Knowledge Score (Score out of 28):** (Combined 7 variables; Contraceptive Knowledge):
    a. Are condoms effective in preventing STIs: 0= not sure, 1= none, 2= somewhat, 3= effective, 4= very effective
    b. Are BCPs effective in preventing STIs: 0= not sure, 1= very effective, 2= effective, 3= somewhat, 4= none
    c. Are female condoms effective in preventing STIs: 0= not sure, 1= none, 2= somewhat, 3= effective, 4= very effective
    d. Is the diaphragm effective in preventing STIs: 0= not sure, 1= very effective, 2= effective, 3= somewhat, 4= none
    e. Is spermicidal foam effective in preventing STIs: 0= not sure, 1= very effective, 2= effective, 3= somewhat, 4= none
    f. Is asking a person if they have a STI before sex effective in preventing STIs: 0= not sure, 1= none, 2= somewhat, 3= effective, 4= very effective
    g. Is not having sex effective in preventing STIs: 0= not sure, 1= none, 2= somewhat, 3= effective, 4= very effective
12. **Age in years at first intercourse**: (Single variable; Risk Behaviours)
13. **Perceived risk belief score (Score out of 6):** (Two variables combined; Risk Behaviours):
    a. How much risk do you have of contracting a STI: 0= none, 1= not very much, 2= quite a lot, 3= greatly
    b. How much risk do you have of contracting HIV: 0= none, 1= not very much, 2= quite a lot, 3= greatly

Once final scores were computed the values were grouped into 0,1,2+

14. Actual risk behaviour score (Score out of 18): (Five variables combined; Risk Behaviour):
    a. BC used first sex: 0= male condom, 1= BCP/Depo, 2= withdrawal, 3= not sure, 4= none
    b. Number of sexual partners ever: 0= none, 1= 1-2, 2= 3-5, 3= 6-10, 4= 11-20, 5= 21+

c. Relationship last sexual partner: 0= never had sex, 1= married, 2= living together, 3= steady, 4= not steady

d. Alcohol or drugs first sex: 0= no, 1= yes

e. Frequency of condom use: 0= always, 1= most of the time, 2= half the time, 3=occasionally, 4= never

15. Condom Self-Efficacy Score (Score out of 16): (Eight variables combined; Behavioural Beliefs):

    a. Do condoms make sex less enjoyable: 0= yes, 1= not sure, 2= no

    b. Do condoms prevent pregnancy: 0= not sure, 1= no, 2= yes

    c. Do condoms prevent HIV infection: 0= not sure, 1= no, 2 yes

    d. Do condoms prevent STD infections: 0= not sure, 1= no, 2 = yes

    e. Do condoms show you care: 0= not sure, 1= no, 2= yes

    f. Would condoms offend your partner: 0= not sure, 1= yes, 2= no

    g. Would using condoms suggest an STI infection: 0=not sure, 1= yes, 2= no

    h. Are using condoms difficult to plan ahead for: 0= not sure, 1= yes, 2= no

Once final scores were computed the values were grouped into: value = 1 contained scores of 0-10, value = 2 contained scores 11-13 and value = 3 contained scores 14+

16. Normative Belief & Motivations to Comply Score; (Score out of 32): (eight variables combined; Normative Beliefs & Motivations to Comply):

    a. My current partner wants to use condoms: 1= disagree, 2= strongly disagree, 3= agree, 4= strongly agree

    b. A new partner would want to use condoms: 1= disagree, 2= strongly disagree, 3= agree, 4= strongly agree

    c. My friends think it is a good idea to use condoms: 1= disagree, 2= strongly disagree, 3= agree, 4= strongly agree

    d. I do what my current partner wants me to do: 1= strongly agree, 2= agree, 3= strongly disagree, 4= disagree

    e. I do what a new partner would want me to do: 1= strongly agree, 2= agree, 3= disagree, 4= strongly disagree

    f. I do what my friends want me to do: 1= strongly agree, 2= agree, 3= disagree, 4= strongly disagree

g. I do what the nurse/doctor want me to do: 1= strongly disagree, 2= disagree, 3= agree, 4= strongly agree
h. I do what the government tells me to do: 1= strongly disagree, 2= disagree, 3= agree, 4= strongly agree

Once final scores were computed the values were grouped into: value = 1 contained scores 14-17, value = 2 contained scores 18-22 and value = 3 contained scores of 23+

17. Negotiating Condom use & Perceived Control Score (Score out of 9): (eight variables combined (Self Efficacy & Perceived Control):
    a. Would you be embarrassed to buy condoms at the store: 0= likely, 1= unlikely
    b. Would you be someone that forgets to use condoms: 0= likely, 1= unlikely
    c. Is it difficult to get condoms at the health centre: 0= likely, 1= unlikely
    d. Is it easy to get carried away during sex and not use condoms: 0= likely, 1= unlikely
    e. Is it difficult to discuss condom use with your partner: 0= likely, 1= unlikely
    f. Would your partner get angry if you suggested using condoms: 0= likely, 1= unlikely
    g. Would you fear giving a bad impression if you suggested using condoms: 0= likely, 1= unlikely
    h. How much control do you have over condom use: 0= no control, 1= some control, 2= total control

Once final scores were computed the values were grouped into: value = 1 contained scores of 0-4, value = 2 contained scores 5-7 and value = 3 contained scores 8+

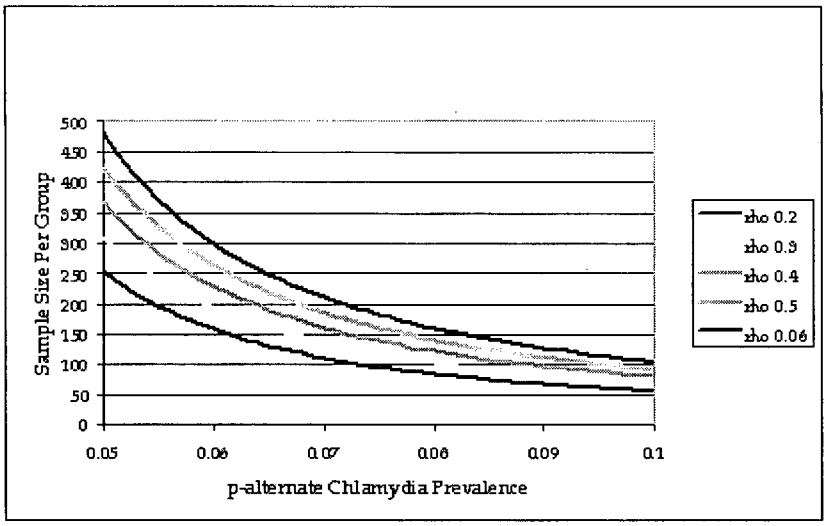


Figure 3.11.3-A

Sample Size Calculations For Alternate Chlamydia Prevalence

APPENDIX V

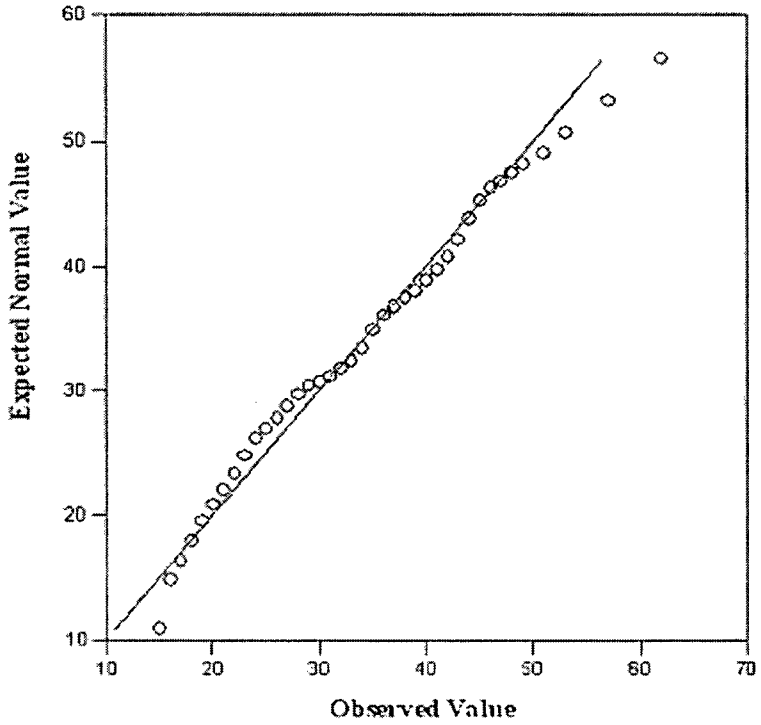


Figure 4.1-A

QQ Plot for Baseline Age Distribution

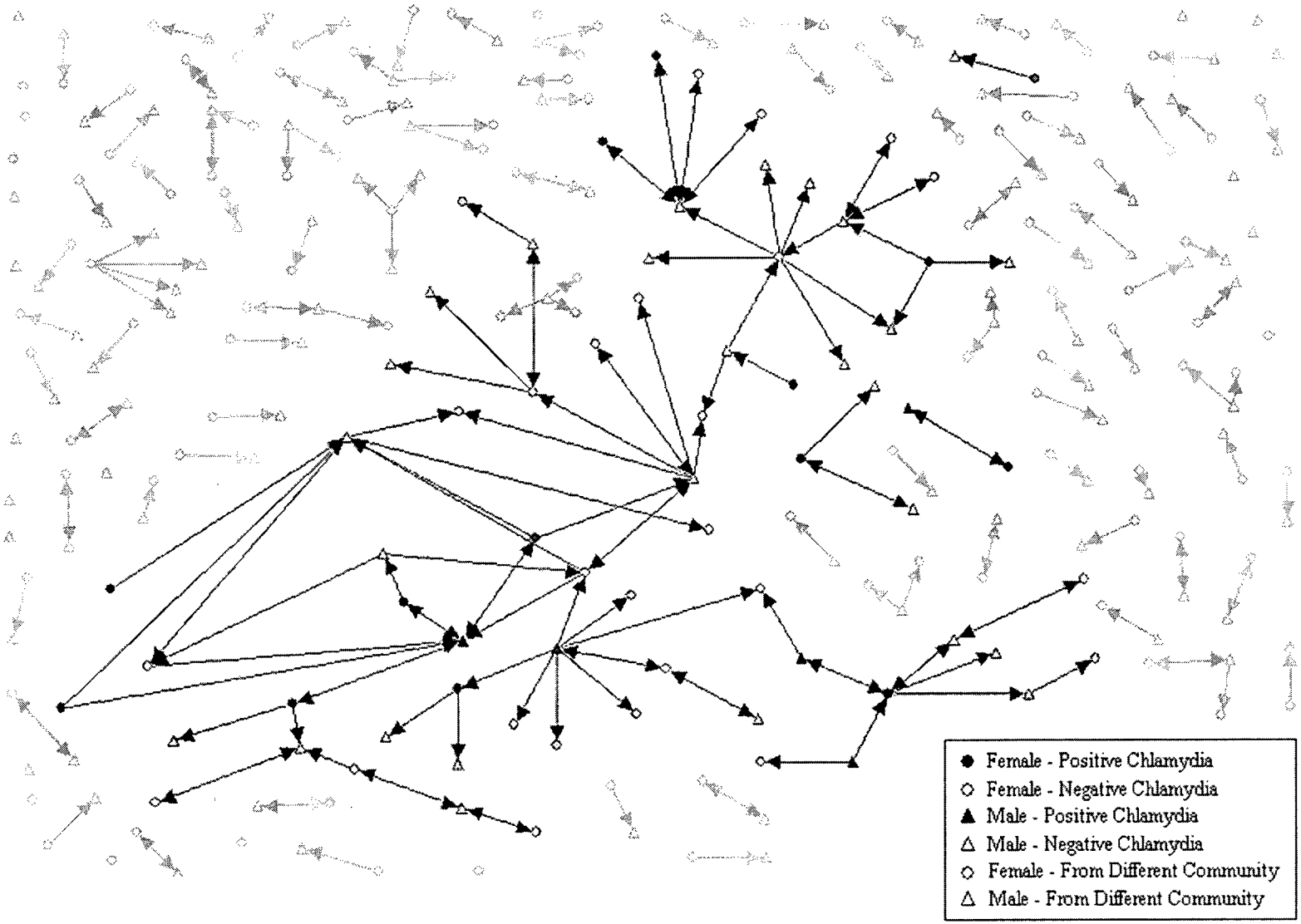


Figure 4.4-A

Baseline Complete Network