“Context Counts: Towards a Poverty-Focused Approach to HIV/AIDS
Prevention in Canada”

by

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A Thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Master of Social Work

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Canada”

submitted by Kate-Lynn Duplessis, H.B.A

in partial fulfillment of the requirements for

the degree of Master of Social Work

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ABSTRACT

HIV/AIDS prevention has historically been heavily focused on changing behavior. Recently, a novel HIV/AIDS prevention model has been put forward by Eileen Stillwaggon. Based on a study of developing countries, Stillwaggon argues that specific synergies of poverty, such as malnutrition, STDs, parasitic infections, and income inequality increase people's vulnerability to HIV/AIDS, and must form the basis for effective prevention.

The question this thesis addresses is whether Stillwaggon's argument is relevant in Canada. More specifically: Do the synergies of STDs, income inequality, and hunger shape the HIV/AIDS epidemic in Canada, and do these factors need to be considered more centrally in Canadian prevention? Using a structural social work perspective, this question is explored through several regression analyses. Hunger, STDs, income inequality, and population density were found to be significantly statistically related to HIV rates. The main argument presented is that that Stillwaggon's model deserves greater attention in HIV/AIDS prevention in Canada.

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CHAPTER 1 – INTRODUCTION

Every day, close to 14,000 people throughout the world are infected with HIV/AIDS, resulting in 5 million new infections every year (UNAIDS, n.d. a). The epidemic is most severe in Africa, where an estimated 28.5 million people are now infected, but no country has been left untouched by the virus. This includes Canada, where approximately 60,000 people have been infected with HIV/AIDS, and overall rates of infection have been increasing slowly, but steadily, over the last decade (AVERT, 2007; Public Health Agency of Canada, 2006 a).

Such figures have helped to install prevention programs as a central component of HIV/AIDS work (UNAIDS, n.d. a). Thus far, prevention programs have focused heavily on changing behavior through programming and educational campaigns on such topics as; abstinence, condom use, monogamy and clean needle use for injection drug users. Implicit in these programs is the assumption that changing behavior is the most effective means of preventing the spread of HIV/AIDS. There has also been some focus on the relationship between gender inequality and increased vulnerability of women to HIV/AIDS as well as the contribution of both racism and poverty to infection risk (Stockdill, 2003). These ideas currently shape the mainstream discourse and policy around HIV/AIDS prevention, with the bulk of attention and resources being directed at behavior change programs and policies.

Recently, a novel theoretical framework for approaching prevention has been put forward by an American academic named Eileen Stillwaggon. Stillwaggon (2006) focuses her research on explaining why global AIDS policy has failed to stop the spread of HIV/AIDS and why HIV/AIDS has had such a devastating impact on developing

countries. Looking at behavior-focused prevention programs in Africa, Stillwaggon argues that these programs are based on the widely accepted (albeit incorrect and racist) notion that high rates of HIV/AIDS in Africa are primarily the result of over-sexualized African behavior (Stillwaggon, 2003; Stillwaggon, 2006). Stillwaggon argues that this approach to prevention fails to consider the “social and biological context in which behavior occurs” (Stillwaggon, 2006, p. 13). More specifically, despite the fact that there is an established literature, which demonstrates that “persons with nutritional deficiencies, with parasitic diseases, whose general health is poor, who have little access to health care services, or who are otherwise economically disadvantaged have greater susceptibility to infectious diseases,” HIV/AIDS prevention programs do not generally attempt to ameliorate these factors (Stillwaggon, 2006, p. 5). Stillwaggon posits that the practice of addressing malnutrition, sexually transmitted diseases, income inequality, parasitic infection, and lack of access to health care must form the basis for effective HIV/AIDS prevention because these synergies of poverty increase people’s vulnerability to contracting the HIV virus.

The major question that this thesis addresses is whether Stillwaggon’s argument that nutritional deficiencies, economic disadvantage and disease can increase vulnerability to HIV/AIDS infection is relevant in a Canadian (developed world) context. This question is relevant in a Canadian context because many of the conditions of poverty highlighted by Stillwaggon are also a reality in Canada (though in less severe and prevalent forms). For example, in the Downtown Eastside neighborhood of Vancouver, poverty, the sex trade, lack of adequate housing, high rates of unemployment, poor general health, and high rates of sexually transmitted disease are endemic (City of

Vancouver, 2007; Patrick *et al.*, 2002). In addition, a consideration of general Canadian demographics shows that poverty is a significant problem in Canada. For example, statistics show that approximately 10% of Canadians live with food insecurity, and despite high levels of overall wealth, 16% live with low incomes¹ (Rainville & Brink, 2001; Che & Chen, 2001; Raphael, 2007).

Based on this picture of poverty in Canada, I began this project with the hypothesis that Stillwaggon's argument may have some resonance in Canada. This hypothesis is tested in this thesis through several statistical analyses that assess the relationship between HIV prevalence and various poverty measures, at the level of Canadian health regions. A comprehensive review of the literature is also provided to help assess the accuracy of this hypothesis. It is important to note at the outset of this thesis that because this type of research has not been performed previously in a Canadian context, this thesis is a largely exploratory study rather than a strict confirmatory test of the hypothesis.

➤ *Organization of the Chapter*

This chapter will describe the groundwork that was done to posit the hypothesis that Stillwaggon's argument might have relevance to HIV/AIDS prevention in Canada. The first part of the chapter elaborates on the thesis question and sub-question. This is followed by a discussion of the significance of the research project and a description of the project's theoretical framework. The chapter concludes with an overview of the organization of the thesis.

¹ The rate of low income (16%) was determined using the Low Income Cut-Off (LICO) set by Statistics Canada (Raphael, 2007). LICOs are determined by "analyzing family expenditure data below which families will devote a larger share of income to the necessities of food, shelter or clothing than the average family would" (Statistics Canada, 2007).

Thesis Question & Sub-Question

➤ *Thesis Question*

The specific question that this thesis addresses is: Do the synergies of sexually transmitted diseases, income inequality, and hunger shape the HIV/AIDS epidemic in Canada, and do these factors need to be considered more centrally in prevention programs in Canada?

➤ *Thesis Sub-Question*

As many of the variables focused on in Stillwaggon's research (such as severe malnutrition and parasitic illness) are related to large portions of Africans living in a context/climate with tropical diseases and severe endemic malnutrition, it is necessary to question whether this shifts the relevance of Stillwaggon's argument in the context of Canada. More specifically, an important sub-question that must be answered is: Does the less severe, less widespread hunger that exists in Canada (in comparison to the developing regions focused on by Stillwaggon) also impact on HIV/AIDS vulnerability? The significance of answering these questions is discussed below.

Significance of the Research Project

HIV/AIDS has caused indescribable suffering for millions of people across the globe. As noted above, the HIV/AIDS epidemic has affected Africa most significantly, but no country has been left untouched by the disease. In Canada, men who have sex with men, Aboriginal persons and injection drug users have been particularly affected by the HIV/AIDS virus. To quantify this reality:

- 8% of cumulative AIDS cases and 17% of cumulative HIV diagnoses can be attributed to injection drug users (Public Health Agency of Canada, 2006 b).

- Men who have sex with men represented 45% of new Canadian HIV/AIDS cases in 2005 (Public Health Agency of Canada, 2006 b).
- Aboriginal persons make up only 3.3% of the Canadian population, yet approximately 7.5% of total Canadian HIV/AIDS infections (Public Health Agency of Canada, 2006 b).

Women are also accounting for a growing proportion of the population of new Canadian HIV/AIDS infections. To be more specific, the proportion of women testing positive for HIV has increased from 11.3% in the 1985-1996 period, to 27.8% of new infections in 2006 (Public Health Agency of Canada, 2006 b). In total, HIV/AIDS has taken the lives of more than 13,000 Canadians, and more than 60,000 Canadians have been infected (Public Health Agency of Canada, 2006 c). These statistics highlight the importance of effective HIV/AIDS prevention programming in Canada.

Thus far, HIV/AIDS prevention programs in Canada have been focused heavily on behavior change, especially within the above groups. The assumption made by those developing behavior-focused prevention programs has been that if people were told about how HIV/AIDS is transmitted, and informed about how to prevent transmission, they would undertake appropriate precautions and be protected from the spread of this deadly virus. However, in study after study, the literature shows that large numbers of Canadians continue to have unprotected sex – often with multiple partners – even though they are aware of the consequences of their behavior (Canadian Strategy on HIV/AIDS, 2001). For example, a recent Health Canada study demonstrates that 27.1% of Canadian men and 28.2% of Canadian women do not use condoms on a regular basis (Canadian Strategy on HIV/AIDS, 2001). More striking are the statistics that reveal that overall HIV prevalence rates continue to increase despite more than two decades of prevention efforts. To elaborate, the Public Health Agency of Canada has reported that overall

prevalence rates in Canada increased 24% between 1996 and 1999, and have continued to increase since 1999 (e.g. by 16% between 2002 and 2005) (Public Health Agency of Canada, 2002; Public Health Agency of Canada, 2006 d). These statistics indicate that in the third decade of the epidemic, behavior models alone are not proving to be sufficient in preventing the spread of HIV/AIDS in Canada.

In AIDS and the Ecology of Poverty, Stillwaggon (2006) addresses the failure of behavior change programs in income-poor countries, and argues that we must consider how people's social context of poverty may influence their vulnerability to contracting HIV/AIDS. This is an innovative contribution to the literature that helps us begin to understand why structural factors must be considered in prevention programs. This thesis project contributes to the quest to understand how structural factors influence HIV/AIDS vulnerability, by questioning whether Stillwaggon's research has resonance in Canada. In doing so, this research contributes to our understanding of HIV/AIDS vulnerability so that more effective prevention policies and strategies can be developed.

Theoretical Framework

This research project will use a structural approach to social work as the theoretical framework for approaching the thesis question. The structural approach to social work is critical of conventional social work practice (Carniol, 1992). It is "based on socialist ideology, grounded in critical theory, and espouses a conflict view of society" (Lundy, 2004, p. 58). The main essence of this approach is that individual problems are rooted in wider societal structures (Mulally, 1997; Carniol, 1992; Lundy, 2004). Mulally (1997) elaborates on this position:

Structural social work views social problems as arising from a specific societal context – liberal/neo-conservative capitalism – rather than from the failings of individuals. The essence of...[the structural framework]...is that inequality: (1) is a natural, inherent (e.g. structural) part of capitalism; (2) falls along the lines of class, gender, race, age, ability and geographical region; (3) excludes these groups from opportunities, meaningful participation in society, and a satisfactory quality of life; (4) is self-perpetuating (p. 113).

Based on this way of seeing the world, social workers practicing from this perspective are concerned with the long term goal of transforming oppressive social structures that “exploit and dehumanize people” (Lundy, 2004, p. 67). In the short term, structural social workers aim to alleviate the immediate negative effects of structural oppression that are experienced by marginalized individuals (Mullaly, 1997).

The ultimate objective of the structural social work perspective is the transformation of liberal capitalist society into a society that is “more congruent with socialist principles” (Mullaly, 1997, p. 134). Carniol (1991) describes this goal for transformation in more detail, explaining that “a new form of intervention would call for a restructuring of our social institutions, so that they become answerable to the public rather than being strictly controlled by a small class of people controlled primarily of white wealthy males” (p. 22). Without such a transformation, Carniol (1991) argues that “social problems will be perpetuated endlessly into the future” (p. 22).

Using a structural framework, this thesis will focus on the structure of poverty, looking at how class influences vulnerability to HIV/AIDS infection. However, this research will go beyond simply articulating that there is an interlocking relationship between poverty and HIV/AIDS risk, and instead will aim to reveal the complex, multi-faceted effects of these relations including linkages within the literature to race, gender and geography. It will also aim to uncover the specific mechanisms through which

power plays out on the human body, and how this impacts vulnerability to HIV/AIDS infection in a Canadian context.

Organization of the Thesis

The remainder of this thesis is organized into four chapters. Chapter 2 outlines the literature that is relevant to this project. This chapter is divided into three distinct parts. Part I provides a critical review of the main approaches and ideas about HIV prevention that are currently being examined in the literature. Part II discusses the literature that is relevant to assessing Stillwaggon's argument in Canada. Several subjects are covered in this section, including the relationships between poor nutrition and susceptibility to infectious disease; malnutrition and HIV/AIDS transmission; sexually transmitted diseases and poverty; sexually transmitted diseases and HIV/AIDS; and, income inequality and HIV/AIDS. Part III of this chapter describes the prevalence of the variables under consideration in this study: hunger, sexually transmitted diseases, and income inequality.

Chapter 3 provides a detailed description of the methodology used in this study. This chapter explains why the project's methodology was selected, and how it aims to replicate Stillwaggon's research in a Canadian context. Details of the methodological design are also outlined, including specifics about the data sources, variables and statistical methods used in the analysis. The chapter concludes with a discussion of methodological limitations.

Chapter 4 presents the results of this project's statistical analyses. More specifically, this chapter presents the results of the bivariate and multivariate regression analyses for both 2003 and 2005. Chapter 5 builds on chapter 4, discussing the results of

the statistical analyses in relation to the literature outlined in chapter 2. The main argument of the thesis is presented in chapter 5, which is that Stillwaggon's argument has some resonance in Canada, and deserves greater attention in Canadian prevention programming and research. The chapter concludes with a discussion of the implications of this thesis for social work. Recommendations for poverty-focused prevention and directions for further research are also discussed.

CHAPTER 2 – LITERATURE REVIEW

This chapter outlines the literature that is relevant to this thesis project. The chapter is divided into three distinct parts. Part I provides a critical overview of the main approaches and ideas about prevention that are discussed in the literature. Part II examines the literature that is relevant to assessing the significance of Stillwaggon's argument in Canada. Part III describes the prevalence of the variables under consideration in this study: hunger, sexually transmitted diseases, and income inequality. The literature presented in this chapter provides a framework for beginning to consider the thesis question, which is: Do the synergies of sexually transmitted diseases, income inequality and hunger shape the HIV/AIDS epidemic in Canada, and do these factors need to be considered more centrally in prevention programs? A more comprehensive introduction to each of the three parts of this chapter is provided at the outset of each section.

PART I: LITERATURE CONCERNING APPROACHES TO PREVENTION

This section discusses the main approaches and ideas about HIV/AIDS prevention that are examined in the literature. Specifically, this section begins by discussing the two main approaches contained in the literature; behavior-focused approaches and gender-focused approaches. This is followed by a discussion of the poverty-focused HIV/AIDS prevention literature. While this literature does not represent a third "approach" to prevention (in that it has not been translated into practical strategies), it constitutes a significant portion of the discussion about HIV/AIDS prevention, and is therefore

relevant to this project. Finally, this section concludes with a comprehensive overview of Stillwaggon's approach, which represents a fourth, poverty-focused, understanding of prevention. Throughout this section, the gaps, weaknesses and strengths of these approaches and ideas will be reviewed. The overall purpose of this section is to reveal the limits of the existing approaches and ideas about prevention, so as to locate the importance of considering Stillwaggon's argument in Canada.

The Behavior Change Approach

The most prominent trend in the prevention policy literature has been to focus on behavior change (Green, 2003; Stillwaggon, 2006; Campbell, 2003; Sumartojo, 2000). This has been the case at all levels of policy development, from United Nations' policy documents to the national HIV/AIDS strategies of countries across the world (e.g. UNAIDS, n.d. b; Canadian AIDS Society, 2004; Asingwire & Kyomuhendo, 2003; Center for Disease Control, 2006). To examine these policies more fully, it is necessary to discuss the two main foci of these prevention programs. A first focus has been on changing the sexual behavior of individuals through education about 'less risky' sexual options, and distribution of safer sex prophylactics (e.g. condoms) (AVERT, n.d. a; Canadian AIDS Society, 2004; USAID, n.d.). One of the dominant programs that has been developed from this focus is the **ABC** prevention model that calls for people to: **A**bstain, **B**e Faithful & **C**ondomize (Campbell, 2003, AVERT, n.d. b; USAID, n.d.). The second focus of this prevention approach has been on changing the behavior of illegal drug users through harm reduction programs, such as needle exchanges, safe-injection

sites, and the distribution of crack-kits² (Canadian AIDS Society, 2004; World Health Organization, 2004; Hilton *et al.*, 2001; Jarlais *et al.*, 1993). The goal of these programs and policies is to reduce the risk of individuals to contracting HIV/AIDS by changing their 'risky' behavior (Canadian AIDS Society, 2004; Hilton *et al.*, 2001; AVERT, n.d. a; USAID, n.d.).

In Canada, an example of such a policy document is the Canadian AIDS Society's 'HIV Transmission: Guidelines for Assessing Risk' (Canadian AIDS Society, 2004). This document is produced for HIV/AIDS educators and counselors and it offers a framework for assessing one's risk for both HIV/AIDS and hepatitis C. Most of this document focuses on providing a risk model, which assigns a level of risk to specific behaviors (such as injection drug use, and oral sex), so that individuals can understand the degree of risk attached to different sexual and non-sexual acts (Canadian AIDS Society, 2004). For example, unprotected vaginal intercourse and injection drug use with a used needle are both assigned to the category of high risk, whereas kissing without blood is labeled as carrying no risk (Canadian AIDS Society, 2004). The guidelines also provide information on how individuals can reduce their exposure to harm, for example, by using latex condoms during sexual intercourse and clean needles during injection drug use (Canadian AIDS Society, 2004). While this document acknowledges briefly some of the contextual factors that can influence one's ability to manage risk, such as poverty, race, gender inequality, alcohol, and 'getting caught up in the moment,' the focus of the document is explicitly on the modification of behavior (Canadian AIDS Society, 2004). The assumption of this prevention approach is that providing people with accurate

² 'Crack kits' are crack smoking packages that contain a new glass crack pipe, and other items such as chewing gum, lip balm, alcohol wipes, matches and condoms (Hayden & Fischer, 2005).

information about HIV/AIDS and hepatitis C transmission will empower them to reduce their risk by abstaining from ‘risky’ behavior and/or by using harm reduction techniques.

This approach has some proven effectiveness (see, for example, Kelly & Kalichman, 2002; Lamb *et al.*, 1998; Green *et al.*, 2006). However, it has failed to stem the spread of HIV/AIDS. As is explained in chapter 1, this is evidenced by increasing rates of HIV/AIDS infection, as well as by a plethora of studies that demonstrate that people continue to engage in ‘risky’ behavior (e.g. intercourse without a condom) even though they are aware of the possibility that they may contract HIV/AIDS (Canadian Strategy on HIV/AIDS, 2001; Campbell, 2003). In response to these deficiencies, there is a growing body of literature suggesting that researchers and policy makers must look beyond individually focused behavior models, and begin to consider other, more contextually based factors shaping the epidemic (e.g. Campbell, 2003; Stillwaggon, 2006; Farmer, 2003; Sumartojo, 2000). This thesis project aims to do precisely this by considering how the contextual factors of food insecurity, sexually transmitted diseases and income inequality may influence people’s risk of contracting HIV/AIDS in a Canadian context. In doing so, this research contributes to our understanding of HIV/AIDS vulnerability so that more effective prevention policies and strategies can be developed.

Gendered Approaches to HIV/AIDS Prevention

In the past decade, there has been increased attention in the literature to the relationship between gender and HIV/AIDS risk (both globally and in Canada). The essence of the argument put forward by scholars looking at gender and HIV/AIDS is that women are particularly vulnerable to contracting HIV/AIDS because of gender

inequality, and that gendered approaches to prevention are, therefore, necessary (Kumar *et al.*, 2002; Farmer, 1996; Zierler & Krieger, 1997).

In exploring how women's unequal position makes them vulnerable to HIV/AIDS (in income-rich countries) there are several key themes in the literature. A first theme discusses the ways that gender inequality can increase women's vulnerability to contracting HIV/AIDS by making it difficult for women to negotiate safer sex (e.g. condom use). Literature addressing this theme argues that women's lack of power in intimate relationships can make safer sex negotiation difficult (Stockdill, 2003; Amaro, 1995; Zierler & Krieger, 1997; Pulerwitz *et al.*, 2002). For example, in a study of Latino women in the United States, Pulerwitz *et al.* (2002) found that women reporting low levels of relationship power³ were five times less likely to report consistent condom use than women with high levels of relationship power. Lack of power within relationships can also make women vulnerable to sexual violence, which can be accompanied by HIV/AIDS risk (Stockdill, 2003; Zierler & Krieger, 1997; Canadian AIDS Society, n.d. a). Further, these dynamics can be exacerbated if a woman is economically marginalized and financially dependent on her intimate partner (Farmer, 1996; Wingwood & DiClemente, 2000; Amaro, 1995; Zierler & Krieger, 1997).

Gendered expectations about how young women (and even older women) are expected to act in intimate heterosexual relationships can also impede safer sex negotiations (see Kumar *et al.*, 2002; Travers & Bennett, 2000; Holland & Thomson, 1998). Kumar *et al.* (2002) explain this dynamic succinctly:

³ Relationship power was measured in this study using the Sexual Power Relationship Scale (SPRS) – a new measure designed for this study. This 23 item measure, “contains two sub-scales, Relationship Control (e.g. ‘My partner tells me who I can spend time with’) and Decision Making Dominance (e.g. ‘My partner usually has more say about whether we have sex’)” (Pulerwitz *et al.*, 2002, p. 791).

According to the dominant femininity script, young women are not supposed to desire sex or be sexually assertive, and are further expected to resist young men's sexual advances. Enforced through the mechanisms of sexual reputation amongst peers, a young woman can be labeled a 'whore' or a 'slut' if she is seen as too sexually knowledgeable or assertive by her peers or male partner. Thus, an empowered independent young woman with her own active sexual desires, who seeks sexual pleasure and sexual safety on her own terms is not a 'normal' feminine woman. It is these distinctions and accompanying judgments that serve to disempower a young woman by limiting her scope of socially appropriate behaviors within heterosexual relations (p. 2).

The above literature clearly links gender inequality and relationship power to HIV/AIDS infection risk, suggesting that prevention programming that attempts to empower women may decrease their risk of contracting HIV/AIDS. This literature also suggests that economic marginalization can exacerbate the effects of gender inequality. The theme of economic marginalization is explored more fully below, and in proceeding sections.

➤ ***Economic Marginalization and Gendered Risk***

A second theme in the literature about gender inequality and HIV/AIDS risk, addressed briefly above, looks at how economic marginalization can put women at increased risk of contracting HIV/AIDS (Farmer, 1996; Zierler & Krieger, 1997; Wingwood & DiClemente, 2000; Amaro, 1995). Numerous scholars addressing this subject argue that women who are economically dependent on their male partners may have difficulty negotiating condom use out of fear of losing material support for themselves or their children (e.g. housing, food) (Farmer, 1996; Zierler & Krieger, 1997; Wingwood & DiClemente, 2000; Amaro, 1995). The literature about economic marginalization and HIV/AIDS also argues that poor women living with addictions may face particular gendered risks. Specifically, women with addictions are at particular risk because of differential access to needle exchange programs and addiction treatment

programs (Zierler & Krieger, 1997). Women are also more likely to share needles, as a means of securing male protection in unsafe environments, which can increase women's risk (Farmer, 1996; Zierler & Krieger, 1997; Wingwood & DiClemente, 2000; Whynot, 1998). These dynamics add further layers of risk for women that must be addressed in prevention programs.

➤ ***Women's Biological Vulnerability***

A third theme in the literature about women's vulnerability to HIV/AIDS focuses on women's biological vulnerability. This body of literature argues that women are at greater risk of contracting HIV/AIDS than men in any heterosexual encounter (Wingwood & DiClemente, 2000; Quinn & Overbaugh, 2005; Center for Disease Control, 2007; World Health Organization, n.d.; Cummins & Dezzutti, 2000). Several reasons have been identified for this increased vulnerability, including: the high level of viral content in semen (in comparison to vaginal fluids); the greater amount of male fluids transferred from men to women during sex; the greater area of mucous membrane exposed by women during sex; and, micro-tears in the vagina that can result from penetration (World Health Organization, n.d.; Cummins & Dezzutti, 2000; Center for Disease Control, n.d.). Studies have shown that women may also be at greater risk because of concurrent sexually transmitted infections, which often go untreated in women because of lack of symptoms (Quinn & Overbaugh, 2005; Laga, *et al.*, 1993; Fleming & Wasserheit, 1997; Center for Disease Control, 2007). Finally, studies have shown that hormonal contraceptives may increase women's vulnerability to HIV/AIDS, though further research is needed on this subject (Quinn & Overbaugh, 2005; Lavreys *et al.*, 2003). Overall, this body of literature argues that prevention programs must consider

women's biological vulnerability to HIV/AIDS, in order for HIV/AIDS prevention to be successful.

➤ ***Gendered Approaches to HIV/AIDS Prevention***

In recognition of the above themes of literature, HIV/AIDS scholars, organizations and advocacy groups across the globe have focused on developing gender-based approaches to HIV/AIDS prevention (e.g. UNIFEM, n.d.; Sisters for Life International, n.d.; ATHENA, n.d.). In particular, these organizations have focused on developing gender specific education for women that focuses on empowering women to protect themselves from HIV/AIDS infection. In Canada, examples of organizations/advocacy groups developing such strategies include the Canadian AIDS society, Positive Women's Network, Voices of Positive Women, the Canadian HIV/AIDS Information Center, the Canadian AIDS Treatment Information Exchange, and the Planned Parenthood Federation of Canada (Canadian AIDS Society, n.d. b; Positive Women's Network, n.d.; Voices of Positive Women, n.d.; Canadian HIV/AIDS Information Center, n.d.; Canadian AIDS Treatment Information Exchange, n.d.; Planned Parenthood Federation of Canada, n.d.). A specific example of such a gender-based educational document is the 'Women & HIV Education Toolkit,' published by the Positive Women's Network (Positive Women's Network, n.d.). This toolkit provides HIV/AIDS educators with tools specific to informing women about their risk for HIV/AIDS, and empowering them to prevent risk (Positive Women's Network, n.d.).

There has also been recent attention in the strategy focused gender-based literature about the need for alternative methods of protection (other than abstinence or condoms), that women can control. Specifically, attention has been focused on the need

for an effective and safe microbicide (MAGNet *et al.*, n.d.; Uckun & Cruz, 1999; Turpin, 2002). Microbicides are “any substance that can substantially reduce transmission of HIV and other sexually transmitted infection when applied to the vagina or rectum” (MAGNet *et al.*, n.d., p. 3). The development of an odorless and tasteless microbicide would benefit women, who are unable to negotiate condom use, by providing a protection method that does not require male consent (MAGNet *et al.*, n.d.; McCormack *et al.*, 2001; Heise & Elias, 1995). There are currently no microbicides available on the market; however, more than sixty different gels and creams are in the process of being clinically tested, and it is possible that one or more of these products will be made available before 2010 (MAGNet *et al.*, n.d.; Gupta, 2002). Research indicates that women in both income-rich and income-poor countries are interested in such a product (MAGNet, n.d.; Hill *et al.*, 2000; Darroch & Frost, 1999; Bentley *et al.*, 2004). This said, microbicides may be a challenge for some women, particularly in the developing world, who have no money of their own to purchase the product, nowhere to keep such a product, and/or who are expected to engage in ‘dry sex,’ which would be complicated with the use of a microbicide.

In conclusion, the above literature and approaches have marked a very important step for women (in fighting the HIV/AIDS epidemic), and it is critical that such approaches are strengthened in order to reduce women’s risk. However, the present study suggests that the attention paid to gender thus far may be too narrowly focused. More specifically, the attention of scholars and policy makers looking at women and HIV/AIDS has focused almost exclusively on women’s marginalized position in society and greater biological vulnerability to HIV/AIDS infection, and has failed to consider

such things as women's state of nutrition and general health. This is an important oversight as women are more likely to experience nutritional deficiency and poor overall health than their male counterparts, both globally and in a Canadian context (Che & Chen, 2001; Division for the Advancement of Women, 1995; Raphael, 2007; Hick, 2004). While the quantitative analysis in this thesis does not look specifically at gender and food insecurity (due to data limitations), this project helps policy-makers understand that addressing food insecurity – which is disproportionately experienced by women – may decrease the HIV/AIDS risk for poor women.

Poverty & HIV/AIDS

As is noted above, a third argument in the “debate” about prevention is that poverty plays a role in HIV/AIDS transmission. While this position has not been translated into a practical approach to prevention, it has received increasing attention in prevention discussions, and several scholars have suggested its importance (e.g. Raphael, 2007; Kreuger *et al.*, 1990; Spigelman, 2002; Farmer, 1999; Holtgrave & Crosby, 2003; Murrain & Barker, 1997; Zierler & Krieger, 1997; Farmer, 1996). The literature on this subject tends to focus on two areas: 1) making links between HIV/AIDS and poverty; and, 2) explaining why people living in poverty are at increased risk of infection.

➤ *Links Between HIV/AIDS and Poverty*

There is a growing body of literature that has linked both HIV and AIDS to poverty in income-rich countries (e.g. Kreuger *et al.*, 1990; Holman, *et al.*, 1989; Spigelman, 2002; Ezzy *et al.*, 1999; Zierler *et al.*, 2000; Hankins *et al.*, 1998; Murrain & Barker, 1997). Because this study is interested in understanding vulnerability to HIV, rather than the relationship between AIDS and poverty, this review will focus on studies

that consider HIV and poverty. The existing studies that look at this relationship suggest that poverty is connected to HIV vulnerability (e.g. Kreuger *et al.*, 1990; Hankins *et al.*, 1998; Murrain & Baker, 1997; Holman *et al.*, 1989). For example, a study of 3601 clients attending a Seattle HIV testing clinic found that clients with lower incomes were more likely to test positive for HIV, after controlling for other risk factors (Krueger *et al.*, 1990). In a second study carried out in Massachusetts (U.S.), homeless individuals and people without health insurance were found to be at greater risk for HIV (Murrain & Baker, 1997). Further, in a third study done in Montreal (Canada), “higher HIV rates were found among childbearing women from lower socioeconomic areas of Montreal” (Hankins *et al.*, 1998, p. 691). While further research is necessary to explore the relationship between HIV and poverty in income-rich countries, the existing studies provide evidence of at least a tentative relationship. It is also important to note that there is a growing body of literature linking income inequality to HIV/AIDS rates (e.g. Holtgrave & Crosby, 2003; Talbot, 2007; Nepal, 2007; Drain *et al.*, 2004). This literature is explored further in subsequent sections.

➤ ***Reasons Why Poverty is Connected to HIV/AIDS***

Based on the evidence of a relationship between poverty and HIV/AIDS several scholars have posited ideas for why people living in poverty are at greater risk of contracting HIV/AIDS infection (e.g. Stockdill, 2003; Krueger *et al.*, 1990; Spigelman, 2002). Most of these explanations focus on making connections between poverty and risky behavior. A first reason suggested for why people living in poverty are particularly vulnerable to HIV/AIDS is that poor areas and neighborhoods often lack access to meaningful HIV/AIDS prevention information (Stockdill, 2003; Kreuger *et al.*, 1990). A

second reason suggested is that drug addiction is more prevalent in poor communities, which fuels the spread of HIV infection through the sharing of needles and drug influenced sex (Stockdill, 2003; Farmer, 1996; Doherty *et al.*, 2000). The literature also acknowledges that the conditions in which poor people live (e.g. substandard housing or the streets) often lead to poorer health, generally speaking, than that experienced by the middle and upper classes of society (Stockdill, 2003; Raphael, 2007; Spigelman, 2002). Overall, this body of literature identifies the need to target prevention at poor areas/communities; but it has not been translated into a practical approach to prevention that has been adopted into policy.

In conclusion, the poverty-focused literature discussed above, increases our knowledge about HIV/AIDS risk, by adding another dimension of risk to the prevention debate. However, this literature lacks practical strategies, and focuses too exclusively on how poverty influences behavior, failing to consider the ways that more structural aspects of poverty, such as hunger, may influence people's vulnerability to HIV/AIDS infection. The present study builds on this literature by exploring how hunger, income inequality and sexually transmitted diseases influence vulnerability to contracting HIV/AIDS in Canada, using Stillwaggon's model, discussed below.

Comprehensive Outline of Stillwaggon's Model

Stillwaggon's research marks a fourth, poverty focused, understanding of HIV/AIDS prevention. As is noted in chapter 1, Stillwaggon (2006) focuses her research on explaining why global AIDS policy has failed to stop the spread of HIV/AIDS, and why HIV/AIDS has had such a devastating impact on developing countries. Looking at behavior-focused prevention programs in Africa, Stillwaggon (2006) argues that these

programs are based on the widely accepted (albeit incorrect and racist) notion that high rates of HIV/AIDS are primarily the result of over-sexualized African behavior (Stillwaggon, 2003; Stillwaggon, 2006). Stillwaggon (2006) argues that this approach to prevention fails to consider the “social and biological context in which behavior occurs” (p. 13). More specifically, despite the fact that there is an established literature, which demonstrates that “persons with nutritional deficiencies, with parasitic diseases, whose general health is poor, who have little access to health care services, or who are otherwise economically disadvantaged have greater susceptibility to infectious diseases,” HIV/AIDS prevention programs do not attend to ameliorating these factors (Stillwaggon, 2006, p. 5). Stillwaggon (2006) argues that policy-makers must attend to these specific synergies of poverty, because they increase people’s vulnerability to contracting HIV/AIDS. However, it is important to note that Stillwaggon does not argue that behavior and gender based programs are not significant in successful prevention. Instead, Stillwaggon (2006) calls for the development of more comprehensive strategies that focus on specific synergies of poverty (e.g. malnutrition, parasitic diseases, poor general health, lack of access to health care, and economic marginalization), but also consider behavior and gender.

Stillwaggon (2006) brings forward much evidence to support her argument that specific conditions of poverty increase vulnerability to HIV/AIDS. First, Stillwaggon (2006) describes a substantial body of literature that demonstrates that both malnutrition and parasitic infection can lead to increased vulnerability to any infectious disease, including those that are sexually transmitted. Second, Stillwaggon (2006) uses the existing literature to demonstrate that specific biological synergies, such as

schistosomiasis, malnutrition, malaria, and helminthic and filarial infections increase people's vulnerability to HIV/AIDS specifically. Third, Stillwaggon (2006) describes the results of several quantitative statistical analyses, that demonstrate that variables representing income inequality and poor nutrition are significantly related to the prevalence of HIV/AIDS in the developing regions of: Sub-Saharan Africa; Latin America and the Caribbean; and, Eastern Europe and the former Soviet Union⁴ (Stillwaggon, 2006).

To further substantiate her argument that behavior alone cannot explain the high rates of HIV/AIDS in income-poor countries, Stillwaggon (2006) considers statistics about sexual behavior in various parts of the world to demonstrate that high rates of HIV/AIDS in Africa cannot be the result of oversexualized behavior. Stillwaggon explains, for example, that people in Botswana would have to be having eighty times more unprotected sex than people in the United States in order to explain the difference in prevalence rates between the two countries. She also cites statistics from the global North, demonstrating that there are high levels of unprotected multi-partnered sex, yet lower rates of HIV/AIDS infection (Stillwaggon, 2006). Overall, Stillwaggon (2006) provides a compelling case for the argument that conditions of poverty are connected to HIV/AIDS vulnerability.

Based on her argument, Stillwaggon (2006) provides several concrete recommendations for prevention strategies. Some of her recommendations are as follows:

- Eradicate helminth and schistosomiasis infection
- Improve immune systems with cheap and effective nutrient supplements

⁴ Stillwaggon's statistical methods are described in detail in chapter 3.

- Improve health care services
- Develop sustainable agriculture to improve nutrition
- Keep girls in school
- End oppression of women
- Mass communication of health information (Stillwaggon, 2006)

Overall, Stillwaggon (2006) argues for a more comprehensive approach to prevention that is focused on alleviating conditions of poverty, but also recognizes the need for improved behavior change communication and greater empowerment of women.

In conclusion, Stillwaggon's approach to prevention is centered on an analysis of the relationship between poverty and HIV/AIDS in income-poor countries; however, Stillwaggon's research provides a model for considering HIV/AIDS and poverty in income-rich countries. In this project, I will use Stillwaggon's model to analyze the relationship between poverty and HIV/AIDS in Canada.

PART II: LITERATURE RELEVANT TO ASSESSING STILLWAGGON'S ARGUMENT IN CANADA

In exploring the relevance of Stillwaggon's argument in Canada, it is necessary to discuss the Canadian literature. Specifically, it is necessary to discuss links between HIV/AIDS and malnutrition, sexually transmitted diseases (STDs), and income inequality in income-rich countries. However, because there is limited literature exploring the relationship between HIV/AIDS and malnutrition, this section will also consider links between malnutrition and infectious diseases in general. While this literature is not specific to the spread of HIV/AIDS, it helps to explain how malnutrition may increase people's vulnerability to contracting any infectious disease, including those that are sexually transmitted. This section will also briefly discuss links between STDs and

poverty, to demonstrate that STDs are a synergy of poverty (an assumption of this thesis).

The organization of the section is as follows:

- malnutrition and vulnerability to infectious disease
- malnutrition and HIV/AIDS transmission
- sexually transmitted diseases and poverty
- sexually transmitted diseases and HIV/AIDS

This section will conclude with a discussion of the literature that considers the relationship between HIV/AIDS and income inequality.

Poor Nutrition & Vulnerability to Infectious Disease

The association between malnutrition and compromised immunity to infection has been recognized by scientists and epidemiologists since the 1960s (Cunningham-Rundles, 1998; Chandra, 1997; Scrimshaw and SanGiovanni, 1997). In the last twenty-five years, a substantial body of research has been published, which explains the precise mechanisms through which poor nutrition compromises the immune system (Chandra, 1997; Stillwaggon, 2006). These studies indicate that compromised immunity results from both protein-energy malnutrition (PEM)⁵ and from micronutrient deficiencies (Chandra, 1997; Beisel, 1996; Chandra, 2002). The ways that PEM and micronutrient deficiencies contribute to vulnerability to infectious disease are discussed below.

Studies on Protein-Energy Malnutrition

Several studies have demonstrated that PEM has an adverse impact on immunity (e.g. Scrimshaw & SanGiovanni, 1997; Chandra, 1997; Biesel, 1996; Chandra & Kumari, 1994). These studies explain that PEM can negatively impact the immune system through several specific mechanisms, including: atrophy of the lymphoid tissues

⁵ PEM is malnutrition that results from an inadequate intake or absorption of calories and/or protein (macronutrients) (Lochs *et al.*, 2006, p. 182).

(including the thymus, spleen, tonsils and lymph nodes); decreased T cells (especially T helper cells); decreased thymulin activity, impaired secretory immunoglobulin A antibody response; phagocyte dysfunction; and decreased antibody affinity (Biesel, 1996; Chandra & Kumari, 1994; Chandra, 1997). PEM can also compromise the body's physical barriers (skin and mucosal protection), which play an important role in defending the body against opportunistic infection (Woodward, 1998; Scrimshaw & SanGiovanni, 1997; Chandra & Sarchielli, 1996). Further, protein is important in fighting infection because most functions of the immune system rely on cell replication, which requires protein (Karp, 2003; Scrimshaw & SanGiovanni, 1997).

Protein-energy malnutrition has been linked to increased vulnerability to several infectious diseases (Boelaert & Gordeuk, 2002; Chandra & Kumari, 1994; Schaible & Kauffmann, 2007; Baqui *et al.*, 1993). For example, PEM has been connected to increased vulnerability to tuberculosis (TB) in several studies (McMurray, 1998; Chandra, 1992; Boelaert & Gordeuk, 2002). Protein-energy malnutrition has also been linked to increased vulnerability to measles, *pneumocystis carinii*, malaria, diarrhea, influenza and respiratory infections (Chandra & Kumari, 1994; Schaible & Kaufmann, 2007; Baqui *et al.*, 1993). These studies provide further evidence that PEM can harm the immune system, and cause increased vulnerability to a wide range of diseases.

Studies on Micronutrient Deficiency

Numerous studies have demonstrated that a deficiency of several micronutrients can also weaken the ability of the immune system to resist infection (Chandra, 2002; Meydani & Beharka, 1996; Scrimshaw & SanGiovanni, 1997; Biesel, 1996; Black, 2003). These micronutrients include zinc, vitamin A, β -Carotene, B vitamins, vitamin C,

Vitamin E, selenium, copper, folic acid, and iron (Scrimshaw & SanGiovanni, 1997; Biesel, 1996; Chandra, 2002; Meydani & Beharka, 1996; Wintergerst *et al.*, 2007). In order to understand the impact that micronutrient deficiency can have on immunity, it is necessary to elaborate more specifically on a couple of the most common and important micronutrient deficiencies that can impact immunity. The following paragraphs will discuss iron and vitamin A in detail.

➤ ***Iron***

Iron deficiency, the most common nutrient deficiency in the world, has been consistently linked with increased morbidity to infectious diseases in numerous studies (Scrimshaw & SanGiovanni, 1997; Salgueiro *et al.*, 2000; Biesel, 1996). Moreover, iron supplementation has been shown to increase the efficiency of the immune system in many populations, such as marasmic infants, children recovering from malnutrition, patients with sickle-cell anemia, and children with Down's syndrome (Scrimshaw & SanGiovanni, 1997; Salgueiro *et al.*, 2000; Castillo-Duran *et al.*, 1987; Chiricolo *et al.*, 1993; Mostad *et al.*, 1998). Scrimshaw and SanGiovanni (1997) explain that the specific mechanisms impaired by iron deficiency include: "impaired phagocytic killing power, less response to lymphocyte stimulation, few natural killer cells associated with reduced interferon production, and depressed delayed cutaneous [skin] hypersensitivity" (p. 469S). Iron deficiency is particularly common in women and children (Looker *et al.*, 1997; Center for Disease Control, 1998).

➤ ***Vitamin A***

Numerous studies published over the last 30 years have shown that vitamin A deficiency is especially harmful to the immune system, and that vitamin A deficiency is

synergistic with infectious diseases, such as malaria, measles and diarrhea (Semba, 1998; Scrimshaw & San Giovanni, 1997; Kjolhede & Biesel, 1996; Stillwaggon, 2006; Black, 2003). Vitamin A deficiency can compromise the immune system by depressing cellular immunity, causing atrophy of the lymphoid tissues, impairing response to protein antigens, and compromising skin and mucous membranes (which provide protection from infections) (Semba, 1998; Scrimshaw & San Goivanni, 1997; Nimmigada & O'Brien, 1998). Vitamin A is also important to the production of T cells, which are responsible for regulation of the immune system and destruction of foreign cells (e.g. viruses) (Gilbert, 2003).

Is Mild to Moderate Malnutrition Significant in Compromising Immunity?

As the presence of protein-energy malnutrition and micronutrient deficiency in Canada is substantially less severe and endemic than in the income-poor regions where Stillwaggon's argument is focused, it is important to consider whether mild to moderate malnutrition is significant in compromising immunity to infectious disease. While there is some disagreement among researchers about the significance of mild to moderate malnutrition on the immune system there is some compelling evidence that mild to moderate malnutrition increases susceptibility to infectious disease (e.g. Pelletier *et al.*, 1995; Koster *et al.*, 1987; Bhaskaram, 2001; Black, 2003). For example, in a study considering data from fifty-three developing countries, Pelletier *et al.* (1995) found that malnutrition contributed to 56% of child deaths, and that 83% of these child deaths were attributable to children with mild to moderate malnutrition (rather than severe malnutrition). In another study, looking at diarrhea prevalence in Bangladeshi children, Koster *et al.* (1987) found evidence linking moderate protein energy malnutrition with

impaired immunity. Further, several studies demonstrate that moderate, and even mild levels of several micronutrient deficiencies, can also impair immune function (e.g. Bhaskaram, 2001; Black, 2003; Reddy *et al.*, 1989; Nimmigada & O'Brien, 1998). This literature suggests that mild to moderate malnutrition may be linked to reduced immune function and increased vulnerability to infectious disease.

In conclusion, there is a significant body of evidence which suggests that both protein-energy malnutrition and micronutrient deficiency can result in increased vulnerability to infectious disease. While this literature is not specific to HIV/AIDS, it helps to explain how these factors may increase people's vulnerability to contracting any infectious disease, including sexually transmitted diseases, such as HIV/AIDS (Stillwaggon, 2006). Even in mild to moderate cases, there is a demonstrable link between vulnerability to infectious disease and malnutrition. This link is especially relevant in Canada, as there are few instances of severe malnutrition in contemporary Canada.

The Link Between Malnutrition and HIV Transmission

This section reviews the literature that explores links between malnutrition and vulnerability to HIV/AIDS, specifically. While there is a growing body of literature that implicates poor nutrition in the progression from HIV to AIDS (see, for example, Macallan, 1999; Soloman, 2001; Tang *et al.*, 1997; Fawzi *et al.*, 2004), there is less literature that explores how malnutrition contributes to the transmission of the HIV virus (see Friss, 2005; Friss & Michaelsen, 1998; Gillespie & Kadiyala, 2005 a; Semba & Miotti, 1994; Greenberg *et al.*, 1997; Gillespie & Kadiyala, 2005 b). The existing

literature that explores this subject does so through a consideration of both sexual transmission and mother-to-child transmission, which are both discussed below.

➤ ***Mother-To-Child (Vertical) Transmission***

There is a growing body of research that explores the relationship between malnutrition and vertical transmission (Graham *et al.*, 1993; Semba *et al.*, 1994; Dushimimana *et al.*, 1992; Wafaie & Fawzi, 1998; Burns *et al.*, 1999; Burger *et al.*, 1997; Greenberg *et al.*, 1997). Most research on this subject has been carried out in Africa, and focuses on exploring whether micronutrient deficiency in pregnant women is associated with vertical transmission (Graham *et al.*, 1993; Semba *et al.*, 1994; Dushimimana *et al.*, 1992; Wafaie & Fawzi, 1998). These studies have shown evidence that pregnant HIV-positive women in Africa with vitamin A deficiency have a higher rate of transmitting HIV/AIDS to their infants (either in-vitro, or through childbirth) than women without vitamin A deficiency (Graham *et al.*, 1993; Semba *et al.*, 1994; Dushimimana *et al.*, 1992; Wafaie & Fawzi, 1998). For example, a study of 338 HIV-positive pregnant women in Malawi found that “mean vitamin A concentration in 74 mothers who transmitted HIV to their infants was lower than that in the 264 mothers who did not transmit HIV to their infants” (Semba *et al.*, 1994, p. 1585).

The literature on vertical transmission and malnutrition in income-rich countries is more scant, and the results are less conclusive than in studies done in Africa. In two of the three studies published in the United States, no relationship was found between vitamin A deficiency and vertical transmission (Burns *et al.*, 1999; Burger *et al.*, 1997). By contrast, in a third study of 133 HIV-positive women who delivered live births in the United States, Greenberg *et al.* (1997) found that severe maternal vitamin A deficiency

was associated with HIV/AIDS, indicating that vitamin A may play a role in vertical transmission in income-rich countries.

➤ ***Sexual (Horizontal) Transmission***

There is very little research that considers whether malnutrition contributes to the sexual transmission of HIV/AIDS. However, several scholars have suggested the potential importance of this relationship (e.g. Friss, 2005; Friss & Michaelson, 1998; Gillespie & Kadiyala, 2005 a; Gillespie & Kadiyala, 2005 b). Existing studies on this subject have focused on two different ways that malnutrition may increase vulnerability to sexual transmission. First, studies have considered whether micronutrient deficiency may increase viral loads in the bodily fluids of HIV-positive individuals (e.g. seminal fluids and vaginal secretions), thus increasing their level of infectivity. Recent studies in Kenya have found vitamin A deficiency and serum selenium deficiency to be a predictor of increased vaginal shedding of HIV, showing some evidence of this relationship (Mostad *et al.*, 1998; John *et al.*, 1997; Baeten *et al.*, 2001). In contrast, the only available study in an income-rich country, the United States, did not find an association between vitamin A deficiency and genital HIV-1 load (French *et al.*, 2002). More research is necessary in both income-poor and income-rich countries to explore this relationship.

The second area of study on the subject of malnutrition and sexual transmission has considered whether malnutrition in HIV-negative individuals can increase their risk of contracting HIV/AIDS (if sexually exposed to the virus). There is some evidence to suggest the importance of this relationship. For example, a study of sexually active women in India found that low levels of β -carotene were associated with sexual

transmission of HIV/AIDS (Mehendale *et al.*, 2001). Further, in a study of women in Rwanda, weight loss (a correlate of protein-energy malnutrition) was connected to HIV/AIDS transmission (Moore *et al.*, 1993). In contrast to the above research, a study in Kenya found that men with low levels of vitamin A were less likely to contract HIV/AIDS than men with high levels of vitamin A (MacDonald *et al.*, 2001). More research is clearly needed on this subject, and is being called for in the literature (e.g. Moore *et al.*, 1993; MacDonald, *et al.*, 2001).

In conclusion, in spite of a lack of literature on the subject of malnutrition and HIV transmission, the tentative evidence suggests a possible relationship. This study contributes to the quest to understand whether hunger is associated with HIV/AIDS transmission in income-rich countries, through an analysis of Census/health data at the level of Canadian health regions.

Sexually Transmitted Diseases and Poverty

This section briefly discusses the links that have been made between sexually transmitted diseases (STDs) and poverty. As noted above, this literature is important in demonstrating that STDs are a synergy of poverty, which is an assumption of this thesis. Several studies have argued that poverty is associated with an increased risk of contracting STDs (see Wasserheit, 1994; Rice *et al.*, 1991; Holtgrave & Crosby, 2003; Thomas & Thomas, 1999; Farmer, 1996). For example, a population health study by Holtgrave & Crosby (2003), in the United States, found that low income rates and income inequality were both statistically correlated with rates of chlamydia. In another study, using data from Seattle (U.S.), Rice *et al.* (1991) found that “census tracts representing the lowest socioeconomic (SES) quartile accounted for 58% of reported gonorrhea,”

providing further evidence of the connection between poverty and STDs (p. 1252). The literature on this subject suggests that poverty plays a role in STD transmission because poverty is associated with several risk-increasing factors, including: exchange of sex for drugs and money, poor access to health services (e.g. STD treatment), and poor access to meaningful prevention messages about STDs (Wasserheit, 1994; Thomas & Thomas, 1999; Farmer, 1996).

Sexually Transmitted Diseases and HIV/AIDS Transmission

This section discusses the literature that considers connections between HIV/AIDS and sexually transmitted diseases. This literature is relevant in assessing whether STDs increase vulnerability to contracting HIV/AIDS, which is a central concern of this thesis. The following paragraphs will provide a brief overview of some of the studies that have linked vulnerability to HIV/AIDS with both ulcerative and non-ulcerative STDs. This is followed by a brief discussion of how STDs influence vulnerability to HIV. Overall, this section provides compelling evidence that STDs are linked to vulnerability to HIV/AIDS in both income-rich and income-poor countries (Fleming & Wasserheit, 1997; Celum *et al.*, 2004; Wald & Link, 2002)⁶.

➤ *Ulcerative STDs (Genital Herpes & Syphilis)*

More than thirty different studies have shown that genital herpes (an ulcerative STD) is associated with HIV/AIDS transmission (e.g. Fleming & Wasserheit, 1999; Celum *et al.*, 2004; Wald & Link, 2002; Holmberg *et al.*, 1998; Weiss *et al.*, 2001). Specifically, these studies have found that having genital herpes (HSV-2) can more than double a person's risk of becoming infected with HIV during sexual activity (Wald &

⁶ In general, studies referenced in this section have controlled for variation in sexual behavior within the study group.

Link, 2002; Celum *et al.*, 2002; Fleming & Wasserheit, 1999). For example, a study by Holmberg *et al.* (1988) of homosexual men in San Francisco found that men with the genital herpes (HSV-2) antibody were 2.6 times more likely to acquire HIV/AIDS than men without HSV-2. In a second study of women in Kenya, Weiss *et al.* (2001) found that women with HSV-2 were 4.1 times more likely to be HIV-positive, providing further evidence of this relationship.

Syphilis, a second type of ulcerative STD, has also been connected to increased risk of HIV/AIDS transmission in a number of studies (e.g. Kuiken *et al.*, 1990; Dominguez, 1996; Darrow *et al.*, 1987; Otten, 1994; Reynolds *et al.*, 2006). For example, a study of women in Miami found that women with HIV/AIDS were more than 8 times more likely to have had a medical record of syphilis than women who remained HIV-negative (Dominguez *et al.*, 1996). Further, in a second (longitudinal) study of people attending STD clinics in India, HIV-negative individuals with syphilis (at baseline) were 4.4 times more likely to seroconvert to being HIV positive than individuals without syphilis (by the end of the study) (Reynolds *et al.*, 2006). These studies provide further evidence that ulcerative STDs are connected to HIV/AIDS vulnerability.

➤ ***Non-Ulcerative STDs (Gonorrhea & Chlamydia)***

There is also evidence that non-ulcerative STDs, such as gonorrhea and chlamydia, can increase people's vulnerability to HIV/AIDS (e.g. Kassler *et al.*, 1994; Laga *et al.*, 1993; Kapiga *et al.*, 1998; Darrow *et al.*, 1987; Dominguez *et al.*, 1996; Taha, 1998). To elaborate, several studies have connected gonorrhea with increased vulnerability to HIV/AIDS (e.g. Kassler *et al.*, 1994; Laga *et al.*, 1993; Kapiga *et al.*,

1998; Darrow *et al.*, 1987). For example, in a study of people attending an STD clinic in Baltimore gonorrhea was linked with a five-fold increase in seroconverting to HIV/AIDS (Kassler *et al.*, 1994). Chlamydia has also been linked to HIV/AIDS, though there have been less studies on this subject than other STDs (e.g. Plummer *et al.*, 1991; Laga *et al.*, 1993; Dominguez *et al.*, 1996). For example, a study of female sex trade workers in Zaire found that women with chlamydia were 1.9 times more likely to become HIV-positive than women without chlamydia (Laga *et al.*, 1993). In a second study of women in Miami, Dominguez *et al.* (1996) also found a link between chlamydia and HIV/AIDS. Collectively, these studies provide evidence that non-ulcerative STDs are also connected to HIV/AIDS vulnerability.

➤ ***Biological Mechanisms through which STDs Increase Risk***

The literature discussing why STDs influence vulnerability to HIV/AIDS explains that STDs can influence vulnerability to HIV/AIDS through a variety of biological mechanisms. Firstly, STDs may increase the infectiousness of HIV-positive individuals by “facilitating shedding of the genital tract,” for example, by increasing levels of HIV in genital secretions (see Fleming & Wasserheit, 1997, p. 4; Galvin & Cohen, 2004; Celum *et al.*, 2004 for a more detailed explanation). Further, STDs can increase the vulnerability of HIV-negative individuals by “disrupting mucosal barriers to infection,” and “by increasing the presence and activation of HIV susceptible cells in the genital tract” (see Fleming & Wasserheit, 1997, p. 4-5; Galvin & Cohen, 2004; Celum *et al.*, 2004 for a more detailed explanation). This literature helps to explain why the studies, discussed above, have found a relationship between HIV/AIDS and STDs.

In conclusion, the studies discussed in this section suggest that STDs “promote HIV transmission through a variety of biological mechanisms” (Fleming & Wasserheit, 1997, p. 3). The present study provides a further examination of this relationship by exploring the relationship between HIV and STDs at the level of Canadian health regions.

The Link Between Income Inequality and HIV

This section discusses the small, but growing, body of literature that explores the relationship between income inequality and HIV/AIDS (e.g. Talbot, 2007; Nepal, 2007; Drain *et al.*, 2004). The existing studies have looked at this relationship primarily through statistical analyses, and have shown some evidence that income inequality may be connected to HIV/AIDS prevalence. For example, in a study of both developed and developing countries, income inequality (as measured by the Gini index)⁷ was found to be linked to HIV/AIDS rates (Nepal, 2007). In a second, statistically based study of 122 developing countries, the Gini index was also found to be significantly statistically connected to HIV/AIDS rates⁸ (Drain *et al.*, 2004). Thirdly, this relationship has also been examined statistically in one study specific to an income-rich country; the United States. In this study, Holtgrave & Crosby (2003) considered the relationship between income inequality and AIDS at the level of American states. This study found that income inequality within states was a strong predictor of AIDS prevalence (Holtgrave and Crosby, 2003). Overall, this body of literature suggests that income inequality may

⁷ The Gini index is a measure of inequality calibrated on a scale from 0 (perfect equality) to 100 (perfect inequality) (United Nations Development Programme, 2006, p. 272). Scores range “from 33 in South Asia to 57 in Latin America to more than 70 in sub-Saharan Africa” (United Nations Development Programme, 2006, p. 272). Gini index and Gini coefficient are equivalent, but for the fact that the index is calibrated on a scale from 0 – 100, while the coefficient is calibrated from 0 – 1.

⁸ This study agrees with the results of Stilwaggon’s analysis, which also found a relationship between income inequality (measured by the Gini coefficient) and HIV/AIDS in developing countries (Stillwaggon, 2006).

be an important risk factor for HIV/AIDS, and highlights the need for further research on this subject in both income-poor and income-rich countries. The present study contributes to the quest to understand this relationship by exploring the connection between HIV and income inequality in Canada.

PART III: LITERATURE DESCRIBING THE EXTENT OF POVERTY IN CANADA

This section describes the prevalence of the independent variables under consideration in this study: malnutrition, sexually transmitted diseases, and income inequality. The literature examined outlines the extent of poverty in Canada, and provides context when examining the potential relationship of these variables to HIV prevalence in the present study.

Malnutrition/Food Insecurity

There have been few recent accounts of malnutrition in Canada. Certainly neither the breadth nor the severity of the issue compares to that in developing countries. There is, however, a portion of the Canadian population that experiences elements of hunger which at extreme levels would cause malnutrition as witnessed in a developing country context, and that at lower levels could cause mild to moderate malnutrition. In North America, these elements of hunger are discussed under the umbrella term ‘food insecurity.’ Precise definitions and measures of food insecurity vary, but generally include the inability to obtain or consume food of sufficient nutritional quantity or quality (see Bickel *et al.*, 2000, p. 6; Statistics Canada, 2005 a, p. 150; Rainville & Brink, 2001 for sample definitions and measures). There is widespread agreement in the food insecurity literature that hunger is a serious issue in Canada (Rainville & Brink, 2001;

Che & Chen, 2001; Vozoris & Tarasuk, 2003; McIntyre *et al.*, 2000). For example, studies analyzing data from the National Population Health Survey showed that 10.2% of Canadian households experience some food insecurity, and 4.1% of households experience severe food insecurity (Rainville & Brink, 2001; Che & Chen, 2001). The food insecurity literature shows that certain groups of Canadians are particularly vulnerable to experiencing food insecurity. These groups include female-headed lone parent families, people relying on social assistance, and persons of Aboriginal descent living off of reserves (McIntyre *et al.*, 2000; Che & Chen, 2001; Raphael, 2007; Canadian Association of Food Banks, 2005). For example, research by McIntyre *et al.* (2000) found that female-headed lone parent families were eight times more likely to report food insecurity than other types of families, and that children from families receiving social assistance were thirteen times more likely to experience food insecurity than non-welfare families. In conclusion, although there is not significant malnutrition literature discussing the situation in Canada, the food insecurity literature shows a significant instance of hunger in Canada.

Sexually Transmitted Diseases

The most comprehensive data on sexually transmitted disease (STDs) in Canada is kept by the Public Health Agency of Canada.⁹ In particular, the Public Agency of Canada (PHAC) provides comprehensive information about gonorrhea, syphilis, and chlamydia, because new diagnoses of these diseases must be reported to the PHAC (e.g. by physicians, laboratories) (Public Health Agency of Canada, 2007 a). PHAC reports show that rates of gonorrhea, chlamydia and syphilis have been increasing steadily since

⁹ See: <http://www.phac-aspc.gc.ca/std-mts/index.html>

1997, and confirm that “STDs are an escalating public health concern and challenge” (Public Health Agency of Canada, 2007 a, p. v). Of the reportable STDs, chlamydia is the most commonly reported, with nearly 63,000 cases in 2004, a rate of 197.1 per 100,000 (Public Health Agency of Canada, 2007 a). Gonorrhea is the second most commonly reported STD. Rates of gonorrhea have nearly doubled since 1997, from 14.9/100,000 in 1997 to 28.9/100,000 in 2004 (Public Health Agency of Canada, 2007 a). Rates of syphilis are less common, but have been increasing. Specifically, rates have increased nine fold since 1997, to a rate of 0.8 per 100,000 in 2004. Men over thirty years of age appear to be particularly vulnerable to contracting syphilis, with 72% of cases found in men aged 30-54 (Public Health Agency of Canada, 2007 a).

Other STDs are not nationally reportable in Canada, making it more difficult to assess their prevalence. In the case of genital herpes (HSV-2), there are no studies published that assess the overall prevalence rate in Canada (Malkin, 2004). However, small studies done in Canada show that genital herpes may be relatively common. For example, in a study of pregnant women aged 15-44 in Vancouver, 17.3% of women were found to be infected with genital herpes (Patrick, *et al.*, 2001). In another study, using randomly selected samples from both men and women obtained from Ontario laboratories, the HPV-2 seroprevalence rate was found to be 9.1% (Howard *et al.*, 2003). In a third study of people attending STD clinics in Alberta, the HSV-2 prevalence rate was 19% (Singh, *et al.*, 2005). These studies provide further evidence that STDs are a significant public health concern in Canada.

Income Inequality

Income inequality in Canada is high in comparison to other wealthy industrialized countries, such as the Netherlands, Germany, Belgium, Sweden and Finland (United Nations Development Programme, 2006; Picot & Myles, 2005; Raphael, 2007). To describe the extent of inequality in Canada, it is useful to consider Census data that compares the bottom 20% of the population to the top 20% of the population. Census data, from 2001, shows that:

the average income of the bottom 10% of Canadians was \$10,341 and for the next 10% was \$23,655. Together, this bottom 20% of Canadians shared 5.2% of total Canadian income. In contrast, the top 10% of Canadian families had average incomes of \$185,070 and the next 10% earned on average \$103,183. Together, this top 20% took in 43.6% of the total Canadian income (Raphael, 2007, p. 46).

These figures show that there is significant income inequality in Canada. Another measure of income inequality, the Gini index, measures inequality within countries by way of a single value.¹⁰ Canada's score on the Gini index is 32.6, which is higher than most other wealthy industrialized nations: e.g. Sweden (25.0); Norway (25.8); Japan (24.9); Netherlands (30.9); Finland (26.9); Austria (29.1); Germany (28.3) (United Nations Development Programme, 2006). Canada's score on the Gini index provides further evidence that there is significant income inequality in Canada.

CONCLUSION

In conclusion, this chapter has provided an overview of the literature relevant to this thesis. This literature will be discussed again in chapter 5, in relation to the results of

¹⁰ See page 36 for a detailed definition of the Gini index.

the statistical analyses. The next chapter provides a comprehensive outline of the methodological design for this project

CHAPTER 3 – METHODOLOGY

The objective of this research project is to try to understand whether Stillwaggon's argument that nutritional deficiencies, economic disadvantage and sexually transmitted diseases contribute to HIV/AIDS vulnerability is relevant in a Canadian (developed world) context. In meeting this objective, a major task of this research was the design of the project's methodology. This chapter describes the methodological approach used in this study, and the rationale for its selection.

The chapter is divided into two distinct parts. Part I provides background information about the methodological design, focusing on why the project's methodology was selected, and how it aims to replicate Stillwaggon's methodology in a Canadian context. Part II explains the details of the methodological design, including specifics about the data sources, variables, and statistical methods used in the analysis. Part II concludes with a discussion of the limitations of the selected methodology. Overall, the objective of this chapter is to explain the methods used to answer the thesis question, which is: Do the synergies of sexually transmitted diseases, income inequality, and hunger shape the HIV/AIDS epidemic in Canada, and do these factors need to be considered more centrally in HIV/AIDS prevention programs in Canada?

PART I: BACKGROUND INFORMATION

Because this study aims to replicate Stillwaggon's research in a Canadian context, the objective in designing this study's methodology was to replicate Stillwaggon's methods as closely as possible. For this reason, Part I begins with an overview of Stillwaggon's methodology. The remainder of Part I discusses the challenges faced in

replicating Stillwaggon's methods, the selection of data sources, and the present study's methodological design.

Summary of Stillwaggon's Methodology

Stillwaggon's methodology included several bivariate and multivariate regression analyses that aimed to establish whether variables representing hunger, lack of access to health care and economic disadvantage are significantly related to HIV/AIDS prevalence in developing countries (Stillwaggon, 2006). In designing these regression analyses Stillwaggon undertook several steps. First, she made the decision to limit her analysis to all countries ranked by the United Nations Development Programme as having low or medium development. Second, Stillwaggon (2006) decided on two ways to measure the dependent variable, HIV prevalence, in her regression analyses. Stillwaggon's first measure of HIV/AIDS prevalence was based on national estimates of adult HIV prevalence generated by UNAIDS. Her second was based on "numerous separate studies of urban low-risk populations...collected in the HIV/AIDS Surveillance Database of the U.S. Bureau of Census" (Stillwaggon, 2006, p. 84). After compiling the available HIV/AIDS data from these sources, Stillwaggon eliminated the countries from her analysis where HIV/AIDS data was not available (Stillwaggon, 2006).

In the next phase of Stillwaggon's experimental design, attention was focused on the selection of independent variables to measure hunger, lack of access to health care, and economic disadvantage. The following measures were selected as independent variables to be included for analysis:

- Change in average protein consumption between 1970 and 1995

- Change in the urban population between 1970 and 1995¹¹
- Inequality in the distribution of income (represented by the Gini coefficient)
- Real per capita Gross Domestic Product (based on purchasing power parity)
- Change in per capita Gross Domestic Product (GPD) between 1960-1995
- Proportion of the population without access to health care services; access to clean water and sanitation; and, access to attended births.
- Change in average caloric intake between 1970 and 1995¹² (Stillwaggon, 2006)

Data for each other these variables was obtained from the United Nation's Development Programme, and the World Bank.¹³ Data for some variables were missing for some countries, reducing the sample size to a total of forty-four Asian, African and Latin American countries (Stillwaggon, 2006).

Stillwaggon (2006) began her statistical analysis by running bivariate regressions to test for a relationship between HIV prevalence and her selected independent variables. She found that access to health care, clean water and sanitation, and attended births were not significantly related to HIV prevalence, and these variables were dropped from the analysis.¹⁴ The remaining variables (change in caloric intake, change in protein consumption, Gini coefficient, change in urban population, real GDP per capita, and change in per capita GPD) were found to be significantly related to HIV prevalence, and

¹¹ Change in urban population was included because increasing urban population was "expected to increase viral traffic, exposing larger populations to viruses" (Stillwaggon, 2006, p. 85).

¹² Stillwaggon noted that she used changes in caloric intake, rather than level of calories, "because worsening nutrition in a population is a better indicator of increasing vulnerability to disease as the epidemic unfolded" (Stillwaggon, 2006, p. 84).

¹³ Stillwaggon's model was "intended to test as independent variables the conditions that existed when the epidemics began. After reaching prevalence rates of five percent or more, as many African countries have, the stage is already set for extensive spread" (Stillwaggon, 2006, p. 84).

¹⁴ Stillwaggon notes that caution should be exercised when interpreting the results about the relationship between access to health care and HIV/AIDS, for the following reasons: "Access to health services reported by national governments can be exaggerated for political purposes. Also, access to health care services means only that a person can go to a clinic, but it does not mean that the clinic will have any medicine to offer, such as antibiotics for curable STDs. [As well], access to medicines fell sharply during the period in which HIV flourished. Another reason that access to health care may not correlate with lower HIV is attributable to medical injections...While health care obviously offers many benefits, it could increase HIV transmission through unsafe injections" (Stillwaggon, 2006, p. 85).

these variables were included for further multiple regression analysis. Change in protein consumption was later dropped from this analysis because, while this measure was found to be significantly (negatively) related to HIV prevalence in the bivariate analysis, it was highly collinear with changes in caloric intake (Stillwaggon, 2006). Stillwaggon's final multivariate regression model, therefore, included: changes in calories, Gini coefficient, change in urban population, real GDP per capita, and change in per capita GDP.¹⁵

Replicating Stillwaggon's Methods in a Canadian Context

Replicating Stillwaggon's methodology was difficult on a number of levels. The primary difficulty in replicating Stillwaggon's methodology was that she used country level data in her regression analysis. This presented an obvious problem as this research project considers only the country of Canada, and by definition, regressions require more than one data point. It became clear that the only way to carry out a regression analysis in Canada would be to consider multiple geographic units within the country of Canada.

Several options were considered. The first option was the use of provincial and territorial level data; however, Canada's ten provinces and three territories did not represent a large enough sample to run a regression analysis with an acceptable level of confidence. A second option explored was the possibility of using city level data. This also proved unworkable, as HIV/AIDS data at this geographical resolution is available for only a few very large cities (e.g. Toronto, Vancouver).

A third option considered was the use of American data as a proxy for the situation in Canada. Appropriate U.S. data was secured to represent the variables of

¹⁵ From this model, change in calories, Gini coefficient and changes in urban population were found to be significantly related to HIV prevalence. Real GDP per capita was not found to be significantly related to HIV prevalence, and change in real GDP was significant when using the UNAIDS measure of HIV, but not the U.S. Bureau of Census HIV data (Stillwaggon, 2006).

HIV/AIDS, income inequality, food insecurity, and sexually transmitted diseases (at the level of U.S. cities); however, this was not an ideal option (due to possible differences between the two countries in rates of HIV/AIDS, income inequality, sexually transmitted disease and food insecurity), and was ultimately rejected once more suitable data was obtained.

The fourth and final option considered - the use of health region¹⁶ level data - was selected for the following reasons. First, the provinces of British Columbia, Ontario, Quebec, Manitoba and Alberta¹⁷ keep HIV/AIDS data at this geographic resolution, providing enough data points to pursue a regression analysis with an acceptable level of confidence. Second, previous studies employing similar methodologies use health region level data in their analyses (see, for example, Filate *et al.*, 2003). Further, a wide range of data are tracked at the level of health regions, including metrics related to the independent variables required for the present study. This allowed for the selection of appropriate independent variables for the analysis, which completed the methodological design. Specifically, the following measures were selected from the Canadian Community Health Survey, and Statistics Canada 2001 Census Data, to be included for analysis as independent variables:¹⁸

¹⁶ Health regions are “an important geographic unit by which health and health related data are produced” in Canada (e.g. Census data, health survey data) (Statistics Canada, n.d). Health regions are defined by provincial ministries of health and generally comprise legislative areas representing geographic areas of responsibility for hospital boards or regional health authorities (Statistics Canada, n.d.) The number of health regions per province/territories varies from 1 in Nunavut to 36 in Ontario (Statistics Canada, n.d).

¹⁷ Data for the province of Alberta was available for only two regions (Calgary and Capital).

¹⁸ Lack of access to health care and low income were also considered as possible variables for analysis. Lack of access to health care was not included for a number of reasons. Most importantly, an appropriate measure could not be obtained. Secondly, this variable was not found to be significant in Stillwaggon’s analysis of developing countries and is, therefore, not likely significant in Canada where access to basic health care is much closer to universal. Low income was considered in a preliminary statistical analysis, but was not found to be significantly related to HIV prevalence. Since this variable was collinear with a second variable that was found to be significant in preliminary analysis (income inequality), it was not considered for further analysis.

- Proportion of the population (of each health region) diagnosed with a sexually transmitted disease, 2003 and 2005
- Proportion of the population (of each health region) who eat fruits and vegetables less than five times a day (as a proxy for malnutrition), 2003 and 2005
- Proportion of the population (of each health region) who experienced some food insecurity in the past 12 months, 2003
- Proportion of the population (of each health region) reporting ‘food insecurity with hunger,’ 2005
- Income inequality (within each health region), 2003 and 2005
- Population density¹⁹ (of each health region), 2001

These variables, and their data sources, are discussed in further detail below.

Data was selected from the years 2003 and 2005, the most current data available.²⁰ Two years of data were included in the analysis to increase the robustness of the analysis. In total, this allowed for a sample size of 69 health regions for the year 2003, and 70 health regions for the year 2005²¹ (see Appendix A for lists of the specific health regions used).

PART II: SPECIFIC METHODOLOGICAL DESIGN

Part II of this chapter elaborates on the details of this project’s methodological design, including specifics about the data sources, variables, and analytical methods used in the analysis. Part II concludes with a discussion of the limitations of this project’s methodology.

¹⁹ Population density was included in the analysis as a control variable. See page 57-58 for further information regarding the inclusion of this measure.

²⁰ Population density data was obtained for the year 2001 because later data was not available (due to Census cycles). This makes it necessary to assume that relative population densities have not changed appreciably between 2001 and 2005.

²¹ Health regions were occasionally combined to match the organization of other data sets (see Appendix A).

Data Sources

As noted above, data for this project came from a number of different sources. The following sections will describe these data sources in further detail.

➤ *HIV/AIDS Data from Provincial Sources*

Data representing the dependent variable, HIV prevalence, was obtained from several different provincial information sources (B.C. Center for Disease Control, 2003; B.C. Center for Disease Control, 2005; Alberta Health and Wellness, 2005; Institut de Sante Publique du Quebec, 2006; R. Remis, personal communication, May 9, 2006; M. Dyck, personal communication, June 28, 2007). Table 3.1 below, provides specific information about the HIV data sources for each province.

Table 3.1: Provincial HIV Data Sources

PROVINCE	DATA SOURCE	REPORT/TABLE NAME
British Columbia	B.C. Center for Disease Control	<ul style="list-style-type: none"> • “STD/AIDS Control 2003: Annual Report” • “STD/AIDS Control 2005: Annual Report”
Quebec	Institut National de Sante Publique du Québec	<ul style="list-style-type: none"> • Programme de surveillance de l’infection par le virus de l’immunodéficience humain (VIH) au Québec – Cas cumulatifs 2002-2005
Manitoba	Manitoba Health	A custom data set was obtained from Manitoba Health. ²²
Ontario	Ontario HIV Epidemiologic Monitoring Unit ²³	A custom data set was obtained from the Ontario HIV Epidemiologic Monitoring Unit. ²⁴
Alberta	Alberta Health and Wellness	Data was obtained through the Alberta Health and Wellness Website. ²⁵

²² It was necessary to obtain a custom HIV data set from Manitoba Health because the HIV data available in Manitoba Health Reports (for 2003 and 2005) had not been adjusted to coincide with post-1998 changes to health region boundaries. The custom data set obtained from Manitoba Health was adjusted according to 2003 and 2005 boundaries, as required.

²³ The Ontario HIV Epidemiologic Monitoring Unit is a joint undertaking of the Ontario Ministry of Long Term Care and Department of Public Health Sciences at the University of Toronto (Ontario Epidemiological Monitoring Unit, n.d.).

²⁴ It was also necessary to obtain a custom HIV data set for Ontario due to a review of Ontario’s HIV data that took place in the summer of 2006 (by the HIV Epidemiologic Monitoring Unit). This review focused on correcting for two main problems: 1) duplicate records; 2) incorrect reporting of HIV infected infants (who actually contracted the passive maternal anti-body), and led to an overall reduction of HIV counts. These changes have not yet been incorporated into available reports. The custom data set obtained for this study was adjusted for corrections made in this review.

➤ ***Statistics Canada, Demography Division***

Health region level population estimate data (for 2003 and 2005), used to convert HIV data into a rate/100,000, was obtained from Statistics Canada, Demography Division (Statistics Canada, Demography Division, n.d.). This data (using 2005 health region boundaries)²⁶ was based on 2001 Census results “adjusted for net Census undercoverage and for the estimated population growth” since the 2001 Census (Statistics Canada, Demography Division, n.d.).

➤ ***The Canadian Community Health Survey***

Data representing the independent variables of food insecurity, income inequality and STDs were obtained from in the Canadian Community Health Survey (CCHS). The Canadian Community Health Survey is, “a cross-sectional survey that collects information related to health status, health care utilization, and health determinants for the Canadian population” (Statistics Canada, 2006 a, p.1). The CCHS operates on a two-year collection cycle, which began in 2001. The “first year of the cycle, ‘.1,’ is a large sample, general population survey, designed to provide reliable estimates at the health region level. The second year of the survey, cycle ‘.2,’ has a smaller sample, and is designed to provide provincial level results on specific health topics” (Statistics Canada, 2006 a, p.1). Data used for this study came from cycles 2.1 (carried out between January 2003 and December 2003), and 3.1 (carried out between January 2005 and December 2005) (Statistics Canada, Health Statistics Division, 2005; Statistics Canada, 2006 a).

²⁵ Specifically, data was obtained from a table, posted on the Alberta Health and Wellness website, titled: ‘Table B-10-1: New and Cumulative Cases by Year of Report and Location of Examination Alberta, 1998-2005.’ This table can be accessed at http://www.health.gov.ab.ca/regions/BIO_2_2005.htm.

²⁶ One health region boundary change (from 2003 to 2005), relevant to population data, should be noted. In 2005, the health region of Calgary (Alberta) gained a population of approximately 13,000 from the David Thompson Health Authority, representing a 1.2% increase from 2003 boundaries. For the purposes of this study, it is assumed that this marginal increase in health region size/population did not appreciably alter the Calgary HIV rate for 2003.

Data from the CCHS accounts for approximately 98% of the population, aged 12 years and older. A number of groups were excluded from this survey including Canadians living on Indian Reserves and Crown Lands, full time members of the Canadian Armed Forces, and individuals in some remote regions. The total sample size for the surveys was 134,072 for cycle 2.1 and 132,947 for cycle 3.1 (Statistics Canada, Health Statistics Division, 2005; Statistics Canada, 2006 a). Data were weighted in order to be representative of the Canadian population, and not just the sample itself (Statistics Canada, Health Statistics Division, 2005).

The CCHS provides data in an ‘instances per health region’ format. In all cases where data were used from this survey, these figures have been converted to a rate of incidence for the health region. It is also important to note that in instances where gaps were present in the CCHS data, a category average was used.

➤ *Census Data*

Population density data, used as a control variable in this study, was obtained from Statistics Canada, 2001 Census (20% sample) (Statistics Canada, 2003 a). These data (for 2001) were adjusted to correspond with changes in health region boundaries that took place in 2003 (Statistics Canada, 2003 a).²⁷

Conceptual Framework/Measurement of Variables

The following sections provide further information about the variables selected for the analysis. Before describing each selected variable, the concept that each variable

²⁷ In 2005 two new Ontario health regions (North Bay Parry Sound District Health Unit and Simcoe Muskoka District Health Unit) were formed from dissolved health regions. Because population density was based on 2003 boundaries, population density data was not available for these regions. Therefore, the average population density of the health regions used for 2005 was substituted for these regions. The average population density was also substituted for the combined health regions used for both 2003 and 2005 (see Appendix A for combined health regions).

is intended to measure is underlined and defined. Specifics are then provided about how each variable is measured, and why it was selected for the analysis.

➤ ***HIV/AIDS***

HIV stands for Human Immunodeficiency Virus, and it is the virus that causes AIDS. HIV “progressively destroys the body’s ability to fight infections and certain cancers” by damaging the body’s immune system (National Institute of Allergy and Infectious Diseases, 2005). AIDS stands for Acquired Immunodeficiency Syndrome, and it “applies to the most advanced stages of HIV infection” (National Institute of Allergy and Infectious Diseases, 2005). People with AIDS are susceptible to life threatening infections and cancers due to compromised immunity (National Institute of Allergy and Infectious Diseases, 2005). HIV/AIDS can be spread through sexual behaviors (e.g. oral sex, intercourse), the sharing of drug injection equipment (e.g. needles, crack pipes), blood transfusions, and from mother to child (through vertical transmission or breast feeding) (National Institute of Allergy and Infectious Diseases, 2005; Canadian AIDS Society, 2004).

This study is interested in understanding the factors that increase vulnerability to HIV infection, specifically, rather than the progression of HIV to AIDS. Therefore, data reporting new diagnoses of HIV were selected for this analysis, rather than data reporting new diagnoses of AIDS. Specifically, the data selected for this study report the number of new HIV diagnoses per health region for the years 2003 and 2005. The number of new cases for each health region was divided by the total population of the health region, and multiplied by 100,000 to get the rate/100,000 for each health region.

➤ ***Malnutrition***

Malnutrition is a condition that occurs when an individual consumes an inadequate level of nutrients. Malnutrition can result from an inadequate or unbalanced diet, lack of a single or multiple vitamins, digestive problems, absorption problems, or other medical conditions (University of Maryland Medical Center, 2007). As is noted in chapter 2, research demonstrates that compromised immune function can result from two specific aspects of malnutrition: micronutrient deficiency²⁸ and protein-energy malnutrition (a lack of the calories/protein needed for normal functioning) (Chandra, 1997; Biesel, 1996; Chandra, 2002). Therefore, variables representing malnutrition were selected that attend to these particular aspects of malnutrition.

A first variable used to measure malnutrition (for both 2003 and 2005) was obtained from the Canadian Community Health Survey. This variable, titled ‘Grouping of Daily Consumption – Total Fruits and Vegetables,’ classified respondents into the following categories based on the number of times per day that they consume fruit and vegetables: 1) eats fruits and vegetables less than 5 times per day; 2) eats fruits and vegetables between 5-10 times per day; 3) eats fruits and vegetables more than ten times per day (Statistics Canada, 2005 a, p. 44; Statistics Canada, 2006 b, p. 100-101). The percentage of the population of each health region consuming fruits and vegetables less than 5 times per day was selected as a proxy for malnutrition (specifically micronutrient deficiency) because fruits and vegetables are a rich source of micronutrients (e.g. vitamin A, B-vitamins, vitamin C, vitamin E) (Food and Agricultural Organization of the United Nations, 2003). Further, numerous studies demonstrate that having a low intake of fruits

²⁸ As noted in Chapter 2, the following micronutrients are needed for healthy immune functioning: zinc, vitamin A, β -Carotene, B-vitamins, vitamin C, vitamin E, selenium, copper, folic acid, and iron (Scrimshaw & SanGiovanni, 1997).

and vegetables can be a major contributing factor to experiencing micronutrient deficiency (Food and Agricultural Organization of the United Nations, 2003).²⁹ Therefore, low consumption of fruits and vegetables was thought to be a good proxy for micronutrient deficiency.

Two other measures were selected as proxies for malnutrition. These variables were selected as measures of protein-energy malnutrition (PEM). Because a specific measure of PEM was not available, the variables selected for the analysis capture situations where an individual experienced food insecurity, hunger, and reduced caloric intake.

The variable selected for 2003 was the 'Flag Indicating Food Insecurity' in the CCHS (Statistics Canada, 2005 a, p. 150). This variable is defined, in the CCHS, as follows:

The variable indicates whether the respondent had any food insecurity in the past 12 months. The respondent is considered to have experienced food insecurity if any of the following conditions are met: 1) the respondent or someone else in the household worried that there would not be enough to eat because of lack of money; 2) the respondent or someone else in the household did not have enough to eat because of lack of money; or, 3) the respondent or someone else in the household did not eat the quality or variety of foods that they wanted to eat because of lack of money (Statistics Canada, 2005 a, p. 150).

The percentage of the population in each health region classified as 'food insecure' was used for this analysis.

The variable selected for the year 2005, was the 'Household Food Security' Scale in the CCHS (Statistics Canada, 2006 b, p. 253-255). This measure was adopted from the U.S. model of food security status levels, published by the U.S. department of

²⁹ Studies suggest that it is optimal to consume 9-10 servings of fruits and vegetables a day, while dietary guidelines tend to suggest 5 servings a day, as a minimum (Food and Agricultural Organization of the United Nations, 2005).

Agriculture, and has proven validity (Bickel, *et al.*, 2000; Statistics Canada, 2006 b).

This variable is based on a set of 18 questions that ask about the following conditions, events, behaviors, and subjective reactions:

- anxiety that household food budget or food supply might be insufficient to meet basic needs;
- the experience of running out of food, without money to obtain food;
- perception by the respondent that food eaten by household members was inadequate in quality or quantity;
- adjustments to normal food use, substituting fewer and cheaper foods than usual;
- instances of reduced food intake by adults in the household, or consequences of reduced intake such as the physical sensation of hunger or loss of weight; and,
- instances of reduced food intake, or consequences of reduced food intake, for children in the household (Bickel, *et al.*, 2000. p. 8).

Four situations are captured by this variable:

- 1) **Food secure**: Household members show no or minimal evidence of food insecurity.
- 2) **Food insecure without hunger**: Household members feel anxious about running out of food or compromise on the quality of foods they eat by choosing less expensive options. Little or no reduction in the household member's food intake is reported.
- 3) **Food insecure with moderate hunger**: Food intake for adults in the household has been reduced to an extent that implies that adults have repeatedly experienced the physical sensation of hunger. In most (but not all) food insecure households with children, such reductions are not observed at this stage for children.
- 4) **Food insecure with severe hunger**: At this level, all households with children have reduced the children's food intake to an extent indicating that the children have experienced hunger. Adults in the households with and without children have repeatedly experienced more extensive reductions in food intake (Statistics Canada, 2006 b, p. 253).

For this study, respondents classified as 'food insecure with moderate hunger' and 'food insecure with severe hunger' were combined together as the variable 'food insecurity with hunger.'

➤ *Sexually Transmitted Diseases*

Sexually transmitted diseases (STDs) are a group of infectious diseases that can be spread through sexual contact (U.S. Department of Health and Human Services, 2005). STDs include non-ulcerative infections (such as gonorrhea & chlamydia), and ulcerative infections (such as genital herpes and syphilis) (Fleming & Wasserheit, 1997).

The variable selected to represent sexually transmitted diseases (STDs), for both 2003 and 2005, came from the CCHS. This measure asked survey participants whether they had ever been diagnosed with an STD, and classified respondents into the categories of ‘yes’ or ‘no.’ The proportion of the population of each health region classified as ‘yes’ was included for analysis (Statistics Canada, 2003 b, p. 167; Statistics Canada, 2005 b, p. 217).

It should be noted that some respondents who answered ‘yes’ to this question may have been reporting a diagnosis of HIV/AIDS. It was not possible to remove these cases of HIV/AIDS from the analysis because the CCHS did not ask survey participants to specify which STDs they were infected with. However, because HIV/AIDS cases are relatively rare,³⁰ it is likely that HIV/AIDS diagnoses represent a minimal number of ‘yes’ responses.

A second weakness of this measure is that it does not allow for an analysis of the relationship between HIV/AIDS and specific STDs (e.g. herpes, gonorrhea).³¹ Despite these weaknesses this measure allows for a general understanding of the association

³⁰ Approximately 0.2% of the total Canadian population is currently infected with HIV/AIDS (Public Health Agency of Canada, 2007 b). By contrast, STDs rates are much higher. For example, as noted in chapter 2, studies on genital herpes in Canada, have found rates from 9-19% (Patrick *et al.*, 2002; Howard *et al.*, 2003).

³¹ Data measuring specific STDs was not available at the levels of health regions.

between HIV/AIDS prevalence and STDs at the level of Canadian health regions, and contributes to our overall understanding of the relationship between STDs and HIV/AIDS vulnerability.

➤ ***Income Inequality***

Income inequality “refers to the extent to which income is distributed unequally among members of a society...In a perfectly equal society, each 10% of the population would receive 10% of the overall income” (Raphael, 2007, p. 51-52).

Income inequality was measured through similar, but not identical, measures for the years 2003 and 2005. For 2003, the income inequality measure was derived from a CCHS variable titled ‘Total Household Income – 5 Categories.’ This variable “classified the total household income into 5 categories based on total household income and the number of people living in the household” (Statistics Canada, 2005 a, p.147). The five categories were:

- 1) **lowest income:** (<\$10,000 if 1 to 4 people; <\$15,000 if 5+ people);
- 2) **lower middle income:** (\$10,000-\$14,999 if 1 or 2; \$10,000-\$19,999 if 3 or 4; \$15,000-\$29,999 if 5+);
- 3) **middle income:** (\$15,000-\$29,999 if 1 or 2; \$20,000-\$39,999 if 3 or 4; \$30,000-\$59,999 if 5+);
- 4) **upper middle income:** (\$30,000-\$59,999 if 1 or 2; \$40,000-\$79,999 if 3 or 4; \$60,000-\$79,999 if 5+);
- 5) **highest income:** (>\$60,000 if 1 or 2; >\$80,000 if 3+) (Statistics Canada, 2005 a, p. 148).

From this variable, ‘lowest income’ was divided by ‘highest income’ to get an estimate of income inequality within each health region.

The income inequality measure used for 2005 was derived from a variable titled ‘Distribution of Household Income – Health Region Level’ in the CCHS (Statistics Canada, 2006 b). This variable ranks each household in a health region on a scale from

one to ten, based on the distribution of ratios of household income to the Low-Income Cut Off (LICO) for all of Canada. For each health region, the lowest income group, income ratio group 1, is the proportion of the health region that falls in the lowest National income decile (income defined as the adjusted ratio of their income to LICO), and income ratio group 10 is the proportion of the health region that falls in the highest National income decile (income defined as the adjusted ratio of the of their income to LICO) (Statistics Canada, 2006 b). For the present study, ‘income inequality’ was determined by dividing decile 1 by decile 10. This provides the ratio of the proportion in the bottom decile to the proportion in the top decile in each health region. When ‘income inequality’ is <1 for a health region, the proportion of the poor is less than the proportion of the rich (indicating a well-off health region). When ‘income inequality’ =1 the proportion of the poor is equal to the proportion of the rich (indicating an average health region). When ‘income inequality’ is >1 , the proportion of the poor is larger than the proportion of the rich (indicating a poor health region).

➤ ***Population Density***

As noted above, population density was included in the statistical analysis as a control variable. This control was included, as it became obvious while compiling data that areas with high population density had substantially higher HIV rates, and there was concern that not considering this variable would confound the results of the statistical analyses. An examination of the literature provided further evidence of the strong relationship between population density and HIV/AIDS (e.g. Levinton *et al.*, 2000; Poundstone, 2004). A comprehensive analysis of the relationship between population density and HIV/AIDS is beyond the scope of this study; however, population density is

included in the statistical analysis for both 2003 and 2005 to improve the accuracy of the results.

Population density is defined in this study as the average number of people per square kilometer (by health region) (Statistics Canada, 2003 a). This variable is measured in the statistical analyses using population density data for each health region produced by Statistics Canada. As noted above, these data are from 2001, and based on 2001 Census data (Statistics Canada, 2003 a).

Descriptive Statistics

Tables 3.2 and 3.3, below, provide descriptive information about the variables used in the statistical analysis.

Table 3.2: Descriptive Statistics, 2003

	N	Minimum	Maximum	Mean	Std. Deviation
HIV Rate (per 100,000 people)	69	0.00	36.00	4.6949	5.90400
Population Density (people/km ²)	69	0.32	4,238.75	322.6712	827.77758
Fruit/Veg. Consumption (% reporting 5x/day or less)	69	49.9	68.0	58.115	4.4981
STDs (% reporting at least one diagnosis)	69	2.2	13.0	6.458	2.5695
Food Insecurity (% food insecure)	69	9.5	21.3	14.774	2.1320
Income Inequality (lowest income/highest income)	69	0.01	0.27	0.0852	0.05202

Table 3.3: Descriptive Statistics, 2005

	N	Minimum	Maximum	Mean	Std. Deviation
HIV Rate (per 100,000 people)	70	0.00	34.39	4.8724	5.71806
Population Density (people/km ²)	70	0	4,239	318.97	822.284
Fruit/Veg. Consumption (% reporting 5x/day or less)	70	49.02	66.36	57.3804	3.43295
STDs (% reporting at least one diagnosis)	70	1.71	12.49	6.5170	2.33548
Food Insecurity (% food insecure with hunger)	70	0.38	3.54	1.8886	0.57258
Income Inequality (decile 1/ decile 10)	70	0.94	1.19	1.0367	0.04386

Method of Analysis

The analysis of the data involved several steps. First, bivariate linear regression analyses were run for both 2003 and 2005, using all independent variables selected for

each year. Second, linear multivariate regressions were run for both 2003 and 2005, using all independent variables selected for each year's analysis. Third, as in Stillwaggon's methodology, variables were dropped from the analyses that were not found to be significantly related to HIV prevalence in the initial analyses. Multivariate regressions models were then run to test the relationships between the remaining independent variables (for each year), and HIV prevalence. All regression calculations were computed using the Statistical Package for the Social Sciences (SPSS Inc., n.d.).

Limitations and Range of Validity

There are some limitations of this study that warrant consideration. First, conclusions about individuals cannot be drawn from the statistical analyses of this study, which are based on health region level data. Doing so would be committing an error of reasoning known as the ecological fallacy. Vogt (2005) describes this concept more fully as "an error of reasoning committed by coming to conclusions about individuals based on data about groups" (p. 101).

Second, there are some limitations within the Canadian Community Health Survey (CCHS). First, the CCHS is subject to possible bias. Specifically, the survey "relies on self-report or proxy-report and the voluntary participation of randomly selected participants, and as such the results were not independently verified" (Filate *et al.*, 2003, p. 1242). Second, as was discussed above, Aboriginal persons living on reserves are not included in this survey. This is unfortunate, as Aboriginal Canadians have particularly high rates of HIV/AIDS (making up 12.9% of new HIV/AIDS cases in 2004) (Public Health Agency of Canada, 2004). However, despite these limitations, the CCHS

provided the best health region level information available for considering hunger, STDs and income inequality.

A third limitation of this project's methodology is that the size of the sample (69 regions for 2003 and 70 regions for 2005) is smaller than ideal. However, based on the limited availability of HIV/AIDS data, this was the largest sample that could be obtained. This points out the need for more extensive data collection to track HIV/AIDS in Canada.

Fourth, as is discussed above, there are two weaknesses with the sexually transmitted disease (STD) measure used in this study: the measure may include some cases of HIV/AIDS and the measure does not allow for an analysis of the relationship between HIV/AIDS and specific STDs. However, data for specific STDs was not available, and the selected measure allows for a general understanding of the relationship between HIV prevalence and STDs at the level of Canadian health regions.

CONCLUSION

This chapter has explained, in detail, the methodology selected for this project. This methodology is based on Stillwaggon's experimental design, and uses the best existing data available. The next chapter provides the results of the regression analyses described in this chapter. The results of the 2003 analyses are presented first, followed by the results for 2005.

CHAPTER 4 – RESULTS

This chapter presents the results of the statistical analyses described in chapter 3. As noted in chapter 3, the statistical analyses in this study were designed to test the relationship between HIV prevalence and the independent variables of malnutrition, sexually transmitted diseases, income inequality and population density. This chapter begins by reporting all results for 2003, followed by the results from 2005. When providing the results for each year, the bivariate results are presented first, followed by the results of the multivariate analyses. The standard level of alpha significance used in a regression analysis is $p = 0.05$.³² However, because the sample sizes obtained for this study are small, and because this is an exploratory study rather than strictly a confirmatory test of the hypothesis, a more liberal level of significance will be used.³³ Effects with levels of significance at, or very close to, $p = 0.10$ will be considered for inclusion in the models. Definitions of the technical terms used in this chapter are footnoted throughout this chapter (e.g. Beta, R^2).

2003 Results

2003 Bivariate Regressions

Table 4.1, below, shows the results of the bivariate regressions for the year 2003.

³² The probability value, or p value, is the “probability that a result could have been produced by chance or error...The smaller the number the greater the likelihood that the result expressed was not merely due to chance. For example, $p < 0.001$ means that the chances are one in a thousand (one-tenth of 1%) against the result being a fluke. What is being reported is the alpha level or significance level. The p value is the actual probability associated with an obtained statistical result” (Vogt, 2005, p. 225).

³³ It is important to note that other studies (using regression analyses) have used 0.10 as their level of significance (e.g. Boland & Daniel, 1999; Webster, 1975). See also Tabachnick (2007) for a discussion of sample size and significance tests.

Table 4.1: Bivariate Regressions, 2003

Independent Variables	Standardized Coefficients	<i>p</i> value
	Beta	
Population Density	0.803	0.000
Fruit/Veg. Consumption	-0.003	0.979
STDs	0.284	0.018
Food Insecurity	0.254	0.035
Income Inequality	0.141	0.248

Dependent Variable: HIV Rates

As shown in table 4.1, fruit and vegetable consumption and income inequality were not found to be significantly related to HIV prevalence (all *p* values were greater than 0.20). By contrast, population density, sexually transmitted diseases (STDs), and food insecurity were all found to be significantly and positively related to HIV prevalence. More specifically, population density was very strongly and significantly related to HIV prevalence ($\beta = 0.803$, $p < 0.000$),³⁴ while both sexually transmitted diseases and food insecurity were strongly and significantly related ($\beta = 0.284$, $p = 0.018$ and $\beta = 0.254$, $p = 0.035$ respectively).

2003 Multivariate Regression using all Independent Variables

Table 4.2, below, shows the results of a multivariate regression analysis using all independent variables considered for the year 2003. The R^2 of this model³⁵ is 0.712, and the *p* value of the F-test³⁶ was < 0.000 .

³⁴ Beta (β) is the regression coefficient. Specifically, β is defined as: “a regression coefficient for a sample expressed in standard deviation units (e.g. z-scores). Specifically, the beta coefficient indicates the difference in a dependent variable associated with an increase (or decrease) of one standard deviation in an independent variable” (Vogt, 2005, p. 23-24).

³⁵ R^2 is defined as the “symbol for a coefficient of multiple determination between a dependent variable and two or more independent variables. It is a commonly used measure of the goodness-of-fit of a linear model...For example, if the R^2 between average individual income (the dependent variable) and father’s income, education level, and IQ were 0.40, that would mean that the effects of father’s income, education level, and IQ together explained (or predicted) 40% of the variance in individuals’ average incomes – and that they did not explain 60% of the variance” (Vogt, 2005, p. 259).

Table 4.2.: Multivariate Regression using all Independent Variables, 2003

Independent Variables	Standardized Coefficients	<i>p</i> value
	Beta	
Population Density	0.767	0.000
Fruit/Veg. Consumption	0.009	0.911
STDs	0.194	0.017
Food Insecurity	0.190	0.008
Income Inequality	-0.050	0.489

Dependent Variable: HIV Rates

The above table shows very similar results to the 2003 bivariate regressions (see table 4.1). As in the bivariate regressions, fruit and vegetable consumption and income inequality were not found to be significantly related to HIV prevalence (all *p* values were greater than 0.450). Further, as in the bivariate analysis, population density, STDs, and food insecurity were found to be significantly and positively related to HIV prevalence. More specifically, population density was very strongly and significantly related ($\beta = 0.767$, $p < 0.000$), while both STDs and food insecurity were strongly and significantly related ($\beta = 0.194$, $p = 0.017$; $\beta = 0.190$, $p = 0.008$).

2003 Multivariate Regression using Population Density, STDs and Food Insecurity

Table 4.3, below, shows the results of a multivariate analysis using the independent variables found to be significant in the analyses, above. This model is the most parsimonious of the 2003 models. It has an R^2 comparable to the model in table 4.2 (0.709 vs. 0.712), while employing only three variables: population density, STDs and food insecurity. The *p* value of the F-test was < 0.000 .

³⁶ An F-test is: “a test of the results of a statistical analysis, perhaps most closely associated with, but by no means limited to, analysis of variance (ANOVA). The *F*-test yields an F ratio or F statistic. This is the ratio of the variance between groups (or unexplained variance) to the variance within groups (or unexplained variance)” (Vogt, 2005, p. 127).

Table 4.3: Multivariate Regression using Population Density, STDs & Food Insecurity, 2003

Independent Variables	Standardized Coefficients	<i>p</i> value
	Beta	
Population Density	0.760	0.000
STDs	0.177	0.011
Food Insecurity	0.193	0.006

Dependent Variable: HIV Rates

Table 4.3., above, shows that population density, STDs and food insecurity were all significantly and positively related to HIV prevalence. More specifically, population density was very strongly and significantly related ($\beta = 0.760$, $p < 0.000$), while STDs and food insecurity were strongly and significantly related ($\beta = 0.177$, $p = 0.011$ and $\beta = 0.193$, $p = 0.006$ respectively).

The importance of including population density as a control (as was discussed in chapter 3) is evident when we consider this model without population density. Specifically, the betas for STDs and food insecurity are higher, at $\beta = 0.290$ and $\beta = 0.261$ respectively, without including population density as a control. The reason that the STDs and food insecurity beta values are larger when population density is not included in the model is because they are positively correlated with population density, and thus “carry” or measure some of the population density effect on HIV when population density is not included in the equation.

2005 Results

2005 Bivariate Regressions

Table 4.4, below, shows the results of the bivariate regressions for the year 2005.

Table 4.4: Bivariate Regressions, 2005

Independent Variables	Standardized Coefficients	<i>p</i> value
	Beta	
Population Density	0.770	0.000
Fruit/Veg. Consumption	0.019	0.874
STDs	0.324	0.006
Income Inequality	0.253	0.035
Food Insecurity with Hunger	0.150	0.216

Dependent Variable: HIV Rates

As shown in Table 4.4, fruit and vegetable consumption and food insecurity with hunger were not found to be significantly related to HIV prevalence (all *p* values were greater than 0.20). By contrast, the remaining independent variables were found to be significantly and positively related to HIV prevalence. Specifically, population density was very strongly and significantly related to HIV prevalence ($\beta = 0.770$, $p < 0.000$), while STDs and income inequality were strongly and significantly related ($\beta = 0.324$, $p = 0.006$ and $\beta = 0.253$, $p = 0.035$ respectively).

2005 Multivariate Regression using all Independent Variables

Table 4.5, below, shows the results of a multivariate regression analysis using all independent variables considered for the year 2005. The R^2 of this model is 0.650 and the *p* value of the F-test was < 0.000 .

Table 4.5: Multivariate Regression using all Independent Variables

Independent Variables	Standardized Coefficients	<i>p</i> value
	Beta	
Population Density	0.702	0.000
Fruit/Veg. Consumption	0.018	0.812
STDs	0.170	0.028
Income Inequality	0.138	0.079
Food Insecurity with Hunger	0.125	0.105

Dependent Variable: HIV Rates

Table 4.5 shows similar results to the 2005 bivariate regression analyses, with one important exception. As in the bivariate analysis, fruit and vegetable consumption was not found to be significantly related to HIV prevalence ($p = 0.812$). Further, as was shown in the bivariate regressions, population density was found to be very strongly and

significantly related to HIV prevalence ($\beta = 0.702$, $p < 0.000$), while STDs and income inequality were strongly and significantly related ($\beta = 0.170$, $p = 0.028$, $\beta = 0.138$, $p = 0.079$). An important difference from the bivariate analysis was that food insecurity with hunger was found to significantly and positively related to HIV prevalence ($\beta = 0.125$, $p = 0.105$).

2005 Multivariate Regression using Population Density, STDs, Income Inequality & Food Insecurity with Hunger

Table 4.6, below, shows the results of a multivariate analysis, which includes population density, STDs, income inequality and food insecurity with hunger. These variables were included for analysis because they were shown to be significant in one or both of the previous analyses. This is the most parsimonious of the 2005 models. It has an identical R^2 to the model in Table 4.5 (0.65), while employing only four variables: population density, STDs, income inequality and food insecurity with hunger. The p value of the F test was < 0.000 .

Table 4.6: Multivariate Regression using Pop. Dens., STDs, Inc. Inequality & Food Ins. with Hunger

Independent Variables	Standardized Coefficients	p value
	Beta	
Population Density	0.703	0.000
STDs	0.170	0.028
Income Inequality	0.138	0.076
Food Insecurity with Hunger	0.124	0.106

Dependent Variable: HIV Rates

Table 4.6, above, shows that population density, STDs, income inequality and food insecurity with hunger were all significantly and positively related to HIV prevalence. More specifically, population density was very strongly and significantly related ($\beta = 0.703$, $p < 0.000$), while STDs, income inequality and food insecurity were strongly and significantly related ($\beta = 0.170$, $p = 0.028$; $\beta = 0.138$, $p = 0.076$; and, $\beta = 0.124$, $p = 0.106$ respectively).

It is also important to note that, as with the 2003 results, the importance of including population density in the final 2005 model is evident. Specifically, when we consider the model without population density the beta values for STDs, income inequality, and food insecurity with hunger are higher, at $\beta = 0.297$, $\beta = 0.260$ and $\beta = 0.206$, respectively.

CONCLUSION

This chapter has provided the results of the statistical analyses testing the relationship between HIV prevalence and the independent variables of hunger, STDs, income inequality, and population density. In the next chapter, these results are discussed in further detail in relation to the literature. The main argument of this thesis is also presented in this chapter. Additionally, implications for social work and directions for further research are also discussed.

CHAPTER 5 – ANALYSIS & CONCLUSIONS

This chapter provides an analysis of the results presented in chapter 4, and conclusions of the overall study. The chapter is divided into three parts. Part I expands on the explanation of the results provided in chapter 4, providing further discussion about how each independent variable is connected to HIV/AIDS prevalence in the statistical analysis, and how these results relate to the existing literature. Part II considers the results of the statistical analysis as a whole, and presents the main argument of this study: that Stillwaggon's model deserves greater attention in Canada. Part III is focused on the implications of this study, and discusses: 1) the implications of this study for social work; 2) recommendations for poverty-focused prevention programming; and, 3) directions for further research.

PART I: ANALYSIS OF THE RESULTS

This section describes the results associated with each independent variable examined - hunger/malnutrition, sexually transmitted diseases, income inequality and population density, in relation to the literature. In addition, results pertaining to the thesis' sub-question are addressed.

Malnutrition/Hunger

As discussed in chapter 3, three different variables were selected to measure the relationship between malnutrition/hunger and HIV vulnerability in the statistical analysis. The fruit and vegetable measure, selected as a proxy for micronutrient deficiency, was the only hunger measure that was not found to be significantly related to HIV prevalence. This result was unexpected; however, this may be more a reflection of the utility of the

particular measure used than an indication that micronutrient deficiency is not connected to HIV vulnerability. To elaborate, a large portion (between 49-68%) of the population of every health region consumed fruits and vegetables less than five times per day in 2003.³⁷ Studies estimate that only 10% of Canadians are living with food insecurity/hunger, and there is no evidence to suggest that micronutrient deficiency in Canada occurs at rates of up to 68% of the population (Rainville & Brink, 2001; Che & Chen, 2001). It is possible that a measurement with a finer scale, for example the percentage of the population who consume fruits and vegetables once (or less) per day, may be a more accurate proxy for micronutrient deficiency. An analysis using a better proxy for micronutrient deficiency may show a relationship between micronutrient deficiency and HIV/AIDS.

In contrast to the results of the fruit and vegetable measure, analysis using the 'food insecurity' variable selected for 2003 was found to be significantly and positively related to HIV prevalence. The measure of 'food insecurity with hunger,' selected for 2005 was also found to be significantly and positively related to HIV prevalence. These results suggest that malnutrition/hunger is connected to vulnerability to HIV/AIDS infection (at the population level) in a Canadian context.

The relationship between malnutrition/hunger and increased vulnerability to HIV found in this study is not surprising in light of the substantial body of literature developed over the past twenty-five years that has connected malnutrition with increased vulnerability to infectious diseases in general (Cunningham-Rundles, 1998; Scrimshaw & San Giovanni, 1997; Chandra, 1997; Biesel, 1996). As noted in chapter 2, this body of literature argues that deficiencies of both protein/calories and micronutrients can increase

³⁷ The range of variation for 2005 was 49-66%.

people's vulnerability to a wide range of infectious diseases, including tuberculosis, measles, malaria and diarrhea (Boelar & Gordeuk, 2002; Schaible & Kaufmann, 2007; Baqui *et al.*, 1993; Scrimshaw & San Giovanni, 1997; Biesel *et al.*, 1996; Semba, 1998). While this literature does not specifically relate to HIV/AIDS, it suggested that malnutrition can increase people's vulnerability to any infectious disease, including sexually transmitted infections such as HIV/AIDS.

The results of the statistical analyses considering malnutrition/hunger and HIV prevalence can also be analyzed in relation to the existing body of literature connecting HIV/AIDS and malnutrition. As discussed in chapter 2, the existing literature on this subject is scant and focuses primarily on the link between maternal micronutrient deficiency and vertical (mother to child) transmission. In particular, this literature has linked vitamin A deficiency to vertical transmission of HIV/AIDS in both Africa and in income-rich countries (Graham *et al.*, 1993; Semba *et al.*, 1994; Greenberg *et al.*, 1997). A very small body of literature has also considered the relationship between malnutrition and sexual transmission of HIV/AIDS. The results of these studies are mixed, but there is some evidence that malnutrition can increase people's vulnerability to HIV/AIDS by both increasing the level of infectivity (viral loads) of HIV infected individuals, and by suppressing the immune systems of non-infected persons (Mostad *et al.*, 1998; John *et al.*, 1997; Baeten *et al.*, 2001; Mehendale *et al.*, 2001; Moore *et al.*, 1993). The present study adds evidence to this body of literature suggesting that hunger is a risk factor for HIV/AIDS, and suggests that malnutrition/hunger deserves greater consideration in HIV/AIDS prevention research and policy in Canada.

Sub-question about Hunger

The results of the statistical analyses considering hunger and HIV prevalence also allow for reflection on the sub-question that this thesis aimed to answer. To reiterate, this question was concerned about whether the less severe conditions of poverty in Canada in comparison to those in the developing regions focused on by Stillwaggon might shift the relevance of Stillwaggon's argument in the context of Canada. The specific sub-question posed was: Does the less severe, less widespread hunger that exists in Canada (in comparison to the developing regions focused on by Stillwaggon) also impact on HIV/AIDS vulnerability?

As discussed above, the food insecurity variables for both 2003 and 2005 used in this project's statistical analysis were found to be significantly related to HIV prevalence. This suggests that Stillwaggon's argument has relevance in a Canadian context, where there is less extreme and less prevalent malnutrition than income-poor countries. This finding is consistent with the literature discussed in chapter 2, which has connected less extreme (mild and moderate) malnutrition to reduced immune function and increased vulnerability to infectious disease (Pelletier *et al.*, 1995; Bhaskaram, 2001; Black, 2003; Reddy *et al.*, 1989).

The connection between HIV vulnerability and less severe hunger is an important finding of this thesis because mild to moderate hunger is a significant issue in Canada (Rainville & Brink, 2001; Che & Chen, 2001; Canadian Association of Food Banks, 2005). As noted above, approximately 10% of Canadian households experience food insecurity/hunger, the majority of which does not compare to the severity experienced in income-poor countries (Rainville & Brink, 2001; Che & Chen, 2001). The results of this

study suggest that alleviating all forms of hunger (from mild to severe) may be an important component of effective HIV/AIDS prevention programming. This may be especially important for certain groups in Canada that are particularly vulnerable to experiencing food insecurity: women, female-headed families, people relying on social assistance, and persons of Aboriginal descent living off of reserves (McIntyre *et al.*, 2000; Che & Chen, 2001; Raphael, 2007; Canadian Association of Food Banks, 2005). Strategies for addressing food insecurity in Canada are discussed below in part III.

Sexually Transmitted Diseases

As noted in chapter 4, the level of sexually transmitted diseases in a health region was found to be significantly and positively related to HIV prevalence in the statistical analyses for both 2003 and 2005. This finding agrees with the wide body of literature, discussed in chapter 2, which links STDs to increased vulnerability to HIV infection (e.g. Fleming & Wasserheit, 1997; Celum, 2004; Wald & Link, 2002; Weiss, 2001; Kassler, 1994; Laga *et al.*, 1993). As is discussed in chapter 2, this body of literature has connected both ulcerative STDs and non-ulcerative STDs with vulnerability to HIV/AIDS in both income-rich and income-poor countries (e.g. Fleming & Wasserheit, 1997; Celum, 2004; Wald & Link, 2002; Weiss, 2001; Kassler, 1994; Laga *et al.*, 1993). This study provides further evidence of a relationship between STDs and HIV/AIDS (at the population level) in the income-rich context of Canada.

It is important to consider the relationship between STDs and HIV/AIDS vulnerability (suggested by this study and the existing literature) when thinking about HIV/AIDS prevention in Canada, because STDs are “an escalating public health challenge and health concern” within the Canadian population (Public Health Agency of

Canada, 2007 a, p. v). This is evidenced by the substantial incidence of STDs in Canada, discussed in chapter 2. To reiterate, small scale studies on genital herpes have found rates from 9-19% (Howard *et al.*, 2003; Singh *et al.*, 2005). Further, chlamydia rates are currently 197.1/100,000, gonorrhea rates are 14.9/100,000, and syphilis rates are 0.8/100,000 (Public Health Agency of Canada, 2007 a). Suggestions for incorporating STD prevention and treatment into HIV/AIDS prevention are discussed below.

Income Inequality

As noted in chapter 4, income inequality was found to be significantly and positively related to HIV prevalence in the 2005 analysis, but not in the 2003 analysis. The significant result from 2005 is not surprising in light of the growing body of literature discussed in chapter 2 that has linked HIV/AIDS in population based studies. As discussed in chapter 2, this body of literature has connected income inequality to HIV/AIDS in studies including both income-poor and income-rich countries (e.g. Holtgrave & Crosby, 2003; Nepal, 2007; Talbot, 2007; Drain *et al.*, 2004). The present study provides further evidence that income inequality is linked to HIV/AIDS, by showing a relationship in the income-rich country of Canada. This is an important finding when thinking about HIV/AIDS prevention in Canada because there is significant income inequality in Canada (Raphael, 2007; United Nations Development Program, 2006; Picot & Myles, 2005).

When considering why a relationship between HIV and income inequality was not found in 2003, two possible explanations can be offered. First, it is possible that income inequality was less extreme in 2003 than 2005. The literature; however, does not support this explanation, and suggests that income inequality in Canada has not changed

substantially over the past three decades (Picot & Myles, 2005). A second, more likely, explanation is that the coarseness of the 2003 measure obscures a possible relationship between income inequality and HIV. More specifically, the 2003 measure considered the highest and lowest 20% of income earners, while the 2005 measure considered only the highest and lowest deciles. The coarser 2003 measure includes individuals closer to the middle of the income spectrum, and may not capture the full extent of inequality present.

Finally, when considering how income may be related to HIV/AIDS vulnerability, it may be valuable to consider the relationship between HIV/AIDS and low income. As is noted in chapter 2, a growing body of literature has connected low income to HIV/AIDS in individual based studies, suggesting a possible relationship (e.g. Krueger *et al.*, 1990; Hankins *et al.*, 1998). While the present study did not find a relationship between low income and HIV prevalence during preliminary analysis, further studies exploring the relationship between low income and HIV at both the population and individual-based level may provide further insight into how income is connected to HIV vulnerability (Krueger *et al.*, 1990; Hankins *et al.*, 1998).

Population Density

As was expected at the outset of this thesis, the results of the statistical analysis found a very strong relationship between population density and HIV/AIDS. A comprehensive analysis of this result is beyond the scope of this thesis; however, two significant issues are brought to light by this finding. First, any statistical analysis exploring HIV/AIDS and other variables should consider including population density as a control variable to avoid confounding the results obtained. As was shown in chapter 4, the β value for the relationship between HIV and STDs, income inequality, and food

insecurity increased markedly when population density was not included. This demonstrates that population density can be important as a control variable.

Second, the strong relationship found between population density and HIV/AIDS shows that HIV is particularly prevalent in urban areas. Although the conclusion that the urban poor are most vulnerable to HIV/AIDS cannot be drawn from this study, the potential relationship between urban poverty and HIV/AIDS risk warrants further examination in light of the results of this thesis. This result does, however, suggest that targeting prevention in urban areas would reach a large number of at risk individuals.

PART II: COMPREHENSIVE ANALYSIS

When examined together, the results of this study suggest that Stillwaggon's argument has some resonance in Canada. Specifically, the synergies of hunger, income inequality, and STDs appear to be important possible risk factors for HIV/AIDS. Therefore, the main conclusion of this thesis is that Stillwaggon's argument deserves greater attention in Canadian HIV/AIDS prevention programming and research.

The central suggestion of this thesis is that HIV/AIDS prevention programs must go beyond the behavior and gender strategies that have come to dominate prevention, towards a structural understanding of the epidemic that considers how poverty impacts risk. This marks a shift from focusing exclusively on the individual, to a strategy which includes a consideration of social context. However, it is important to acknowledge that while this thesis argues for a greater consideration of poverty in prevention, it does not propose the abandonment of behavior change strategies or gender empowerment programs. As noted in chapter 2, these approaches to prevention are important to reducing risk connected to gender oppression and behavior (Kelly & Kalichman, 2002;

Lamb *et al.*, 1998; Green *et al.*, 2006). What is needed are more comprehensive prevention programs that consider behavior, gender and poverty.

When considering the above argument, it is important to recognize that the present study has some inherent limitations. Most significantly, this is the first study of this nature undertaken in Canada, and further research is necessary to solidify this argument. Second, this study was performed with a limited sample size and liberal level of statistical significance, due to the lack of available data. A larger sample size would increase confidence in the results obtained. Despite these limitations, the general conclusion of this study; that poverty has an important impact on HIV vulnerability in Canada, is presented with confidence. Suggestions for possible poverty-focused programming are made in part III of this chapter.

A possible counter-argument to the case made in this section is that people living in poverty have higher rates of HIV/AIDS infection because they have more unprotected sex. While it is not possible to challenge this argument with statistical evidence, this theory is not supported by the literature. Specifically, the literature does not support the notion that poor people have more sex, or more unprotected sex, than middle class or rich people (e.g. Lauman *et al.*, 1994; Weinberg *et al.*, 1997). Further, the literature demonstrates several historical instances when poor individuals have been portrayed incorrectly as hypersexual. This has been largely the result of stigma, stereotypes and a historical anxiety associated with the perception that 'disrespectful' members of society would reproduce at such a rate as to outpace 'respectable' citizens (Sangster, 2001; McLaren, 1990; Valverde, 1985). The perceived hypersexualization of Aboriginal women (for most of the 20th century), and the subsequent regulation of their sexual

practices, is an excellent example of this type of historical stereotype based on class (and in this case race) (Sangster, 2001). Overall, the literature refutes the argument that HIV is connected to poverty because poor people have more sex or more unprotected sex, as well as the more general argument that the poor are hypersexual.

Finally, reflecting on the findings of this study using a structural perspective, one can observe certain interrelations. Although the findings of this study focus most directly on the ways in which class (in particular, specific synergies of poverty) influences vulnerability to HIV/AIDS, there is also some evidence to suggest that geography, particularly population density, also impacts vulnerability. Further, while racism and sexism are not explored explicitly in this analysis, this thesis has discussed in detail the literature connecting gender inequality and HIV/AIDS risk (see chapter 2). To reiterate, this literature argues that women are particularly vulnerable to contracting HIV/AIDS because of gender inequality, and that gendered approaches to prevention are, therefore, necessary (Kumar *et al.*, 2002; Farmer, 1996; Zierler & Krieger, 1997). The existing literature looking at race/ethnicity and HIV/AIDS also suggests that inequalities in race/ethnicity are connected to HIV/AIDS vulnerability (e.g. Zierler & Krieger, 1997; Farmer, 1996; Stockdill, 2003; Judith & Norton, 2001). Taken together, these findings present a strong case that several structures of poverty are at play in influencing HIV/AIDS vulnerability, and suggest that a structural understanding of the epidemic is needed. More research is needed to explore how the complex structures of race, class, gender and geography interlock to influence vulnerability to HIV/AIDS in Canada.

PART III: IMPLICATIONS OF THIS THESIS PROJECT

This section discusses the implications of this thesis project. First, implications for social work are discussed. Second, recommendations are provided for poverty-focused HIV/AIDS prevention strategies. Third, directions for further research are considered.

Implications for Social Work

As noted several times in this thesis, HIV/AIDS prevention work in Canada tends to focus on changing behavior and gender empowerment. This study suggests that social workers doing HIV/AIDS prevention work may be able to improve their practice by incorporating a structural (poverty-focused) analysis of the HIV/AIDS epidemic into their work. Specifically, social workers may be able to improve their practice by striving to implement prevention strategies that address the synergies of hunger, STDs and income inequality. Specific suggestions are provided below for tactics social workers might incorporate into their practice.

Further, in a broad sense, the results of this study suggest the need for a more holistic approach to both HIV/AIDS programming and anti-poverty work. Social workers practicing in both of these areas should be aware that in addition to the more commonly acknowledged negative effects of poverty, individuals living with poverty may also be at increased risk of HIV infection.

Strategies/Recommendations for Poverty Focused Prevention

Given the conclusions presented in this chapter, several recommendations can be made for poverty focused prevention. The reader is reminded that the conclusions of this thesis are made tentatively, and so too are the following recommendations.

This study suggests that sexually transmitted infections are connected to increased vulnerability to contracting HIV/AIDS. Therefore, a first recommendation for prevention is improved STD prevention and treatment programs (e.g. more STD clinics). Since people living in poverty are particularly vulnerable to STDs, improved prevention and treatment are particularly relevant to marginalized populations. However, Canadians from all income brackets would benefit from improved STD programs and prevention information.

A second area that should be attended to in poverty focused prevention is the goal of greater food security. As noted above, food insecurity was linked to HIV/AIDS in this study, suggesting that the alleviation of food insecurity may be an important component of effective HIV/AIDS prevention. Community based strategies, such as community gardens and community kitchens may provide a means to improve food security (Fano, 2004; Engler-Stringer & Berenbaum, 2007). However, while these strategies hold some potential to decrease hunger, several studies suggest that an improved government safety net (that increases household's economic status) is also essential to alleviating food insecurity (Tarasuk, 2001; Tarasuk, 2005; Engler-Stringer & Berenbaum, 2007). An improved government safety net should, therefore, be a third component of poverty focused prevention. This component would also contribute to lessening income inequality, which was a third variable linked to HIV prevalence in the present study.

To elaborate on this suggestion of an improved government safety net, there is a need to challenge systems that perpetuate poverty, and to push for structural changes that would improve the economic status of Canadians. Some specific suggestions for alleviating poverty include providing a guaranteed annual income to all Canadians, increasing minimum wages, and generating employment. There is also a need to provide better job training, child care, education opportunities and disability supports for people living in poverty. The adoption of these policies would not only be useful in addressing income inequality amongst Canadians; they would also contribute to the alleviation of the other synergies of poverty discussed in this thesis: food insecurity and STDs. In working towards the goal of an improved government safety net, social workers may want to consider linking with anti-poverty groups. These groups work towards creating structural change (focused on poverty alleviation) by raising awareness about poverty and pressuring governments to address poverty, and would make excellent partners for HIV/AIDS prevention workers operating within an anti-poverty framework.

Finally, a last recommendation of this thesis is that individuals doing prevention work should try to draw attention to the need to consider poverty in HIV/AIDS prevention. Specifically, when making public statements about HIV/AIDS prevention, social workers need to speak to the issue of poverty and how this might contribute to risk. Putting the subject of poverty onto the HIV/AIDS prevention agenda in Canada is an important first step in the long-term goal of achieving more effective poverty-focused prevention.

Recommendations for Further Research

The relationship between HIV/AIDS and poverty has been given little attention in Canada. This study provides compelling evidence that poverty may be a risk factor for HIV/AIDS in Canada; however, further research is necessary to explore this subject. One recommendation would be to replicate the present study using a larger sample size and a more stringent level of statistical significance (e.g. more health regions or cities). If this direction were taken, an inclusion of measures of low income and specific sexually transmitted diseases (e.g. genital herpes, chlamydia, syphilis), in the statistical analysis would be valuable. However, it is important to note that a larger scale study would require the collection of a significant amount of new data, as additional HIV and specific STD data are not currently available. This points to the need for more extensive data collection of health information in general.

A second direction for further research might be a large scale survey of Canadians living with HIV/AIDS to document their living conditions prior to becoming HIV-positive. Such a study could include an examination of HIV/AIDS rates in rural and urban individuals living in poverty in order to test the hypothesis that the urban poor are particularly vulnerable to HIV/AIDS. Further, this type of survey could potentially strengthen the argument made in this thesis by linking synergies of poverty to specific cases of HIV/AIDS.

Finally, further scientific research is also needed to explore the relationship between malnutrition and both vertical and sexual transmission of HIV/AIDS. As this work is being developed, policy makers and social scientists should pay close attention to the results of these studies and consider them in the development of HIV/AIDS policy.

The importance of grounding HIV/AIDS policy in scientific research is also noted in Stillwaggon's research (Stillwaggon, 2006).

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Appendix A: Health Regions Used in the Statistical Analysis – 2003 & 2005

2003 Health Regions

Central Vancouver Island
East Kootenay
Fraser East
Fraser North
Fraser South
Kootenay Boundary
North Shore Coast Garibaldi
North Vancouver Island
Northern Interior
<i>Northwest/Northeast</i> ³⁸
Okanagan
Richmond
South Vancouver Island
Thompson Cariboo Shuswap
Vancouver
Abitibi Temiscamingue
Bas St. Laurent
Chaudiere Appalaches
Cote Nord
Etrie
Gaspesie Iles de la Madeleine
Lanaudiere
Laurentides
Laval
Mauricie et Centre du Quebec
Monteregie
Montreal Centre
Outaouais
Quebec
Saguenay Lac St. Jean
Algoma
Brant
Chatham-Kent
Durham
Eastern Ontario
Elgin-St. Thomas
Grey Bruce
Haldimand-Norfolk

³⁸ Combined health regions are bolded and italicized

Haliburton-Kawartha-Pine Ridge
Halton
Hamilton-Wentworth
Hastings-Prince Edward
<i>Huron/Perth</i>
Kinston-Frontenac
Lambton
Leeds-Grenville-Lanark
Middlesex-London
Niagara
Northwestern
Ottawa
Oxford
Peel
Peterborough
Porcupine
Renfrew
Sudbury
Thunder Bay
Toronto
Waterloo
Wellington-Dufferin-Guelph
Windsor-Essex
York Region
Calgary
Capital
Winnipeg
<i>Brandon/Assiniboine</i>
<i>N. & S. Eastman</i>
Interlake
Central

2005 Health Regions

Algoma
Brant
Chatham-Kent
Durham
Eastern Ontario
Elgin-St. Thomas
Grey Bruce
Haldimand-Norfolk
Haliburton-Kawartha-Pine Ridge
Halton
Hamilton-Wentworth
Hastings-Prince Edward
<i>Huron/Perth</i>
Kinston-Frontenac
Lambton
Leeds-Grenville-Lanark
Middlesex-London
Niagara
Northwestern
Ottawa
Oxford
Peel
Peterborough
Porcupine
Renfrew
Simcoe-Muskoka
Sudbury
Thunder Bay
Toronto
Waterloo
Wellington-Dufferin-Guelph
Windsor-Essex
York Region
Central Vancouver Island
East Kootenay
Fraser East
Fraser North
Fraser South
Kootenay Boundary

North Shore Coast Giribaldi
North Vancouver Island
Northern Interior
<i>Northwest/Northeast</i>
Okanagan
Richmond
South Vancouver Island
Thompson Cariboo
Vancouver
Calgary
Capital
Bas St. Laurent
Etrie
Abitibi Temiscamingue
Gaspesie Iles de la Madelaine
Chaudiere Applaches
Cote-Nord
Saguenay Lac St Jean
Mauricie et Centre du Quebec
Laurentides
Lanaudiere
Laval
Outaouais
Quebec
Monteregie
Montreal-Centre
Winnipeg
<i>Brandon/Assiniboine</i>
<i>N. & S. Eastman</i>
Interlake
Central