The Economic Burden of HIV/AIDS in Canada

TERRY ALBERT
GREGORY WILLIAMS

with the collaboration of
BARBARA LEGOWSKI and DR. ROBERT REMIS

CPRN Study No. H|02|

ISBN 1-896703-24-0

Available from:
Renouf Publishing Co. Ltd.
5369 Canotek Road
Ottawa, ON K1J 9J3
Tel.: (613) 745-2665
Fax: (613) 745-7660
Home Page: http://www.renoufbooks.com

Contents

Foreword

In late 1994, CPRN was commissioned by Health Canada to coordinate an Economic Research Initiative on HIV/AIDS. Accordingly, an Advisory Committee was formed, priorities were established, a request for proposals was issued, and the ensuing research proposals were carefully reviewed. Major projects to gather economic information in association with clinical and health service information were commissioned in Vancouver, Calgary, and Toronto. In addition, smaller community-based social, economic, and health service projects were funded in Edmonton, Ottawa and Montreal. These projects will all be completed in March 1998, and the project leaders will be publishing their own results.

More recently, Health Canada asked CPRN to coordinate a series of economic projects on prevention of HIV/AIDS. They too will be completed in 1998.

In his site visits and regular contact with the researchers, Terry Albert, program coordinator, has witnessed the human dimensions and the complexities of this disease, as well as the commitment of providers, caregivers, and researchers. This study is an early synthesis of learnings from many of the projects, while still in progress. Project leaders have provided emerging data on costs, the changing patterns of illness among HIV-positive people, and the shifting incidence of the infection as witnessed from the clinics participating in the projects. The significance of this emerging information was assessed by CPRN with the help of two expert panels – one on epidemiology and the other on clinical issues.

Our object was to estimate the economic burden of HIV/AIDS. What does a disease cost? The obvious costs are for the care and treatment of people who are ill. Add to that the loss to society when someone dies prematurely or is unable to function as well as he/she could have done in a healthy state.

But infectious diseases are different. They are preventable. Many have been stopped by identifying a vaccine and organizing comprehensive immunization programs. But there is no vaccine or cure, as yet, for HIV, which is transmitted mainly through sexual intercourse and the injection of drugs. The only way to prevent HIV is through changes in behaviour. This presents challenges of a different order because it is necessary to ask why people engage in risky behaviours. Some may do so out of ignorance. But the evidence on this epidemic is that the most vulnerable populations are now people who have been marginalized from society. They are poor, unemployed, suffer from racial discrimination,

etc. For them, the risk of AIDS may seem remote or insignificant in relation to the other risks they face in their daily lives.

Thus what started out as fairly straightforward economic study was transformed into a serious set of social and political issues. The costs of this disease to Canadian society are very high. The epidemic is shifting to new populations. The number of new infections has increased rapidly in the last few years. The solution lies in prevention. But there is no instant tool kit of prevention programs that has been proven to be effective among the marginalized people who are at risk of becoming HIV infected. The study therefore points to the need for a much greater focus on surveillance and prevention, and to new approaches to governance in the health system, which bring experts in criminal justice, housing, employment, and social services into the effort to address the economic and social costs of HIV/AIDS.

I would like to thank Terry Albert, who is on the staff of CPRN, his coauthor, Gregory Williams, a consultant to the project, along with Barbara Legowski and Dr. Robert Remis, who collaborated on key sections of the paper. I also want to thank the panels of experts and the Advisory Committee for this initiative for giving us good advice as the authors diligently worked their way through a vast amount of raw data to come up with a comprehensive portrait of the state of the epidemic in Canada today.

Judith Maxwell
President

Acknowledgments

This study would not have been possible without the cooperation and collaboration of several people and groups from across Canada. Health Canada must first be recognized for having the vision and foresight to invest in the HIV/AIDS Economic Research Initiative and this research project in particular. Through their cooperation and contribution of data, the various provincial departments and ministries of health proved invaluable in this first attempt, in Canada, at measuring investment in HIV prevention.

As well, we are indebted to Dr. John Gill from the Southern Alberta Clinic, Calgary Regional Health Authority, and to his research associate, Mr. Bill Davidson, for contributing key data. Dr. Gill's investment in a longitudinal database will be of ongoing value for many avenues of research. We also wish to recognize the work of Dr. Chris Archibald, from Health Canada's Laboratory Centre for Disease Control, for a very fruitful collaboration with CPRN in the development of epidemiological estimates. As well, the data provided by the BC Centre for Excellence in HIV/AIDS, the HIV Ontario Observational Database (HOOD) and numerous community-based AIDS service organizations across the country is much appreciated.

Two Delphi meetings were convened by CPRN involving experts from across the country. The information generated from these sessions was critical to the research findings contained in this report. We wish to thank the participants and Dr. Catherine Hankins and Dr. Mark Wainberg for chairing these sessions. Participants are listed in the Appendices to Chapters II and III.

Special thanks are due to our colleagues and collaborators in this research. Barbara Legowski was instrumental in acquiring and analysing the HIV prevention expenditure data collected within Canada and internationally. Dr. Robert Remis made a critical intellectual contribution to this project through his leadership and the expertise he provided in the epidemiological analysis and modelling. We are also indebted to Eden Cloutier for his statistical advice and input.

This research has been reviewed by several people whose comments have improved the final product. In particular, we would like to thank Doug Angus, Russell Armstrong, Janet Dunbrack, Robin Hanvelt, Philip Jacobs, Barbara Jones, Heidi Liepold, Julia Martin, Nancy Meagher, Bob Shearer and David Schneider.

Finally, we are truly grateful for the input, guidance and high-level thinking

provided by Judith Maxwell. Her unwavering support, critical reviews and analytical input were invaluable to this project and typify CPRN's mission to create knowledge and lead public debate on socio-economic issues important to the well-being of Canadians.

This project was funded by the AIDS Care, Treatment and Support Program under the National AIDS Contribution Program of the National AIDS Strategy, Health Canada.

The Economic Burden of HIV/AIDS in Canada

I Overview

1 Background and Introduction

Concerns about the magnitude and impact of HIV/AIDS on the health care system and on society in general were raised soon after AIDS was recognized in 1981. Economists make up the third wave of researchers to consider the implications of HIV/AIDS after the initial involvement by epidemiologists and clinicians, and second wave of social and behavioural study researchers (Hanson, 1992). From the perspective of a person living with HIV/AIDS (PHA), a cure will be the ultimate result of the research effort. However, it is widely accepted that the HIV/AIDS epidemic is still largely in front of us and not behind us (Hankins and Handley, 1992) and society must cope with cumulating numbers of new infections each year and the related economic impacts. Hence, while the search for a cure continues, we must also better understand the economic dimensions of the epidemic in order to guide us in evidence-based policy formulation and optimal resource allocation.

Health Canada's contribution in this area was the creation of the National HIV/AIDS Economic Research Initiative. The primary objective was to make a healthy start and build a solid foundation for future research. The initiative is comprised of two major components each with a number of major projects (refer to Appendix I) in locations across the country: 1) HIV/AIDS care, treatment and support; and 2) HIV prevention and education. CPRN was given the mandate to coordinate the initiative and to also undertake a research project on "The Economic Burden of HIV/AIDS in Canada."

Two research workshops were held under the initiative in order to share interim results and explore linkages between the research projects. A final national workshop for the research initiative will be held in February 1998. CPRN will be preparing a final report in March, 1998, which will synthesize the research findings from the initiative and identify a longer term research agenda in this area.

2 The Economic Burden of HIV/AIDS in Canada: A Map of the Paper

A key objective in conducting this study was to capitalize on the emerging findings from the research projects of the initiative, link these results to other research and bring these interim results to bear on pressing policy issues. A cost of illness or economic burden approach was selected as the most suitable framework. The overriding objective was to quantify and make explicit several key economic dimensions of the HIV/AIDS epidemic in Canada.

Critics of economic burden studies have likened them to Oscar Wilde's definition of a cynic: "one who knows the price of everything, and the value of nothing." While this is harsh, it does highlight a major limitation – they are not economic evaluations where costs are examined in relation to consequences (i.e., inputs relative to outputs). However, the output of economic burden studies have an intrinsic value – the economic dimensions of specific diseases are made explicit. They also provide the numerator for cost-effectiveness studies and significant value-added can accrue from linking this information to other areas such as prevention and epidemiology.

Examining the HIV/AIDS epidemic through an economic lens is one of several interrelated and complementary approaches that will assist in creating a process of evidence-based policy development and decision making. But amid all the numbers

and dollar figures we must not forget the pain and suffering of those Canadians living with HIV/AIDS, and the rief and loss of their family, friends and loved ones.

2.1 Conceptual Overview

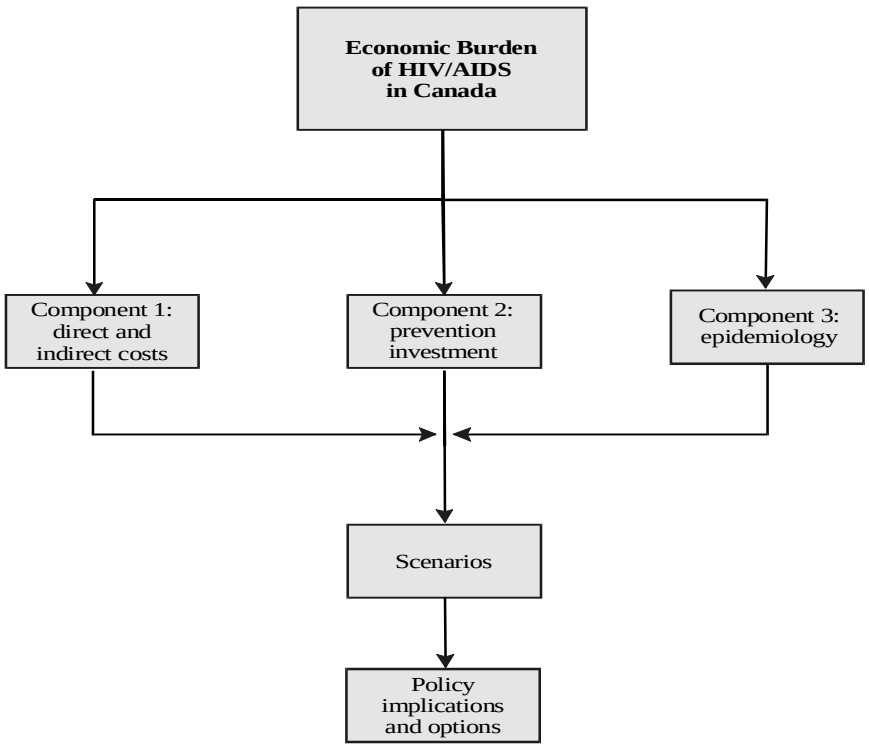
This paper sits on three pillars, which represent the analytical core for the research. As depicted in the conceptual overview (Figure I-1), the three core components are interrelated and the findings from each are brought to bear on a scenario chapter, which, in turn, informs the final chapter on policy implications and options.

The rationale behind including these core components is quite simple. First, it is intuitive that identifying and capturing direct and indirect costs is a fundamental aspect of gaining a better understanding of the economic impact of ill health and in making societal losses explicit. Epidemiology, in turn, provides estimates of prevalence and incidence and hence functions as the multiplier for determining overall economic burden. Finally, as a natural extension, our national investment in HIV prevention is included in the paper as a measured response geared to reducing economic burden.[1]

Ultimately, the findings from these three analytical components will reveal the contrast between the cost per case infected and cost per case averted. Additionally, it will allow for the establishment of a break-even point in terms of the number of prevented cases required in order to recover the annual national investment in HIV prevention.

Figure I-1

Conceptual Overview



2.2 Direct and Indirect Costs

Conflicting and contradictory estimates of the direct costs of HIV/AIDS have been used in media and other reports over the past five or six years. The findings from this paper and the other research projects funded under this initiative will provide up-to-date information and better estimates more firmly grounded in Canadian experience.

More importantly, however, is the objective of deriving more current cost estimates associated with the new and emerging HIV/AIDS episode. Direct cost estimates produced in the late 1980s reflected an episode that was dominated by inpatient hospital costs. Over the past five years, the natural history of HIV disease and treatment patterns have evolved and changed rapidly and a new HIV/AIDS episode has emerged. Drugs now outstrip inpatient hospital costs in the episodic resource consumption profile.

The main analytical challenges in capturing these costs relate to characterizing the new episode in terms of duration and phases of illness and, second, to build resource consumption profiles over these phases.

Fortunately, a recent and reliable Canadian estimate of the indirect episodic costs associated with HIV/AIDS is available from the literature for use within the context of this study (see Hanvelt et al., 1994).

2.3 Epidemiology

The HIV/AIDS epidemic has been characterized as a somewhat hidden epidemic due to the lag time between time of infection and diagnostic discovery. Hence there is a risk of underestimating incidence and prevalence. A number of analytical techniques have been employed by epidemiologists and statisticians in order to estimate current levels of the epidemic in the Canadian population.[2] These estimates are adjusted downstream once closer to actual incidence figures become available from HIV testing data and AIDS case data.[3] There is anecdotal evidence that the time gap is narrowing between date of seroconversion (infection) and date of diagnosis. Some attribute this to the new drug therapies and the related incentive to get tested and start the drugs as early as possible in the infection process.[4] If this holds true, then there could be a positive effect on the timeliness and accuracy of epidemiological estimations. However, it is also known that HIV infection is increasing in populations at the margins of society and many of these people, after becoming infected, present themselves to the health care system much later in the infection process.

The prevalence and incidence estimates for this study were produced in collaboration with Health Canada's Laboratory Centre for Disease Control (LCDC). A component model patterned after the Holmberg (1996) study in the United States was replicated (see Chapter II). This essentially entails building prevalence estimates for Canada by subpopulations in major metropolitan centres.

While reliable estimates of the prevalent HIV population in Canada are important for generating the multiplier for the cost data, they also provide rich analytical potential in relation to Canada's investment patterns and choices in HIV prevention.

2.4 Investment in HIV Prevention

This is the first time Canada's national investment in HIV prevention is quantified. This includes investments made at the federal, provincial and municipal levels as well as private investment from corporations and individuals. This data provides initial insights into the types and level of investment relative to the directions of the epidemic over time. The data also enable some initial international comparisons and provide some context for the Canadian data.

2.5 Future Scenarios

The data from the three core components of the research are also applied in a "crystal ball" type of exercise, where plausible future scenarios for the

direction of the epidemic are connected to the cost data as a means of exploring the future economic impacts of the epidemic. This produces cost differentials between various incidence scenarios and makes explicit the economic incentive behind investing in HIV prevention.

2.6 Policy Implications

The empirical findings of this paper raise key policy issues relating to the HIV/AIDS epidemic in Canada. Key policy questions are raised or framed as an important first step in future policy development and formulation. We must better understand the implications of our policies and the consequences of not acting or acting inappropriately. While we have the benefit of learning from our mistakes, we must also prevent mistakes in the first place. We must keep a vigilant eye on this epidemic and, to the extent possible, stay ahead of it with innovative, fiscally responsible, ethical and equitable policy and program development.

Appendix I

National HIV/AIDS Economic Research Initiative

Component 1: Care and Treatment

Major Projects

1. *The Economic Costs and Resource Impacts of HIV/AIDS in British Columbia* (Robin Hanvelt, Robert Hogg, David Schneider, Tobin Copley and Nancy Meagher), BC Centre for Excellence in HIV/AIDS and Faculty of Medicine, University of British Columbia.

2. *The Cost of Community-based Care for Persons with HIV/AIDS* (John Gill, Myron Weber, Bill Davidson), Southern Alberta Clinic, Foothills Hospital and Faculty of Management, University of Calgary.

3. *Preventing Mycobacterium Avium Complex Infection in People Living with HIV and AIDS: A Cost-Utility Analysis* (Donald Redelmeier and Ahmed Bayoumi), Wellesley Hospital Research Institute and Department of Medicine, University of Toronto.

4. *Costing Community Care Programs for People Living with HIV/AIDS: A Pilot Study Proposal* (Philip Jacobs, Peter Calder), University of Alberta; (Russell Armstrong, Dawn Walker and Blaze Mumford) Canadian AIDS Society and Canadian Association for Community Care.

5. *Economic Evaluation of Various Patient Management Models for HIV-infected Women and Children* (Normand Lapointe, André-Pierre Contandriopoulos, Johanne Samson and Cristian Morales), Sainte-Justine Hospital and University of Montreal.

6. *The Cost and Outcomes of the HIV/AIDS Epidemic in Ontario: Expanding the HIV Ontario Observational Database (HOOD) to Inform Policy-Makers on Service Utilization, Cost and Outcomes Related to HIV/AIDS* (Margaret Millson, Gregory Robinson, James Lavery, Ron Wall, Dale McMurchy), HOOD, University of Toronto, University of Western Ontario.

Building Research Capacity Projects

1. Two comprehensive literature reviews on HIV/AIDS and informal care:

   The Opportunity Costs of Informal Care Giving: A Review of the Literature (Marie Allard, enyse Dagenais, Paul Lanoie and Véronique Ouellettte), École des Hautes Études Commerciales, Montreal.

   Informal Delivery of Care and Support Services in General and in HIV/AIDS (Jean-Pierre Bélisle), École des Hautes Études Commerciales, Montreal.

2. *Towards Development of a Management Information System for Community-based AIDS Service Organizations* (Joint project between the Canadian AIDS Society, Health Canada and CPRN).

3. *The Application of Resource Utilization Profiles from the B.C. Community Care Costing Project in Other Jurisdictions* (Robin Hanvelt, David Schneider, Nancy Meagher and Tobin Copley).

Component 2: HIV Prevention and Education

1. *Mathematical Modelling of HIV/AIDS Prevention: A Synthesis of Experience, Evidence, and Theory* (Robin Hanvelt, Nancy Meagher, David Schneider and Tobin Copley), BC Centre for Excellence in HIV/AIDS and the Faculty of Medicine, University of British Columbia.

2. *The Cost-Effectiveness of Behavioural Interventions in an Emergent Risk Group: Edmonton's Streetworks Program* (Philip Jacobs, Peter Calder, Duncan Sanders, Stan Houston, Marliss Taylor and Jason Brown).

3. *Development of a Prototype National HIV/AIDS Prevention Database* (William Swan, Christine Knott and Patrick Taylor), Queen's Health Policy Research Unit, Kingston.

4. *International Comparison of HIV Prevention in Five OECD Countries: In Search of Best Practice* (Gregory Williams and Barbara Legowski), Canadian Policy Research Networks and

Notes

1 It is understood that the primary reason for engaging in HIV prevention is to prevent unnecessary pain and suffering and to increase overall societal quality of life. In doing so, economic burden is also reduced.

2 For example, Dr. Ping Yan at Health Canada's Laboratory Centre for Disease Control used a back-calculation model using current AIDS case data in order to derive HIV incidence estimates for previous periods.

3 An HIV case becomes designated as an AIDS case through a definitional process that is based on a combination of biological markers and clinical indicators.

4 While many clinicians are reporting improvements in biological markers in their patient populations (i.e., rebounding CD-4 counts and undetectable viral load), there are many PHAs who cannot tolerate the toxic side effects of the new drug regimens. As we continue to evaluate the impacts of these new drug therapies, quality of life/functional health status measures need to be examined alongside the biological measures.

References

Hankins, Catherine and Margaret Handley (1992), "Towards an HIV/AIDS Research Agenda for the 1990s: A Background Discussion Paper," prepared for the Canadian Association for HIV Research through a grant from the National Health Research and Development Programme, Ottawa: Health Canada.

Hanson, K. (1992), "AIDS: What Does Economics Have to Offer," *Health Policy and Planning* 7(4):315-28.

Hanvelt, Robin A. et al. (1994), "Indirect Costs of HIV/AIDS Mortality in Canada," *AIDS* 8(10).

Williams Research.

II HIV Epidemiology: A Dynamic Epidemic

1 Introduction

Keeping track of the HIV epidemic is a challenge. Vital statistics on AIDS and HIV are potentially confusing and misleading to the lay person. For example, at this year's Canadian Association for HIV Research (CAHR) scientific conference, two important findings were released: first, that AIDS incidence has decreased as has AIDS mortality; second, HIV infections according to a new estimate are increasing. HIV is the underlying viral infection that causes AIDS, a clinically and biologically defined illness. The lag time between viral infection and presentation of even early illness may be as long as 5 to 10 years or more. The recent decrease in AIDS cases and AIDS deaths is a function of the success in reducing new infections in the mid-1980s and improvements in treatment of HIV infection that tend to prolong life.

The increase in new infections reflects the spread of the epidemic to new populations, especially injection drug users (IDU). This has unleashed a third wave of HIV infection and created a whole new set of challenges to both health and social policy. To date, there have been three waves of HIV infection in Canada:

- the first, among persons from countries where HIV is endemic to the heterosexual population;
- the second, and most significant wave thus far, among men who have sex with men (MSM);
- the third is driven by new infections among injection drug users.

Chart II-1 shows the dynamic path of new infections since the early 1980s. In the early years (1981-83), the infections were concentrated among men who have sex with men (MSM) – 82 percent of all new infections (Archibald et al., 1997). By 1996, their share of new infections had fallen to 37 percent. Intravenous drug users were not a major factor in the early 1980s, but they now account for 49 percent of all new infections. Rates of infection are also rising among women. This chapter describes the shifting pattern of the epidemic and the need for more accurate and comprehensive methods to track the epidemic.

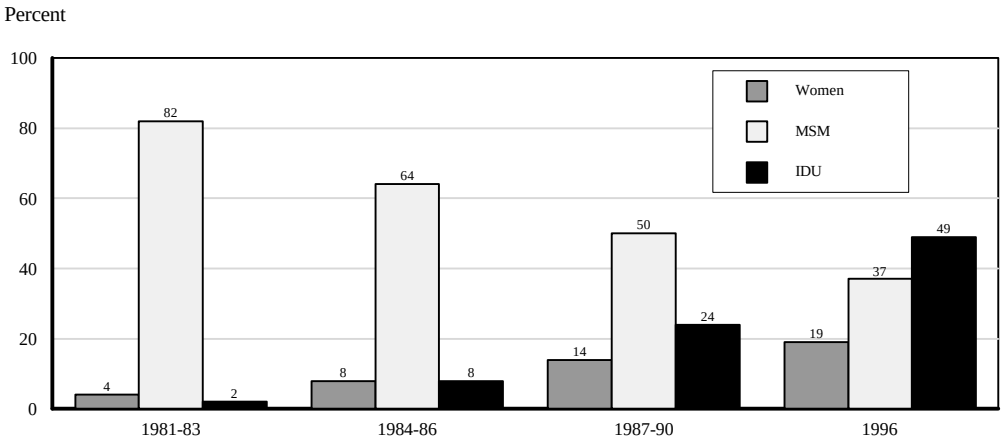
1.1 The Challenge of Surveillance

Annual incidence, the number of new infections in a given year, indicates whether the epidemic is growing or shrinking over time, and is also, therefore, the single most important measure of success or failure at epidemic control. Unfortunately, unless a person is being repeatedly tested (e.g., volunteers in longitudinal studies like VIDUS,[1] OMEGA,[2] etc.), we seldom know the actual rate of infection, or incident rate, for HIV in a given subpopulation *when it is actually happening*. Estimating incidence with any sensitivity on a year-to-year basis for the entire country in all its regional diversity therefore represents an even greater challenge.

As more Canadians come forward for HIV testing, it is possible to compile HIV positive test reports or serodiagnostic data.[3] Ontario, for example, has an excellent serodiagnostic database. This is an important contribution, but again, the relationship between time of infection and time of diagnosis through testing is not consistent. There is also the question of how representative these databases are of both the general population and, more importantly, those populations that are most at risk. What prompts an individual to be tested? According to a large national study, about 40 percent of Canadians who sought

Chart II-1

HIV Incidence in Canada by Three Risk Groups



MSM = Men who have sex with men; IDU = injection drug users.
Note: Comparison based on back-calculations.
Source: Based on data presented by Dr. Chris Archibald, LCDC, at the Canadian Association for HIV Research Scientific Conference '97.

testing did so for purposes of monitoring their health, but about another 30 percent sought testing because they erceived themselves to be at risk for infection (Sutherland et al., 1996). Serodiagnostic databases therefore have a substantial representation of individuals that perceive themselves to be at high risk or, in epidemiologic jargon, a potential selection bias. These databases tell us less about populations that do not perceive themselves to be at serious risk.

Self-perceived risk and epidemiological risk are not necessarily correlated. For example, in a recent study of women undergoing abortion in Quebec, 80 percent of the HIV-positive women perceived themselves to be a low risk (Remis et al., 1997). Women, in particular, appear to be underreported in serodiagnostic data-bases. In New Brunswick, a recent study found 111 HIV-positive women of childbearing age although there are only 31 women currently reported in the system (Getty et al., 1997). HIV testing data are important and contribute to the overall picture of the epidemic's evolution, but they are a poor proxy for incidence data. Without some sense of incidence, the leading edge of the epidemic remains hidden from view.

Despite the challenges associated with surveillance, there is a real need for reliable estimates of HIV incidence – the number of new infections per year, and HIV prevalence – the number of HIV-infected Canadians living in a given time. Incidence, in both the general population but more specifically in the high-risk subpopulations or "core groups," is a high-level indicator of success or failure of epidemic control. The size of the epidemic as determined by prevalence, and some under-standing of the composition of that population with respect to disease progression, is a prerequisite for estimating the resources needed to provide care and treatment for that population. In this exercise, the prevalent population is the basic multiplier used to determine the economic burden. Ideally, public policy is evidence based, and therefore reliable estimates of both incidence and prevalence are needed to inform decisions about the allocation of scarce resources to prevent the spread of the epidemic and provide care and treatment for the infected.

The purpose of this chapter, therefore, is to shine a light on the hidden epidemic to provide: a) a conceptual understanding of the dynamics of the epidemic that can evade sight; b) plausible estimates of current HIV prevalence and incidence for 1996; and c) plausible estimates of historical HIV prevalence and HIV incidence, and a critical interpretation of these trends.

1.2 The History of Multiple Epidemics: Biological and Environmental Factors

In Canada, as in other developed countries, the epidemiology of HIV has been characterized as "overlapping epidemics moving in waves through a series of different risk groups" (Blower et al., 1990). The first evidence of a full-scale epidemic came in the early 1980s with the presentation of previously rare forms of cancer and viral pneumonia among gay men with severely suppressed immune systems. HIV was not isolated in the laboratory until 1985. Prior to that, the exact etiology of Acquired Immune Deficiency Syndrome (AIDS) had not been known. HIV is a blood borne pathogen. Specific forms of human behaviour that promote the exchange of contaminated blood or blood byproducts, like semen, are the biological routes of infection. HIV has been isolated in other human body fluids, like saliva, but not in sufficient quantities to promote effective transmission. The precise pathways by which HIV causes the breakdown of the immune system are still not understood, but all but a few skeptics now agree that HIV is requied in the body to produce AIDS. HIV is the necessary causative agent at the root of a disastrous global epidemic, which has caused grave human suffering and continues to have profound social and economic consequences.

Successful transmission of any infectious disease requires a susceptible host and a virulent agent. However, transmission occurs in an environment the social and economic characteristics of which may serve to catalyze or inhibit the evolution of an epidemic. In theory, virtually everyone is at risk for HIV infection. Practically speaking, this is not the case. Who is actually exposed to contagion, and is therefore at practical risk, is determined by a host of factors including behavioural and environmental factors. Tuberculosis, an old public health problem, which is occurring with renewed intensity, is associated with poor housing and bad ventilation. It is also a disease of the poor and the marginalized. Like HIV, it disproportionately affects Aboriginals and is common among the injection drug community and street-involved people, including youth. The very fact of being either an Aboriginal, an injection drug user or a street-involved youth puts an individual at greater risk for both HIV and tuberculosis.

Canada is a country of many subpopulations, which can be stratified by age, region, gender, ethnicity, sexual identity, income, etc. Different groups have different health problems, but one truth is always evident. The health of the poor is always worse relative to the health of the middle-class and the rich (Evans et al., 1994). The popular version of AIDS as an epidemic of rich, gay white men distorts the reality of the changing demographics of HIV/AIDS. Analysis of a national, cross-sectional survey of 1,136 HIV-infected Canadians, most of whom identified themselves as gay men, suggests a trend to both lower education and lower income levels *prior to infection* among those who were most recently infected (Echenberg, 1997).

The study of infectious disease in populations has provided insight into the way contagions interact with human society. A classical model of the epidemiology of infectious disease tends to view society as a static entity and the infectious agent as some-thing that acts on the society. The public health goal that derives from this model seeks to stop the spread of infectious disease without really changing the society (Mann, 1996). A vaccine, for example, does not require substantial social change to stop the spread of infectious disease, although producing one may require both substantial social organization and a commitment of resources. A vaccine acts at the biological level to induce immunity in the host. If it is effective, it requires only one significant behavioural change: the vaccination itself.

Currently, there is no vaccine to decrease susceptibility and in turn to biologically block the spread of HIV.[4] Therefore, it is essential to anticipate the epidemic's evolution, and make a concentrated effort to help communities at risk so they may resist infection. This effort will require a vigilant and imaginative public health response that can elucidate and monitor the leading edges of the epidemic (much like a probe searches the unknown regions of space), and deliver timely, effective and measured interventions. Simultaneously, policy must address the social and economic conditions that are proving fertile soil for HIV, other infectious diseases, and a myriad of health problems that waste human potential.

1.3 The First Infections: HIV among Persons from Endemic Countries

Historically speaking, the first reported cases of AIDS in Canada were among Canadians from Haiti living in Quebec in the early 1980s. Haiti is a country where HIV is pervasive, or endemic, among the heterosexual population. The first infections in Canada were among Canadians from "endemic countries." The primary modes of transmission for this risk group are sexual activity and perinatal transmission from pregnant mother to child.

1.4 The Epidemic among Men Who Have Sex with Men

The second wave of infections, and to date the most substantial, occurred among men who have sex with men (MSM). In this community HIV is primarily a sexually transmitted disease (STD). High rates of infection among men who have sex with men drove the epidemic in Canada until between 1984 and 1986 when it peaked and infection rates began to drop (Yan et al., 1996; Schecter et al., 1992). Currently, MSM comprise approximately 37 percent of new infections compared to 82 percent in 1981-83 (Archibald et al., 1997). There is some evidence to support a resurgence of infection among MSM in the late 1980s as a new cohort of young MSM became sexually active (Yan et al., 1996). This resurgence would correspond to the second peak of the curve in Chart II-2. There is also evidence to support the belief that there is a new epidemic among young gay men, at least in Vancouver,[5] following similar patterns in American cities such as San Francisco. This corresponds to the intuitive notion that young people, including young gay men, are at higher risk as they learn to negotiate new sexual practices with confidence.

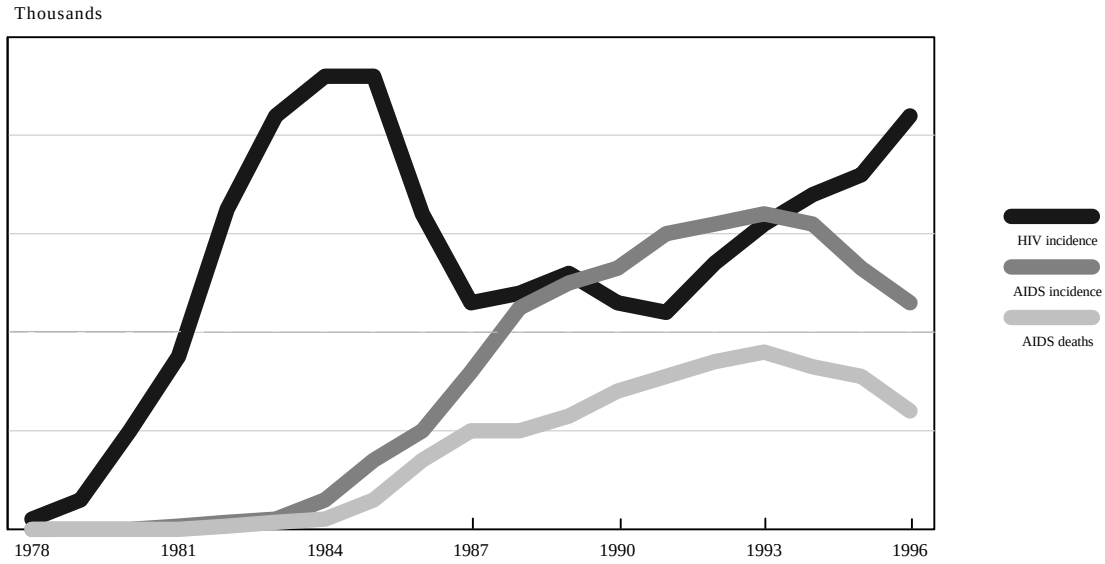
Social and economic marginalization appears to continue to play a role in undermining the health of young gay men and making them susceptible to HIV. A study of risk-taking sexual behaviour among young gay men found that risk takers were significantly more likely to have unstable housing, less education, problems with depression, use cocaine, alcohol and nitrate inhalants and smoke cigarettes than non-risk takers (Strathdee et al., 1996). Risk takers in this study were also more likely to have been paid for sex or having reported nonconsensual sex.[6] A high proportion of young gay men in a recent study of risk behaviour in a prospective cohort of young gay men in Vancouver reported high rates of suicidal thoughts and attempted suicide. The authors note that depression, substance abuse and homophobia impact negatively on self-esteem and negotiating skills thereby increasing vulnerability to HIV infection. The role of violence in compounding this phenomenon among young gay men is noted as an important area for further investigation (Martindale et al., 1997).

1.5 The Epidemic among Injection Drug Users

This is a highly unstable and volatile epidemic. As noted earlier, injection drug users accounted for almost half (49 percent) of new HIV infections in 1996 compared to 24 percent in 1987-90[7] (Archibald et al., 1997). Recent data from the Vancouver Intravenous Drug Users Study (VIDUS) indicates that the HIV incidence in Vancouver could be as high as 20 percent, that is 1 in 5 injection drug users in Vancouver will become infected in a given year. The base case model for 1996, developed by the Laboratory

Chart II-2

HIV Incidence, AIDS Incidence and AIDS Deaths in Canada



Source: Plausible estimate of HIV incidence modelled by Dr. Robert Remis and Gregory Williams. AIDS incidence and mortality data from LCDC.

Centre for Disease Control in collaboration with CPRN, used a more conservative estimate of 12.3 percent per 100 person-years under the assumption that VIDUS participants represented the Vancouver IDU population at highest risk.

In Montreal, HIV prevalence among IDU remains moderate and stable over time. At the CACTUS needle exchange, approximately 19 percent of 650 IDU were infected. New infections are occurring in this group at a rate of approximately 8.3 percent per 100 person-years. While not as explosive as Vancouver's reported incidence rates among IDU, this is still relatively high (Hankins et al., 1997). The same phenomenon of stable HIV prevalence and high HIV incidence has been observed in Québec City (Poulin et al., 1997). The combination of high incidence and stable prevalence points to a dynamic epidemic: one in which there is substantial outflow due to mortality, rehabilitation, and out-migration but also a substantial inflow of new IDU due to initiation, relapse, and in-migration. Although moderate and stable, these prevalence rates are substantial enough to fuel an epidemic in a community where risk behaviours remain high. Both behavioural risk and HIV incidence rates among a network of eight needle exchange programs in the province of Quebec and in Ottawa were recently reported as high. Almost half the respondents in a recent study (1,041 out of 2,458) reported having injected with borrowed needles in the previous six months (Parent et al., 1997). A recent report of IDU and HIV infection in Ottawa suggests that a fresh IDU epidemic may be starting in that city (Leonard et al., 1997; Remis, Millson and Major, 1997).

1.6 The Epidemic in the Heterosexual Population

While there is limited data on HIV incidence and HIV prevalence in the heterosexual population over

time, the number of Canadians living with HIV infection in 1996 who contracted the virus through heterosexual contact is estimated to be 7,300. The estimated number of new infections among heterosexuals in 1996 was 500[8] (Archibald et al., 1997).

AIDS data would indicate that heterosexuals represent an increasing proportion of the epidemic (Chart II-3). These AIDS cases would represent infections that took place 5 to 10 years ago. Within the heterosexual population, HIV incidence among women is increasing (Chart II-1). The majority of heterosexual AIDS cases are the result of either exposure through sexual contact with a high-risk individual or originate in an HIV endemic country. They are concentrated in British Columbia, Ontario, and Quebec.[9]

1.7 HIV Infection among Canadian Aboriginal People

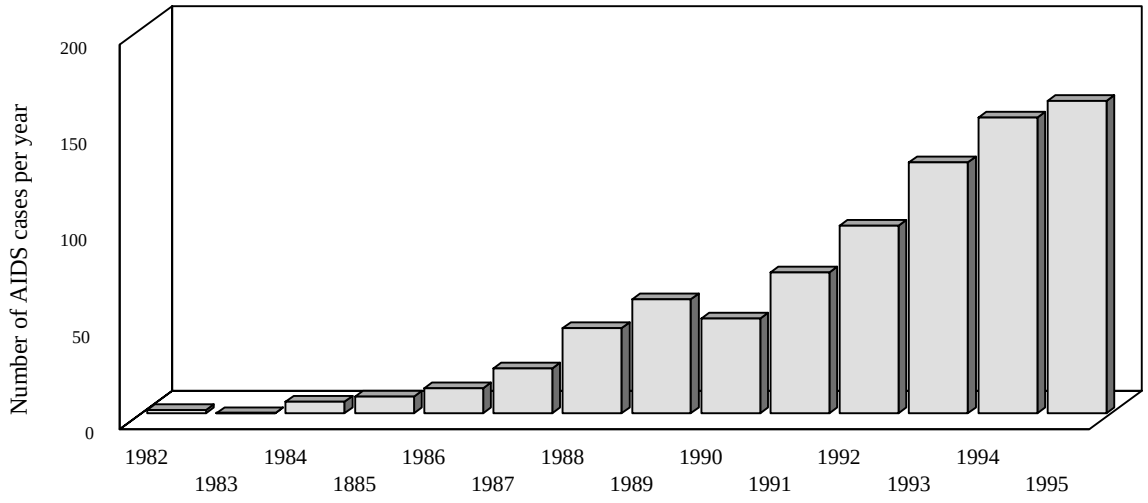
In the past 500 years, indigenous populations worldwide have been vulnerable to emerging infectious disease and HIV is not an exception (Rowell, 1996). Canadian Aboriginal people experience high rates of socio-economic and behavioural risks for HIV, infection, including poverty, incarceration, injection drug use, sexually transmitted diseases (STDs) and commercial sex (Houston and Reese, 1996).

STD rates among Canadian Aboriginals are three times higher than the national average (McKenna, 1993). High rates of STD incidence have facilitated the rapid dissemination of HIV in the heterosexual population in developing countries.[10] In both Canada and Australia, experts have warned that the high STD rate among indigenous people, compounded with the other problems characteristic of social and economic marginalization, including poverty, drug use, etc., is a recipe for a disastrous epidemic among Aboriginals with the same characteristics noted in developing countries (Wortman, 1990; Heath et al., 1993).

The number of Aboriginal AIDS cases has increased steadily from 1984 to 1995 (Chart II-4). Again, these AIDS cases do not indicate what the

Chart II-3

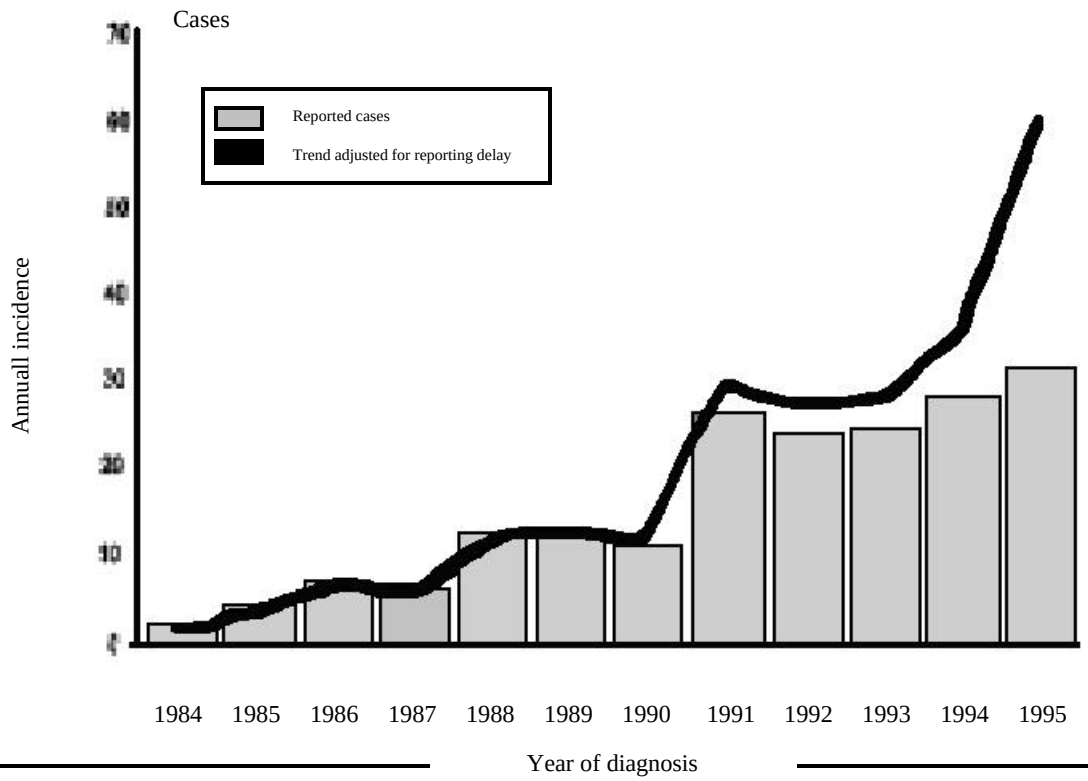
Number of AIDS Cases Diagnosed by Year, Adjusted for Reporting Delays and Underreporting, Heterosexual Transmission



Note: Cumulative number of AIDS diagnosed: 920 (approximately).
Source: Bureau of HIV/AIDS and STD, Laboratory Centre for Disease Control, Health Canada.

Chart II-4

Reported Aboriginal AIDS Cases in Canada (n = 187) by Year and Trend Adjusted for Reporting Delay[1]



1 Data to March 31, 1996.
Source: Laboratory Centre for Disease Control, Health Canada.

current rates of infection are but rather what they were 5 to 10 years ago. These reported cases probably underrepresent the size of the epidemic among Aboriginals as approximately one-third of the AIDS cases do not have ethnicity information (Nyguen et al., 1996). Compared to non-Aboriginals, Aboriginal AIDS cases are more likely to be young (less than 30) and injection drug users: in 1991, 38 percent of the 4,000 users of Vancouver's needle exchange program were Aboriginal(Rekart et al., 1991).

1.8 HIV Infection among Canadian Youth

The HIV epidemic has a disproportionate impact on young Canadians. The estimated median age at the time of infection between 1985 and 1990 was 23 years of age (LCDC, 1996*a*). For those infected prior to 1983 the estimated median age of infection is 32. Among young Canadians, socially and economically marginalized youth are at greatest risk, including young gay men, street-involved youth and Aboriginals.

Young women are biologically at higher risk for infection because male to female HIV transmission, particularly in the absence of other STDs, is estimated to be several times more efficient than female to male. Young women alienated from their homes are found to be more likely to gravitate toward peer groups with antisocial behaviours, engage in

spontaneous sexual encounters, use alcohol or drugs during sex, use condoms inconsistently, and perceive themselves to be at low risk for contracting STDs (Connop et al., 1997). For these women, peer group expectations take precedence over protecting their own health.

Street-involved youth "are characterized by personal histories of neglect, abuse, homelessness, limited employment skills, and increased vulnerability to numerous health related risks, including AIDS" (Postiano and Vardy, 1996). The prevalence rates for HIV infection for street-involved youth are 700 times higher than the general population (Postiano and Vardy, 1996). In the 1980s this population was identified as high-risk due to high rates of unprotected intercourse and needle sharing (Radford et al., 1989). Of 712 street-involved youth surveyed in 1994 the majority were sexually active, 22 percent reported one previous STD. High-risk behaviours for transmission of STDs, including HIV, were reported by 47 percent of males and 41 percent of females (Macdonald et al., 1994). Youth in the process of dropping out of school and drifting toward the street have been found to be very sexually active but not sufficiently educated to protect themselves from STD transmission (Wells et al., 1992).

While young people often go through periods of risky behaviour, they face greater risk in the presence of HIV and greater social and economic isolation than previous generations. The disappearance of high-wage low-skill jobs, the high rates of unemployment and low wages for those who do work, combined with the high costs of housing in urban areas and cutbacks in social services and transfers all conspire to push young people to the streets and into despair.

2 Methodology

2.1 Estimating the Plausible Limits of HIV Prevalence and Incidence in 1996: The Base Case

At the beginning of this chapter, some of the challenges in getting accurate reports on the incidence and prevalence of HIV infection are described. To overcome these challenges, CPRN collaborated with the Laboratory Centre for Disease Control to adapt a new methodology to estimate the number of new infections in 1996 (HIV incidence) and the number of Canadians currently living with HIV infection (HIV prevalence). (An outline of the methods used to estimate national HIV prevalence and incidence at the end of 1996 is included in Appendix II-A).

Four different methods are used to estimate prevalence and incidence in various risk groups in major urban areas using data from a wide variety of sources. These estimates are then extrapolated to the rest of Canada based on regional ratios in AIDS case reports and HIV positive test reports. These components are then summed to construct a national estimate. The method for the Canadian analysis was adapted from Scott Holmberg's (1996) study for the United States. The process is iterative in that it draws on the expertise and commentary from Canadian HIV epidemiologists, researchers and public health officials, to interpret the data and weigh the contributing estimates of risk group population size, incidence and prevalence, in terms of their reliability, validity, and potential biases.

3 Findings

Tables II-1 and II-2 present the base case for HIV infection in Canada in 1996. Table II-1 contains the estimated prevalence by risk group. Prevalence refers to the number of Canadians currently estimated to be living with HIV infection. Table II-2 presents the estimated number of incident infections for 1996 or the number of estimated new infections in that year.

4 Discussion

These estimates are alarming. They show that both prevalence and incidence are increasing. The number of infected persons living with HIV/AIDS in Canada reached 38,900 in 1996, up from approximately 30,000 in 1989 (Schecter et al., 1992). From the perspective of epidemic control, the increased size of the prevalent population increases the likeli-

Table II-1

Estimated HIV Prevalence or Number of Canadians Infected, by Exposure Group for 1996[1]

	Injection drug users	Men who have sex with men	Heterosexuals	Other	Total
Number of infected	6,100	25,100	7,300	300	38,900
(as percentage of total infected)	(16%)	(65%)	(19%)	(<1%)	(35,700-41,900)

1 LCDC (C. Archibald, P. Yan, J. Farley and S. Sutherland) in collaboration with CPRN (R. Remis, G. Williams, T. Albert, and E. Cloutier).

Table II-2

HIV Incidence or Number of New Infections, by Exposure Group for 1996[1]

	Injection drug users	Men who have sex with men	Heterosexuals	Other	Total
Number of new infections	1,950	1,470	500	20	3,940
(as percentage of total new infections)	(49%)	(37%)	(13%)	(<1%)	(2,950-4,900)

1 LCDC (C. Archibald, P. Yan, J. Farley and S. Sutherland) in collaboration with CPRN (R. Remis, G. Williams, T. Albert and E. Cloutier).

hood of further spread of the virus throughout the population.

In the meantime, improved clinical management and the relative success of new antiretroviral therapies have important consequences for the future of the epidemic. First, the new therapies should mean an improved quality of life for those living with HIV who have access to the therapies and sufficient income to procure adequate housing and nutrition to provide a healthy basis from which to manage the infection. It is not clear how helpful the therapies will be to marginalized populations, particularly street-involved people and injection drug users, who have difficulty complying with the stringent guidelines required to make the new therapies effective.

Second, in epidemiologic terms, this shift in disease management should decrease the incidence of AIDS cases and AIDS-related mortality. The new therapies reduce the amount of virus circulating in the blood thereby slowing the immune deterioration caused by HIV.[11] As long as the therapies continue to be effective, there should be a corresponding decrease in the number of AIDS defining illnesses and AIDS deaths. The resource implications for treating this growing population are discussed in Chapter III.

The new incidence estimates are very troubling. In the past five years the number of new infections in Canada has increased from an estimated 2,700 a year to approximately 4,000 a year. The proportion of prevalent infections resulting from new infections that year has also increased from 9 to 11 percent in the same period. One would expect that given the decreasing mortality rates among the HIV infected, the opposite should be true. If we were successful in

stemming the "flow" of new infections, then the proportion of new to prior infections in the prevalent population should be decreasing, especially as those already infected are living longer and AIDS-related mortality is decreasing.

4.1 HIV Incidence, AIDS Incidence and AIDS Deaths

Chart II-2 depicts three significant trends over time: the annual number of HIV infections in Canada; the annual number of new AIDS cases; and the annual number of AIDS related deaths. For the past three years, the number of HIV infections has continued to increase while the annual number of new AIDS cases and AIDS deaths has decreased.

The HIV infection curve is based on plausible estimates of HIV infection in an attempt to reconstruct the HIV epidemic in Canada.[12] For the most part, the HIV curve is imputed from the AIDS curve through a method called back-calculation. The shortcoming of the national time trend is that it tends to obscure the multiple epidemics described earlier. However, one can discern two broad trends based on the two significant waves of the Canadian epidemic. The first significant wave of the epidemic was driven by very high rates of infection among MSM and the second driven by high rates of infection among the IDU population. IDU HIV infection rates currently remain both high and unstable. Intensive infections in the IDU population did not probably begin until 1985, at which point infections among MSM had already peaked. The HIV incidence curve is now rising again steeply, driven by high rates of infection among injection drug users and, to a lesser extent, young gay men. The IDU epidemic began earlier in Ontario and Quebec, and it is currently most volatile in British Columbia.

4.2 The Falling Curve 1985-88: Saturation or Effective Prevention

There is some controversy as to why HIV infection among MSM peaked and then fell so rapidly after 1985. There is evidence to suggest that many gay men did modify their behaviour, which contributed to the decrease in new infections. Was the behaviour significant enough to account for such a rapid decrease in infection or did the susceptible population of gay men become saturated with HIV infection? Gabrielle Rotello (1997) convincingly argues that saturation explains much of the rapid drop. Rotello also notes that rates of infection among young gay men continue to increase as the epidemic is fed fresh fuel.

Ping Yan's work in Canada, which analyses the patterns of infection by age cohort, indirectly supports this hypothesis. Yan divided the patterns of HIV infection among gay men by age cohort and demonstrated that the epidemic moved into increasingly younger cohorts throughout the late 1980s (Yan et al., 1996). In Canada, one could argue, the epidemic moved into younger populations of gay men and resurged at the end of the 1980s after it had saturated the population of older, susceptible gay men.

It is likely that both factors, the prevention effect and saturation, contributed to the rapid drop in incidence among gay men after 1985 because both reduced the size of the susceptible population. It is a morbid irony that successful prevention and saturation produce the same outcome: fewer individuals susceptible to infection. What this economic exercise makes clear in Chapter V, however, is that saturation is a far more expensive means of reducing the size of the susceptible population.

Moreover, even after the virus appears to have exhausted its possibilities in one population, it does not burn out. Most infectious diseases require a minimum number of susceptible individuals, or *threshold density*, to become established in the population. HIV and STDs are an exception to the rule. Persistence of HIV, and other STDs, does not appear to be dependent on population density (Boily and Brunham, 1993). HIV can therefore remain persistent in populations with a very low density. It is possible, therefore, to reduce HIV to a burning

ember only to have it flare up if it encounters a fresh susceptible population. Currently, the inflow of new susceptibles, as young Canadians become sexually active or start injecting drugs, is ensuring a steady supply of fuel.

4.3 Hot Spot: The IDU Epidemic in Vancouver

The epidemic in Vancouver appears alarming, particularly in light of 2 million clean needles distributed on a yearly basis. There are several reasons cited for the steep curve of the IDU epidemic in Vancouver.

- When the drug of choice switched from heroine to injection cocaine (approximately 1993-94), IDU began injecting three or four times a day as opposed to once. It is conceivable that 2 million needles are therefore not enough. Moreover, too few needles might encourage a rationing effect, which is counterproductive to the principle of using a clean needle every time one injects.

- Individuals are most infectious during seroconversion when the amount of virus in their blood is very high. A high concentration of seroconverters in a population with high-risk behaviour will produce exponential rates of transmission.

- The use of a central needle exchange may have created social networks for needle sharing particularly if there was still a relative shortage of clean needles.

- As yet unpublished ethnographic studies indicate that there are other dimensions to injection drug use aside from injection (e.g., the preparation of the drug prior to injection), that are an unacknowledged mode of transmission.

- Finally, although needle exchange has proved effective around the world, it is not enough on its own. For example, needle exchange should be linked to other services like counselling, STD treatment, and drug treatment.

4.4 Ontario's IDU Epidemic: Relative Success or Emerging Problem?

Incidence and prevalence data collected to construct the base case estimate for 1996 would indicate that Ontario's IDU epidemic is currently less volatile than either British Columbia's or Quebec's. At the Delphi session held in preparation for this study it was suggested that the geographical diffusion of drug users in Metropolitan Toronto and across the province was probably contributing to the relative stability of the IDU epidemic in Ontario thus far. (Thirty-four percent of HIV+ tests between 1992-96 attributed to IDU for the province of Ontario were diagnosed in Metropolitan Toronto compared to British Columbia, where 67 percent of HIV+ tests attributed to IDU were diagnosed in Vancouver.) As a result of the decentralization of the IDU community, needle-sharing networks are theoretically more difficult to establish.

However, if the virus becomes established in a city like Ottawa, with established networks of needle sharing and sexual pairing, there is a potential for a rapid spread of the virus. This is especially true in the early stages of infection when the virus is present in greater quantities in the body and the chances of successful transmission are that much greater. In this scenario, the rate of reproduction with the core group heats up quickly increasing the risk to individuals at the periphery of the group. The rate of reproduction, or R_0, is the rate at which one person infects others.[13] The time for aggressive intervention targeted at the core group is in this early phase of an epidemic.[14] Recent behavioural studies among IDU in several cities, including Ottawa, reinforce the reason for alarm: the behavioural patterns to transmit the virus are in abundance (Parent et al., 1997) and rates of infection appear to be climbing (Remis, Millson and Major, 1997).

In summary, the prognosis at this juncture in the epidemic is not good.

- HIV prevalence is at an all time high. There are more people than ever living with HIV infection in Canada.
- HIV incidence is substantially higher than it was five years ago and continues to rise.

- Behavioural research indicates that the two behaviours that most contribute to the spread of HIV, unprotected sexual intercourse and the sharing of injection drug use equipment, are still widespread, particularly among marginalized groups.

- The trend toward social and economic marginalization continues to provide fertile ground for the virus to spread. Increasingly, those communities most at risk appear to be those most poorly equipped to resist the epidemic.

4.5 Epidemiology for HIV Prevention

Epidemiology is the study of the distribution and determinants of disease in human populations. In the context of infectious disease, epidemiology plays a critical role in prevention, control, and treatment: it is the basic science that supports the public health mandate of promoting and protecting the health of the population. The applications of epidemiology that support HIV prevention include:

1. ***Surveillance***: providing systematic and reliable reporting of the patterns of the epidemic's evolution.

2. ***Research***: obtaining more detailed information that helps to characterize in more depth prevalence and incidence of HIV/AIDS.

3. ***Interpretation:*** integrating data from surveillance and research to explain the HIV epidemic's occurrence and evolution.

4. ***Evaluation***: measuring the effectiveness of our efforts to control the epidemic once it has begun.

These activities form the basis of epidemic prevention and control, and generate vital information to guide prevention efforts. The HIV epidemiology database in Canada is substantial but less than comprehensive. It is unfortunately least informative on the subject that is most urgent: where is the leading edge of the epidemic now? If HIV in Canada is composed of multiple epidemics moving through different communities, then it is vital to know where each susceptible community is in the epidemic cycle in order to target prevention programs.

Gaps in the HIV epidemiology knowledge base are the source of the real challenges to surveillance presented by HIV. There are ways to fill the gaps, as demonstrated by the successful collaboration of experts from across the country in the preparation of the base case model for 1996, under the leadership of Dr. Chris Archibald. By pooling data and research expertise from a *de facto* network of sentinel surveillance sites, they were able to build a composite picture of the state of the epidemic. Formalizing this network and expediting the ongoing exchange of important information by exploiting developments in communications and information technology, like the Internet, would make a substantial contribution to improving HIV surveillance in Canada. To be effective such a network cannot be ad hoc. Epidemiology requires standardization. Data must be systemically collected and analysed.

There is also considerable room in Canada, as in the rest of the world, to develop innovative methodologies to address the challenges presented by HIV to both surveillance and evaluation. For example, improving understanding of STD rates as potential proxy markers for HIV incidence and/or HIV risk behaviour would provide a useful outcome marker for both surveillance and evaluation purposes. Epidemiology can also make a substantial contribution to understanding how to combat infectious disease if it is linked to analysis of the social and economic factors that facilitate the spread of these diseases.

Effective information systems are the cornerstone of the policy response to the HIV epidemic. The unique characteristics of the hidden epidemic can be addressed through strategic use of the four core applications of epidemiology described above.

Coordination is imperative. Community-based front-line prevention efforts require epidemiologic analysis to guide and evaluate interventions and

programmes. The front lines can also provide critical data about the state of Canada's multiple epidemics: STD clinics; HIV prevention programmes; Aboriginal health clinics, both on and off reserve; needle-exchange programs; homeless shelters, etc. are all important nodes for monitoring the evolution of the epidemic and providing policymakers with the information they need to plan a rational policy response and allocate resources efficiently and equitably. Linking epidemiology to prevention means enhancing Canada's capacity for active epidemiological HIV surveillance at the front lines of the epidemic and formalizing the two-way linkages between the front lines, epidemiological laboratories at the regional, provincial and national levels, and policy decision makers. The challenge is to collect, analyse, and expedite the timely flow of quality information to support a coordinated HIV prevention response that is as dynamic as the epidemic itself. The opportunity is to prevent the spread of an infection that remains one hundred percent preventable but for which there is no cure. Canada's goal should be to "break the back" of this epidemic.

Appendix II

A Outline of Methods Used to Estimate National HIV Prevalence and Incidence to the End of 1996

To begin the estimation procedure, the country was divided into regions based on data availability, with the smallest regions being the major cities in Canada. Within each region, separate estimates were developed for four risk categories: injection drug users, men who have sex with men, heterosexuals, and "other." These regional/risk group estimates were then combined to produce the national estimate as of December 31, 1996.

Data sources used in the estimation procedure are as follows: AIDS case and death reports, provincial HIV serodiagnostic databases, provincial drug treatment programs, targeted epidemiological studies, unlinked anonymous antenatal seroprevalence surveys, population-based surveys of risk behaviour and HIV testing history, and expert opinion. Up to four different methods were used to estimate each parameter, depending on data availability. Although each method on its own was at times weak and resulted in a relatively uncertain estimate, the degree of certainty was improved by calculating different estimates and combining them in a type of "triangulation" procedure. The four methods used were as follows:

1. The direct method or components model, which was the preferred method if data were available. In this method, the size of the population at risk is multiplied by the prevalence (or incidence) rate to give the estimated prevalent (or incident) number of infections at a point in time (1996 in this case). Population size was estimated from expert opinion, behavioural survey data, census data, and HIV testing data. Prevalence and incidence rates were obtained from specific epidemiologic studies. This method (combined with point 3, below) was used by Holmberg (1996) to estimate current incidence and prevalence in the United States.

2. The indirect method starts with the number of individuals in a particular region/risk group who are known to be HIV infected (data obtained from serodiagnostic databases). If the proportion that these individuals represent of all HIV-infected

persons is known, then the number of prevalent infections can be calculated. The proportion of known infections was estimated from surveys of HIV testing history in population-based and in targeted epidemiologic studies.

3. The third method, the ratio method, has two parts. First, the overall ratio of prevalent HIV infections to cumulative reported AIDS cases was calculated and used as one estimate of prevalence. Second, this method was to estimate prevalence and incidence in regions with limited data by extrapolating from neighbouring regions with more extensive data. Extrapolation for prevalence was based on the corresponding regional ratio among cumulative HIV-positive tests; extrapolation for incidence was based on the ratio among recent HIV-positive tests (1995-96).
4. The final method was a type of modelling that involved developing a spreadsheet of annual and cumulative HIV and AIDS data. Input data were AIDS cases and deaths, cumulative positive serodiagnostic tests, and previous estimates of cumulative incidence and prevalence. A sensitivity analysis of estimated annual incidence was used to examine the output of annual prevalence, and this served as an internal consistency check with the input data.

Thus, for each prevalence and incidence parameter, several estimates were generated with the likely point estimate being taken as the mean of the estimates. The advantages of this methodology are that it makes maximum use of a wide variety of surveillance and research data, it can readily incorporate new data, and it serves to highlight gaps in existing knowledge.

B Epidemiology Delphi Workshop Participants

Dr. Catherine Hankins (Chair)
McGill University
Montreal General Hospital
Montreal

Mr. Terry Albert
CPRN
Ottawa

Dr. Chris Archibald
Laboratory Centre for Disease Control
Health Canada
Ottawa

Dr. Marie-Claude Boily
Laval University
Québec

Ms. Janet Dunbrack
Health Canada
Ottawa

Dr. John Farley
Laboratory Centre for Disease Control
Health Canada
Ottawa

Dr. Robert Remis
University of Toronto
Toronto

Dr. Martin Schecter
BC Centre for Excellence in HIV/AIDS
Vancouver

Mr. Gregory Williams
CPRN
Ottawa

Dr. Ping Yan
Laboratory Centre for Disease Control
Health Canada
Ottawa

Notes

1 Vancouver Injection Drug User Study (VIDUS). Longitudinal cohort of high-risk IDU with an alarmingly high rate of HIV incidence (approximately 20 percent annually).

2 A longitudinal cohort of HIV-negative gay men in Montreal.

3 See LCDC (1996*b*), *HIV in Canada: Surveillance Report for the Period 1985-1995*.

4 HIV vaccine research has been disappointing thus far. However, even the development of a low efficacy vaccine could have a public health benefit. A low efficacy vaccine could, if added to other interventions, reduce the rate of transmission in core groups where HIV infection is concentrated (Garnett and Anderson, 1996).

5 An analysis of recent seroconversions in the VANGUARD study released at CAHR in May 1997 suggests an urgent need to intervene aggressively to stop the spread of HIV infection among young gay men. Incidence in this study was 2.8 percent annually, twice as high as expected (Strathdee et al., 1997).

6 Defined as "any type of sexual activity that you were forced or coerced into."

7 Estimate from back-calculation by Dr. Ping Yan, LCDC.

8 The incidence figures used for this estimate were derived not from seroconversion rates but rather from serodiagnostic data, which may capture a portion of HIV diagnosis but not current rates of infection. The estimate of 500 heterosexual infections for 1996 is therefore likely conservative.

9 LCDC (1997), *AIDS in Canada*, Quarterly Report, April 1997.

10 The presence of ulcerative STDs increases the efficiency of HIV transmission by providing a point of entry for the virus into the bloodstream. In addition, high rates of STDs among core groups are thought to reduce immunity thereby making people in the core more susceptible to HIV infection once they are exposed. This complex of health problems related to poverty, substance abuse, inadequate medical care, exposure to other diseases such as tuberculosis and other STD infections is sometimes referred to as the "synergism of plagues" (Rotello, 1997).

11 Theoretically, reducing the amount of virus in the body could also reduce the infectivity of the infected individual undergoing treatment and thereby also reduce the chances of infecting someone else.

12 Plausible estimates of HIV infection modelled by Dr. Robert Remis and Gregory Williams.

13 The basic reproductive rate, or R_0, is the average number of secondary infections when an infected individual is introduced into the population.

$$R_0 = B \times K \times d.$$

B is equal to the transmission risk per contact. *K* is the average number of contacts a person has in a period of infectivity and *d* is the duration of infectivity. If R_0 is greater than 1, then the epidemic will grow until it runs out, or saturates, the susceptible population. If R_0 is equal to 1 then the epidemic will remain persistent, or endemic, and if R_0 is less than 1 then the epidemic will decay. The goal of aggressive targeted prevention at core groups is get the reproductive rate down.

14 Core groups are defined as those with high rates of activity that can transmit the virus, needle sharing or unprotected intercourse, high levels of HIV prevalence and incidence, and established links of networking within the group. Core groups can sustain the infection within the overall population.

References

Archibald, Chris et al. (1997), "Estimating Current Prev-alence and Incidence of HIV in Canada," Bureau of HIV/AIDS and STD, Laboratory Centre for Disease Control, Health Protection Branch, Health Canada in collaboration with Canadian Policy Research Networks, Plenary Presentation at CAHR Conference, 1997.

Blower, S. M. et al. (1990), "Loglinear Models, Sexual Behavior and HIV: Epidemiological Implications of Heterosexual Transmission," *Journal of Acquired Immune Deficiency Syndromes* 3(8).

Boily, M. C. and R. C. Brunham (1993), "The Impact of HIV and Other STDs on Human Populations: Are Predictions Possible," *Infectious Disease Clinics of North America* 7(4) (December):771-91.

Canadian AIDS Society (1995), "Income Security Project," unpublished data.

Connop, H. et al. (1997), "Young Women at Risk," CAHR Conference, abstract no. 129.

Echenberg, Havi (1997), "Personal Transfers: Analysis of CAS Income Security Data and Policy Implications," background paper prepared for CPRN.

Evans, R. G. et al. (1994), "Producing Health, Consuming Health Care," in R. G. Evans, M. L. Barer and T. R. Marmor (eds.) *Why Are Some People Healthy and Others Not?: The Determinants of Health of Populations*, New York: Aldine deGruyter (previously published in 1990 in *Social Science and Medicine* 31(12):1347-63).

Garnett, G. P. and R. M. Anderson (1996), "The Potential Impact of Low Efficacy HIV Vaccines," Centre for the Epidemiology of Infectious Disease, University of Oxford, Oxford, U.K., in *Conf. Adv. AIDS Vaccine Dev.*, February 11-15, p. 106.

Getty, G. et al. (1997), "NB Antenatal Seroprevalence Study," CAHR Conference, abstract no. 223.

Hankins, Catherine et al. (1997), "Moving from Surveillance to the Measurement of Programme Impact: CACTUS-Montreal Needle Exchange Programme (NEP)," CAHR Conference, abstract no. 223.

Heath, T. et al. (1993), "The Acquired Immunodeficiency Syndrome in the Northern Territory of Australia: An Impending Fourth World Epidemic," Royal Darwin Hospital, Annual Conference Australia's Soc. HIV Medicine, abstract no. FE5.

Holmberg, Scott (1996) "The Estimated Prevalence and Incidence of HIV in 96 Large US Metropolitan Cities," *American Journal of Public Health* 86(5):642-54.

Houston, S. and H. Reese (1996), "HIV Infection among First Nations People in Northern Alberta," University of Alberta Hospitals, Edmonton, International Conference on AIDS, abstract no. Mo.C.1420.

Laboratory Centre for Disease Control (LCDC) (1997*a*), *AIDS in Canada: Quarterly Surveillance Update*, Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS and STD, Health Protection Branch, Ottawa: Health Canada (May).

ccc (1997*b*), *Inventory of HIV Incidence and Prevalence Studies in Canada*, Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS and STD, Health Protection Branch, Ottawa: Health Canada.

ccc (1996*a*), *Epi Update*, Bureau of HIV/AIDS and STD, Health Protection Branch, Ottawa: Health Canada (December).

ccc (1996*b*), *HIV in Canada: Surveillance Report for the Period 1985-1995*, Division of HIV/AIDS Surveillance, Bureau of HIV/AIDS and STD, Health Protection Branch, Ottawa: Health Canada.

Leonard, L. (1997), "Differences in HIV-related Risk Behaviors and Behavioral Change Intention among IDU Attending Ottawa-Carleton Needle Exchange," Report to Public Health Branch, Ontario Ministry of Health.

Leonard, Lynne et al. (1997), "Are IDU an Homogenous Risk Group for HIV Infection: Implications for Tailoring Interventions," CAHR Conference, abstract no. 223.

Macdonald, N. E. et al. (1994), "Canadian Street Youth: Correlates of Sexual Risk-taking Activity," *Pediatric Infectious Disease Journal* 13(8):690-7.

Mann, Jonathan (1996), "AIDS and the Future of Public Health," International Conference on AIDS, abstract no. Th.D.350.

Martindale, S. et al. (1997), "Evidence of Psychological Distress in a Cohort of Young Gay/Bisexual Men," CAHR Conference, abstract no. 102.

McKenna, N. (1993), *Disaster Waiting to Happen*, World AIDS Day, as quoted in Rowell, R. M. (1996), "The Spread of HIV/AIDS...."

Nyguen, M. et al. (1996), "Aboriginal HIV/AIDS in Canada," Bureau of HIV/AIDS and STD, Laboratory Centre for Disease Control, Health Protection Branch, Health Canada, International Conference on AIDS, abstract no. Tu.C.2630.

Parent, R. et al. (1997), "HIV among IDU: Second Surveillance Year of the Survidu Network," CAHR Conference, abstract no. 220.

Postiano, K. and G. Vardy (1996), "AIDS Outreach Program Targeting Street-Involved Adolescents Through Peer Education," International Conference on AIDS, abstract no. We.Cc.206.

Poulin, Céline et al. (1997), "Prevalence and Incidence of HIV among Injection Drug Users (IDU) Attending a Needle Exchange Program (NEP) in Quebec City," CAHR Conference, abstract no. 218.

Radford, J. et al. (1989), "Adolescents at Risk for HIV Infection," Queen's University, Kingston, Ontario, International Conference on AIDS, abstract no. M.D.0.8.

Rekart, M. L. et al. (1991), "HIV and North American Aboriginal Peoples," B.C. Centre for Disease Control, International Conference on AIDS, abstract no. M.C.3237.

Remis, R. S. et al. (1997), "HIV Prevalence and Incidence and Reported Risk Factors among Women Undergoing Abortion in Montreal," CAHR Conference, abstract no. 242.

Remis, Robert, Margaret Millson and Carol Major (1997), *The HIV Epidemic among Injection Drug Users in Ontario: The Situation in 1997*, Department of Public Health Sciences, University of Toronto and HIV Laboratory, Central Public Health Laboratory, Laboratory Services Branch, Ontario Ministry of Health. Prepared for the AIDS Bureau, Ontario Ministry of Health (July).

Rotello, Gabrielle (1997), *Sexual Ecology: AIDS and the Destiny of Gay Men*, New York: Dutton Publishing.

Rowell, R. M. (1996), "The Spread of HIV/AIDS in the World's Indigenous Populations," in Jonathan M. Mann and Daniel J. M. Tarantola (eds.), *AIDS in the World 11: Global Dimensions, Social Roots, and Responses*, New York: Oxford University Press.

Schecter, Martin et al. (1992), "How Many Persons in Canada Have Been Infected with Human Immunodeficiency Virus? An Exploration Using Backcalculation Methods," *Clinical Investigative Medicine* 15(4):331-45.

Strathdee, S. A. et al. (1996), "Sexual Abuse Is an Independent Predictor of Sexual Risk-taking among Hiv-negative Gay Men: Results from a Prospective Study at Baseline," International Conference on AIDS, abstract no. Mo.C.900.

___ (1997), "HIV Prevalence, Incidence and Risk Behaviours among a Cohort of Young Gay/Bisexual Men," CAHR Conference, abstract no. 204.

Sutherland, D. et al. (1996) "HIV Testing Behavior of Canadians," Bureau of HIV/AIDS and STD, Health Canada, International Conference on AIDS, abstract no. Mo.C.210.

Wells, G. et al. (1992), "HIV/STD Risk Behavior and Knowledge among Youth: Students, Dropouts, Street Youth," University of Ottawa, International Conference on AIDS, abstract no. PoD 5864.

Wortman, J. A. (1990), "The AIDS Pattern among Canadian Aboriginals," Division of STD Control, Ministry of Health, Vancouver, B.C., International Conference on AIDS, abstract no. Th.C.709.

Wright, Nicola et al. (1995), "Trends of HIV Positive Test Reports in Canada," Division of HIV/AIDS Surveillance, Laboratory Centre for Disease Control, Health Canada, CAHR Conference, abstract no. 226.

Yan, P. et al. (1996), "Estimation of the Historical Age-specific HIV Incidence in Canada," Bureau of HIV/AIDS and STD, Laboratory Centre for Disease Control, Health Canada, International Conference on AIDS, abstract no. Tu.C.573.

III The Direct and Indirect Costs

1 Introduction

The seminal work on cost of illness (COI) or economic burden studies was completed by Dorothy Rice (1966) and updated a decade later (Cooper and Rice, 1976). Subsequently, a body of COI literature emerged covering several disease areas, including HIV/AIDS (Scitovsky and Rice, 1987; Fraser and Cox, 1988; Hellinger, 1993; and Harkness, 1989).

Examining the HIV epidemic through an economic lens is one of several interrelated and complementary approaches that will assist evidence-based policy formulation and decision making. It is important to note at the outset that COI studies do have limitations. They are not economic evaluations and hence conclusions cannot be drawn concerning costs and consequences/outcomes. COI studies quantify economic burden by measuring direct and indirect costs. However, there is a story behind the numbers that is not captured (i.e., pain, suffering, restrictions in activities of daily living, functional health status). It has been said that COI studies are much akin to Oscar Wilde's definition of a cynic – "one who knows the price of everything, and the value of nothing" (Thompson and Meyer, 1989). However, notwithstanding these limitations, economic burden studies do serve a role in making explicit the impact of a disease on societal economic product.

Direct costs represent the value of resources used to treat a given illness (e.g., hospitalizations, drugs) and indirect costs represent productivity losses (future income forgone due to premature mortality and time away from regular activity due to disability). A standardized cost framework for HIV/AIDS treatment and care costs has been developed for use in Europe, which includes a schedule of cost items and a measurement protocol for unit costing and market/shadow pricing (Tolley and Gyldmark, 1993). This framework was used to guide the data collection for this study. Indirect costs are generally captured through the human capital method, which represents an estimate of productivity losses (expressed in monetary terms and potential years of life lost) associated with disability and premature death. For the purposes of this study, we have chosen to use estimates based on existing research in Canada specific to HIV/AIDS (Hanvelt et al., 1994; Harkness, 1989).

Tracking the direct costs associated with HIV disease has been somewhat of a "moving target" due to the changing natural history of the disease and treatment patterns. Specifically, AIDS mortality is decreasing and HIV disease has evolved from having a resource consumption profile dominated by hospital costs to a disease that is similar to a chronic illness where the venue of care is largely in primary/community care settings and where drug costs now surpass hospital costs.

Economic burden of disease studies usually employ either a prevalence or incidence approach. The prevalence approach involves measuring the direct and indirect costs in a given time period, usually a year. Direct costs are assigned to year of payment and indirect costs to periods of disability or death (Thompson and Meyer, 1989). Prevalence is a stock concept, while incidence relates to future flow (Lindgren and Silverberg, 1990). Hence the prevalence approach is less dependent on assumptions.

Incidence costing entails estimating a stream of present and future costs that relate to new cases in a given period – i.e., the lifetime direct and indirect costs of new cases in a given year and with all costs assigned to year of incidence (Scitovsky, 1982). Of the two, the prevalence costing approach is more commonly used. Incidence costs are generally more

difficult to estimate given the need to know the natural history of the disease and duration of the episode (Rice, Hodgson and Hopstein, 1985). However, advocates of the incidence approach suggest that, since infectious diseases are preventable, costs should be "preassigned, if anywhere, to the year of incidence" – i.e., year of infection (Thompson and Meyer, 1989).

The incidence approach often requires a "crystal ball" and realistic assumptions concerning the likely course of the disease. The characterization of the new and emerging HIV/AIDS episode contained in this report is also based on several assumptions generated through a clinical key informant consultation process, which is described later in this chapter.

For the purposes of this study on the economic burden of HIV/AIDS in Canada, we have chosen to employ a form of the incidence approach through estimating the lifetime costs of the *prevalent* HIV population in 1996. Otherwise, for those currently infected with HIV, we estimate the direct and indirect costs *incurred to date* and the future direct and indirect costs (discounted to present value) that *will be incurred* for the 1996 prevalent population (i.e., the predominantly irreducible costs). In Chapter V of this report, streams of future costs are estimated for various incidence scenarios beginning in 1997 (i.e., the preventable costs).

It is worth noting that estimates of prevalence costs are possible since we have built the HIV/AIDS episode by stage of illness, months in stage (i.e., transit times) and average monthly costs by stage. This enables the assignment of annual costs "to the years in which they are borne or directly associated" (Hartunian, Smart and Thompson, 1980).

The perspective for this study is societal. The viewpoint for COI studies has a bearing on the schedule of costs to be included. For example, from a societal perspective, transfer payments such as CPP disability and social assistance are not considered costs since they are a reallocation of resources and the net effect of the transfer to society is zero (Rice et al., 1990; Thompson and Meyer, 1989). Others argue that personal transfers should be included as a cost since, if illness did not occur, then transfer payments could be used for other purposes – e.g., reducing the deficit (Knapp and Beecham, 1990). The compromise is to present the costs separately (Cassidy and Klymasz, 1995). Although we estimate the average episodic value of personal transfers, we have chosen to present these figures separately from our estimates of overall economic burden. It should be noted that if this study were conducted from a government perspective, then transfer payments would be considered a cost.

2 Methodology

2.1 Indirect Costs

For the purposes of this study, we rely on the episodic indirect costs estimates from a Canadian study (Hanvelt et al., 1994). There are two widely known approaches to estimating indirect costs – human capital and willingness to pay methods. The human capital method is used to estimate the production losses attributable to premature mortality in the study referred to above. This method uses "an output accounting approach because an employed person is seen as producing a stream of output over the years that is valued at the individual's earnings" (Rice, Hodgson and Hopstein, 1985). The willingness to pay approach takes human behaviour into account by estimating the amount of money that people are willing to pay in order to reduce the probability of death. For example, "patients with moderately active rheumatoid arthritis have stated a willingness to pay 22 percent of their household income for a hypothetical cure" (Thompson and Meyer, 1989).

Some view the two approaches as being complementary (not alternatives). It has also been suggested that the human capital method "may at least be a lower bound to a person's willingness to pay for a decreased risk of death" (Rice, Hodgson and Hopstein, 1985). Noted limitations of the human capital method include the failure to recognize pain, suffer-

ing, and the value of retirement and pre-work years of life (e.g., adolescence). It also "sets a minimal value on the worth of the housespouse since the market value of labour in the home is low" and it does not "adequately reflect the aspects of our lives that our society values" (Thompson and Meyer, 1989).

Specifically, Hanvelt et al. (1994) identify the number of premature deaths due to HIV/AIDS and then apply "an estimated economic value of the future earnings produced for each of the potential years of life lost. Computed cost estimates take into account varying life expectancies and labour force participation rates for different age groups, shifting patterns of earnings at successive ages, and the discounting of potential future earnings into their present value."

The average loss in human capital stock was found to be US$558,000 per HIV/AIDS case and, on a relative basis, HIV/AIDS ranked first in comparison to other causes of death (motor vehicle accidents – $547,300; suicide – $516,800; cerebrovascular disease – $223,000; and diabetes – $218,700). It is also noted that the effect of using a 5 percent discount rate as opposed to 3 percent would result in a 20 percent reduction in the estimated human capital loss (Hanvelt et al., 1994). The high indirect costs associated with HIV/AIDS reflect the youth of those affected by the epidemic (i.e., the future income lost generated by the potential years of life lost).

In the interest of deriving conservative and orders-of-magnitude estimates, we assume a 5 percent discount rate for the Hanvelt et al. estimate and convert this estimate to Canadian dollars. Based on this, we estimate the episodic (per case) *indirect cost to be $600,000*.

2.2 Direct Costs

A key challenge for this study is identifying the change in treatment patterns and cost of a typical HIV/AIDS episode that is emerging as a result of the introduction of high activity antiretroviral therapies (HAART) during 1996. These new drug regimens, also known as triple combination therapies (e.g., AZT, 3TC plus a protease inhibitor), have resulted in stabilized/rebounding CD-4 counts (a measure of immune system damage), reductions in viral load (level of virus in the blood), reduced mortality and increases in the time spent in given stages of illness. There is also anecdotal evidence of improvement in quality of life that accompanies changes in these biological markers.[1]

The pre-HAART episode is used as our reference point in building and estimating the HAART episode. The pre-HAART HIV/AIDS episode occurs over a decade[2] or more, involving several different types of care delivered through multiple venues (e.g., hospitals, outpatient clinics, physician offices, AIDS service organizations [ASO], alternative health care sites, home care, hospices, etc). Hence building an episodic resource consumption profile is a complex task and very often requires patching and grafting data from several different sources (i.e., hospital inpatient and outpatient data, physician billing data, home care data, drug data, out-of-pocket costs, etc.).

2.2.1 Episodic Cost Estimates

For the purposes of this study, an episode represents the period in HIV disease from diagnosis to death. In order to build the pre-HAART (i.e., baseline) and the HAART episodes, the required key variables include the average number of months spent in each of four CD-4 ranges[3] (>500; 499 - 200; 199 - 75; <75) and the average monthly costs in each of the four CD-4 ranges. The Southern Alberta Clinic (SAC) database[4] was used to generate most of this information. International literature was also reviewed. Summing across the average costs per stage yields the direct costs for one HIV episode. The new transit times (i.e., time spent in each stage of illness) for HAART were derived from a one-day key informant consultation with

HIV clinicians and other care experts.

2.2.2 Distribution of Disease in the Population

Applying the episodic costs to the prevalent population yields the total costs for caring for those people living with HIV/AIDS in Canada. However, an intermediate step is required – it is first necessary to distribute the prevalent population over the four CD-4 ranges and thereby assign the population to a stage of illness. This stratification of the infected population is based on four regional databases in Canada (i.e., Quebec, Ontario, British Columbia and the SAC in Alberta). While Alberta may not represent an epicentre per se, distributions from the SAC are also included because of the importance in terms of the fit with other centres and the use of SAC cost data. As well, there is evidence of an increasing and changing epidemic in Alberta.[5] The mean of these distributions is used as a proxy for the disease staging of the prevalent HIV population in Canada.

Given the relatively long transit times within each CD-4 range, it is necessary to further stagger and disaggregate these populations into more refined stages of illness (i.e., assign by months already spent in the CD-4 range). This is accomplished by assigning one-third of each CD-4 range population to a specific time in the range, thus creating 12 population cohorts (i.e., 4 stages x 3 cohorts per stage). The more refined staging reduces the error associated with assigning cohorts to the beginning of each CD-4 range and serves the objective of producing *orders-of-magnitude cost estimates.*

2.2.3 Total Direct Costs for the Prevalent Population

Both pre-HAART and HAART average monthly costs are multiplied by the respective pre-HAART and HAART transit times (i.e., number of months in each stage) and the number of people in each of 12 cohorts (*a* to *l*) to estimate: 1) pre-HAART costs for the prevalent population (i.e., the irreducible costs or amount already expended); and 2) the expected stream of future costs for the HAART portion of the episode (commencing in January 1997) for the prevalent population.

2.2.4 Summary of Methodology

Step 1: *Determine Pre-HAART and HAART Episodic Costs*

- Sum of stage totals = pre-HAART episodic costs.
- This formula is replicated using average monthly costs and transit times specific to HAART in order to calculate the total direct cost of the new episode (i.e., the HAART episodic costs).

Step 2: *Assign the Prevalent HIV Population to a Stage of Illness*

- Based on the average of the distributions of HIV-infected populations from four regional databases, distribute the Canadian HIV-infected population across four CD-4 ranges (>500; 499 - 200; 199 - 75; <75).
- Break down these four distributions further into three cohorts within each of the four stages by assigning the cohorts to three different start points within each stage (i.e., differing amounts of time already spent in the stage).

Step 3: *Calculate the Total Direct Costs for the Prevalent HIV Population in Canada*

- Assign pre-HAART average monthly costs to the pre-HAART portion of the episode for each cohort to determine the costs already incurred for the prevalent population.
- Assign HAART average monthly costs to the HAART portion of the episode for each cohort to determine the expected future stream of costs associated with caring for the prevalent population.

3 Findings

Our findings fall into three interrelated categories – episodic costs; disease staging of the prevalent population; and total direct and indirect costs for the prevalent population.

3.1 Episodic Costs

Three episodic cost estimates are derived for the pre-HAART, HAART 1 and HAART 2 episodes. Each episode varies according to the transit times within each of the four CD-4 ranges. The pre-HAART and HAART episodes also differ in terms of average monthly costs in each CD-4 range.

3.1.1 Pre-HAART Episodic Costs

It is estimated that the pre-HAART episode occurs over 130 months or roughly 11 years from diagnosis to death (Table III-1). A lymphadenopathy study in British Columbia designed to measure the time from seroconversion or infection (as opposed to diagnosis) to death estimates this time to be between 11 and 13 years.[6] Given the time delay between seroconversion (time of infection) and diagnosis, the length of the pre-HAART episode based on the SAC data appears reasonable as a baseline for developing the HAART episode and component transit times.

The international body of literature in this area also adds a degree of validation to this length of episode estimate (Table III-2). In particular, a study on stage duration found good agreement between studies in relation to the two middle CD-4 ranges. However, they note a lack of agreement in the transit times for the >500 CD-4 range and attribute this to the variable times between seroconversion and diagnosis. For our study, they do point towards a fairly good estimate of stage duration for the middle two ranges (Hurley et al., 1996). The end-stage disease duration times are difficult to compare due to the unstandardized classification of CD-4 ranges.

Table III-1

Pre-HAART CD-4 Range Transit Time Estimates

	>500	499 - 200	199 - 75	<75	Total
Months in stage	34	55	23	18	130

Source: SAC – Dr. John Gill and Mr. Bill Davidson.

Table III-2

Transit Times by CD-4 Range, Multiple Studies

	>500	499 - 200	<200[a]
		(Months)	
Longini et al. (1991)	49.0	46.0	19.0
Hellinger (1993)	67.0	44.0	12.0
Lange (1992)	54.0	62.0	–
Mean of studies	56.6	50.6	16.5

a Excludes time spent with AIDS diagnosis in nonterminal and terminal phases. For broad comparison purposes, we have assumed that this range extends down to between CD-4 = 75 to 50.

Source: Hurley et al., 1996.

In order to calculate the pre-HAART episodic cost, average monthly costs by CD-4 range are estimated and multiplied by the corresponding CD-4 range transit times. SAC data are used as the primary source for this information. Out-of-pocket costs and baseline health care costs are taken from other sources and used to adjust the SAC data.

Out-of-pocket costs over the pre-HAART episode amount to approximately $15,000 or, in present value terms, approximately $12,000 (discounted at 4 percent) (Table III-3).[7] Out-of-pocket costs are an important and integral item in the cost schedule when the societal perspective is employed in cost of illness studies (Tolley and Gyldmark, 1993). While at first glance out-of-pocket costs may appear insignificant relative to overall direct episodic costs, they are indeed nontrivial in terms of economic burden for infected individuals who are increasingly coming from marginalized populations.

Some analysts have suggested that baseline health care costs should be deducted from estimates of direct costs (Hurley et al., 1996). Baseline health care costs represent the regular or non-HIV/AIDS health care costs. Since SAC cost data are HIV/AIDS specific, there is no need to subtract these costs from the pre-HAART or HAART average monthly costs by stage of illness.[8]

Using SAC data as a foundation, monthly out-of-pocket costs are added to develop the pre-HAART episodic cost estimates presented in Table III-4. For the purposes of discussion within the context of this study, we have chosen the discounted pre-HAART episodic cost figure of $67,355. Hence the total direct and indirect pre-HAART episodic costs amount to roughly $667,000 in present value terms.

3.1.2 HAART 1 and HAART 2 Episodic Costs

A key feature of this study is the estimate of new CD-4 range transit times based on new treatment protocols associated with HAART. The net effect is higher average monthly costs (due primarily to the new drug – viral load testing package) and extended transit times.

The new extended CD-4 transit time estimates were developed through a key informant/Delphi consultation. (See Appendix III-A for a list of the participants.) These participants used several parameters and preliminary clinical experience with the new therapies in order to derive three transit time estimates for each CD-4 range (pessimistic, likely and optimistic). For purposes of this study, the pessimistic and likely estimates are used to derive direct cost estimates (Table III-5). However, the HAART 2 (likely) episode is used to calculate the economic burden estimates presented later in this chapter. The HAART 1 episode is estimated to take place over approximately 13 years, while the likely HAART 2 episode is estimated to occur over a 17-year period.

Table III-3

Undiscounted Pre-HAART Out-of-pocket Costs

	>500	499 - 200	199 - 75	<75	Total
			(Dollars)		
Episodic	3,446.26	5,856.95	2,900.07	2,683.80	14,887.08
Monthly[1]	101.36	106.49	126.09	149.10	

1 From Williams (1996), "Canadian AIDS Society Income Security Study."

Table III-4

Pre-HAART Episodic Direct Costs[1]

CD-4 Range	Average monthly costs (dollars)	Average number of months in stage	Total stage costs (dollars)
>500	334.31	34	11,367
499 - 200	531.07	55	29,209
199 - 75	843.83	23	19,408
<75	1,551.53	18	27,928
Total	–	**130**	–
Total Pre-HAART Episodic Cost: Undiscounted =			87,911
Discounted			
3 percent	=		71,822
4 percent	=		67,355
5 percent	=		63,263
6 percent	=		59,510

1 Includes SAC clinic care, other physicians, drugs, outpatient lab and diagnostic imaging tests, hospitalizations and home care.

Table III-5

Pre-HAART, HAART 1 and HAART 2 CD-4 Range Transit Time Estimates[a]

	>500	499 - 200	199 - 75	<75	Total
			(Months in stage)		
Pre-HAART[b]	34	55	23	18	130
HAART 1[c]	46	57	31	18	152
HAART 2[c]	58	69	43	30	200

Note: HAART 1 = pessimistic estimate; HAART 2 = likely estimate.
a At the time of the clinical delphi session, pre-HAART stage duration times for the 499 - 200 and 199 - 75 stages based on SAC data were estimated to be 45 and 19 months, respectively. Later, due to a change in methodology, these times changed to 55 and 23 months, respectively.
b Data from Southern Alberta Clinic.
c Consensus estimates from key informant meeting.

Estimates of the average monthly HAART costs by CD-4 range are primarily based on cost data provided by SAC (Table III-6). The increase in average monthly costs is attributable to the addition of a third antiretroviral drug and the viral load testing that is an integral part of HAART.

As shown in Table III-7, the out-of-pocket costs component is estimated to be $23,000 for HAART or roughly $1,400 per year over the course of the new episode.

Table III-8 displays the HAART 1 and HAART 2 episodic costs according to various discount rates. Again, for the purposes of this study we have chosen the episodic cost figures associated with the 4 percent discount rate where the HAART 1 is estimated to be roughly $123,000 and

Table III-6

Average Monthly Costs, Pre-HAART and HAART by CD-4 Range[1]

>500			499 - 200			199 - 75			<75		
PH	H	Percent change	PH	H	Percent change	PH	H	Percent change	PH	H	Percent change
$334	$732	120	$531	$980	85	$844	$1,270	51	$1,552	$1,874	21

Note: Pre-HAART = PH; HAART = H

1 Baseline health care costs for the HAART 1 episode would amount to $18,240 and approximately $24,000 for the HAART 2 episode. At a 4 percent discount rate, HAART 1 and HAART 2 baseline health care costs amount to $14,400 and $17,600, respectively. Again, SAC data did not include these costs and hence we did not subtract them.

Source: SAC – Dr. John Gill and Mr. Bill Davidson; and clinical Delphi session.

Table III-7

Undiscounted HAART 1 and HAART 2 Out-of-pocket Costs[1]

	>500	499 - 200	199 - 75	<75	Total
			(Dollars)		
HAART 1	4,662.56	6,069.93	3,908.79	2,683.80	17,325.08
HAART 2	5,878.88	7,347.81	5,421.87	4,473.00	**23,121.56**
Monthly[2]					
HAART	101.36	106.49	126.09	149.10	

1 For purposes of this study, it was assumed that pre-HAART and HAART average monthly out-of-pocket expenses are the same. While this may not be the case, the CAS survey was conducted in a pre-HAART period and other data sources were not available.

2 See Williams (1996), "Canadian AIDS Society Income Security Study."

HAART 2, $153,000.

As can be seen, the choice of discount rate can have a significant effect on the estimated stream of future costs. A recent Australian study employs a 5 percent discount rate (Hurley et al., 1996). However, given that current interest rates and inflation have remained stable and low, a strong argument for a 4 percent discount rate can be made.

The HAART 2 (i.e., likely) episode has been chosen for the projections presented in this report. Hence, the total estimated direct and indirect episodic costs for HAART amount to **$753,000**. *The remaining analysis in this report will be based on this estimate.*

3.2 Disease Staging of the Prevalent HIV-infected Population in Canada

The distribution of disease within the prevalent HIV-infected population in Canada is spread across the four stages of illness used for this study. Assigning the prevalent population (n = 38,900) to a stage of illness is a prerequisite to calculating the overall economic burden associated with the pre-HAART

Table III-8

Discounted HAART Direct Episodic Costs, Per Case

Discount rate	HAART 1	HAART 2
(Percent)	(Dollars)	
3	131,342	166,820
4	122,799	152,875
5	115,033	140,525
6	107,962	129,560

Table III-9

Percentage Distribution of Populations by CD-4 Range

	>500	499 - 200	199 - 75	<75
Ontario[1]	10.5	36.7	21.5	31.3
Quebec[2]	17.0	41.0	17.3	24.7
British Columbia[3]	9.2	46.3	21.0	23.5
Southern Alberta[4]	25.7	36.0	18.0	20.2
Mean	**15.6**	**40.0**	**19.5**	**24.9**

1 From the HIV Ontario Observational Database – Dr. Margaret Millson.
2 Estimates based on Markov Model developed by Dr. Robert Remis, University of Toronto.
3 From the BC Centre for Excellence in HIV/AIDS (Dr. Aslim Anis) – based on population in the Drug Database and most likely underrepresents distribution in the >500 CD-4 range.
4 From the Southern Alberta Clinic (Dr. John Gill).

care already received (the bills paid to date) and the expected future stream of HAART costs.

This stratification of the prevalent population by stage of disease is accomplished by using the mean of the CD-4 distributed populations from four regional databases (Table III-9). In effect, four cohort populations are created.

Using the mean of the CD-4 ranges from the regional populations, the prevalent HIV-infected population in Canada is assigned to four CD-4 ranges (Chart III-1). This assumes that the anchor-in point for this analysis and commencement of the HAART episode is January 1, 1997.

Given the relatively long transit times (especially in the first two stages), it is necessary to further divide these four cohorts into more refined positions within each CD-4 range (i.e., assignment based on the number of months already spent in a given CD-4 range as of January 1, 1997). This yields a total of 12 cohorts categorized from *a* to *l*. Table III-10 contains a "snapshot" of where in the CD-4 range continuum each cohort will commence the HAART episode.

In order to determine the residual amount of HAART time remaining for each cohort, the pre-HAART time already spent in the commencement range is subtracted from the estimated HAART transit time for the range. For example, as of January 1, 1997 cohort *f* had already spent 36 months of pre-HAART time in the 499 - 200 CD-4 range.

Chart III-1

Distribution of Estimated Prevalent Cases by CD-4 Range

Based on mean CD-4 distributions and prevalence = 38,900

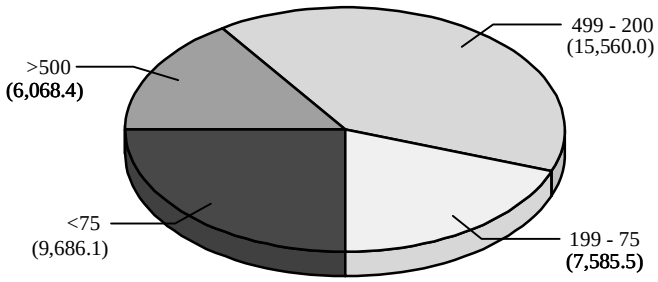


Table III-10

Assignment of 38,900 Prevalent Cases to 12 Cohorts, by CD-4 Range and HAART Commencement Position in Range

>500	499 - 200	199 - 75	<75
	(Months in range and cases)		
a) 1 (n = 2,022.8)	**d)** 1 (n = 5,186.7)	**g)** 1 (n = 2,528.5)	**j)** 1 (n = 3,228.7)
b) 15 (n = 2,022.8)	**e)** 18 (n = 5,186.7)	**h)** 8 (n = 2,528.5)	**k)** 8 (n = 3,228.7)
c) 30 (n = 2,022.8)	**f)** 36 (n = 5,186.7)	**i)** 16 (n = 2,528.5)	**l)** 16 (n = 3,228.7)

Interpretation: As of January 1, 1997, cohort *f* – 5,186.7 prevalent HIV cases have completed month 36 in the 499 - 200 CD-4 range in the pre-HAART episode and now commence the HAART episode within that range. Cohort *a*, on the other hand, has no pre-HAART episodic time and will commence the HAART episode in month 1 in the first CD-4 range. Otherwise, cohort *a* represents the full HAART episode (refer to Appendix III-C for more detail).

The estimated new transit time for HAART for this stage of illness is 69 months. Cohort *f* will therefore spend 33 months (69 minus 36) of HAART time in this CD-4 range.

The disease staging of the prevalent population and the time spent in the pre-HAART and HAART episodes are presented in Table III-11.

3.3 Total Costs Associated with the Prevalent Population

The total costs associated with the prevalent HIV-infected population fall into two categories: pre-HAART costs already incurred and the expected future stream of costs associated with HAART.

Table III-11

Disease Staging of the Prevalent HIV/AIDS Population in Canada

Time spent (months) by 12 cohorts in each CD-4 range for pre-HAART and HAART										
	Pre-HAART (PH)					HAART (H)				
PH total	>500	499 - 200	199 - 75	<75	Cohort	>500	499 - 200	199 - 75	<75	H total
0	0	0	0	0	**a** (n = 2,022.8)	58	69	43	30	200
15	15	0	0	0	**b** (n = 2,022.8)	43	69	43	30	185
30	30	0	0	0	**c** (n = 2,022.8)	28	69	43	30	170
34	34	0	0	0	**d** (n = 5,186.7)	0	69	43	30	142
52	34	18	0	0	**e** (n = 5,186.7)	0	51	43	30	124
70	34	36	0	0	**f** (n = 5,186.7)	0	33	43	30	106
89	34	55	0	0	**g** (n = 2,528.5)	0	0	43	30	73
97	34	55	8	0	**h** (n = 2,528.5)	0	0	35	30	65
105	34	55	16	0	**i** (n = 2,528.5)	0	0	27	30	57
112	34	55	23	0	**j** (n = 3,228.7)	0	0	0	30	30
120	34	55	23	8	**k** (n = 3,228.7)	0	0	0	22	22
128	34	55	23	16	**l** (n = 3,228.7)	0	0	0	14	14
Total					**38,900**					

Using both the pre-HAART and HAART transit times and monthly cost estimates, and with the prevalent population stratified by stage of illness, the aggregate pre-HAART and HAART direct costs are calculated for each of the 12 cohorts and then summed to yield the overall economic burden.

The total economic burden related to the future stream of HAART costs for all cohorts (i.e., aggregate HAART costs for all cohorts) are presented in Table III-12 according to the raw cost and the discounted (present value) cost according to different discount rates. Hence the *future direct costs* (discounted at 4 percent) relating to the current prevalent HIV-infected population in Canada is estimated to be almost **$4 billion** (refer to Appendix III-C for detail).

In order to derive an overall estimate of future economic burden, the discounted indirect cost estimated to be $600,000 per case must be calculated for the prevalent HIV population in order to take account of the overall losses to society. Based on a prevalence of 38,900, the discounted future *indirect costs* are estimated to amount to **$23.3 billion**.

Based on these aggregate direct and indirect costs, the future economic burden associated with the *current prevalent HIV population* in Canada is estimated to be **$27.3 billion**.

This does not include the costs already incurred for the current prevalent population (i.e., the money already expended on the pre-HAART portion of each episode in the prevalent population). Based on pre-HAART average monthly costs and transit times, pre-HAART direct costs already incurred are estimated to be almost $1.4 billion (refer to Table III-13 for detail).

When the pre-HAART (*sunk*) costs are added to the HAART (*future*) costs, the overall economic burden for the prevalent HIV-infected population in Canada totals **$28.7 billion** or almost $1,000 per Canadian (refer to Table III-14).

3.4 Summary of Economic Burden

The main focus of the analysis in this chapter is on the prevalent HIV-infected population in Canada (i.e., those living with HIV/AIDS). In terms of assessing the overall economic impact of the HIV/AIDS epidemic to date in Canada, adding to the prevalent costs the human capital losses (indirect costs) associated with the approximately 11,000 AIDS deaths ($6.6 billion), plus the direct costs ($970 million) associated with caring for these individuals until their death, provides a sense of the magnitude of the societal losses.

The total economic burden associated with the HIV/AIDS epidemic to date amounts to some $36 billion or about $1,200 per Canadian (Table III-14). The costs associated with the expected new infections for subsequent years (i.e., avoidable or reducible costs) will add to this total.

Table III-12

Raw and Discounted Aggregate Future HAART Costs for the Prevalent Population

	($ millions)
Raw cost (undiscounted)	4,940
Discount rate	
3 percent	4,175
4 percent	3,963
5 percent	3,769
6 percent	3,591

Table III-13

Total Pre-HAART Costs for the Prevalent Population

Total ($ millions)	>500	499 - 200	199 - 75	<75	Cohort
0	0	0	0	0	**a** (n = 2,022.8)
10.1	10.1	0	0	0	**b** (n = 2,022.8)
20.2	20.2	0	0	0	**c** (n = 2,022.8)
58.9	58.9	0	0	0	**d** (n = 5,186.7)
108.5	58.8	49.6	0	0	**e** (n = 5,186.7)
158.1	58.9	99.2	0	0	**f** (n = 5,186.7)
102.5	28.7	73.8	0	0	**g** (n = 2,528.5)
119.6	28.7	73.8	17.1	0	**h** (n = 2,528.5)
136.6	28.7	73.8	34.1	0	**i** (n = 2,528.5)
193.7	36.7	94.3	62.7	0	**j** (n = 3,228.7)
233.8	36.7	94.3	62.7	40.1	**k** (n = 3,228.7)
273.9	36.7	94.3	62.7	80.2	**l** (n = 3,228.7)
1,416					**Total: 38,900**

Table III-14

Total Economic Burden of HIV/AIDS Epidemic to Date

		Prevalent population		
	AIDS deaths[a]	Pre-HAART	HAART	Total
		($ billions)		
Direct costs	0.97[b]	1.4	4.0	6.4
Indirect costs	6.60	23.3		29.9
Total	7.60	28.7		**36.3**

a Based on 11,000 deaths to date in Canada.
b Pre-HAART episodic costs x 11,000.

4 Discussion

The costs presented here are not intended to be applied on an individual basis. Rather they are useful in planning for populations and for the purposes of estimating economic burden. In addition, it should be understood that the average monthly costs used in this study are based on a population that exhibits varying resource consumption profiles. Average monthly costs could rise if the uptake on the new drug therapies increases (e.g., more people in the >500 CD-4 range deciding to take drug treatment earlier and others moving from double combination therapies to triple).[9]

4.1 Annual Direct Cost Projections

Deriving annualized direct cost estimates associated with the prevalent HIV population in Canada over five years would require a complex and intricate dynamic modelling exercise driven by two interrelated and primary factors.

First, there is a stock and flow situation involving an interplay between incidence rates and mortality rates. Otherwise, each year new (incident) cases are added to the prevalent population and deaths are subtracted. Several evidence-based assumptions would be required in order to forecast these rates over a five-year planning horizon.[10]

Second, the HIV-infected population is moving progressively through the four stages of HIV disease with stage durations and average monthly costs changing from stage to stage and varying by subpopulation (risk group). Disease staging of the prevalent population over a five-year modelling/ planning period would be required. This component of the exercise would also be fed by the stock and flow analysis above.

Finally, it should also be understood that simply estimating HIV/AIDS incidence and prevalence is not a straightforward exercise. As described in Chapter I, the epidemic is largely hidden and there are variable lag times between date of infection and date of diagnosis. The modelling exercise described above is entirely dependent on a refined epidemiological analysis where incidence and prevalence are estimated by subpopulation (risk group) and major region across the country.

4.2 Annual Direct Cost Estimate for the 1997 Prevalent Population

Based on the data used in this paper, it is possible to estimate the direct costs for the prevalent population for 1997. Estimating beyond this one year would require dynamic modelling.

The average monthly costs reflecting the new therapies and the new disease stage durations enables the calculation of one year of HAART costs for the prevalent population.

The prevalent HIV-infected population was assigned to a stage of disease for the 1997 calendar year. Since during this one-year period none of the cohorts change stages of illness and HIV incidence and mortality are reflected in the prevalence estimates, it is possible to estimate the direct costs for the prevalent population for one year.

Based on a national prevalence of 38,900 for 1996, the annual direct costs for this population are estimated to be approximately **$570 million.**

4.3 Applying Costs to Populations vs. Individuals

The present value of the direct costs of the new HIV/AIDS episode is estimated to be **$153,000** spread over a 17-year episode. Although the average annual costs change from year to year based on stage of illness, overall the average annual direct costs amount to **$9,000** or **$750** per month. This should be examined on a population basis only.

It is critical to understand the limitations of applying this average figure. First, it cannot be applied on an individual basis. The cost figures are

derived from a population perspective and from population databases. Within an HIV-infected population, a percentage of individuals would not be receiving the new drug therapies for various reasons, some relating to personal choice and others relating to clinical decision making and access to care.

It would be possible, however, to construct cost profiles for only those receiving HAART treatment. The databases from the Southern Alberta Clinic and the BC Centre for Excellence in HIV/AIDS could be used for this purpose. Again, some limitations would apply. For example, a person moving from double combination therapy would most likely respond differently to triple combination therapy and have different downstream costs than someone who is newly infected and starting triple combination therapy.

In terms of indirect costs (productivity losses), applying the average episodic figure of *$600,000* to individuals would be invalid. It is an average figure representing the productivity losses across a spectrum of income earners. While on the one hand it would appear that this amount overestimates the indirect costs of an HIV-infected and marginalized injection drug user, on the other it could be argued that it underestimates the indirect costs of an HIV-infected software engineer. Given the shift of the epidemic to more marginalized populations, it may be useful to revisit the current estimate. However, one would question the usefulness of discovering that HIV-infected injection drug users generate lower indirect costs – does this imply that less should be done? It is obviously important to view the human capital losses or indirect costs as the absolute minimum value of a human life or the potential minimum value of the forgone human potential due to premature death.

4.4 Comparisons with Other Studies

The direct cost estimates presented are difficult to compare with estimates from other studies due to several factors. First, in terms of HAART estimates, we did not find any other estimates in the literature. In terms of pre-HAART estimates, comparisons are complicated because many studies do not present discounted cost estimates, different currencies are used and access to health care and utilization varies considerably between countries.

Hurley et al. (1996) highlight the differences between their pre-HAART episodic direct cost estimate of US$87,800 and the US$119,000 estimate of Hellinger (1993). The difference is not due to higher episodic costs in the Hellinger estimate for the United States. Rather, the Hurley et al. estimate is discounted (at 5 percent) and Hellinger's is not. When discounted, Hellinger's episodic cost estimate is $74,900 (Hurley et al., 1996). Using the same discount, our study yields an estimate of about C$63,300 for pre-HAART episodic costs.

It is difficult to ascertain the factors influencing the difference between the Canadian and Australian estimates. Our study methodology compares well with the Australian study. However, it may be due to the fact that the Australian figure is based on a theoretical episode commencing at seroconversion, while our study is based on an episode commencing at diagnosis. Still, it is difficult to determine the overall impact this has on the difference between our estimates. Other Canadian studies have produced conflicting estimates of pre-HAART episodic costs ranging from $100,000 (Grover et al., 1992) to $82,000 (Fraser and Cox, 1988). However, the treatment patterns during these study periods are quite different.

The recently released report on *The Economic Burden of Illness in Canada, 1993* (Health Canada, 1997) provides estimates of the direct and indirect costs of specific illness categories. HIV/AIDS is nested within the infectious and parasitic disease category and not as a line item. Hence it is difficult to draw any comparisons to our estimates. However, one key and critical difference is that the Health Canada estimates are annual aggregate costs for each disease class and are *not* costs per episode. As such, cardiovascular diseases, musculoskeletal diseases, injuries and cancer rank as the top four disease categories in terms of overall economic bur-

den. However, many of these diseases and conditions have high front-end costs and limited time episodes. For example, many injuries are treated and resolved within a short period of time and the episode ends. As well, a heart attack has an expensive front-end that usually involves an inpatient stay with or without a surgical intervention. While upon discharge the episode does not end since heart disease is considered a chronic illness, the costs over the entire episode of care are likely to be minimal in comparison to the episodic costs for treating HIV/AIDS, where costs increasingly escalate towards end-stage disease.

While it is clear that annual economic burden of illness figures cannot be compared to episodic figures, it should also be understood that the ranking of disease burden using annual costs can be misleading due to length of episode and distribution of costs over the episode. Using the Health Canada annual cost estimates might lead one to conclude that, in terms of prevention of disease, the top four disease classes should have priority in resource allocation decisions. Since HIV/AIDS is buried in the infectious and parasitic disease category, which does not rank in the top 10 diseases for either direct or indirect disease burden, it theoretically could receive a lower priority for prevention and other resources.

Annual economic burden of disease estimates are useful for short-term-planning budgeting purposes. However, they are of limited use when comparing across disease categories due to differences in the natural history of the diseases/conditions and the cost and treatment patterns. Episodic costing, however, is more costly and time consuming on the one hand, but provides more useful information to guide public policy.

Finally, the limitations of comparing infectious diseases to other less preventable diseases should be fully understood. In fact, it is somewhat spurious. For example, while we have knowledge of how to reduce the risk of getting cancer, we cannot yet prevent many cancers. HIV/AIDS is theoretically 100 percent preventable and hence so too are the costs that go with an infected case. Investment in prevention has a potentially large pay back (refer to Chapter V). These differences are often forgotten or neglected when comparisons across disease entities are made.

4.5 The New Episode

It is expected that HAART will extend the length of the episode by approximately 6 years (+54 percent). Average monthly direct costs in each of the four stages of illness have risen by 120, 85, 51 and 21 percent, respectively. When the extended transit times are factored in with the higher average monthly direct costs, the HAART increases overall episodic direct costs by 127 percent. In the pre-HAART episode, drug costs represent about 44 percent of average monthly costs and approximately 77 percent over the HAART episode.

While the episode is expected to last longer and become more expensive, it should be understood that there are offsetting costs. For example, if the new drug regimens increase productivity by reducing disability, then the indirect costs associated with HIV disease will be reduced. If HAART treatment increases the period of productive life for those people living with HIV/AIDS by 15 percent, the savings in indirect costs will cover the increased costs of treatment.[11] More important, however, is the fact that an economic value has not been placed on nor quantified for any improvements in quality of life from the perspective of a person living with HIV/AIDS.

4.6 Transfer Payments

Although personal transfers such as social assistance, Canada Pension Plan Disability and employer-based long-term disability are not considered costs in cost-of-illness studies, we have chosen to present the average value of personal transfers for a percentage of the HIV cases in a population in order to identify a key policy issue.

The data for this exercise are taken from the Canadian AIDS Society survey conducted as part of the Income Security Study (Williams, 1996). These data reflect pre-HAART treatment patterns and populations. It is important to note that the survey was conducted in 1993 and reflected an infected population with more resources than the more marginalized HIV-infected population of today.

This shift has implications for social assistance and welfare plans. The liability for income replacement is shifting away from CPP disability and employer-based long-term disability to provincial and municipal welfare programs. The average value of all types of personal transfers on an episodic basis is estimated to be $26,871.39, based on the old episode, and is likely to increase due to the increased duration of the new episode. The only offset to this may be the increases in productive living that may be achievable through the new drug therapies. But, there are other factors related to marginalization that are barriers to productive living (e.g., substance abuse). Many of the newly infected people are not receiving social assistance because they are infected. Rather, they were receiving personal transfers prior to becoming infected. Becoming HIV infected will most likely result in a continued reliance on some form of personal transfer, most likely welfare. Hence understanding the determinants of marginalzation will provide an important context for addressing the unique aspects of HIV/AIDS.

Equity in access to care and the distribution of benefit are ethical issues that must not be lost in the national response to this epidemic. Marginalized populations tend to be diagnosed later in the HIV infection process, they are less compliant with the new drug therapies and exhibit poorer outcomes. Hence there is limited benefit from the new therapies for this population. Compliance is an important consideration for clinicians when deciding to initiate therapy. Poor compliance has two serious consequences: failure of the drug therapies and the development of drug resistant viruses. The latter can have far-reaching consequences for the control of the epidemic.

These issues have a strong relationship to the population health policy issues that are discussed in the final chapter of this report. HIV infection can be considered a complicating factor of marginalization along with addiction, homelessness, unemployment, etc.

4.7 Conclusion

The magnitude of the economic impact of the HIV/AIDS epidemic is significant and, indeed, the HIV/AIDS epidemic is still largely in front of us, not behind us. New challenges have arisen and more lie ahead. Prevention is the only response available until such time as a cure or vaccine is developed. The effectiveness of the prevention response is crucial to reducing the socio-economic and human impacts of the epidemic. The next chapter of this report quantifies and examines Canada's investment in HIV prevention over the course of the epidemic. Following this, Chapter V outlines plausible targets for reducing the economic burden and the pain and suffering associated with the HIV/AIDS epidemic in Canada.

Appendix III

A Clinical Delphi Workshop Participants

Dr. Mark Wainberg (Chair)
Canadian Association for HIV Research
Montreal

Mr. Terry Albert
CPRN
Ottawa

Dr. Brian Conway
Physician, BC Centre for
Excellence in HIV/AIDS
Vancouver

Dr. John Goodhew
Physician
Toronto

Dr. Colin Kovacs
Physician
Toronto

Mr. Craig McLure
Community AIDS Treatment
Information Exchange
Toronto

Dr. Anne Phillips
Physician, Wellesley Hospital
Toronto

Dr. Gary Rubin
Physician
Toronto

Dr. Chris Tsoukas
Physician, Montreal General Hospital
Montreal

Mr. Gregory Williams
CPRN
Ottawa

B Southern Alberta Clinic Database Description

I Average Monthly Cost Calculations

Mean monthly health care costs were calculated using a methodology that implicitly recognizes that the CD-4 count of a person with HIV infection will change over time. This process can be summarized as follows:

1. Mean costs – by cost item, by disease stage and by month – were calculated for every patient who visited SAC at least once during the period April 1, 1995 to March 31, 1996. This end point was chosen for collecting cost information because 3TC became widely accessible in April 1996 to all persons living with HIV/AIDS in Alberta, as a result of a decision by the Government of Alberta to provide funding for these antiretroviral drugs. Hence pre-HAART = pre-3TC for the one-year period referred to above.

2. Monthly costs were determined by multiplying service (or product in the case of pharmaceuticals) usage by unit service costs (plus an appropriate overhead allocation) for each month in the study period. Monthly costs were allocated to a disease stage based on the patient's most recent CD-4 count as of the end of the month in question.

3. All active SAC patients were allocated to one of four disease stages according to the patient's most recent CD-4 count as of the end of the month in question, service usage during the month notwithstanding.

4. Mean costs were then calculated for each cost category by dividing total monthly costs per disease stage by the number of patients in each disease stage that month, matching disease stages and months. The iterative process inherent in calculating mean costs on a monthly basis is the key to recognizing and dealing with changing CD-4 counts over time. Each series of monthly mean costs was then summed and averaged to arrive at mean monthly costs per person for the entire period under review.

5. Costs were captured in the following categories:

   – Pharmaceuticals
   – Hospitalizations
   – Outpatient laboratory tests and diagnostic imaging
   – Clinical care (SAC and other physicians)
   – Home care

II Disease Staging and Occupancy Times

1. The mean occupancy time (stage duration or transit time) in *stage I* was obtained by calculating the mean time to a CD-4 count of 500 for all SAC patients who presented with a CD-4 count >500 (n = 243).

2. Mean occupancy times in *stages II and III* were obtained from observations of changes in CD-4 over time for all SAC patients who had at least 3 recorded CD-4 counts. The methodology comprised linear regression – where CD-4 count is the dependent variable, and time is the independent variable. The mean rate of change was obtained by averaging the rates of change for all SAC patients. The result is an average decline rate for all patients (n = 778) of 0.18 x 10^6/L/day (about 65 per year).

3. The mean occupancy time in *stage IV* was determined by creating a subset of all SAC patients with a recorded CD-4 count <75 who subsequently died (n = 321). For this subset, the date when their CD-4 count would have reached 75 was estimated by back-projecting from the date of their first CD-4 <75 at the rate of change noted above. Stage IV occupancy time was then calculated by averaging the time to death from the projected date when the CD-4 count reached 75.

Based on the above information, stage duration estimates are as follows:

Stage	*Months in Stage*
>500	34
499 - 200	55
199 - 75	23
<75	18

C Spreadsheets: HAART and Pre-HAART Episodic Costs

(See pages 44 to 47.)

HIV/AIDS Episodic Costs - HAART1, HAART2 and Pre-HAART (HAART commences January 1, 1997)

Effective Annual Discount Rate = 3.00%

Effective Monthly Discount Rate = 0.25%

Monthly Cost - CD-4>500 $732

Monthly Cost - 499>CD-4>20 $980

Monthly Cost - 199>CD-4>75 $1,270

Monthly Cost - 75>CD-4 $1,874

HAART 1 : 152 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
Cohort	**Cases**	**Months**	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Months**	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Raw Cost (Case)**		**Raw Cost (Cohort)**	**PV(1997) (Cohort)**
a	2023	46	$732	$33,651	$31,775	57	$980	$55,886	$46,497	31	$1,270	$39,379	$29,381	18	$1,874	$33,729	$23,688	$162,646	$131,342	$329,000,005	$265,678,953
b	2023	31	$732	$22,678	$21,807	57	$980	$55,886	$48,248	31	$1,270	$39,379	$30,487	18	$1,874	$33,729	$24,580	$151,673	$125,121	$306,803,618	$253,095,290
c	2023	16	$732	$11,705	$11,463	57	$980	$55,886	$50,064	31	$1,270	$39,379	$31,635	18	$1,874	$33,729	$25,505	$140,700	$118,666	$284,607,232	$240,037,983
d	5187	0	0	0	0	57	$980	$55,886	$52,076	31	$1,270	$39,379	$32,906	18	$1,874	$33,729	$26,530	$128,995	$111,513	$669,058,367	$578,383,277
e	5187	0	0	0	0	39	$980	$38,238	$36,414	31	$1,270	$39,379	$34,398	18	$1,874	$33,729	$27,733	$111,347	$98,545	$577,522,033	$511,124,052
f	5187	0	0	0	0	21	$980	$20,590	$20,041	31	$1,270	$39,379	$35,958	18	$1,874	$33,729	$28,990	$93,698	$84,990	$485,985,699	$440,815,573
g	2529	0	0	0	0	0	0	0	0	31	$1,270	$39,379	$37,867	18	$1,874	$33,729	$30,529	$73,109	$68,396	$184,855,550	$172,939,672
h	2529	0	0	0	0	0	0	0	0	23	$1,270	$29,217	$28,370	18	$1,874	$33,729	$31,137	$62,946	$59,507	$159,159,922	$150,462,869
i	2529	0	0	0	0	0	0	0	0	15	$1,270	$19,055	$18,684	18	$1,874	$33,729	$31,757	$52,784	$50,440	$133,464,293	$127,538,748
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	18	$1,874	$33,729	$32,952	$33,729	$32,952	$108,902,372	$106,392,252
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	10	$1,874	$18,739	$18,487	$18,739	$18,487	$60,501,318	$59,688,680
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	2	$1,874	$3,748	$3,734	$3,748	$3,734	$12,100,264	$12,055,647

HAART 2 : 200 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
Cohort	**Cases**	**Months**	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Months**	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Raw Cost(Case)**		**Raw Cost(Cohort)**	**PV(1997)(Cohort)**
a	2023	58	$732	$42,429	$39,489	69	$980	$67,652	$53,866	43	$1,270	$54,623	$37,860	30	$1,874	$56,216	$35,605	$220,920	$166,820	$446,876,491	$337,444,157
b	2023	43	$732	$31,456	$29,811	69	$980	$67,652	$55,893	43	$1,270	$54,623	$39,285	30	$1,874	$56,216	$36,945	$209,947	$161,935	$424,680,104	$327,561,706
c	2023	28	$732	$20,483	$19,768	69	$980	$67,652	$57,997	43	$1,270	$54,623	$40,764	30	$1,874	$56,216	$38,336	$198,974	$156,865	$402,483,717	$317,307,284
d	5187	0	0	0	0	69	$980	$67,652	$62,138	43	$1,270	$54,623	$43,675	30	$1,874	$56,216	$41,073	$178,490	$146,886	$925,776,365	$761,855,644
e	5187	0	0	0	0	51	$980	$50,003	$46,932	43	$1,270	$54,623	$45,655	30	$1,874	$56,216	$42,936	$160,842	$135,522	$834,240,031	$702,914,290
f	5187	0	0	0	0	33	$980	$32,355	$31,037	43	$1,270	$54,623	$47,724	30	$1,874	$56,216	$44,882	$143,194	$123,643	$742,703,697	$641,300,782
g	2529	0	0	0	0	0	0	0	0	43	$1,270	$54,623	$51,766	30	$1,874	$56,216	$48,683	$110,839	$100,449	$280,255,653	$253,984,245
h	2529	0	0	0	0	0	0	0	0	35	$1,270	$44,461	$42,545	30	$1,874	$56,216	$49,652	$100,676	$92,197	$254,560,025	$233,120,335
i	2529	0	0	0	0	0	0	0	0	27	$1,270	$34,298	$33,142	30	$1,874	$56,216	$50,640	$90,514	$83,781	$228,864,396	$211,841,207
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	30	$1,874	$56,216	$54,122	$56,216	$54,122	$181,503,953	$174,744,444
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	22	$1,874	$41,225	$40,078	$41,225	$40,078	$133,102,899	$129,401,171
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	14	$1,874	$26,234	$25,755	$26,234	$25,755	$84,701,845	$83,155,507

Pre-HAART : 130 Months (Pre-HAART defined as pre-3TC period)

CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4					
Months	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Months**	**$/Month**		**PV(1997)**	**Months**	**$/Month**	**Raw Cost**	**PV(1997)**	**Raw Cost**	**PV(1997)**
34	$334	$11,367	$10,890	55	$531	$29,209	$25,091	23	$844	$19,408	$15,135	18	$1,552	$27,928	$20,706	**$87,911**	**$71,822**

Note: 1.The discount rate used throughout is a monthly rate of 0.2466% such that when compounded to over 12 months, produces an effective annual rate 3.000%.

2. The only costs considered are future cost. Sunk costs (ie. those incurred before 1997) are replaced by zero.

3. PV(1997) is the present value at the start of 1997 of future costs discounted monthly at 0.2466%.

HIV/AIDS Episodic Costs - HAART1, HAART2 and Pre-HAART (HAART commences January 1, 1997)

Effective Annual Discount Rate = 4.00%

Effective Monthly Discount Rate = 0.33%

Monthly Cost - CD-4>5($732
Monthly Cost - 499>CD- $980
Monthly Cost - 199>CD- $1,270
Monthly Cost - 75>CD-4 $1,874

HAART 1 : 152 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
	Cases	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost (Case)	PV(1997) (Case)	Raw Cost (Cohort)	PV(1997) (Cohort)
a	2023	46	$732	$33,651	$31,192	57	$980	$55,886	$43,800	31	$1,270	$39,379	$26,702	18	$1,874	$33,729	$21,105	$162,646	$122,799	$329,000,005	$248,397,577
b	2023	31	$732	$22,678	$21,531	57	$980	$55,886	$46,001	31	$1,270	$39,379	$28,043	18	$1,874	$33,729	$22,165	$151,673	$117,741	$306,803,618	$238,166,615
c	2023	16	$732	$11,705	$11,385	57	$980	$55,886	$48,312	31	$1,270	$39,379	$29,453	18	$1,874	$33,729	$23,279	$140,700	$112,429	$284,607,232	$227,421,572
d	5187	0	0	0	0	57	$980	$55,886	$50,906	31	$1,270	$39,379	$31,034	18	$1,874	$33,729	$24,529	$128,995	$106,468	$669,058,367	$552,220,042
e	5187	0	0	0	0	39	$980	$38,238	$35,843	31	$1,270	$39,379	$32,914	18	$1,874	$33,729	$26,015	$111,347	$94,772	$577,522,033	$491,553,880
f	5187	0	0	0	0	21	$980	$20,590	$19,866	31	$1,270	$39,379	$34,909	18	$1,874	$33,729	$27,592	$93,698	$82,367	$485,985,699	$427,211,588
g	2529	0	0	0	0	0	0	0	0	31	$1,270	$39,379	$37,389	18	$1,874	$33,729	$29,552	$73,109	$66,941	$184,855,550	$169,259,611
h	2529	0	0	0	0	0	0	0	0	23	$1,270	$29,217	$28,100	18	$1,874	$33,729	$30,335	$62,946	$58,435	$159,159,922	$147,751,646
i	2529	0	0	0	0	0	0	0	0	15	$1,270	$19,055	$18,565	18	$1,874	$33,729	$31,138	$52,784	$49,703	$133,464,293	$125,673,892
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	18	$1,874	$33,729	$32,703	$33,729	$32,703	$108,902,372	$105,588,118
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	10	$1,874	$18,739	$18,406	$18,739	$18,406	$60,501,318	$59,426,072
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	2	$1,874	$3,748	$3,729	$3,748	$3,729	$12,100,264	$12,041,102

HAART 2 : 200 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
	Cases	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost(Case)	PV(1997)(Case)	Raw Cost(Cohort)	PV(1997)(Cohort)
a	2023	58	$732	$42,429	$38,587	69	$980	$67,652	$50,025	43	$1,270	$54,623	$33,592	30	$1,874	$56,216	$30,671	$220,920	$152,875	$446,876,491	$309,235,945
b	2023	43	$732	$31,456	$29,298	69	$980	$67,652	$52,539	43	$1,270	$54,623	$35,280	30	$1,874	$56,216	$32,212	$209,947	$149,329	$424,680,104	$302,061,961
c	2023	28	$732	$20,483	$19,542	69	$980	$67,652	$55,179	43	$1,270	$54,623	$37,053	30	$1,874	$56,216	$33,831	$198,974	$145,604	$402,483,717	$294,527,502
d	5187	0	0	0	0	69	$980	$67,652	$60,467	43	$1,270	$54,623	$40,603	30	$1,874	$56,216	$37,073	$178,490	$138,143	$925,776,365	$716,506,057
e	5187	0	0	0	0	51	$980	$50,003	$45,983	43	$1,270	$54,623	$43,064	30	$1,874	$56,216	$39,319	$160,842	$128,366	$834,240,031	$665,794,979
f	5187	0	0	0	0	33	$980	$32,355	$30,621	43	$1,270	$54,623	$45,673	30	$1,874	$56,216	$41,702	$143,194	$117,996	$742,703,697	$612,011,011
g	2529	0	0	0	0	0	0	0	0	43	$1,270	$54,623	$50,875	30	$1,874	$56,216	$46,451	$110,839	$97,326	$280,255,653	$246,088,588
h	2529	0	0	0	0	0	0	0	0	35	$1,270	$44,461	$41,943	30	$1,874	$56,216	$47,682	$100,676	$89,625	$254,560,025	$226,615,974
i	2529	0	0	0	0	0	0	0	0	27	$1,270	$34,298	$32,775	30	$1,874	$56,216	$48,945	$90,514	$81,719	$228,864,396	$206,627,493
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	30	$1,874	$56,216	$53,460	$56,216	$53,460	$181,503,953	$172,607,022
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	22	$1,874	$41,225	$39,713	$41,225	$39,713	$133,102,899	$128,220,439
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	14	$1,874	$26,234	$25,601	$26,234	$25,601	$84,701,845	$82,657,968

Pre-HAART : 130 Months (Pre-HAART defined as pre-3TC period)

CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4					
Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost	PV(1997)
34	$334	$11,367	$10,740	55	$531	$29,209	$23,883	23	$844	$19,408	$13,955	18	$1,552	$27,928	$18,777	**$87,911**	**$67,355**

Note: 1.The discount rate used throughout is a monthly rate of 0.3274% such that when compounded over 12 months, produces an effective annual rate 4.0000%.

2. The only costs considered are future cost. Sunk costs (i.e., those incurred before 1997) are replaced by zero.

3. PV(1997) is the present value at the start of 1997 of future costs discounted monthly at 0.3274%.

HIV/AIDS Episodic Costs - HAART1, HAART2 and Pre-HAART (HAART commences January 1, 1997)

Effective Annual Discount Rate = **5.00%**

Effective Monthly Discount Rate = **0.41%**

Monthly Cost - CD-4>500 **$732**

Monthly Cost - 499>CD-4 **$980**

Monthly Cost - 199>CD-4 **$1,270**

Monthly Cost - 75>CD-4 **$1,874**

HAART 1 : 152 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4						
Cohort	Cases	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost (Case)	PV(1997) (Case)	Raw Cost (Cohort)
a	2023	46	$732	$33,651	$30,629	57	$980	$55,886	$41,290	31	$1,270	$39,379	$24,290	18	$1,874	$33,729	$18,824	$162,646	$115,033	$329,000,005
b	2023	31	$732	$22,678	$21,263	57	$980	$55,886	$43,886	31	$1,270	$39,379	$25,818	18	$1,874	$33,729	$20,008	$151,673	$110,975	$306,803,618
c	2023	16	$732	$11,705	$11,309	57	$980	$55,886	$46,646	31	$1,270	$39,379	$27,441	18	$1,874	$33,729	$21,266	$140,700	$106,663	$284,607,232
d	5187	0	0	0	0	57	$980	$55,886	$49,782	31	$1,270	$39,379	$29,286	18	$1,874	$33,729	$22,696	$128,995	$101,763	$669,058,367
e	5187	0	0	0	0	39	$980	$38,238	$35,289	31	$1,270	$39,379	$31,509	18	$1,874	$33,729	$24,419	$111,347	$91,217	$577,522,033
f	5187	0	0	0	0	21	$980	$20,590	$19,695	31	$1,270	$39,379	$33,902	18	$1,874	$33,729	$26,273	$93,698	$79,870	$485,985,699
g	2529	0	0	0	0	0	0	0	0	31	$1,270	$39,379	$36,923	18	$1,874	$33,729	$28,615	$73,109	$65,538	$184,855,550
h	2529	0	0	0	0	0	0	0	0	23	$1,270	$29,217	$27,836	18	$1,874	$33,729	$29,561	$62,946	$57,397	$159,159,922
i	2529	0	0	0	0	0	0	0	0	15	$1,270	$19,055	$18,448	18	$1,874	$33,729	$30,538	$52,784	$48,986	$133,464,293
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	18	$1,874	$33,729	$32,459	$33,729	$32,459	$108,902,372
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	10	$1,874	$18,739	$18,325	$18,739	$18,325	$60,501,318
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	2	$1,874	$3,748	$3,725	$3,748	$3,725	$12,100,264

HAART 2 : 200 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4						
Cohort	Cases	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost(Case)	PV(1997)(Case)	Raw Cost(Cohort)
a	2023	58	$732	$42,429	$37,721	69	$980	$67,652	$46,503	43	$1,270	$54,623	$29,842	30	$1,874	$56,216	$26,459	$220,920	$140,525	$446,876,491
b	2023	43	$732	$31,456	$28,801	69	$980	$67,652	$49,428	43	$1,270	$54,623	$31,719	30	$1,874	$56,216	$28,123	$209,947	$138,071	$424,680,104
c	2023	28	$732	$20,483	$19,321	69	$980	$67,652	$52,536	43	$1,270	$54,623	$33,713	30	$1,874	$56,216	$29,892	$198,974	$135,462	$402,483,717
d	5187	0	0	0	0	69	$980	$67,652	$58,871	43	$1,270	$54,623	$37,778	30	$1,874	$56,216	$33,496	$178,490	$130,145	$925,776,365
e	5187	0	0	0	0	51	$980	$50,003	$45,068	43	$1,270	$54,623	$40,647	30	$1,874	$56,216	$36,039	$160,842	$121,754	$834,240,031
f	5187	0	0	0	0	33	$980	$32,355	$30,217	43	$1,270	$54,623	$43,733	30	$1,874	$56,216	$38,776	$143,194	$112,726	$742,703,697
g	2529	0	0	0	0	0	0	0	0	43	$1,270	$54,623	$50,013	30	$1,874	$56,216	$44,343	$110,839	$94,356	$280,255,653
h	2529	0	0	0	0	0	0	0	0	35	$1,270	$44,461	$41,358	30	$1,874	$56,216	$45,810	$100,676	$87,167	$254,560,025
i	2529	0	0	0	0	0	0	0	0	27	$1,270	$34,298	$32,417	30	$1,874	$56,216	$47,324	$90,514	$79,741	$228,864,396
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	30	$1,874	$56,216	$52,815	$56,216	$52,815	$181,503,953
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	22	$1,874	$41,225	$39,355	$41,225	$39,355	$133,102,899
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	14	$1,874	$26,234	$25,450	$26,234	$25,450	$84,701,845

Pre-HAART : 130 Months (Pre-HAART defined as pre-3TC period)

CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4					
Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost	PV(1997)
34	$334	$11,367	$10,594	55	$531	$29,209	$22,748	23	$844	$19,408	$12,876	18	$1,552	$27,928	$17,045	**$87,911**	**$63,263**

Note: 1.The discount rate used throughout is a monthly rate of 0.4074% such that when compounded over 12 months, produces an effective annual rate 5.0000%.

2. The only costs considered are future cost. Sunk costs (i.e., those incurred before 1997) are replaced by zero.

3. PV(1997) is the present value at the start of 1997 of future costs discounted monthly at 0.4074%.

HIV/AIDS Episodic Costs - HAART1, HAART2 and Pre-HAART (HAART commences January 1, 1997)

Effective Annual Discount Rate = 6.00%

Effective Monthly Discount Rate = 0.49%

Monthly Cost - CD-4>500 $732

Monthly Cost - 499>CD-4>2($980

Monthly Cost - 199>CD-4>7 $1,270

Monthly Cost - 75>CD-4 $1,874

HAART 1 : 152 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
Cohort	Cases	Months		Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost (Case)	PV(1997) (Case)	Raw Cost (Cohort)	PV(1997) (Cohort)
a	2023	46	$732	$33,651	$30,084	57	$980	$55,886	$38,952	31	$1,270	$39,379	$22,117	18	$1,874	$33,729	$16,809	$162,646	$107,962	$329,000,005	$218,385,253
b	2023	31	$732	$22,678	$21,002	57	$980	$55,886	$41,895	31	$1,270	$39,379	$23,788	18	$1,874	$33,729	$18,079	$151,673	$104,764	$306,803,618	$211,916,325
c	2023	16	$732	$11,705	$11,234	57	$980	$55,886	$45,060	31	$1,270	$39,379	$25,585	18	$1,874	$33,729	$19,444	$140,700	$101,324	$284,607,232	$204,958,641
d	5187	0	0	0	0	57	$980	$55,886	$48,701	31	$1,270	$39,379	$27,652	18	$1,874	$33,729	$21,015	$128,995	$97,368	$669,058,367	$505,020,517
e	5187	0	0	0	0	39	$980	$38,238	$34,751	31	$1,270	$39,379	$30,178	18	$1,874	$33,729	$22,935	$111,347	$87,864	$577,522,033	$455,723,760
f	5187	0	0	0	0	21	$980	$20,590	$19,527	31	$1,270	$39,379	$32,935	18	$1,874	$33,729	$25,030	$93,698	$77,491	$485,985,699	$401,924,396
g	2529	0	0	0	0	0	0	0	0	31	$1,270	$39,379	$36,470	18	$1,874	$33,729	$27,717	$73,109	$64,187	$184,855,550	$162,295,976
h	2529	0	0	0	0	0	0	0	0	23	$1,270	$29,217	$27,577	18	$1,874	$33,729	$28,814	$62,946	$56,392	$159,159,922	$142,586,892
i	2529	0	0	0	0	0	0	0	0	15	$1,270	$19,055	$18,333	18	$1,874	$33,729	$29,956	$52,784	$48,288	$133,464,293	$122,097,125
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	18	$1,874	$33,729	$32,219	$33,729	$32,219	$108,902,372	$104,025,864
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	10	$1,874	$18,739	$18,247	$18,739	$18,247	$60,501,318	$58,912,649
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	2	$1,874	$3,748	$3,721	$3,748	$3,721	$12,100,264	$12,012,486

HAART 2 : 200 Months

		CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4							
Cohort	Cases	Months		Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost(Case)	PV(1997)(Case)	Raw Cost(Cohort)	PV(1997)(Cohort)
a	2023	58	$732	$42,429	$36,888	69	$980	$67,652	$43,270	43	$1,270	$54,623	$26,543	30	$1,874	$56,216	$22,859	$220,920	$129,560	$446,876,491	$262,074,503
b	2023	43	$732	$31,456	$28,320	69	$980	$67,652	$46,539	43	$1,270	$54,623	$28,548	30	$1,874	$56,216	$24,586	$209,947	$127,994	$424,680,104	$258,906,484
c	2023	28	$732	$20,483	$19,105	69	$980	$67,652	$50,056	43	$1,270	$54,623	$30,705	30	$1,874	$56,216	$26,444	$198,974	$126,310	$402,483,717	$255,499,108
d	5187	0	0	0	0	69	$980	$67,652	$57,345	43	$1,270	$54,623	$35,177	30	$1,874	$56,216	$30,295	$178,490	$122,817	$925,776,365	$637,016,593
e	5187	0	0	0	0	51	$980	$50,003	$44,185	43	$1,270	$54,623	$38,390	30	$1,874	$56,216	$33,062	$160,842	$115,637	$834,240,031	$599,775,935
f	5187	0	0	0	0	33	$980	$32,355	$29,823	43	$1,270	$54,623	$41,896	30	$1,874	$56,216	$36,082	$143,194	$107,801	$742,703,697	$559,133,835
g	2529	0	0	0	0	0	0	0	0	43	$1,270	$54,623	$49,178	30	$1,874	$56,216	$42,352	$110,839	$91,530	$280,255,653	$231,433,493
h	2529	0	0	0	0	0	0	0	0	35	$1,270	$44,461	$40,788	30	$1,874	$56,216	$44,030	$100,676	$84,818	$254,560,025	$214,462,967
i	2529	0	0	0	0	0	0	0	0	27	$1,270	$34,298	$32,067	30	$1,874	$56,216	$45,774	$90,514	$77,841	$228,864,396	$196,820,234
j	3229	0	0	0	0	0	0	0	0	0	0	0	0	30	$1,874	$56,216	$52,186	$56,216	$52,186	$181,503,953	$168,493,382
k	3229	0	0	0	0	0	0	0	0	0	0	0	0	22	$1,874	$41,225	$39,004	$41,225	$39,004	$133,102,899	$125,933,745
l	3229	0	0	0	0	0	0	0	0	0	0	0	0	14	$1,874	$26,234	$25,301	$26,234	$25,301	$84,701,845	$81,688,308

Pre-HAART : 130 Months (Pre-HAART defined as pre-3TC period)

CD-4 > 500				499 > CD-4 > 200				199 > CD-4 > 75				75 > CD-4					
Months		Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Months	$/Month	Raw Cost	PV(1997)	Raw Cost	PV(1997)
34	$334	$11,367	$10,452	55	$531	$29,209	$21,680	23	$844	$19,408	$11,891	18	$1,552	$27,928	$15,486	**$87,911**	**$59,510**

Note: 1.The discount rate used throughout is a monthly rate of 0.4868% such that when compounded over 12 months, produces an effective annual rate 6.0000%.

2. The only costs considered are future cost. Sunk costs (i.e., those incurred before 1997) are replaced by zero.

3. PV(1997) is the present value at the start of 1997 of future costs discounted monthly at 0.4868%.

Notes

1 As yet there appear to be few, if any, cost-utility studies available from the literature that measure quality of life or patient preferences associated with HAART. Within the overall HIV/AIDS Economic Research Initiative there is one cost-utility study underway, which was designed to evaluate the cost-effectiveness of various prophylactic antibiotic therapies for Mycobacterium Avium Complex (MAC – an opportunistic infection afflicting individuals with severely compromised immune systems). (See Redelmeier et al., 1997 – list of projects, Chapter I, Appendix I).

2 This duration is consistent with widely quoted estimates of 10 years. See Hurley et al., 1996.

3 Based on consultation with Dr. John Gill, Southern Alberta Clinic, and the Clinical Delphi Workshop Participants (see Appendix III-A), the ranges were chosen based on their relevance as clinical "watersheds."

4 A key objective of the HIV/AIDS Economic Research Initiative was to fund research that contributes to improving our knowledge of the direct costs of HIV/AIDS. One such project led by Dr. John Gill at the SAC had the data required in order to define and characterize the pre-HAART episode for the purposes of this study. Dr. Gill invested in the creation of a longitudinal database for SAC's patient population. Almost all HIV-infected individuals in Southern Alberta receive their care through SAC. This simplified ongoing data collection since, in essence, SAC is a "one-stop-shopping" location for care (refer to Appendix III-B for detail on the database). However, there were other service provider organizations (e.g., AIDS Calgary Awareness – an ASO) that provided services and incurred direct costs. The SAC research project was designed to capture this additional non-SAC resource use through surveying the patient population (Gill et al. [work in progress] – see list of projects, Chapter I, Appendix I).

5 Refer to Chapter II on Epidemiology for more detail.

6 Information provided in a meeting with Dr. Michael O'Shaughnessy and staff of the BC Centre for Excellence in HIV/AIDS.

7 Out-of-pocket cost estimates are derived from a Canadian AIDS Society survey of 1,136 people living with HIV/AIDS that was conducted as part of an income security and disability study. (See Williams, 1996.)

8 Using age-related per capita health expenditures from the publication *National Health Expenditures, 1975-1994* (Health Canada, 1996), baseline health care costs could be computed. The annual per capita health expenditure estimate of $1,437 or about $120 per month for the 15 to 44 age group could be used. Baseline health care costs for the pre-HAART HIV/AIDS episode would amount to $13,920 or, in present value terms, approximately $11,500 (discounted at 4 percent).

9 Data from the SAC demonstrate this affect: January 1996 – 2 percent of patient population on triple combination therapy (TCT); November 1996 – 8 percent on TCT; January 1997 – 42 percent on TCT; Projection for March 1998 – 60 percent on TCT.

10 Recent media reports note the alarming number of individuals (53 percent) who cannot tolerate the new therapies or who fail. As we gain more experience with these effects of the new therapies and as more information becomes available, the modelling exercise will become more refined and reflective of the true impacts of the new treatment regimens.

11 Physicians participating in the clinical Delphi session suggested that, based on their initial experience with HAART, about 20 percent of their patient population well enough to return to work.

References

Cassidy, Michael and Andrea Klymasz (1995), *The Economic Costs of Schizophrenia in Canada: A Preliminary Study*, Schizophrenia Society of Canada and Health Canada.

Cooper, Barbara S. and Dorothy P. Rice (1976), "The Economic Cost of Illness Revisited," *Social Security Bulletin*, February.

Fraser, Rod and Ann Cox (1988), "The Economic Impact of HIV Infection and AIDS," in Royal Society of Canada, *AIDS: A perspective for Canadians*, Ottawa.

Grover, S. A. et al. (1992), *The Natural History of Symptomatic HIV Infection and the Costs Associated with Medical Care: Final Report*, Montreal General Hospital, Centre for the Analysis of Cost-Effective Care, National Health Research and Development Program Contract No. 6605-2938-AIDS.

Hanvelt, Robin A. et al. (1994), "Indirect Costs of HIV/AIDS Mortality in Canada," *AIDS* 8(10).

Harkness, John (1989), "The Economic Cost of AIDS in Canada," *Canadian Public Policy* XV(4):405-12.

Hartunian, N. S., C. N. Smart and M. S. Thompson (1980), "The Incidence and Economic Costs of Cancer, Motor Vehicle Injuries, Coronary Heart Disease, and Stroke: A Comparative Analysis," *American Journal of Public Health* 70(12):1249-60.

Health Canada (1996), *National Health Expenditures in Canada, 1975-1994*, Policy and Consultation Branch, Ottawa: Supply and Services Canada.

___ (1997), *The Economic Burden of Illness in Canada, 1993*, Health Protection Branch, Ottawa.

Hellinger, F. J. (1993), "The Lifetime Cost of Treating a Person with HIV," *JAMA* 270:474-78.

Hurley, Susan F. et al. (1996), "Lifetime Cost of Human Immunodeficiency Virus-Related Health Care," *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology* 12(4):371-78.

Knapp, Martin and Jennifer Beecham (1990), "Costing Mental Health Services," *Psychological Medicine* 20:893-908.

Lange, N. et al. (1992), "Hierarchical Bayes Models for the Progression of HIV Infection Using Longitudinal CD4 T-cell Numbers," *Journal of American Stat Assos* 87:615-26, cited in Hurley et al., *op. cit.*

Lindgren, B. and Raymunda Silverberg (1990), "Economic Burden of AIDS," in M. F. Drummond and L. M. Davies, *AIDS: The Challenge for Economic Analysis*, University of Birmingham, United Kingdom.

Longini, I. M. et al. (1991), "The Dynamics of DC4 T-lymphocyte Decline in HIV-infected Individuals: A Markov Modelling Approach," *J AIDS Hum Retrovirol* 4:1141-47, cited in Hurley et al., *op cit*.

Rice, Dorothy P. (1966), *Estimating the Cost of Illness*, Health Economic Series No. 6, U.S. Public Health Service, Washington.

Rice, Dorothy P., T. A. Hodgson and A. Hopstein (1985), "The Economic Cost of Illness: A Replication and Update," *Health Care Financing Review* 7:61-80.

Rice, Dorothy P. et al. (1990), *Economic Costs of Alcohol and Drug Abuse and Mental Illness*, Alcohol, Drug Abuse and Mental Health Administration, Rockville, MD.

Scitovsky, Anne A. (1982), "Estimating the Direct Costs of Illness," *Millbank Memorial Fund Quarterly/ Health and Society* 60(3):463-91.

Scitovsky, Anne A. and Dorothy P. Rice (1987), "Estimates of the Direct and Indirect Costs of Acquired Immunodeficiency Syndrome in the United States, 1985, 1986, and 1991," Public Health Reports 102(1) (January-February).

Thompson, Mark S. and Heidi J. Meyer (1989), "The Costs of AIDS: Alternative Methodological

Approaches," in Conference Proceedings: *Health Services Research Methodology: A Focus on AIDS*, National Centre for Health Services Research and Health Care Technology Assessment, Rockville, MD.

Tolley, K. and M. Gyldmark (1993), "The Treatment and Care Costs of People Living with HIV Infection or AIDS: Development of a Standardised Cost Framework for Europe," *Health Policy* 24:55-70.

Williams, Gregory T. (1996), *Income Security Project – Phase II: Narrative Report*, Ottawa: Canadian AIDS Society.

IV Canada=s Investment in HIV Prevention

1 Introduction

Prevention has become an important issue in health policy, especially in light of the fiscal pressures exerted on the health care system. The control of HIV infection is almost totally dependent on prevention interventions and strategies, and theoretically, HIV is one hundred percent preventable. In the absence of a cure or vaccine, the HIV/AIDS epidemic remains a long-term threat to the well-being of Canadian society and to the sustainability of the health care system.

It is clear that the resources available for HIV prevention are limited and resource allocation choices have to be made. How should scarce resources be allocated? More specifically, how should funds be allocated among alternative HIV prevention programs and strategies in order to maximize the number of HIV infections averted? While these are important questions, a key prerequisite is to first know what we are investing in and how much. The analysis in this chapter takes account of Canada's investment in HIV prevention since the mid-1980s. This accounting has never been done before in Canada and it enables several new analytical possibilities, such as international comparisons.

1.1 Is Prevention a Good Investment?

The impact of HIV prevention is difficult to measure since an averted HIV infection is essentially invisible. Hence several estimation techniques, procedures and models are used to estimate the number of prevented infections. Kahn (1996) estimates that "the number of HIV infections averted in 5 years with $1 million in annual prevention spending ranges from 164 in high-risk populations to 0.4 in very-low-risk populations." While the potential number of infections averted is a useful statistic, so too is the clear message that targeting is a critical factor in maximizing the output from prevention resources. Lurie and Drucker (1997) estimate the number of infections that could have been prevented had the United States implemented needle exchange programs early in the HIV/AIDS epidemic. They conclude that

> our conservative estimate of the number of HIV infections that could have been prevented ranged from 4,394 (15 percent incidence reduction due to needle exchanges) to 9,666 (33 percent incidence reduction) ... If current policies are not changed, we estimate that an additional 5,150-11,329 preventable HIV infections could occur by the year 2000.

The estimates of the overall economic burden of HIV/AIDS to Canadian society contained in this paper demonstrate the strong economic incentive for investing in HIV prevention. Indeed, it is "the only game in town" and the British acknowledge prevention as the "core of the Governments AIDS Strategy" (Foreign and Commonwealth Office, 1995). They have also set objectives and targets under the HIV/AIDS and Sexual Health umbrella as follows:

> The Government's main objectives are: to reduce the incidence of HIV infection and other sexually transmitted diseases; to develop further and strengthen monitoring and surveillance; and to reduce the number of unintended pregnancies.... National targets have been set: to reduce the incidence of gonorrhoea in people aged 15-64 by at least 20 percent by 1995, as an indicator of HIV/AIDS trends; to reduce the percentage of injecting drug misusers who report sharing in injecting equipment in the previous four weeks by at least 50 per cent by 1997, and by at least a further 50 per cent by the year 2000.

Holtgrave et al. (1994), in a comprehensive literature review of the cost-effectiveness of HIV prevention, summarize the value of HIV prevention by tating, "HIV prevention programs need have only a small positive impact on behavioural outcomes for the program's economic benefits to outweigh the financial costs." HIV prevention is a sound investment both in human and financial terms.

The accounting exercise contained in this chapter is a key first step in the process of designing and configuring a truly national response to the HIV/AIDS epidemic premised on best practice and the cost-effective use of limited resources.

1.2 Defining HIV/AIDS Prevention and Education

A key challenge for this study was to define a basic package of HIV prevention activities and interventions. However, these activities are often embedded or nested within other activities and are often difficult to specifically identify in terms of definition and cost.

Some organizations engage in both treatment and prevention activity, and funding sources and financing are often not separately identified. For example, while some activities are clearly identifiable as prevention and education, others such as research have been funded in blocks, and still others are not consistently or specifically tied to prevention as opposed to treatment. A key pre-requisite to conducting a survey on investment in HIV prevention and education is to first define an easily recognizable package of prevention and education activity in order to standardize data collection.

The substance of HIV/AIDS prevention and education is interventions designed to limit the disease or block its emergence. Angus and Shariatmadar (1996) categorize primary interventions as: strategies to prevent someone from contracting HIV; techniques to influence behaviour of those infected to reduce or arrest transmission; and antibody screening and testing to determine the sources and degree of risk within a population.

Expenditures on HIV/AIDS prevention and education are a function of the types of interventions employed, which are related to the number and coverage of programs thought necessary. These in turn are related to the extent and location of the epidemic within a country's population, and available funds. HIV/AIDS prevention and education strategies have therefore included a variety of activities, of varying costs.

In developing countries, the World Health Organization (WHO) (1994) resource requirement model for HIV prevention describes a "Hypothetical Package of Essential HIV Prevention Strategies," with front-line interventions such as screening of donated blood and provision of condoms as part of the "feasible best practice" in the fiscal context of developing countries. The model estimates US$0.27 to US$0.38 per capita as the range of expenditure required to provide the complete HIV prevention package (without STD treatment) in the developing countries studied. By contrast, a study in 1987 on HIV/AIDS prevention and education expenditures by the public sector in West Germany included typical front-line interventions, plus accounted for the costs of reducing occupational exposure, and the costs of research on preventative interventions and vaccines. The per capita cost estimated from that study is US$1.05.[1]

The principle activities discussed in this chapter are summarized below. They include the current components of Health Canada's National AIDS Strategy, and the key initiatives funded by the provincial and territorial health ministries/departments. Also included are the gross expenditures on HIV prevention initiatives by other provincial and territorial government departments (labour, education, and social services), those of a sample of municipalities, and for a sample of community-based AIDS organizations using private contributions. All HIV prevention activities captured are for Canada. Only broad international comparisons are presented in the discussion section of this chapter.

a) HIV/AIDS Prevention and Education Components of the National AIDS Strategy

- Community development and support to national nongovernment organizations, including infrastructure costs
- Research on prevention interventions and education techniques
- Epidemiology and surveillance
- Research and interventions to ensure a safe blood supply
- Prevention and education interventions

b) By Provincial/Territorial Departments of Health

- Mass media campaigns
- School education
- Needle exchange
- Prevention research
- HIV testing
- Hot lines
- Advisory committees
- Staff salaries not included in above categories
- Other activities such as epidemiology and population surveillance, conferences
- Transfers to community-based AIDS organizations for HIV/AIDS prevention and education
- Transfers to public health units or regional health service structures for HIV/AIDS prevention and education

c) By Municipalities and Departments of Labour/Workers' Compensation Boards (WCB), Education, Correctional Services, and Social Services

- Total expenditures attributable to HIV/AIDS prevention and education

d) With Private Funds through Community-based AIDS Organizations

- Total expenditures attributable to HIV/AIDS prevention and education

2 Methodology

This study estimates the national aggregate expenditures on HIV/AIDS prevention and education by Canadian public sector institutions since 1985, and the private contributions attributable to prevention and education in community-based AIDS organizations in 1996. It includes a descriptive analysis of findings, including indicators of response (as expenditures) to need (as HIV prevalence and incidence) in Canada, and comparisons to the responses in three other developed countries.

2.1 The Public Sector

Public sector data were collected from funding sources. Some provincial health department/ ministry contacts were members of the Federal/ Provincial/Territorial Government (HIV/AIDS) Prevention Program Committee. For provinces and territories not represented on the Committee, for provincial/territorial departments other than health, and for municipalities, contacts were determined by Health Canada or CPRN. For Health Canada, the staff of the HIV/AIDS Policy, Coordination, and Programs Division, Health Promotion and Programs Branch, provided the expenditure data.

Provincial/territorial departments and ministries were surveyed using a data collection form based on an activity classification scheme developed with the assistance of key informants (see Appendix IV-A). Contacts were faxed a covering letter and the data collection form. Follow-up phone calls were made to confirm receipt of the form and to explain the data requirements and deadline. Subsequently, contacts were called occasionally to determine status until the data were received along with supporting documentation, whenever available.

Health Canada expenditure data were delivered in the activity categories given in the National AIDS Strategy.

With the other provincial departments and municipalities, the covering letter and data collection

form were sometimes faxed, but, most often, communication was by telephone, starting with an explanation of the research initiative and maintaining contact until data were received. Most often estimates were given during the phone interviews.

2.2 The Private Sector

Private sector contributions were identified by the community-based AIDS organizations that received the funds. Data for 1996-97 were collected using a questionnaire developed in consultation with key informants (see Appendix IV-B).

The questionnaire is modelled after the omnibus survey conducted by the Canadian AIDS Society (CAS) in 1995-96. Contacts were provided by CAS, Coalition des organismes communautaires québécois (COCQ-Sida), Health Canada's AIDS Community Action Program, and AIDS Vancouver. The questionnaire was sent to 87 organizations that agreed to participate. In addition, telephone interviews were held with several participants. Private donations were considered to be contributions from individuals, private corporations, and agencies.

2.3 Limitations of the Data

Restructuring and downsizing in several provincial departments of health have left corporate history limited to the most recent years. As well, the study caught some health services in the process of being regionalised, with central departments of health having only high-level budgets that did not isolate HIV/AIDS prevention and education activities, and regions varying in their recording of these expenditures. Estimates were accepted in these situations whenever possible.

In situations where HIV/AIDS prevention and education programs had separate budgets, but where interventions for other sexually transmitted diseases were carried-out, the costs for the other interventions were not subtracted. Conversely, in the case where a program was designed to prevent a range of infectious diseases with HIV as one, a portion of the expenditures attributable specifically to HIV had to be estimated using an allocation guideline or proxy. For example, if a pamphlet on preventing sexually transmitted diseases was developed and one-third of the pamphlet was devoted to HIV/AIDS, then one-third of the total cost of this activity (i.e., content development, printing, distribution, etc.) would be attributed to HIV prevention.

While they contribute to local public health units, municipalities were not able to consistently isolate the proportion of their contributions to health units that could be attributed specifically to HIV/AIDS prevention and education. They were however able to identify their direct involvement in, or contributions to local initiatives such as community-based AIDS organizations and fundraising events.

With school education programs, expenditure data on centrally developed curricula were sometimes available, and sometimes directly attributable to HIV/AIDS. In cases where curricula were developed for general sexual health and included HIV/AIDS as a component, the expenditure for HIV/AIDS was based on the ratio of HIV/AIDS lessons to total lessons. The study does not capture comprehensively the individual school board responses to curriculum adjustment/development, procurement of training materials, and teacher training within each province.

Regarding provincial expenditures on HIV in the workplace, the prevention and education programs are typically not specific to HIV/AIDS but deal with universal precautions with blood borne pathogens. Departments of labour/WCB had difficulty extracting a portion of costs specific to HIV/AIDS from research and guidelines developed for universal precautions, and from the corresponding training and regulations enforcement. Furthermore, no attempt was made to capture the expense of changes in work practice, for example, in public laboratories dealing with infected body and blood products. The data that were submitted were qualified as being a significant underestimate of the actual expenditures.

Table IV-1

Total Estimated Expenditures on HIV/AIDS Prevention and Education, 1985-86 to 1996-97
(Unadjusted Dollars – Millions)

	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	Total dollars	Percent
Provincial/ territorial health departments/ ministries	5.00	6.00	19.0	21.0	30.0	30.0	34.0	39.0	43.0	47.0	50.0	55.0	379	66
Other provincial departments/ ministries	0.01	0.04	1.0	0.9	1.0	0.9	0.9	1.1	1.2	1.6	1.6	1.6	12	2
Municipalities	0	0.30	0.3	0.5	0.6	0.7	0.8	1.5	2.3	3.3	3.3	3.5	17	3
Health Canada	1.00[a]	1.90	2.9	11.5	14.8	17.6	16.9	17.4	19.7	20.0	19.4	19.4	163	29
Total public sector expenditures	6.01	8.24	23.2	33.9	46.4	49.2	52.6	59.0	66.2	71.9	74.3	79.5	571	100
Private contributions to AIDS service organizations												4.3		
Public and private sector expenditures												83.8		

a Represents the sum of expenditures up to and including 1985-86.

The countless in-service, training and education/ information sessions provided in public and private sector workplaces to introduce new practices based on health and safety regulations for blood borne pathogens are not captured within the context of this study.

In light of the limitations described above and because missing data were not imputed into the totals, the estimates of public sector expenditures may be considered conservative.

3 Findings

3.1 National Investment in HIV Prevention

From 1985 to 1996, Canadians spent an estimated $571 million through their public institutions on HIV/AIDS prevention and education. The federal contribution through Health Canada was approximately 29 percent of total expenditures ($163 million); the provincial and territorial expenditures amounted to 68 percent of the total ($391 million); and municipal funding was approximately 3 percent of the total ($17 million) (Table IV-1).

Canada invested over $80 million in HIV prevention and education in 1996-97 (Chart IV-1). Of the $60 million invested by the provinces, territories and municipalities, roughly 29 percent was transferred to community-based AIDS service organizations (ASO) (Chart IV-2). At the federal level, Health Canada invested roughly 52 percent of its total HIV prevention and education funds at the community-based level (Chart IV-3). In 1996, private contributions that supported HIV/AIDS prevention and education activities in community-based AIDS organizations amounted to $4.3 million, or 5 percent of the total public and private expenditures in that year.

3.2 Health Canada Expenditures

In the earliest days of the AIDS epidemic (the first reported cases in Canada were in 1982), Health and Welfare Canada responded by taking steps applicable to any communicable disease in that reporting requirements for health authorities across the country were instituted (Lindquist and Rayside, 1992). To review the information about the disease as it emerged, a National Advisory Council on AIDS was formed in 1983. By 1985, the Health Services and Promotion Branch of Health and Welfare Canada had begun giving grants for community development, but it was in 1986 that a substantial commitment was made by the federal government to fight AIDS. The National Centre for AIDS was created and a budget for HIV prevention and education was established. Prior to 1986-87, approximately $960,000 had been allocated for prevention and education from $3.2 million spent on HIV/AIDS (Table IV-2).

For 1986-87 and 1987-88, Health Canada promoted HIV prevention and education through community development strategies, transferring approximately $4.6 million to community-based and nongovernment organizations. In 1988-89, Health Canada increased its monetary commitment to HIV/AIDS prevention and education four times compared to the previous year, jumping from $2.9 to $11.5 million. The AIDS Community Action Program was launched to consolidate funding for community groups. As well, $8 million (70 percent of total available funds for HIV/AIDS) were allocated to collaborative prevention and education programs involving other federal agencies, and to those in provinces and territories.

In 1989-90, Health Canada's direct support for prevention and education began to decline relative to its allocations to other HIV/AIDS prevention initiatives (see Chart IV-4). The emerging strategy was to aim prevention and education activities at the populations where rates of transmission were known to be the highest, using organizations with roots in the communities most vulnerable to HIV. Therefore, more Health Canada funding started to shift to community-based AIDS organizations relative to other initiatives, to build local infrastructures that supported prevention of infection and care for those infected.

Chart IV-1

Total Estimated National Expenditures on HIV/AIDS Prevention and Education, 1996-97

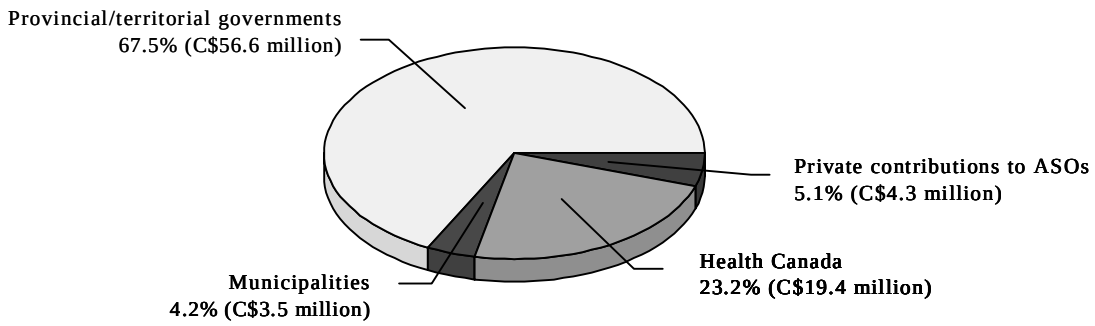
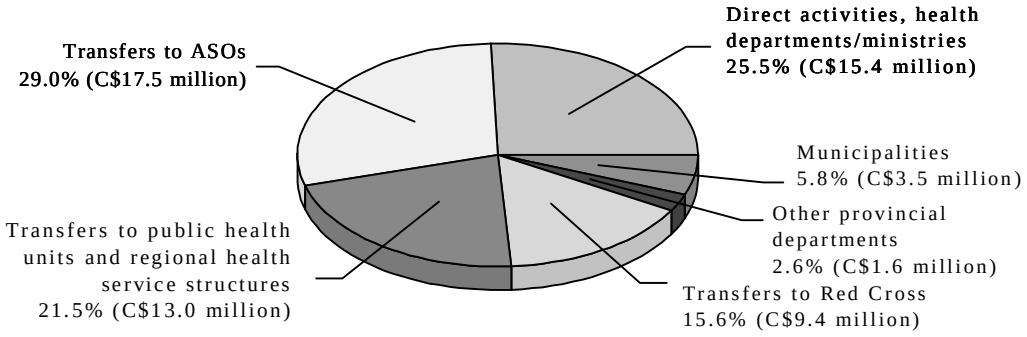


Chart IV-2

Estimated Provincial, Territorial and Municipal HIV Prevention and Education Expenditures, 1996-97



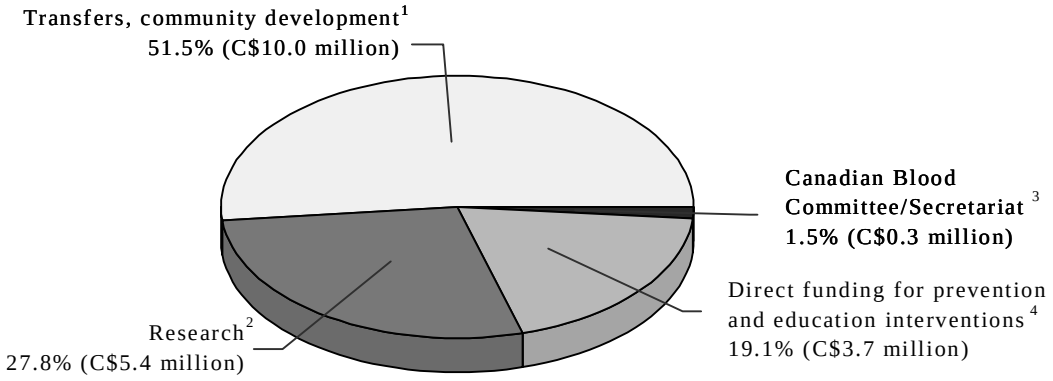
As the threat of HIV/AIDS became more apparent, expenditures grew, and in 1990 the National AIDS Strategy (NAS) was launched. The first phase saw a commitment of $112 million from 1990-91 to 1992-93, and the second phase, 1993-94 to 1997-98, $203.5 million. For each phase, approximately 42 percent of the total National AIDS Strategy funds is attributed to HIV/AIDS prevention and education (Table IV-3).

3.3 Provincial, Territorial and Municipal Government Expenditures

The provincial, territorial and municipal governments combined spent an estimated $407 million from 1985 to 1996 on HIV/AIDS prevention and education, of which $379 million or 93 percent came from departments/ministries of health. Approximately 35 percent of the ministry of health

Chart IV-3

Health Canada Expenditures on HIV/AIDS Prevention and Education, 1996-97



1 Includes funds for infrastructure of NGOs; comprised of transfers to the AIDS Community Action Program (includes some care and support activities), and includes initiatives involving Correctional Services Canada, the Canadian AIDS Society, and the Canadian Hemophilia Society.
2 Includes 25 percent of total National Health Research and Development Program grants; includes epidemiology and surveillance; includes programs for blood safety.
3 Assumed half of the total funding of the Canadian Blood Committee as attributable to HIV up to 1991-92 when HIV was an emerging issue in dealing with blood borne pathogens; from 1993-94, includes total expenditures of the Canadian Blood Secretariat.
4 Includes "HIV in the Workplace" program; funding for First Nations and Inuit programs.

funds went to programs and services that they provided directly or developed for implementation by other government departments such as education and correctional services. The remaining 65 percent of these funds was transferred to other agencies either related to the ministries, such as public health units, or to independent bodies such as community AIDS organizations or to the Red Cross (Table IV-4).

In some provinces, departments such as correctional services, education, and labour/Workers' Compensation Board directly supported their own programs, accounting for a very conservative estimate of $12 million or 3 percent of total provincial/territorial/municipal spending on HIV/AIDS prevention. The municipal portion was estimated at $17 million or 4 percent of the combined provincial/territorial/municipal investment.

The allocation pattern of the provincial and territorial governments is somewhat similar to that of Health Canada in that, over time, relatively more funds were transferred to community-based AIDS organizations than were allocated to other initiatives (Chart IV-5). Nonetheless, there is an interesting difference in Health Canada's strategy versus that of the provinces in the early years of response to the epidemic. In 1986 and 1987, Health Canada chose to promote prevention and education almost exclusively through community-based organizations, while the provincial departments of health intervened directly to a much greater extent, spending 44 percent of funds available for HIV/AIDS prevention and education on programs they developed and/or delivered themselves, while 5 percent was transferred to community organizations. Presumably, the more aggressive intervention by the provinces and territories was motivated by their direct responsibility for health

Table IV-2

Health Canada Expenditures on HIV/AIDS Prevention and Education Up to 1996-97
(Unadjusted Dollars – Millions)

	Prior to 1986-87	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	Total
Direct funding for prevention and education interventions[1]		0	0	8.0	7.4	5.1	4.80	4.8	3.5	3.5	3.5	3.7	44.30
Research[2]		0	0	0	0	3.2	3.20	3.2	5.9	6.0	5.3	5.4	32.20
Transfers for community development[3]		1.9	2.7	3.3	7.2	9.1	8.90	9.4	10.2	10.2	10.1	10.0	83.00
Canadian Blood Committee/ Secretariat[4]			0.2	0.2	0.2	0.2	0.05		0.1	0.3	0.5	0.3	2.05
Health Canada expenditures on HIV/AIDS prevention and education	1.0	1.9	2.9	11.5	14.8	17.6	16.95	17.4	19.7	20.0	19.4	19.4	162.55

1 Includes "HIV in the Workplace" program; funding for First Nations and Inuit programs.
2 Includes 25 percent of total NHRDP grants; includes epidemiology and surveillance; includes programs for blood safety.
3 Includes funds for infrastructure of NGOs; comprised of transfers to the AIDS Community Action Program (includes some care and support activities), and includes initiatives involving Correctional Services Canada, the Canadian AIDS Society, and the Canadian Hemophilia Society.
4 Assumed half of the total funding of the Canadian Blood Committee as attributable to HIV up to 1991-92 when HIV was an emerging issue in dealing with blood borne pathogens; from 1993-94, includes total expenditures of the Canadian Blood Secretariat.
Source: HIV/AIDS Policy, Coordination and Programs Division, Health Promotion and Programs Branch, Health Canada.

Chart IV-4

Relative Change in Health Canada Expenditures Up to 1996-97

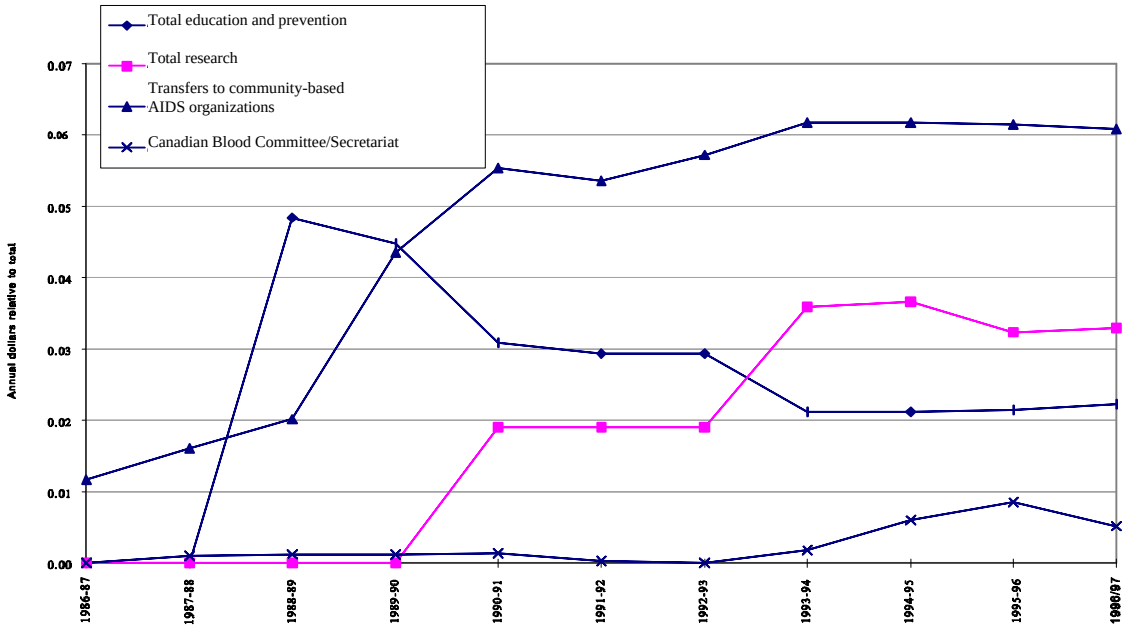


Table IV-3

Health Canada HIV/AIDS Prevention and Education Expenditures

Phase	Millions of dollars
Pre NAS up to 1989-90	32
NAS Phase I 1990-91 to 1992-93	52
NAS Phase II 1993-94 to 1996-97	79
Total	**163**

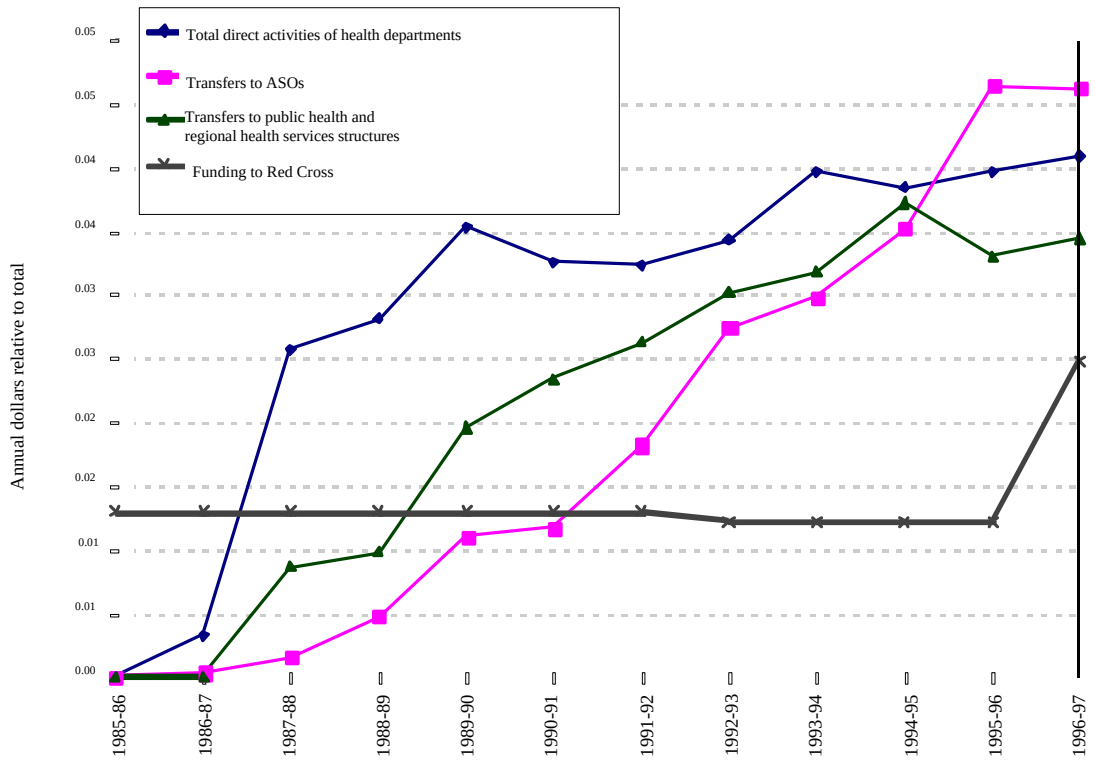
Table IV-4

Estimated Provincial, Territorial and Municipal Expenditures, 1985-86 to 1996-97
(Unadjusted Dollars – Millions)

	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	Total
Direct activities of health departments/ministries	0	1.20	9.7	10.6	13.3	12.3	12.1	13.0	15.0	14.5	15.0	15.4	132.20
Health department/ministry transfers to ASOs	0	0.10	0.6	1.8	4.2	4.4	6.9	10.3	11.2	13.3	17.6	17.5	87.90
Health department/ministry transfers to public health units and regional health service structures	0	0	3.2	3.7	7.4	8.8	10.0	11.4	12.3	14.0	12.4	13.0	96.20
Health department/ministry transfers to Red Cross	4.90	4.90	4.9	4.9	4.9	4.9	4.9	4.6	4.6	4.6	4.6	9.4	62.10
Total health departments/ ministries	4.90	6.20	18.5	21.0	29.8	30.4	34.0	39.3	43.1	46.4	49.6	55.3	378.50
Other provincial departments	0.01	0.04	1.0	0.9	1.0	0.9	0.9	1.1	1.2	1.6	1.6	1.6	11.85
Municipalities	0	0.30	0.3	0.5	0.6	0.7	0.8	1.5	2.3	3.3	3.3	3.5	17.10
Total provincial and municipal expenditures	4.90	6.50	19.8	22.4	31.4	32.0	35.6	42.0	46.6	51.3	54.5	60.4	407.35

Chart IV-5

Relative Change in Provincial/Territorial Health Department/Ministry Expenditures from 1985-86 to 1996-97



care (except for First Nations and Inuit people).

3.4 Provincial/Territorial Health Department/Ministry Expenditures

The earliest responses to the epidemic by ministries of health, during 1986 and 1987, were dominated by programs that were directly provided by the ministries, in particular, mass media campaigns, HIV testing, and information hot lines (Table IV-5). The ministries were concentrating on monitoring the progression of the epidemic, and were simultaneously informing the general population on the extent of risk, the modes of transmission, and the means to prevent the disease. At the same time, funds had been transferred to community-based organizations, although they were modest by comparison: $114,000 in 1986 for community development compared to $1.2 million for the programs provided directly by ministries.

By 1989, ministry of health transfers to community-based AIDS organizations leapt to over $4 million or 17 percent of funds available for HIV/AIDS prevention and education, excluding transfers to the Red Cross. Direct activities by ministries still dominated, at $13.3 million, and the second largest expenditure was transfers to public health units and regional health service structures, worth $7.4 million (doubled from the previous year). Subsequently, transfers to community organizations grew every

Table IV-5

Breakdown of Estimated Expenditures on Direct Activities of Provincial/Territorial Health Departments/Ministries, 1985-86 to 1996-97
(Unadjusted Dollars – Millions)

	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	Total
Mass media	0	0.46	4.56	5.33	6.17	4.50	2.90	2.99	2.30	1.65	0.69	0.45	32.00
School education	0	0	1.30	0.10	0.23	0.35	0.32	0.36	0.36	0.37	0.26	0.86	4.51
Needle exchange	0	0	0	0	0.22	0.51	0.75	1.88	2.53	2.73	3.83	3.83	16.28
Prevention research	0	0	0.30	0.20	0.05	0.30	0.20	0.10	0.21	0.16	0.38	0.39	2.29
HIV testing	0	0.52	1.29	1.68	2.43	2.65	3.27	3.68	4.06	4.54	4.68	4.88	33.68
Advisory Committee	0	0.20	0.21	0.21	0.22	0.28	0.23	0.23	0.28	0.25	0.23	0.23	2.57
Hot lines	0	0	1.60	1.70	1.55	1.48	1.43	1.15	1.10	1.13	1.16	1.13	13.43
Miscellaneous[1]	0	0.03	0.15	0.22	0.53	0.72	0.80	1.00	1.47	1.80	1.64	1.58	9.94
Government staff salaries	0	0.01	0.29	1.14	1.92	1.52	2.24	1.55	2.65	1.85	2.08	2.07	17.32
Total direct activities of health departments/ ministries	0	1.22	9.70	10.58	13.32	12.31	12.14	12.94	14.96	14.48	14.95	15.42	132.02

1 Comprised of some surveillance and epidemiologic monitoring, train-the-trainer programs, conferences, sessional speakers, contribution to special federal/provincial shared programs.

year until 1995-96. By that time, the value of these transfers had overtaken the funding for direct ministry activities and transfers to public health units. By 1996, provincial departments of health were transferring on average 31 percent (about $17.5 million) of HIV/AIDS prevention and education funding to AIDS service organizations.

3.5 Private Sector

The private sector contributions shown in Table IV-6 are derived from two sources: a CPRN survey in 1997, and the Canadian AIDS Society (CAS) Omnibus Survey of 1995-96. The CPRN survey involved 87 organizations, some of them members of CAS. The CAS survey captured data from 55 member organizations in 1993-94, and 61 member organizations in 1994-95.

Because of the different numbers of organizations reporting in each year shown in Table IV-6, and because two surveys are informing the table, year-to-year variations must be interpreted cautiously. Nonetheless, there appears to have been a fairly significant increase (about 40 percent) in provincial funding in actual dollars from 1994-95 to 1996-97. This is confirmed by trends in provincial spending shown earlier.[2] Private funding sources appear to have contributed significantly more to community-based organizations in 1996-97 than in 1994-95. Excluding gifts-in-kind and volunteer hours in 1996-97,[3] private contributions doubled from 1994-95 to 1996-97 (Table IV-7).

While Table IV-6 presents the actual funds received by the community organizations, a significant impact of the funding, beyond the support for organizational infrastructures and activities, has been the leveraging of hundreds of thousands of volunteer hours. For example, the CAS Omnibus Survey reports 745,433 volunteer hours in 63 AIDS organizations in 1994-95 (used in Table IV-7 as an estimate for 1996-97). The value of these hours in 1996-97 is half of the total value of private contributions for that year.

With gifts-in-kind and a value assigned to volunteer input, the total private contributions for 1996-97 were estimated to be worth $15 million. Based on the

Table IV-6

Community-based AIDS Organizations Funding Sources
(Unadjusted Dollars – Millions)

	1993-94[a]		1994-95[b]		1996-97	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
Federal government	4.5	29	5.7	32	5.7	24
Provincial governments	5.8	37	6.6	37	9.3	38
Regional and municipal governments	0.9	6	1.2	7	1.3	6
Private (excluding volunteer time)	4.3	28	4.5	25	6.6[c]	32
Total	**15.5**		**18.0**		**23.0**	

a Based on responses from 55 of the 99 CAS member organizations.
b Based on responses from 61 of the 99 CAS member organizations.
c Excludes gifts-in-kind for comparative purposes.

Table IV-7

Private Contributions to Community-based AIDS Organizations
(Unadjusted Dollars – Thousands)

	1993-94[a]	1994-95[b]	1996-97
United Way	170	160	400
Membership fees	10	120	70
Individual donations	840	970	1,400
Foundations	500	230	300
Corporations	100	130	500
Fundraising events	1,400	1,300	3,300
Other	300	400	700
Value of gifts-in-kind			1,000
Value of volunteer input			7,400
Total	**3,320**	**3,310**	**15,070**

a Based on responses from 48 of the 99 CAS member organizations.
b Based on responses from 52 of the 99 CAS member organizations.

CPRN survey of AIDS Service Organizations it was determined that, on average, 29 percent of funds received by the organizaitons were attributed to HIV/AIDS prevention and education. Applying this proportion to $15 million yields an estimated *$4.3 million of total private contributions in 1996-97 going towards prevention and education.*

In general, the survey revealed that more resources were spent on direct support for infected persons than on prevention and education. Respondents explained that this was because of the increasing need for emergency relief for infected people as government-funded support programs experience budget decreases, and also because private donors often request that their contributions be used to help those felt to be in greatest need.

While the expenditures for specific interventions were not identified, a list of HIV/AIDS prevention and education activities undertaken by community organizations was compiled:

- general outreach, as distribution of printed material and condoms in schools, shopping malls, at public events;
- targeted outreach;
- information hot lines;
- training for volunteers and paid service providers;
- resource centres (with books, articles, pamphlets, etc.);
- speakers' bureaus;
- HIV health promotion;
- individual and group counseling; and
- assistance to researchers and students studying HIV/AIDS prevention and education.

Where prevention and education were undertaken, and with limited resources available, activities were most often directed at high-risk populations through targeted outreach.

4 Discussion

4.1 Canada's Response

How much should Canada be investing in HIV prevention or how much is enough? This is a somewhat simplistic question that would require substantial analysis and, in the end, there may not be a definitive answer. However, we do know that Canada (like any other country) does not have unlimited funds to invest in HIV prevention. Hence a key challenge is to maximize the benefit available from limited HIV prevention resources. This is not to say that Canada should not invest more in HIV prevention. Rather it is a recognition of the need to avert as many new infections as possible through sound investments in HIV prevention. The financial "how much" will be dependent on the prevention needs of the populations at risk and the level of the epidemic within these populations. The determination of need will be dependent on information and intelligence gathered through strategic sentinel surveillance, prevention research and timely and targeted prevention interventions. Staying at the leading edge of the epidemic through an HIV prevention strategy premised on the principles of best practice and cost-effectiveness will not only stem the tide of the epidemic but will also assist in the stabilization of prevention expenditures.

Aside from a broad examination of HIV prevention expenditure relative to incidence and prevalence, the research does not include measuring specific outcomes or impacts related to HIV prevention. Instead, the expenditures are viewed as indicating a level of activity, just as the percent of GDP attributable to research and development is presented as a comparative indicator of economic activity at a point in time. Spending on HIV/AIDS prevention and education therefore represents Canada's response in the context of a certain incidence and prevalence of HIV/AIDS cases. The epidemiological dynamics of the epidemic in Canada represent and define the need for inter-vention.

Using prevalence and incidence figures developed with a component modelling technique (described in Chapter II), the following profile of HIV/AIDS prevention and education expenditures was developed

Table IV-8

Estimated Public Expenditures on HIV Prevention per Prevalent Case, Canada, 1992-93 to 1996-97

	1992-93	1993-94	1994-95	1995-96	1996-97
Total estimated public sector expenditures on HIV prevention (millions of dollars)	60.5	67.3	72.4	74.8	79.5
HIV prevalence	30,200	31,600	33,200	35,150	38,900
HIV incidence	2,700	3,100	3,400	3,600	4,000
Expenditures per prevalent case (dollars)	2,003	2,130	2,180	2,128	2,044

(Table IV-8). Data from the last five years were used as a sample of the relatively recent response to need, and expenditures per prevalent case were calculated.

In 1996, Canada invested $2.65 per capita or $2,044 per prevalent case in HIV prevention. In that same year, the country spent $570 million or about $15,000 per prevalent case on direct health care. The prevention investment per prevalent case is roughly 14 percent of the direct health care spending for the infected population in 1996. Over a five-year period, expenditures on HIV/AIDS prevention and education grew at approximately the same rate as the number of prevalent cases for the period shown. Understandably, the expenditures per prevalent case in 1996-97 compared to 1992-93 were similar, with a difference of only $41.

It is quite clear from the incidence estimates that the epidemic is gaining momentum again, despite the increased effort at prevention and education. Hence, although prevention investment matched the growth in the epidemic, the impact was somewhat less effective. This could reflect several possibilities: interventions targeted at specific populations may have been ineffective; the interventions may have been delivered too late and a threshold prevalence was reached (i.e., "the horse was out of the barn"); new risk groups were missed; effective programs were underfunded; or a combination of these factors. While it may prove useful to engage in a diagnostic exercise to illuminate these factors, it would be equally important to take interim measures to ensure a closer link to the leading edge of the epidemic as means to better control. Is there room for improvement? Some very broad international comparisons suggest that other countries have been more successful in epidemic control.

4.2 Canada in an International Context

How do Canadian expenditures on HIV/AIDS prevention and education compare to those of other countries? Two high-level descriptive indicators were chosen for the comparison: expenditures per capita and expenditures per HIV prevalent case. HIV prevalence as a percent of population is also included in order to provide more context for the first two indicators relative to the size of the country-specific epidemics.

Using a familiar indicator such as per capita expenditures is a first step in an analysis of response to need. It allows a ready comparison to other expenditures from the public purse that are typically presented using the same ratio, such as health care, education, and defence. The indicator gives a sense of the relative funding implications of the different programs should this be of interest. Understanding this and recognizing the limitations, the HIV prevention expenditures per prevalent case were also compared. This indicator is a better measure of the response to need than per capita expenditure.

Public sector data for one year, 1996-97, were compared to the most readily available data from three other developed countries, namely Australia, Great Britain and the United States (Table IV-9). While the portion of U.S. expenditures attributed to states is a very conservative estimate, it was accepted nonetheless because the U.S. experience, typified by a rapidly growing infection rate among intravenous drug users and other marginalized people (the third wave of the epidemic), has the potential of becoming a Canadian reality.

For the one year, per capita expenditures, expenditures per prevalent case, and HIV prevalence per 100,000 for Canada and Australia are similar. On the other hand, compared to Canada, the United States spent 37 percent more per capita, 36 percent less per prevalent case, and had over twice the prevalence per 100,000 population.

Great Britain's performance stands out as the one country that seems to have controlled the epidemic through a strong commitment to HIV prevention and education. It had approximately one-third the HIV prevalence and invested 1.9 times more per prevalent case than Canada in 1996-97. However, because the epidemic has been better controlled, expenditures per capita are 30 percent lower than in Canada and half those in the United States.

Table IV-9

Profile of Comparative Expenditures on HIV/AIDS Prevention and Education, 1996-97

Panel A

	Total population[a]	HIV prevalence	Estimated public sector expenditures
	(Millions)		(C$ millions)
Canada	29.9	38,900[b]	79.5
Australia	17.8	19,661[c]	47.3[d]
United States	268.5	750,000[e]	975.0[f]
Great Britain	58.9	28,447[g]	110.8[h]

Panel B

	HIV prevalence per 100,000 population	Estimated per capita expenditure	Estimated expenditure per prevalent case
			(C$)
Canada	129	2.65	2,044
Australia	109	2.64	2,407
United States	270	3.64	1,300
Great Britain	48	1.88	3,897

a Populations for Great Britain and Australia based on 1993-94 figures, to which 1993-94 growth rates applied (compounded). OECD, *Labour Force Statistics*, 1974-94, Paris, 1996.
b Canadian prevalence was based on a components modelling technique (see Chapter II).
c HIV infections. Source: Public Health Education Unit, Commonwealth Department of Health and Family Services.
d Source: Public Health Education Unit, Commonwealth Department of Health and Family Services. Estimate includes Commonwealth funding, plus contributions of States and Territories. Australian dollar multiplied by 1.08.
e Prevalence estimate taken from Holmberg, S.D. (1996), "The Estimated Prevalence and Incidence of HIV in 96 Large US Metropolitan Areas," *American Journal of Public Health* 86.
f Based on US$500 million expenditure by the Center for Disease Control plus a very conservative estimate of state investment of US$250 million. The total does not include private investment, nor that of the National Institutes of Health. US$ multiplied by 1.3.
g HIV infections. From Aggleton, P. (1997), "Success in HIV Prevention," AVERT, West Sussex, England.
h From *AIDS Newsletter* 1996, 12(1), Section 32, page 7. UK currency multiplied by 2.12.

This first and limited comparison of Canadian expenditures on HIV/AIDS prevention and education encourages a more detailed study of the strategies of these and other developed countries. Other countries may be facing the same new set of public health challenges as Canada in that if HIV is still spreading, it is likely that the characteristics of the populations at high risk of contracting it are changing. A more detailed examination of Britain's HIV prevention strategy over time would provide more insight into possible key best-practice attributes.[4]

4.3 Is There Room for Improvement?

The quick and simple answer to this question is yes. However, more questions must be asked in order to delve further into the attributes of best practice and factors influencing success both in Canada and internationally.

Do we actually have a national HIV/AIDS strategy or do we have disparate strategies across the various levels of government and across community-

based organizations? Is there duplication of effort? How well are the various HIV prevention strategies and investments coordinated? Where have we failed and how can we avoid these failures in the future? Where are Canada's successes and how can we continue to build on them? What has contributed to Britain's relative success in containing the HIV/AIDS epidemic? These represent a sampling of the types of questions that could be addressed in moving towards a best-practice model for Canada's National HIV/AIDS strategy. While it is beyond the scope of this paper to enter into a best-practice study, it is worthwhile to discuss some initial concepts in order to stimulate discussion and further thought on the subject.

The development and implementation of best-practice benchmarks would ideally take place at both the micro and macro levels. For example, at the macro/national level, structural aspects of best practice would include mechanisms for "gluing" the national effort together. At the more micro level, best-practice design for the delivery of proven and well-targeted prevention interventions could be standardized and widely disseminated.

Currently there are some mechanisms in place for the coordination of the national HIV prevention effort and the obvious examples are the federal-provincial-territorial committee apparatus, the National Advisory Committee on AIDS and the AIDS Community Action Program. In terms of best practice, these mechanisms might play a more active role in creating a more collaborative prevention response where funds are pooled and directed at areas of need in a coordinated fashion. We have determined that both the federal and provincial governments have made significant investments in community-based AIDS service organizations. However, what emerged from this accounting exercise was the impression that no jurisdiction had a full understanding of the respective investments at the community level and, to some extent, the combined effort appeared somewhat disjointed.

At the more micro or grass roots level, best practice could furnish population-specific interventions that work best and delivery structures that maximize the likelihood of the success of these interventions.

Ultimately, the macro and micro levels have to be iteratively connected. The feedback loops need to be explicitly acknowledged and implemented through formal mechanisms and structures. A key example is the HIV surveillance and prevention linkage as a fundamental attribute of best practice. This linkage is crucial, not only in terms of the information feedback loops between the two activities, but also between the micro and macro activity levels. National HIV surveillance is dependent on provincial, regional and community level surveillance. In fact, the epidemiological analysis contained in this paper is based on building estimates from regional and subpopulation data (i.e., the component model).

Two key challenges or questions surface from this discussion. First, how can the formal linkage between surveillance, prevention programming/design and evaluation be improved in terms of taking advantage of synergistic opportunities, the timeliness of information/analytical exchange and overall cross fertilization of field intelligence and knowledge? Secondly, in terms of the linkage between jurisdictions or levels of activity, how can micro level surveillance be better linked to the macro level in order to create a strategic sentinel surveillance system?

Partial answers to these questions are "on our doorstep." For example, the BC Centre for Excellence in HIV/AIDS and AIDS Vancouver have spearheaded the development of best-practice design and delivery of HIV prevention strategies and interventions. Linking surveillance research such as the Vancouver Injection Drug User Study with the prevention response and the ongoing evaluation of both embodies many best-practice attributes that should be more widely disseminated and also form a key input to a broader exercise in this area.

In terms of the more micro-oriented HIV prevention activity, it is difficult to ascertain from this study the degree to which prevention programming and delivery are based on proven, efficacious or evidence-based prevention interventions and practice. Many prevention strategies and interventions are guided by behavioural research and therefore, to some extent, they are evidence based. However, a key next step may be to improve upon the timeliness of these interventions in order to keep our prevention efforts closely tied to the leading edge of the epidemic and, to the extent possible, create more proactive as opposed to reactive responses. This strategy might mitigate "letting the horse out of the barn" or, in other words, enable the fighting of the fire at the burning embers stage.

These important links between macro and micro level activity within a larger best-practice framework involving surveillance, prevention, evaluation and research are discussed in more detail in Chapter VI.

A key first step has been completed in taking inventory of the national investment in HIV prevention in Canada. It has been demonstrated that there is a strong economic incentive to invest in HIV prevention and now is the time to improve upon the "bang for each buck" invested. Indeed, it is the "only game in town" until the research effort produces a vaccine or cure.

Appendix IV

A DATA COLLECTION FORM FOR PROVINCIAL/TERRITORIAL AND MUNICIPAL HIV PREVENTION EXPENDITURES

CPRN-HEALTH CANADA HIV/AIDS ECONOMIC RESEARCH INITIATIVE

January 16, 1997

Total $ by Activity	1996-97	1995-96	1994-95	1993-94	1992-93	1991-92	1990-91	1989-90	1988-89	1987-88	1986-87	?
1) Direct Prov. Govt Activities*												
•Govt Staff Salaries (specific to HIV prevention)												
•Mass Media												
•School Education												
•Needle Exchange												
•Prevention Research												
•HIV Testing (including contracted Lab services)												
•Advisory Committees												
•Hot Lines												
•Other												

Total $ by Activity	1996-97	1995-96	1994-95	1993-94	1992-93	1991-92	1990-91	1989-90	1988-89	1987-88	1986-87	?
***2) Transfers to ASOs**												
•Projects/Activities												
•Infrastructure												
3) Transfers to Public Health Units*												
•Projects/Activities												
•Infrastructure												
4) Other (Including other depts. - Social Serv., Corrections, Education)												
Total $												
**** The project funding for ASOs and Public Health Units (e.g., Needle Exchange) should not be included in the categories for Direct Provincial Government activities.***												

B Questionnaire on Private Investment in Prevention and Education

NAME OF ORGANIZATION:

CPRN-Health Canada HIV/AIDS Economic Research Initiative

QUESTIONNAIRE ON PRIVATE INVESTMENT IN PREVENTION AND EDUCATION

**** Please note: All information taken from this questionnaire will remain confidential and will be used to provide national figures only. In addition to completing the questionnaire, please fax us a copy of your most recent annual report.***

1. Which of the following was your last completed fiscal year? (Please check one box)

❒ Jan. 1, 1996 to Dec. 31, 1996 ❒ April 1, 1995 to March 31, 1996

❒ Other (*please indicate the period)* _____ to _____
month/day/yr month/day/year

2. Please list the amounts of funding your organization received from the following private sector sources for your last completed fiscal year:

UNITED WAY $_____
INDIVIDUAL DONATIONS $_____
CORPORATIONS $_____
FOUNDATIONS $_____
MEMBERSHIP FEES $_____
FUNDRAISING EVENTS (net of costs) $_____
OTHER (e.g. sales of publications, conference fees)
*Please specify:*_____$_____
_____

3. Please assign (if possible) an approximate dollar value to all gifts received in kind (e.g. free printing, equipment donations etc.) from the **private sector** during your last completed fiscal year:
$_____

4. Please indicate approximately what percentage of its **private sector funding** your organization spent in the following areas (including staff salaries) during your last completed fiscal year:

a) **Care, treatment and support**[1] (medication, financial support, counselling and support groups, information on treatments, health care, alternative therapies, etc.) _____ %

[1] *For the purposes of this study, we are considering care, treatment and support to include all services offered to help those affected by HIV/AIDS to cope with the illness. Prevention and education would include all services and activities aimed at preventing the spread of HIV/AIDS. If your organization has a different definition of these categories, or does not use them at all, please indicate your definition and/or categories in question 5.*

b) **Prevention and education** (outreach, condom distribution, production and/or distribution of posters and brochures, workshops, information hot-lines etc.) _____ %
c) **Advocacy** (on behalf of individuals and at the government level) _____ %
d) **Administration** (program management, office supplies, office equipment, rent) _____ %
e) **Other** (*please indicate)*_____ _____ %

5. How does your organization define and/or organize prevention and education?

_____

_____

_____

6. Out of your administration costs that are covered by **private sector funding** (see question 4d), approximately what percentage went to supporting prevention and education programs?

_____%

7. Compared to 1993-1994, did your **private sector funding** during your last completed fiscal year (1995-1996)

❒ increase❒ decrease❒ stay the same❒ N/A

8. Compared to 1994-1995, did your **private sector funding** during your last completed fiscal year (1995-1996)

❒ increase❒ decrease❒ stay the same❒ N/A

9. Please list the amounts of funding your organization received from the following public sector sources for your last completed fiscal year:

FEDERAL GOVERNMENT $_____
PROVINCIAL/TERRITORIAL GOVERNMENT $_____
REGIONAL GOVERNMENT $_____
MUNICIPAL GOVERNMENT $_____

10. Do you have any comments to make on the role of prevention and education in your organization?

_____

_____

_____

Please fax the completed questionnaire to Vanessa Nicolai at (514) 273-7813 no later than January 20, 1997. If you have any questions about the questionnaire or any problems with fax transmission, please call me at (514) 273-8917. Thank you for your help!

Notes

1 118.4 million DM, approximately equivalent to US$64.3 million in 1987, divided by 61,035,000 population in 1987. Based on data from Whitaker's (World) Almanac, 1987 and 1988.

2 In terms of the timing of the increased transfers from provincial governments to community organizations, our findings are supported by those in a CPRN study of the Canadian nonprofit sector (Hirshhorn, 1997). Between 1986 and 1992, a period that approximately matches the time of our study, the growth in provincial government transfers to nonprofits was the highest in its history, jumping from about $4 billion to about $7 billion, a 75 percent increase. The federal contributions by comparison grew from about $1.5 billion to about $2.2 billion in the same period, and local government transfers stayed constant.

3 Excluded because figures were not available for 1994-95.

4 Health Canada has commissioned CPRN under the National HIV/AIDS Economic Research Initiative to undertake a detailed international comparison study in this area.

References

Angus, Douglas E. and A. Shariatmadar (1996), "HIV Prevention Strategies: A Review of the Literature and Experience on Evaluation/Economic Evaluation Programs," Ottawa: Canadian Policy Research Networks, March (draft paper).

Canadian AIDS Society (1996), "CAS Omnibus Survey 1995/96," Ottawa, September.

Foreign and Commonwealth Office (1995), *Improving Britain's Health*, London, UK.

Health Canada (1996), "AIDS Community Action Program, Selected Project Summaries, Supplementary Information by Sector of Activity for Operationally Funded Groups," Ottawa, July.

Hirshhorn, Ronald (1997), *The Emerging Sector: In Search of a Framework*, CPRN Study No. CPRN|01, Ottawa: Canadian Policy Research Networks.

Holtgrave, David R. et al. (1994), "Effectiveness and Efficiency of HIV Prevention Programs: An Overview," draft manuscript, Atlanta: Center for Disease Control.

Jenke, A. and A.-M. Reinkemeier (1990), "The Cost of AIDS and HIV Infection: Public Expenditures for AIDS Prevention in the Federal Republic of Germany," in D. Schwefel et al. (eds.), *Economic Aspects of AIDS and HIV Infection,* Springer-Verlag.

Kahn, James G. (1996), "The Cost-Effectiveness of HIV Prevention Targeting: How Much More Bang for the Buck?," *American Journal of Public Health* 86(12) (December).

Lindquist E. and D. Rayside (1992), "Federal AIDS Policy for the 1990s: Is It Too Early for 'Mainstreaming' in Canada?," *How Ottawa Spends: The Politics of Competitiveness 1992-93*, Ottawa: Carleton University Press.

Lurie, Peter and Ernest Drucker (1997), "An opportunity Lost: HIV Infections Associated with a Lack of a Needle-Exchange Programme in the USA," *The Lancet* 349 (March).

World Health Organization (1994), "Modelling the Costs of HIV Prevention: A Resource Requirement Model for Developing Countries," Geneva, September.

V Scenarios

1 Introduction

Chapter II describes the historical rise of HIV/AIDS in Canada and emphasizes the variation among different risk groups. In this chapter we explore the economic impact of three scenarios for the future evolution of the epidemic. The scenarios are exploratory, not forecasts. The complexity and uncertainty of the world create a demand for projections to counter uncertainty (Jager and van den Boom, 1994). There is much about the AIDS epidemic that is uncertain: prevalence and incidence in different populations, incubation time, infectivity, disease progression, and the social and economic impact. Scenario research provides an alternative to forecasting in that it takes an integrated view of the impact of the epidemic under specific assumed conditions drawing on understanding from more than one discipline (Jager and van den Boom, 1994). This chapter uses experts' opinions from two key informant processes: one of HIV epidemiologists and the other of HIV clinicians and scientists to develop assumptions about two iportant variables that will determine the economic impact of the epidemic: the number of new infections in core groups that will drive the epidemic and the effects of a whole new drug treatment paradigm, HAART, that should extend and improve the lives of the HIV infected.

The epidemiological scenarios presented here are theoretically plausible. The growth or decay of the epidemic that they capture is consistent with an epidemic that is very dynamic**.** Recorded high and low incidences in each population were used to capture the extremes of where we might actually be in terms of epidemic growth. To promote discussion, scenarios should portray the extremes of situations (Jager and van den Boom, 1994).

All three scenarios are rooted in a 1996 base case model incorporating much of the same data used by LCDC, in collaboration with CPRN, to determine the 1996 HIV incidence and prevalence estimates presented in Chapter II. Innovations were made to capture the evolution of the heterosexual epidemic based on an analysis of its three most important subgroups.[1] The 1996 estimate for HIV incidence in Canada produced by this model is therefore slightly higher than the one presented in Chapter II, but is within the same order of magnitude and grounded in the reality of the present.

The discussion of the scenarios includes national investment/expenditures in HIV prevention, a key input in efforts to control the epidemic to date. While there is no empirical evidence of the causal relationship between investment and HIV incidence, investment is an important factor in the baseline scenario for 1996 as an indicator of prevention activity in the context of a growing epidemic.

2 Methodology

2.1 Modelling HIV Incidence in Canada to 2001, Three Scenarios: Brief Description of the Model

CPRN, in collaboration with Dr. Robert Remis,[2] developed the model to project HIV incidence to 2001 in three scenarios. The model takes the form of an electronic tool developed in spreadsheet format. It uses the best available data on incidence and the size of the population at risk to determine incidence. The model is adaptable and as new estimates of incidence and the size of populations at risk become available, parameters can be quickly changed and the output will change accordingly. (The complete parameters and output of the model are included in Appendix V.)

The model uses three basic parameters for calculation of HIV incidence:

- estimated size of the populations at risk in Canada's three largest urban centers: Montreal, Toronto, and Vancouver;
- incidence estimates for each of the risk groups;
- a scaling factor to simulate growth or decay of the epidemic, which takes into account the maturity of the epidemic in each of the three centers in each of the subpopulations at risk. The scaling factors simulate three plausible scenarios for the evolution of the epidemic: uncontrolled growth; the status quo; and effective control. (The slope of each curve for the scaling factors is appended in the scaling gallery.)

The output for the model is determined by multiplying the rate of incidence for each subpopulation in each regional center by the estimated size of the subpopulation at risk. This produces the incidence for 1996. The three scaling factors for the following five years are then applied to the 1996 estimate to produce projected incidence under three different scenarios for the epidemic. These projections by subpopulation and centre are then extrapolated to the rest of the province based on the distribution of recent AIDS cases and recent HIV+ test results. Extrapolations to the rest of Canada are based on the distribution of recent AIDS cases.

2.2 Determining the Parameters

A model is only as good as the assumptions on which it is based. To collect information on the parameters used to build this model, CPRN participated in two important processes. The first was a Delphi session of Canadian HIV epidemiologists coordinated by CPRN and held in Montreal on March 1, 1997, in which experts pooled their knowledge to discuss the dynamic course of the epidemic by risk group in Canada's three largest urban centers. The second process was led by Dr. Chris Archibald of LCDC to collect information for the estimation of base case incidence and prevalence presented in Chapter II. CPRN attended these consultations of epidemiologists, researchers, and public health specialists, and used this key informant input in the construction of the model. In addition, where no Canadian data were available, the literature provided proxy data on comparable American cities.

2.3 Description of Scenarios

Three different scenarios were modelled in this exercise to capture the potential for HIV epidemic growth or decay over the next five years for the following risk groups: MSM, IDU, heterosexuals from endemic countries, heterosexuals with contact with persons from endemic countries, and heterosexuals with contact with MSM and IDU. Broadly speaking, two important factors determine the evolution of the epidemic for each scenario:

1. *The historical epidemiology of the epidemic in major epidemic centers by risk group* – For example, is the epidemic in a given city among a specific group old or relatively new? What is the potential for epidemic spread based on the size of the susceptible population? Montreal's IDU epidemic was determined to be older than Toronto's, for example, and therefore with less potential for growth. Is the epidemic close to saturation in that group? Vancouver's IDU epidemic was deemed to be approaching saturation. Qualitative input to answer these questions was collected at the Delphi session of Canadian HIV epidemiologists coordinated by CPRN and combined with quantitative data on HIV incidence, prevalence, risk group size, etc., to produce the parameters for the model.

2. *The effectiveness of the prevention response in controlling the growth of the epidemic* – These are the determinants from which the scenarios take their titles:

- *Scenario 1: Effective control* represents a public health goal and opportunity. If prevention interventions were strategic, timely and aggressively aimed in the early stage of the epidemic cycle, there exists an opportunity to control epidemic growth in centers where the infection rates have not yet become exponential. In centers where core populations have already experienced exponential growth and/or saturation, prevention interventions would be aimed at peripheral groups. For example, women who have sexual contact with male IDU. This will require a coordinated, adequately resourced prevention response guided by the four core activities of epidemiology outlined in Chapter II, Section 4.5: Epidemiology for HIV Prevention.
- *Scenario 2: Status Quo* assumes that nothing changes in our approach to controlling the epidemic. Infection rates remain constant until the susceptible populations saturate and the epidemic curve begins to fall.
- *Scenario 3: Uncontrolled* is a worst case scenario in which prevention efforts fail because they are not strategic, timely or aggressive. Cities in which HIV infection rates have remained low or stable grow to exponential within core groups.

2.4 Calculating Societal Costs

The next step in exploring the economic impact of the new infections projected by the model defined above is to attach the discounted episodic costs.[3] The episodic direct medical costs imputed from the year of infection and discounted at a rate of 4 percent for all three epidemiological scenarios. Costs are calculated for the HAART episode as described in Chapter III. Incremental indirect costs are also calculated for each scenario.

3 Findings

These exploratory scenarios provide: incidence estimates for the five years commencing in 1997 and the direct and indirect costs associated with HIV incidence in each scenario.

3.1 Scenarios of Incidence

In the uncontrolled epidemic growth scenario there are 29,507 new cases of HIV infection between 1997-2001. The status quo produces 19,578 new cases in the same period. Effective control produces 13,888 new infections over five years (Table V-1).

Modelling a theoretical saturation point in the IDU epidemic in Vancouver and Montreal has a major impact on Scenario 2. As a result, the number of annual infections drops in this scenario although incident rates for all other subpopulations in Vancouver, Toronto and Montreal remain stable. The three scenarios are represented graphically in Chart V-1 as three potential extensions of the base case in 1996.

3.2 Attributing Direct Costs and Indirect Costs to the Scenarios

For the purposes of further analysis and discus-

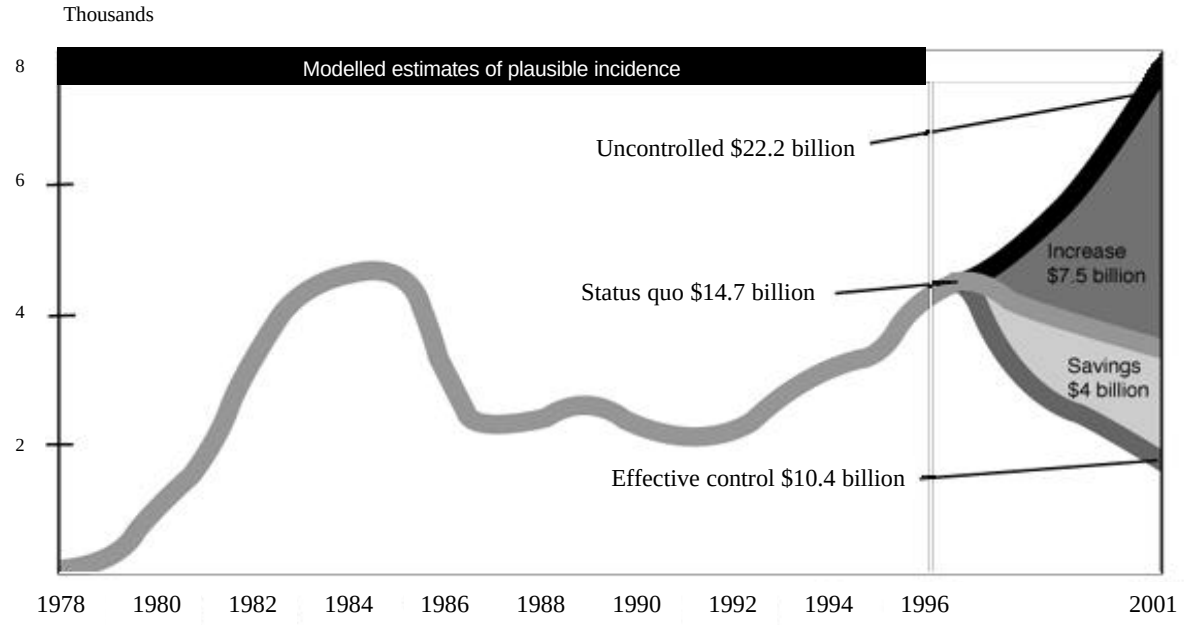
Table V-1

Number of New Infections Per Year in Canada Based on Three Scenarios

		1997	1998	1999	2000	2001	Total
Scenario 1	Effective	4,458	3,062	2,545	2,140	1,683	13,888
Scenario 2	Status quo	4,458	4,135	3,887	3,637	3,461	19,578
Scenario 3	Uncontrolled	4,458	5,029	5,665	6,638	7,717	29,507

Chart V-1

Historical HIV Incidence in Canada and Three Plausible Scenarios of Infection to 2001



sion, a 4 percent discount rate is applied to HAART direct costs. The indirect costs associated with mortality were previously discounted by Hanvelt (1994) at 3 percent.

Costs increase or decrease dramatically with fluctuations in incidence. Scenario 1, in which the epidemic is effectively controlled and incidence drops to 1,683 infections a year by 2001, generates $2.1 billion in direct medical costs over five years (Table V-2). In Scenario 2, the status quo, the epidemic is producing 3,461 new infections a year and generating direct medical costs of almost $3 billion.

4 Discussion

The total direct and indirect costs are presented in the same table in order to make the order of magnitude clear. Both costs contribute to the cost estimate from a societal perspective. The indirect costs remain the largest portion of the economic burden of HIV in all three scenarios.

4.1 The Benefits of Achieving Effective Control

There is strong economic rationale for reducing the number of annual HIV infections in Canada. The cost savings in direct medical costs alone amount to almost $900 million over five years. In addition, the infections avoided permit 5,690 young Canadians to lead productive lives and to contribute to society. These indirect savings amount to $3.4 billion over five years.

Canada currently spends $83 million a year to prevent the spread of HIV. If spending is held constant, this would amount to $415 million over five years. The cost savings in direct medical costs alone

Table V-2

Total and Indirect Costs of Three Scenarios Over Five Years

Epidemic control	Direct costs	Percent change from SQ	Indirect costs	Percent change from SQ	Combined	Percent change from SQ
	($ billions)		($ billions)		($ billions)	
Scenario 1 (effective)	2.1	30	8.3	30	10.4	30
Scenario II (status quo)	3.0	–	11.7	–	14.7	–
Scenario III (uncontrolle)	4.5	+50	17.7	+50	22.2	+50

SQ = status quo

made available by achieving effective control are $900 million. Total HIV prevention expenditures could be increased by $500 million nationally over the next five years to achieve effective epidemic control and the country would break even in terms of direct costs. When indirect costs are included there is a healthy return on this additional investment.

It is difficult to determine how much of an investment is enough at the macro level. Given the potentially large return on investment, however, it seems that there is a strong economic rationale for intensive resource allocation to prevent substantial direct and indirect costs to Canadian society that are attributable to HIV infection.

Appendix V

The Scenarios Model: Parameters and Output

(See page 82 to page 93.)

MSM Projections MODEL PARAMETERS		Point Estimate	Lower Confidence Limits	Upper Confidence Limits
Montreal	Population@risk	35000	28000	45000
	HIV prevalence, rate	0.17	0.12	0.24
	HIV prevalence, number	5950		
	HIV incidence, annual	0.012	0.005	0.025
	Default scale	A		
	Extrap. to Quebec, factor	1.33		
Toronto	Population@risk	38000	30000	50000
	HIV prevalence, rate	0.14	0.1	0.2
	HIV prevalence, number	5320		
	HIV incidence, annual	0.012	0.005	0.025
	Default scale	A		
	Extrap. to Ontario, factor	1.28		
Vancouver	Population@risk	12000	9000	16000
	HIV prevalence, rate	0.12	0.08	0.2
	HIV prevalence, number	1440		
	HIV incidence, annual	0.015	0.005	0.026
	Default scale	A		
	Extrap. to BC, factor	1.27		
Canada	Extrap. to Canada factor	1.13		

PROJECTED HIV INCIDENCE

		1996	1997	1998	1999	2000	2001
MSM - Montreal	Effective control, factor		1	0.85	0.75	0.65	0.5
	Effective control, infections	420	420	357	315	273	210
	Status quo, factor		1	1	1	1	1
	Status quo, infections	420	420	420	420	420	420
	Uncontrolled, factor		1	1.2	1.4	1.7	2
	Uncontrolled, infections	420	420	504	588	714	840
MSM - E xtrap. to Quebec	Effective control, infections	559	559	475	419	363	279
	Status quo, infections	559	559	559	559	559	559
	Uncontrolled, infections	559	559	670	782	950	1117
MSM - Toronto	Effective control, factor		1	0.85	0.75	0.65	0.5
	Effective control, infections	456	456	388	342	296	228
	Status quo, factor		1	1	1	1	1
	Status quo, infections	456	456	456	456	456	456
	Uncontrolled, factor		1	1.2	1.4	1.7	2
	Uncontrolled, infections	456	456	547	638	775	912
MSM - Extrap. to Ontario	Effective control, infections	584	584	497	438	379	292
	Status quo, infections	584	584	584	584	584	584
	Uncontrolled, infections	584	584	700	817	992	1167
MSM - Vancouver	Effective control, factor		1	0.85	0.75	0.65	0.5
	Effective control, infections	180	180	153	135	117	90
	Status quo, factor		1	1	1	1	1
	Status quo, infections	180	180	180	180	180	180
	Uncontrolled, factor		1	1.2	1.4	1.7	2
	Uncontrolled, infections	180	180	216	252	306	360
MSM - Extrap. to BC	Effective control, infections	229	229	194	171	149	114
	Status quo, infections	229	229	229	229	229	229
	Uncontrolled, infections	229	229	274	320	389	457
Total - Quebec, Ontario, and B.C.	Effective control, infections	1372	1372	1166	1028	891	685
	Status quo, infections	1372	1372	1372	1372	1372	1372
	Uncontrolled, infections	1372	1372	1644	1919	2331	2741
Extrapolated to Canada	Effective control, infections	1550	1550	1318	1162	1007	774
	Status quo, infections	1550	1550	1550	1550	1550	1550
	Uncontrolled, infections	1550	1550	1858	2168	2634	3097

IDU Projections MODEL PARAMETERS		Point Estimate	Lower Confidence Limits	Upper Confidence Limits			
Montreal	Population@risk	11000	6000	18000			
	HIV prevalence, rate	0.1	0.05	0.18			
	HIV prevalence, number	1100					
	HIV incidence, annual	0.04	0.02	0.06			
	Default scale	MI					
	Extrap. to Quebec, factor	1.32					
Toronto	Population@risk	13000	7000	20000			
	HIV prevalence, rate	0.05	0.03	0.08			
	HIV prevalence, number	650					
	HIV incidence, annual	0.012	0.008	0.03			
	Default scale	TI					
	Extrap. to Ontario, factor	1.58					
Vancouver	Population@risk	8000	4000	13000			
	HIV prevalence, rate	0.15	0.1	0.23			
	HIV prevalence, number	1200					
	HIV incidence, annual	0.12	0.03	0.19			
	Default scale	VI					
	Extrap. to BC factor	1.33					
Canada	Extrap. to Canada factor	1.13					
PROJECTED HIV INCIDENCE							
		1996	**1997**	**1998**	**1999**	**2000**	**2001**
IDU - Montreal	Effective control, factor		1	0.85	0.75	0.65	0.5
	Effective control, infections	440	440	374	330	286	220
	Status quo, factor		1	0.95	0.9	0.85	0.8
	Status quo, infections	440	440	418	396	374	352
	Uncontrolled, factor		1	1.1	1.2	1.35	1.5
	Uncontrolled, infections	440	440	484	528	594	660
IDU - Extrap. to Quebec	Effective control, infections	581	581	494	436	378	290
	Status quo, infections	581	581	552	523	494	465
	Uncontrolled, infections	581	581	639	697	784	871
IDU - Toronto	Effective control, factor		1	0.95	0.85	0.75	0.65
	Effective control, infections	156	156	148.2	132.6	117	101.4
	Status quo, factor		1	1	1	1	1
	Status quo, infections	156	156	156	156	156	156
	Uncontrolled, factor		1	1.9	3	4.5	6
	Uncontrolled, infections	156	156	296.4	468	702	936
IDU - Extrap. to Ontario	Effective control, infections	246	246	234	210	185	160
	Status quo, infections	246	246	246	246	246	246
	Uncontrolled, infections	246	246	468	739	1109	1479
IDU - Vancouver	Effective control, factor		1	0.3	0.15	0.09	0.07
	Effective control, infections	960	960	288	144	86.4	67.2
	Status quo, factor		1	0.8	0.65	0.5	0.4
	Status quo, infections	960	960	768	624	480	384
	Uncontrolled, factor		1	0.9	0.8	0.7	0.65
	Uncontrolled, infections	960	960	864	768	672	624
IDU - Extrap. to BC	Effective control, infections	1277	1277	383	192	115	89
	Status quo, infections	1277	1277	1021	830	638	511
	Uncontrolled, infections	1277	1277	1149	1021	894	830
Quebec, Ontario, BC	Effective control, infections	2104	2104	1111	838	678	539
	Status quo, infections	2104	2104	1819	1599	1378	1222
	Uncontrolled, infections	2104	2104	2256	2457	2787	3180
Extrapolated to Canada	Effective control, infections	2378	2378	1255	947	766	609
	Status quo, infections	2378	2378	2055	1807	1557	1381
	Uncontrolled, infections	2378	2378	2549	2776	3149	3593

Hetero. Contact w MSM, IDU MODEL PARAMETERS		Point Estimate	Lower Confidence Limits	Upper Confidence Limits
Montreal	Population@risk	0	10150	40600
	HIV prevalence, rate	0.02	0.01	0.04
	HIV prevalence, number	0		
	HIV incidence, annual	0.003	0.0015	0.006
	Default scale	HMI		
	Extrap. to Quebec factor	1.32		
Toronto	Population@risk	0	11160	44600
	HIV prevalence, rate	0.017	0.0085	0.034
	HIV prevalence, number	0		
	HIV incidence, annual	0.003	0.0015	0.006
	Default scale	HMI		
	Extrap. to Ontario factor	1.46		
Vancouver	Population@risk	#REF!	5900	23700
	HIV prevalence, rate	0.008	0.004	0.016
	HIV prevalence, number	#REF!		
	HIV incidence, annual	0.002	0.001	0.004
	Default scale	HMI		
	Extrap. to BC factor	1.31		
Canada	Extrap. to Canada factor	1.13		

PROJECTED HIV INCIDENCE

HETMSMIDU - Montreal		**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
	Effective control, factor		1	0.95	0.85	0.75	0.65
	Effective control, infections	0	0	0	0	0	0
	Status quo, factor		1	1	1	1	1
	Status quo, infections	0	0	0	0	0	0
	Uncontrolled, factor		1	1.2	1.45	1.8	2.2
	Uncontrolled, infections	0	0	0	0	0	0
HETMSMIDU - Extrap. to Quebec	Effective control, infections	0	0	0	0	0	0
	Status quo, infections	0	0	0	0	0	0
	Uncontrolled, infections	0	0	0	0	0	0
HETMSMIDU - Toronto	Effective control, factor		1	0.95	0.85	0.75	0.65
	Effective control, infections	0	0	0	0	0	0
	Status quo, factor		1	1	1	1	1
	Status quo, infections	0	0	0	0	0	0
	Uncontrolled, factor		1	1.2	1.45	1.8	2.2
	Uncontrolled, infections	0	0	0	0	0	0
HETMSMIDU - Extrap. to Ontario	Effective control, infections	0	0	0	0	0	0
	Status quo, infections	0	0	0	0	0	0
	Uncontrolled, infections	0	0	0	0	0	0
HETMSMIDU - Vancouver	Effective control, factor		1	0.95	0.85	0.75	0.65
	Effective control, infections	24	24	22.8	20.4	18	15.6
	Status quo, factor		1	1	1	1	1
	Status quo, infections	24	24	24	24	24	24
	Uncontrolled, factor		1	1.2	1.45	1.8	2.2
	Uncontrolled, infections	24	24	28.8	34.8	43.2	52.8
HETMSMIDU - Extrap. to BC	Effective control, infections	31	31	30	27	24	20
	Status quo, infections	31	31	31	31	31	31
	Uncontrolled, infections	31	31	38	46	57	69
HETMSMIDU - PQ, Ontario and BC	Effective control, infections	210	210	200	179	157	136
	Status quo, infections	210	210	210	210	210	210
	Uncontrolled, infections	210	210	252	305	378	481
HETMSMIDU total - Canada	Effective control, infections	237	237	226	202	177	154
	Status quo, infections	237	237	237	237	237	237
	Uncontrolled, infections	237	237	285	345	427	521

HETERO. CONTACT w ENDEMIC PROJ.

MODEL PARAMETERS		**Point Estimate**	**Lower Confidence Limits**	**Upper Confidence Limits**
QUEBEC	Population@risk	49000	24500	98000
	HIV prevalence, rate	0.007	0.0035	0.014
	HIV prevalence, number	343		
	HIV incidence, annual	0.0014	0.0007	0.0028
	Default scale	HE		
ONTARIO	Population@risk	246000	122000	450000
	HIV prevalence, rate	0.0004	0.0002	0.0008
	HIV prevalence, number	98		
	HIV incidence, annual	0.0001	0.00005	0.0002
	Default scale	HE		

PROJECTED HIV INCIDENCE

		1996	**1997**	**1998**	**1999**	**2000**	**2001**
HETCONw/ENDEMIC-QUEBEC	Effective control, factor		1	0.9	0.8	0.65	0.5
	Effective control, infections	69	69	62.1	55.2	44.9	34.5
	Status quo, factor		1	1	1	1	1
	Status quo, infections	69	69	69	69	69	69
	Uncontrolled, factor		1	1.15	1.25	1.4	1.6
	Uncontrolled, infections	69	69	79.4	86.3	96.6	110.4
HETCONw/ENDEMIC - ONTARIO	Effective control, factor		1	0.9	0.8	0.65	0.5
	Effective control, infections	25	25	22.5	20	16.3	12.5
	Status quo, factor		1	1	1	1	1
	Status quo, infections	25	25	25	25	25	25
	Uncontrolled, factor		1	1.15	1.25	1.4	1.6
	Uncontrolled, infections	25	25	28.8	31.3	35	40
TOTALS - ONTARIO/QUEBEC	Effective control, infections	94	94	84.6	75.2	61.2	47
	Status quo, infections	94	94	94	94	94	94
	Uncontrolled, infections	94	94	108.2	117.6	131.6	150.4

HETERO-ENDEMIC PROJECTIONS MODEL PARAMETERS		**Point Estimate**	**Lower Confidence Limits**	**Upper Confidence Limits**
QUEBEC	Population@risk	35000	35000	35000
Haitian	HIV prevalence, rate	0.03	0.015	0.045
	HIV prevalence, number	1050		
	HIV incidence	0.002	0.001	0.003
	Default scale	E		
QUEBEC	Population@risk	7810	7810	7810
Carribean, non-Haitian	HIV prevalence, rate	0.0025	0.001	0.005
	HIV prevalence, number	20		
	HIV incidence	0.00025	0.00015	0.0004
	Default scale	E		
QUEBEC	Population@risk	5970	5970	5970
African	HIV prevalence, rate	0.03	0.02	0.05
	HIV prevalence, number	179		
	HIV incidence	0.003	0.0015	0.005
	Default scale	E		
Ontario	Population@risk	2000	2000	2000
Haitian	HIV prevalence, rate	0.03	0.015	0.045
	HIV prevalence, number	60		
	HIV incidence	0.002	2378	0.003
	Default scale	E	2378	
			1255	
			947	
Ontario	Population@risk	198000	766	198000
Carribean, non-Haitian	HIV prevalence, rate	0.0015	609	0.003
	HIV prevalence, number	297		
	HIV incidence	0.00015		
	Default scale	E		
Ontario	Population@risk	40000	40000	40000
African	HIV prevalence, rate	0.015	0.01	0.025
	HIV prevalence, number	600		
	HIV incidence	0.0015	0.0008	0.0025
	Default scale	E		

PROJECTED HIV INCIDENCE		**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
HETENDEMIC-QUEBEC	Effective control, factor		1	0.9	0.8	0.65	0.5
Carribean - Haitian	Effective control, infections	70	70	63	56	45.5	35
	Status quo, factor		1	1	1	1	1
	Status quo, infections	70	70	70	70	70	70
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
*	Uncontrolled, infections	70	70	80.5	91	105	126
'HETENDEMIC-QUEBEC	Effective control, factor		1	0.9	0.8	0.65	0.5
'Carribean - Non-Haitian	Effective control, infections	2	2	1.8	1.6	1.3	1
	Status quo, factor		1	1	1	1	1
	Status quo, infections	2	2	2	2	2	2
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
	Uncontrolled, infections	2	2	2.3	2.6	3	3.6
'HETENDEMIC-QUEBEC	Effective control, factor		1	0.9	0.8	0.65	0.5
Africa	Effective control, infections	18	18	16.2	14.4	11.7	9
	Status quo, factor		1	1	1	1	1
	Status quo, infections	18	18	18	18	18	18
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
	Uncontrolled, infections	18	18	20.7	23.4	27	32.4
QUEBEC TOTALS	Effective control, infections	90	90	81	72	58.5	45
	Status quo, infections	90	90	90	90	90	90
	Uncontrolled, infections	90	90	103.5	117	135	162

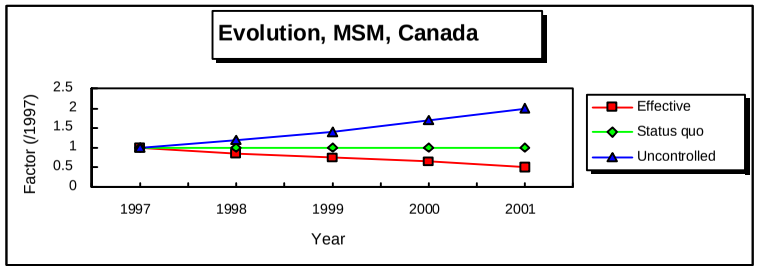
(cont'd)

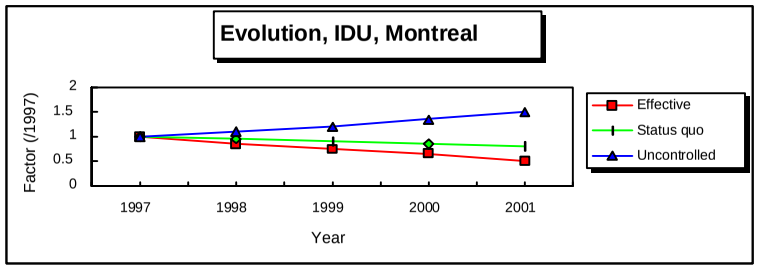
HETERO-ENDEMIC PROJECTIONS (cont'd)		**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
'HETENDEMIC-ONTARIO	Effective control, factor		1	0.9	0.8	0.65	0.5
Carribean - Haitian	Effective control, infections	4	4	3.6	3.2	2.6	2
	Status quo, factor		1	1	1	1	1
	Status quo, infections	4	4	4	4	4	4
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
	Uncontrolled, infections	4	4	4.6	5.2	6	7.2
HETENDEMIC-ONTARIO	Effective control, factor		1	0.9	0.8	0.65	0.5
'Carribean - Non-Haitian	Effective control, infections	30	30	27	24	19.5	15
	Status quo, factor		1	1	1	1	1
	Status quo, infections	30	30	30	30	30	30
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
	Uncontrolled, infections	30	30	34.5	39	45	54
HETENDEMIC-ONTARIO	Effective control, factor		1	0.9	0.8	0.65	0.5
Africa	Effective control, infections	60	60	54	48	39	30
	Status quo, factor		1	1	1	1	1
	Status quo, infections	60	60	60	60	60	60
	Uncontrolled, factor		1	1.15	1.3	1.5	1.8
	Uncontrolled, infections	60	60	69	78	90	108
ONTARIO TOTALS	Effective control, infections	94	94	84.6	75.2	61.1	47
	Status quo, infections	94	94	94	94	94	94
	Uncontrolled, infections	94	94	108.1	122.2	141	169
ONTARIO/QUEBEC TOTALS	Effective control, infections	184	184	165.6	147.2	120	92
	Status quo, infections	184	184	184	184	184	184
	Uncontrolled, infections	184	184	211.6	239.2	276	331

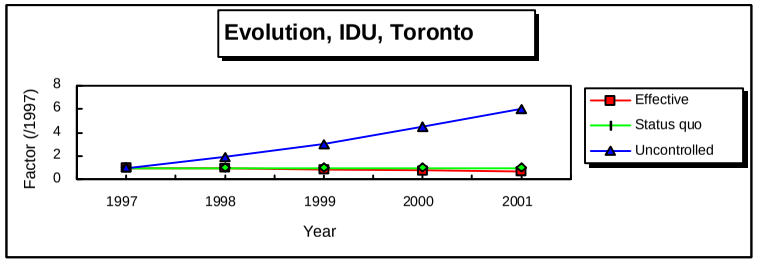
SCALING GALLERY

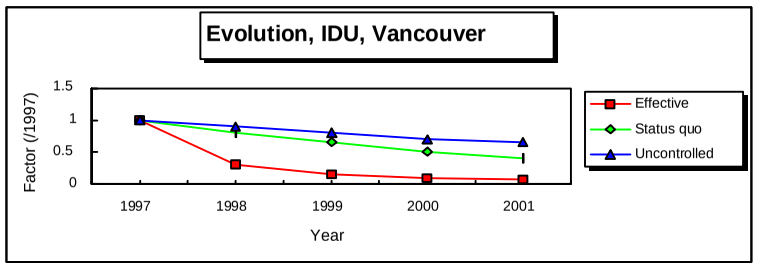
Population@risk	City or Province	Epidemic Control	TYPE	1997	1998	1999	2000	2001
MSM	All Cities	Effective control, infections	A1	1	0.85	0.75	0.65	0.5
		Status quo, infections	A2	1	1	1	1	1
		Uncontrolled, infections	A3	1	1.2	1.4	1.7	2
IDU	Montreal	Effective control, infections	MI1	1	0.85	0.75	0.65	0.5
		Status quo, infections	MI2	1	0.95	0.9	0.85	0.8
		Uncontrolled, infections	MI3	1	1.1	1.2	1.35	1.5
	Toronto	Effective control, infections	TI1	1	0.95	0.85	0.75	0.65
		Status quo, infections	2378	1	1	1	1	1
		Uncontrolled, infections	2378	1	1.9	3	4.5	6
			1255					
			947					
			766					
			609					
	Vancouver	Effective control, infections	VI1	1	0.3	0.15	0.09	0.07
		Status quo, infections	VI2	1	0.8	0.65	0.5	0.4
		Uncontrolled, infections	VI3	1	0.9	0.8	0.7	0.65

(cont'd)



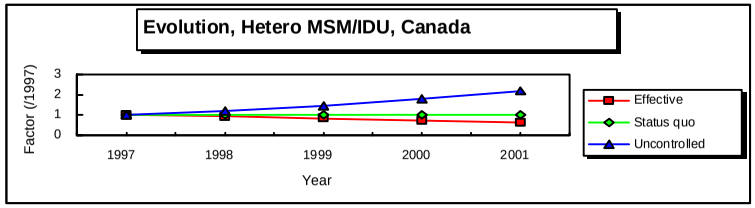




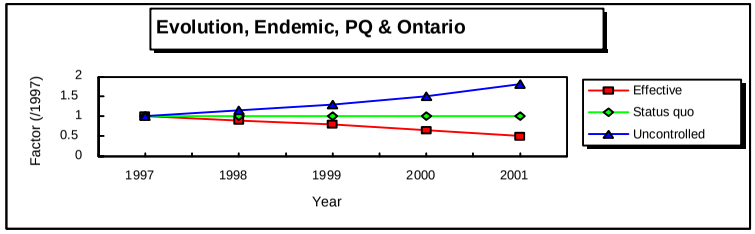


SCALING GALLERY (cont'd)

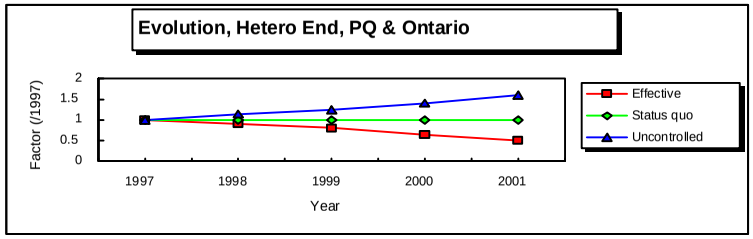
HETERO	Canada	Effective control, infections	HMI1	1	0.95	0.85	0.75	0.65
CONT MSMIDU	(All provinces)	Status quo, infections	HMI2	1	1	1	1	1
		Uncontrolled, infections	HMI3	1	1.2	1.45	1.8	2.2



ENDEMIC	Quebec & Onta	Effective control, infections	E1	1	0.9	0.8	0.65	0.5
		Status quo, infections	E2	1	1	1	1	1
		Uncontrolled, infections	E3	1	1.15	1.3	1.5	1.8



HETERO	Quebec & Onta	Effective control, infections	HE1	1	0.9	0.8	0.65	0.5
CONT ENDEMIC		Status quo, infections	HE2	1	1	1	1	1
		Uncontrolled, infections	HE3	1	1.15	1.25	1.4	1.6



Canada Summary - Effective Control

Parametres

HAART 2 Cost $152,875

Indirect Costs $600,000

		MSM	IDU	Endemic	Het contact MSM / IDU	Het contact Endemic	Total	Total Incident Direct Costs $CAN	Total Indirect Costs $CAN	Total Direct & Indirect Costs $CAN
Quebec	1996	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1997	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1998	475	494	81	77	62.1	1189	$181,768,375.00	$713,400,000.00	$895,168,375.00
	1999	419	436	72	69	55.2	1051	$160,671,625.00	$630,600,000.00	$791,271,625.00
	2000	363	378	58.5	60	44.9	904	$138,199,000.00	$542,400,000.00	$680,599,000.00
	2001	279	290	45	52	34.5	701	$107,165,375.00	$420,600,000.00	$527,765,375.00
Ontario	1996	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1997	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1998	497	234	84.6	93	22.5	931	$142,326,625.00	$558,600,000.00	$700,926,625.00
	1999	438	210	75.2	83	20	826	$126,274,750.00	$495,600,000.00	$621,874,750.00
	2000	379	185	61.1	73	16.3	714	$109,152,750.00	$428,400,000.00	$537,552,750.00
	2001	292	160	47	64	12.5	576	$88,056,000.00	$345,600,000.00	$433,656,000.00
B.C.	1996	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1997	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1998	194	383	2.8	30	1.4	611	$93,406,625.00	$366,600,000.00	$460,006,625.00
	1999	171	192	2.5	27	1.3	394	$60,232,750.00	$236,400,000.00	$296,632,750.00
	2000	149	115	2	24	1	291	$44,486,625.00	$174,600,000.00	$219,086,625.00
	2001	114	89	1.6	20	0.8	225	$34,396,875.00	$135,000,000.00	$169,396,875.00
Rest of Canada	1996	178	274	6.4	27	3.3	489	$74,755,875.00	$293,400,000.00	$368,155,875.00
	1997	178	274	6.4	27	3.3	489	$74,755,875.00	$293,400,000.00	$368,155,875.00
	1998	152	144	5.8	26	3	331	$50,601,625.00	$198,600,000.00	$249,201,625.00
	1999	134	109	5.2	23	2.6	274	$41,887,750.00	$164,400,000.00	$206,287,750.00
	2000	116	88	4.2	20	2.1	230	$35,161,250.00	$138,000,000.00	$173,161,250.00
	2001	89	70	3.2	18	1.6	182	$27,823,250.00	$109,200,000.00	$137,023,250.00
Canada total	1996	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1997	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1998	1318	1255	174	226	89	3062	$468,103,250.00	$1,837,200,000.00	$2,305,303,250.00
	1999	1162	947	155	202	79	2545	$389,066,875.00	$1,527,000,000.00	$1,916,066,875.00
	2000	1007	766	126	177	64	2140	$327,152,500.00	$1,284,000,000.00	$1,611,152,500.00
	2001	774	609	97	154	49	1683	$257,288,625.00	$1,009,800,000.00	$1,267,088,625.00
						Total 1997-2001	13888	$2,123,128,000.00	$8,332,800,000.00	$10,455,928,000.00

Canada Summary and Incident Costs - Status quo

Parametres

HAART 2 Cost $152,875

Indirect Costs $600,000

		MSM	IDU	Endemic	Het contact MSM / IDU	Het contact Endemic	Total	Total Incident Direct Costs	Total Indirect Costs	Total Direct and Indirect Costs
								$CAN	$CAN	$CAN
Quebec	1996	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1997	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1998	559	552	90	81	69	1351	$206,534,125.00	$810,600,000.00	$1,017,134,125.00
	1999	559	523	90	81	69	1322	$202,100,750.00	$793,200,000.00	$995,300,750.00
	2000	559	494	90	81	69	1293	$197,667,375.00	$775,800,000.00	$973,467,375.00
	2001	559	465	90	81	69	1264	$193,234,000.00	$758,400,000.00	$951,634,000.00
Ontario	1996	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1997	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1998	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1999	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	2000	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	2001	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
B.C.	1996	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1997	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1998	229	1021	3.1	31	1.6	1286	$196,597,250.00	$771,600,000.00	$968,197,250.00
	1999	229	830	3.1	31	1.6	1095	$167,398,125.00	$657,000,000.00	$824,398,125.00
	2000	229	638	3.1	31	1.6	903	$138,046,125.00	$541,800,000.00	$679,846,125.00
	2001	229	511	3.1	31	1.6	776	$118,631,000.00	$465,600,000.00	$584,231,000.00
Rest of Canada	1996	178	2378	6.4	27	3.3	2593	$396,404,875.00	$1,555,800,000.00	$1,952,204,875.00
	1997	178	2378	6.4	27	3.3	2593	$396,404,875.00	$1,555,800,000.00	$1,952,204,875.00
	1998	178	1255	6.4	27	3.3	1470	$224,726,250.00	$882,000,000.00	$1,106,726,250.00
	1999	178	947	6.4	27	3.3	1162	$177,640,750.00	$697,200,000.00	$874,840,750.00
	2000	178	766	6.4	27	3.3	981	$149,970,375.00	$588,600,000.00	$738,570,375.00
	2001	178	609	6.4	27	3.3	824	$125,969,000.00	$494,400,000.00	$620,369,000.00
Canada total	1996	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1997	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1998	1550	2055	194	237	99	4135	$632,138,125.00	$2,481,000,000.00	$3,113,138,125.00
	1999	1550	1807	194	237	99	3887	$594,225,125.00	$2,332,200,000.00	$2,926,425,125.00
	2000	1550	1557	194	237	99	3637	$556,006,375.00	$2,182,200,000.00	$2,738,206,375.00
	2001	1550	1381	194	237	99	3461	$529,100,375.00	$2,076,600,000.00	$2,605,700,375.00
					Total 1997-2001		19578	$2,992,986,750.00	$11,746,800,000.00	$14,739,786,750.00

Canada Summary - Uncontrolled

Parametres

HAART 2 Cost $152,875

Indirect Costs $600,000

		MSM	IDU	Endemic	Het contact MSM / IDU	Het contact Endemic	Total	Total Incident Direct Costs $CAN	Total Indirect Costs $CAN	Total Direct and Indirect Costs $CAN
Quebec	1996	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1997	559	581	90	81	69	1380	$210,967,500.00	$828,000,000.00	$1,038,967,500.00
	1998	670	639	103.5	97	79.4	1589	$210,967,500.00	$953,400,000.00	$1,164,367,500.00
	1999	782	697	117	117	86.3	1799	$242,918,375.00	$1,079,400,000.00	$1,322,318,375.00
	2000	950	784	135	145	96.6	2111	$322,719,125.00	$1,266,600,000.00	$1,589,319,125.00
	2001	1117	871	162	177	110.4	2437	$372,556,375.00	$1,462,200,000.00	$1,834,756,375.00
Ontario	1996	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1997	584	246	94	98	25	1047	$160,060,125.00	$628,200,000.00	$788,260,125.00
	1998	700	468	108.1	117	28.8	1422	$217,388,250.00	$853,200,000.00	$1,070,588,250.00
	1999	817	739	122.2	142	31.3	1852	$283,124,500.00	$1,111,200,000.00	$1,394,324,500.00
	2000	992	1109	141	176	35	2453	$375,002,375.00	$1,471,800,000.00	$1,846,802,375.00
	2001	1167	1479	169.2	215	40	3070	$469,326,250.00	$1,842,000,000.00	$2,311,326,250.00
B.C.	1996	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1997	229	1277	3.1	31	1.6	1542	$235,733,250.00	$925,200,000.00	$1,160,933,250.00
	1998	274	1149	3.6	38	1.8	1466	$224,114,750.00	$879,600,000.00	$1,103,714,750.00
	1999	320	1021	4.1	46	2	1393	$212,954,875.00	$835,800,000.00	$1,048,754,875.00
	2000	389	894	4.7	57	2.2	1347	$205,922,625.00	$808,200,000.00	$1,014,122,625.00
	2001	457	830	5.6	69	2.6	1364	$208,521,500.00	$818,400,000.00	$1,026,921,500.00
Rest of Canada	1996	178	274	6.4	27	3.3	489	$74,755,875.00	$293,400,000.00	$368,155,875.00
	1997	178	274	6.4	27	3.3	489	$74,755,875.00	$293,400,000.00	$368,155,875.00
	1998	214	293	7.4	33	3.8	551	$84,234,125.00	$330,600,000.00	$414,834,125.00
	1999	249	319	8.4	40	4.1	621	$94,935,375.00	$372,600,000.00	$467,535,375.00
	2000	303	362	9.7	49	4.6	728	$111,293,000.00	$436,800,000.00	$548,093,000.00
	2001	356	413	11.6	60	5.3	846	$129,332,250.00	$507,600,000.00	$636,932,250.00
Canada total	1996	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1997	1550	2378	194	237	99	4458	$681,516,750.00	$2,674,800,000.00	$3,356,316,750.00
	1998	1858	2549	223	285	114	5029	$768,808,375.00	$3,017,400,000.00	$3,786,208,375.00
	1999	2168	2776	252	345	124	5665	$866,036,875.00	$3,399,000,000.00	$4,265,036,875.00
	2000	2634	3149	290	427	138	6638	$1,014,784,250.00	$3,982,800,000.00	$4,997,584,250.00
	2001	3097	3593	348	521	158	7717	$1,179,736,375.00	$4,630,200,000.00	$5,809,936,375.00
					Total 1997-2001		29507	$4,510,882,625.00	$17,704,200,000.00	$22,215,082,625.00

Costs Savings		Effective Control vs. Status Quo			Effective vs. Uncontrolled		
		Total Incident Direct Costs Savings	Total Incident Indirect Costs Savings	Total Incident Direct & Indirect Costs Savings	Total Incident Direct Costs Savings	Total Incident Indirect Costs Savings	Total Incident Direct & Indirect Costs Savings
Canada total	1996	C$0	C$0	C$0	C$0	C$0	C$0
	1997	C$0	C$0	C$0	C$0	C$0	C$0
	1998	C$164,034,875	C$643,800,000	C$807,834,875	C$300,705,125	C$1,180,200,000	C$1,480,905,125
	1999	C$205,158,250	C$805,200,000	C$1,010,358,250	C$476,970,000	C$1,872,000,000	C$2,348,970,000
	2000	C$228,853,875	C$898,200,000	C$1,127,053,875	C$687,631,750	C$2,698,800,000	C$3,386,431,750
	2001	C$271,811,750	C$1,066,800,000	C$1,338,611,750	C$922,447,750	C$3,620,400,000	C$4,542,847,750
Total Savings		C$869,858,750	C$3,414,000,000	C$4,283,858,750	C$2,387,754,625	C$9,371,400,000	C$11,759,154,625

Costs Savings		Status Quo vs Uncontrolled		
		Total Incident Direct Costs Savings	Total Incident Indirect Costs Savings	Total Incident Direct & Indirect Costs Savings
Canada total	1996	C$0	C$0	C$0
	1997	C$0	C$0	C$0
	1998	C$136,670,250	C$536,400,000	C$673,070,250
	1999	C$271,811,750	C$1,066,800,000	C$1,338,611,750
	2000	C$458,777,875	C$1,800,600,000	C$2,259,377,875
	2001	C$650,636,000	C$2,553,600,000	C$3,204,236,000
Total Savings		C$1,517,895,875	C$5,957,400,000	C$7,475,295,875

Notes

1 The three most important subgroups, which constitute most heterosexual HIV infections are: heterosexuals from endemic countries; heterosexuals with contact with persons from endemic countries, and heterosexuals with contact with MSM or IDU.

2 Dr. Remis is Associate Professor, Department of Preventive Medicine, University of Toronto. He has worked and published extensively on HIV epidemiology in Canada with a special focus on Quebec and more recently Ontario.

3 In effect, we have created five new incident cohorts, each assigned discounted costs of a full episode.

References

Hanvelt, Robin A. et al. (1994), "Indirect Costs of HIV/AIDS Mortality in Canada," *AIDS* 8(10).

Jager, J. C. and M. L. G. van den Boom (1994), "Scenario Analysis, Health Policy, and Decision Making," in Edward H. Kaplan and Margaret L. Brandeau (eds.), *Modelling the AIDS Epidemic: Planning, Policy, Prediction*, New York: Raven Press.

VI Policy Implications

Introduction

Seven years ago the report card on the HIV/AIDS epidemic would have been impressive. Prevention investments of the 1980s were paying off, and the tide of the epidemic was subsiding. HIV incidence among gay men dropped to half of the 1985 peak incidence and remained fairly flat from 1987 to 1990.

Since 1990, the epidemic has gained ground primarily through a shift into younger and more marginalized populations comprised of injection drug users (IDU), Aboriginals, women and young gay men. The spread in the IDU risk group was in theory predictable, a research paper in the journal *Public Health Reports* in 1988 warned of the "underrecognized potential for a rapid increase in infection ... and a silent explosion of infection among IV drug abusers could occur long before a rise in IV drug-associated AIDS cases became evident" (Dondero et al., 1988). The increase in incidence among young gay men came as a surprise to many. Both groups have two things in common – marginalization and high risk of contracting HIV. Both groups also represent avenues for the spread of HIV into other populations. The prevention needs of both groups were probably addressed too late as evident in the higher levels of incidence reported in this study.

There are lessons to be learned from the lost ground in the fight against the HIV/AIDS epidemic and there can be far-reaching consequences to not acting or not acting appropriately. The design of a third national AIDS strategy offers an opportunity to avoid old pitfalls and move towards a truly integrated strategy that is based on the principles of best practice and *upstream* endeavours. It will be critical to improve upon surveillance in order to provide for pre-emptive strikes at the leading edge of the epidemic. The key message: surveillance and prevention must be as dynamic as the epidemic itself.

Key Findings

The new methods of research used in the National HIV/AIDS Economic Research Initiative coordinated by CPRN have produced a solid base of evidence to support decisions in the next phase of the National AIDS Strategy. Much more will be added once the findings of all the projects commissioned by Health Canada in this initiative are completed in the Spring of 1998. In the meantime, the main findings are the following:

1. *New Trends in the Epidemic*

   The epidemic has increased: HIV is on the rise again and infection is spreading in more marginalized and younger populations. The median age of infection is now 23 and many young Canadians are becoming infected in their teens (LCDC, 1996). HIV prevalence is at an all time high – almost 40,000 people living with HIV/AIDS and the annual number of new infections (incidence) has risen by 33 percent over the past five years from 2,700 to 4,000 (Remis, 1997). Most of this increase (86 percent) stems from the injection drug user and young gay men populations. There is also evidence of an increase among Aboriginals and women.

2. *New Populations Affected*

   The epidemic is spreading to new populations – drug users, Aboriginal people, young gay men, and vulnerable women – people who live at the margins of society. They are hard to reach and

challenge current techniques for monitoring and for preventing the spread of the epidemic. In short, the epidemic has become more complex.

3. *Economic Burden Is Significant*

   The economic burden is rising significantly because the number of cases is increasing, the people infected are living longer, and new therapies are more expensive. The lifetime costs of treating someone living with HIV infection are $153,000. The total tab to date amounts to some $36 billion or about $1,200 per Canadian citizen. Between 1997 and 2001, financial savings in the order of $4 billion are available in moving from the status quo to more effective epidemic control. More importantly, if the epidemic shifts from the status quo to becoming uncontrolled, the cost increases are estimated to be some $7.5 billion over this five-year period.

4. *Productivity Losses and the New Therapies*

   To the extent that the new therapies permit people living with HIV to return to normal patterns of living, the economic burden – in terms of lost productivity and participation in society – is reduced. If HAART treatment increases the period of productive life for those people living with HIV/AIDS by 15 percent, the savings in indirect costs will cover the increased costs of treatment.[1] These indirect costs of HIV/AIDS far outweigh the costs of care and treatment, and prevention.

5. *Economic Burden and the Prevention Response*

   There is a strong economic incentive for investment in HIV prevention and education. Canada invested over $80 million in HIV prevention and education in 1996. Of the $60 million invested by the provinces, territories and municipalities, roughly 29 percent was transferred to community-based AIDS service organizations. At the federal level, Health Canada invested roughly 52 percent of its total HIV prevention and education funds at the community-based level. Canada invested roughly $2,044 per person living with HIV compared to $3,897 in Britain and $1,300 in the United States.

6. *Canada in an International Context*

   Control of an HIV epidemic is not just a pipe dream. Britain, for example, has made a solid, ongoing commitment to prevention over time. It spends much more per prevalent case on prevention than does Canada, but the result seems to be a much smaller epidemic – 48 people living with HIV/AIDS per 100,000 population compared to 129 per 100,000 in Canada. Success in preventing infections reduces total investment in care and treatment, as well as the suffering and productivity losses when relatively young people die.

   The United States provides the opposite example. Its investments in prevention and education per prevalent case are less than Canada's, and the epidemic there is twice the size of Canada's, at 270 per 100,000 population.

   Investing in well-targeted prevention interventions that have strong links to a well-structured surveillance network could contribute to achieving effective epidemic control and savings in the order of some $4 billion over the next five years. Upfront investments in HIV prevention are required to achieve this potential pay back.

These findings lead to two sets of conclusions that are highly relevant to the National AIDS Strategy, which will begin in 1998-99. That strategy will have to include initiatives with respect to clinical research and the ongoing care and treatment of people with HIV, in order to build the knowledge base required to find the cure and improve care. But, if Canada is to regain control of the HIV epidemic, it will have to move on two fronts.

- First, the National Strategy must significantly improve the techniques for monitoring an epidemic that is largely hidden from view.

- Second, the National Strategy must give a much higher priority (in money and leadership) to needs-based investment in prevention and education, targeting the marginalized populations that are now so vulnerable to infection.

In both cases, governments, communities, and society are confronting the complex challenge of reaching out to people living on the margins of society. For the most part, these are people who do not hear or read the messages from mainstream society, and when they do, they reject these messages out of distrust or a sense of hopelessness.

The Policy Context

> *Sometimes it feels like this. There I am standing by the shore of a swiftly flowing river and I hear the cry of a drowning man. So I jump into the river, put my arms around him, pull him to shore and apply artificial respiration. Just when he begins to breathe, there is another cry for help. So I jump into the river, reach him, pull him to shore, apply artificial respiration, and then just as he begins to breathe, another cry for help. So back into the river again, reaching, pulling, applying, breathing and then another yell. Again and again, without end, goes the sequence. You know, I am so busy jumping in, pulling them to shore, applying artificial respiration, that I have no time to see who the hell is upstream pushing them all in* (McKinlay, 1990).

Canadian society has experienced substantial socio-economic change over the last five to seven years. The combination of new technologies and global competition has polarized the labour market into good jobs and bad jobs, and cutbacks in the social safety net have pushed more people to the margins of society (Betcherman and Lowe, 1997; Maxwell, 1996). In general, there are fewer social buffers and the bridges to a better life are lacking for many.

Canadians are alarmed at this polarization – forcing governments to give a higher priority to addressing child poverty and youth unemployment, for example. The current challenges in containing the HIV/AIDS epidemic are very much tied to poverty and lack of hope among marginalized groups in society – especially vulnerable women and young people. The risk of becoming HIV infected is only one of several risks to "well-being" for this disenfranchised population, which faces risks such as addiction, homelessness, unemployment, violence, crime, and so on.

The links between socio-economic status and health are more than a matter of ideology and speculation. Research from Manitoba has demonstrated that those regions whose residents were in the poorest health score the most poorly on indicators of socio-economic risk (Cohen and MacWilliam, 1995). Low dwelling value; unemployment at all ages; lack of high school completion at all ages; and female-headed single-parent families all increase the risk of poor health. The residents of these regions have good access to health care. Much of the variation in health status can be explained by a few socio-economic factors (Mustard and Frohlich, 1995).

Socio-economic indicators are also predictive of risk for infectious disease including HIV infection. An investigation into the behaviour of HIV-negative gay men identified that risk takers were both younger and had lower incomes than non-risk takers in the study (Hogg et al., 1993). In Quebec, HIV-infected mothers reside in regions with revenue indexes below the Quebec provincial median (Hankins et al., 1990). Within the HIV-infected population, socio-economic status prior to infection is a predictor of the rate of disease progression and survival (Schecter et al., 1994; Hogg et al., 1994). For example, HIV-positive gay men with incomes less than $10,000 annually expe-rienced significant weight loss, as a pre-AIDS defining condition, significantly faster than their richer counterparts (Voight, 1994). In short, scoring poorly on indicators of socio-economic risk has not only put subpopulations at greater risk for HIV infection but can also accelerate the rate at which these individuals will become sick and die after infection.

Success in controlling the current wave of the epidemic will have to focus on all the social and economic factors that determine the health of these subpopulations. The ideal policy framework will require an integrated approach by a large number of government agencies (across agencies and across jurisdictions) and community-based organizations. Better coordination would mitigate situations where some government departments develop policies that confound the efforts of others. A prime example is the tension between the criminal justice system and departments of health with respect to injection drug use. Needle exchange programs are directed at reducing the risk of HIV transmission among drug users. Because the use of these needles to inject illicit drugs is a criminal offence, law enforcement officers sometimes pursue clients of needle exchange programs, often driving them away from a risk reduction service.[2]

A first step towards a new strategy for HIV/AIDS will be to better understand the organizational barriers to implementing population health. As Greg Stoddart (1996) says, "New policy partnerships and coalitions will need to be developed." He goes on to point out that departments apply their knowledge of the determinants of health "vertically" to their own policy sector and thereby miss the horizontal linkages needed for effective policy.

The Federal-Provincial-Territorial (FPT) Committee apparatus functioning under the Conference of Ministers of Health has served as a coordinating mechanism for health issues within the ambit of departments of health (some of which also deal with social and community services). The problem is, however, that population health issues like HIV/AIDS are not and cannot be the sole responsibility of ministries of health. Thus the FPT Advisory Committee on HIV/AIDS should include representatives from justice, housing, education and employment, at a minimum.

The role of governments is in setting the policy frameworks, monitoring progress and funding and delivering both treatment and prevention. But interventions on the ground critically depend on community organizations. Community interventions have been shown to be highly effective at reaching people at high risk of becoming HIV infected. Most of these organizations emerged as the gay community mobilized to deal with the first and second waves of the epidemic in the 1980s. They have been remarkably effective in looking after their own, but if they are going to remain at the leading edge, they will have to find ways to serve the injection drug users, the youth, the poor women and Aboriginal people who are caught in the third wave of the epidemic. Governments must monitor the response of the existing AIDS service organizations and determine whether and where they need to promote the development of new community-based infrastructures to reach the most vulnerable population groups.

New Surveillance Networks Are Needed

Clearly, there is a critical need to stay as close as possible to the leading edge of this elusive epidemic. What best practices can be defined and operationalized to assist in this effort? One possibility lies in the development of a formal and strategic national sentinel surveillance system (i.e., an early warning system). Sentinel is defined as "a person stationed to keep watch and guard against surprise attack" (Gage Canadian Dictionary, 1983).

Surveillance is currently performed at the national, provincial and regional levels through several mechanisms and techniques.[3] While much information and intelligence is shared, it is not done in a systematic nor integrated fashion. Dondero et al. (1988) note that,

> For monitoring the levels and trends of a condition such as HIV infection, which is not routinely or completely ascertained, quality information collected under standardized conditions in a limited number of places is preferable to information collected haphazardly everywhere.

Examples of sentinels relevant to the current epidemic in Canada would include: select hospitals,

women's health clinics, addiction treatment centres, homeless shelters, food banks and free-meal locations, needle exchange programs, physician HIV practices, Aboriginal reserves, prisons and HIV testing sites. As well, monitoring the results of other related HIV studies would contribute further to staying at the leading edge of the epidemic. For example, two studies currently underway through the National HIV/AIDS Economic Research Initiative have discovered striking insights into the level of the epidemic in the Aboriginal community.[4] Studies following cohorts of risk populations would also be considered key sentinels. It is critical to note that surveillance should respect the well-established privacy, confidentiality and human rights policies in Canada.

Many of the necessary sentinel sites currently exist but are not formally integrated into a strategic national surveillance framework. Ultimately, this organized series of sentinel sites would form a network to support highly effective surveillance that will inform decisions about timely and well-targeted prevention policies, programs and interventions. Creating this network should be a primary goal for the next phase of the national AIDS strategy.

HIV Prevention: The Need for Best Practices

Greg Stoddart (1996) has observed that

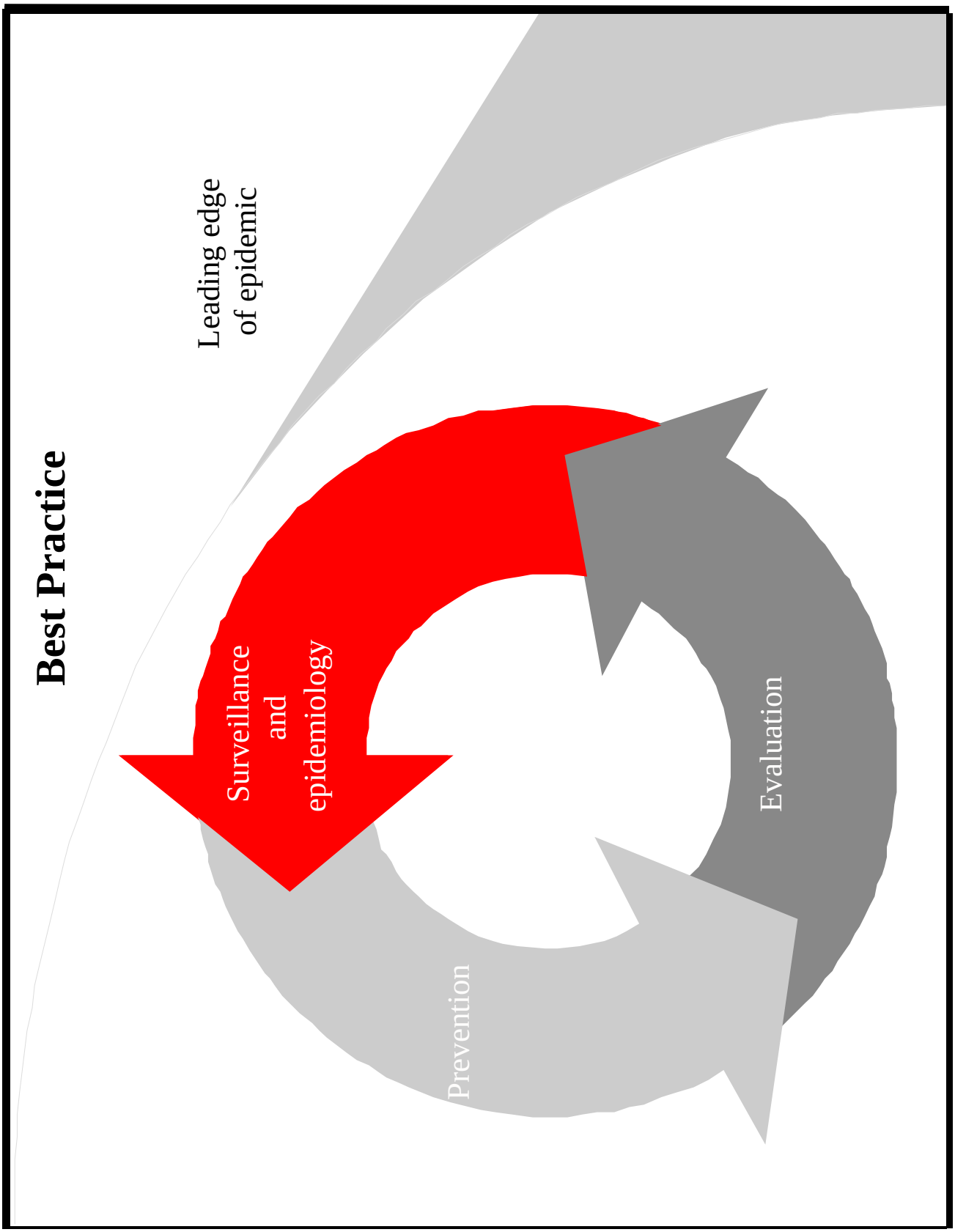
> Specific policies, however, come not from frameworks but from evidence about which interventions work well for different targets and in different groups. At this level of detail, our knowledge of effective interventions appears to lag behind our knowledge of determinants.

As far as HIV prevention interventions are concerned, knowledge of effectiveness is very limited. The HIV/AIDS epidemic has pushed the limits of existing capacity to respond and, at times, it is necessary to move quickly based on very little information and evidence. Hence prevention practice has advanced much faster than the evaluation research surrounding these practices. Governments have a responsibility to invest on two fronts: prevention programs and research that will shed light on what programs work best and why, and what does not work and why.

The main objective now is to identify the principal attributes of best practice in order to ensure that the resources available for HIV prevention will be used to maximize the number of infections averted.

Best practice should occur within a surveillance-response-evaluation cycle (see the figure on Best Practice) responding to the dynamics of the epidemic. Surveillance intelligence can inform the prevention response and allow for the design and delivery of timely interventions before "the horse is out of the barn." It will allow for the location and containment of the "burning embers" of the epidemic so that it does not flare up into a raging and uncontrollable forest fire. The best-practice model shows that for high-risk populations, the number of infections prevented is maximized when prevention is targeted early or at a time of low HIV prevalence in the population in question (Kahn, 1996).

There is an urgent need to identify best practices in targeting prevention programs at the hard-to-reach populations who are most vulnerable to this epidemic. Governments and community organizations need to know what are the optimal methods, designs and structures for delivering and supporting HIV prevention services. Much can be learned from the success in prevention programs that persuaded gay men to change their behaviours in the 1980s, from the rich experiences developed by the AIDS service organizations that sprang up in every major community across the country during the 1980s, and from international successes. In many cases, these same organizations may be well placed to reach one or more of these groups: young gay men, drug users, street people, Aboriginal people and vulnerable women. In other cases, however, it may be necessary to foster the development of new kinds of community-based organizations to reach these groups.


Best Practice
Leading edge of epidemic
Surveillance and epidemiology
Evaluation
Prevention

At the same time, the lessons learned from population health literature suggest that many of the most successful interventions will be at the "community level":

> A community-level intervention is an intervention organized to modify the entire community through community organization and activation, as distinct from interventions that are simply community-based, which may attempt to modify individual behaviours. (Patrick and Wickizer, 1995, cited in Lomas, 1997.)

The distinction between community-level and community-based is important. It is clear that the first-order buffers against HIV infection are a safe home, a job, and an education. When young people lack those buffers, they drift to the streets, and begin to engage in risky behaviours. The second-order buffers, then, are likely to be youth-service supports that offer safe housing, mentoring, drug addiction programs, a chance to get into a training program, complete their education, and/or to find a job. While individual community organizations can and do offer one or more of these buffers, it will take a community-level commitment to ensure that young people drifting to the streets are aware that such options exist and are encouraged to try them out.

The third-order buffers are the programs aimed at people who have already committed to risky behaviours in terms of drug use and sexual activity. These programs are aimed at harm reduction, but they do not in any way alter the tendency to take risks in the first place: they offer clean needles to drug users and condoms to those who engage in risky sexual activity.

Health Canada has commissioned CPRN to undertake a number of economic research projects on prevention interventions to be completed in the spring of 1998. These projects will add to the limited existing knowledge base, but they are only the first stage of an intensive effort to think through the best ways to target vulnerable groups and to begin to establish best practices.

At this early stage, the major steps to include in the prevention segment of the National AIDS Strategy are:

1. A commitment to build careful evaluation into all prevention programs, so that the successful ones are emphasized and the ones that do not work are eliminated. In addition, the key factors leading to success should be well documented and publicized so that they will shape the design of prevention programs across all jurisdictions and all types of government agencies.

2. A commitment to open up a dialogue with all the health and social service agencies that understand, have access to, and are likely to encounter the vulnerable groups, in order to discover how best to mobilize their resources to prevent the spread of HIV infection.

3. A commitment to explore with existing AIDS service organizations, many of which have a historical connection to the gay community, the degree to which they are able to use their existing infrastructure to serve the needs of the new target groups.

4. A commitment to work with youth-serving agencies in all types of government departments at all levels of government to think through the kinds of community-level strategies that would offer young people drifting to the streets alternatives to life on the margins. What many of them need most is hope – a chance to escape marginalization.

Concluding Comments

The economic analysis presented in this report shows that Canada has once again lost effective control of the HIV/AIDS epidemic, that the direct health care costs (excluding indirect costs) of the epidemic are already in the range of $570 million a year, and that the leading edge of the epidemic is largely hidden from view. Nevertheless, there is good reason to hope that the epidemic can be controlled. To regain control, it will be essential to do three

things: 1) make an unwavering commitment to better surveillance through a formal network of sentinel observers; 2) give a much higher priority to prevention and education that is rooted in best practice; and 3) ensure a close linkage between surveillance and the prevention response.

HIV infection is a life-shattering event – wherever it hits. In its new metamorphosis, the epidemic attacks, for the most part, young people who are already feeling down and out. As long as the epidemic thrives among these marginalized people, there is a risk that it will spread to others who are also marginalized and, through them, to those in the mainstream. There is, as yet, no cure and the epidemic remains a current and long-term threat to the well-being of Canadian society and to the sustainability of its health care system. But this is a disease that is preventable – one hundred percent preventable.

Notes

1 Physicians participating in the clinical Delphi session convened by CPRN for the purposes of this study suggested that, based on their initial experience with HAART, about 20 percent of their patient population would become well enough to return to work.

2 As well, governments are reluctant to embrace innovative prevention approaches such as the creation of controlled injection centres (sometimes referred to as shooting galleries), which would ensure safer injection practices. These are difficult decisions that often boil down to choosing "the lesser of two evils."

3 For example, HIV testing centres provide data for surveillance. Back-calculation is a technique that uses AIDS data to provide insights into the historical directions of the epidemic.

4 Dr. Robin Hanvelt and his research team at the BC Centre for Excellence in HIV/AIDS recruited a significant cohort of Aboriginals to the Community Health Resource Project in Vancouver. Dr. Philip Jacobs and his research team (located at the Streetworks Program in Edmonton) conducted interviews from the back of a needle exchange van and discovered that two-thirds of those interviewed were Aboriginal.

References

Betcherman, Gordon and Graham S. Lowe (1997), *The Future of Work in Canada – A Synthesis Report*, Ottawa: Canadian Policy Research Networks Inc.

Cohen, Marsha M. and Leonard MacWilliam (1995), "Measuring the Health of the Population," *Medical Care* 33(12) (Supplement, December): DS21-DS42.

Dondero, Timothy J. et al. (1988), "Monitoring the Levels and Trends of HIV Infection: The Public Health Service's HIV Surveillance Program," *Public Health Reports* 103(3):213-20.

Hankins, Catherine et al. (1990), "HIV Infection among Quebec Women Giving Birth to Live Infants," *Journal of the Canadian Medical Association* 143(9).

Hogg, R. et al. (1993), "Sociodemographic Correlates for Risk-taking Behaviour among HIV Seronegative Men," *Canadian Journal of Public Health* 84(6).

___ (1994), *Lower Socioeconomic Status and Shorter Survival Following HIV Infection*, Vancouver: BC Centre for Excellence in HIV/AIDS.

Kahn, James G. (1996), "The Cost-Effectiveness of HIV Prevention Targeting: How Much More Bang for the Buck?," *American Journal of Public Health* 86(12): 1709-12.

Laboratory Centre for Disease Control (LCDC) (1996), *Epi Update*, Bureau of HIV/AIDS and STD, Health Protection Branch, Ottawa: Health Canada.

Maxwell, Judith (1996), *Social Dimensions of Economic Growth*, The Eric Hanson Memorial Lecture Series, Volume VIII, Department of Economics, Edmonton: University of Alberta.

McKinlay, John B. (1990), "A Case for Refocussing Upstream: The Political Economy of Illness," in P. Conrad and R. Kern (eds.), *The Sociology of Health and Illness: Critical Perspectives*, 3rd edition, New York: St. Martins Press.

Mustard, Cameron A. and Norman Frohlich (1995), "Socioeconomic Status and the Health of the Population," *Medical Care* 33(12) (Supplement, December): DS43-DS54.

Patrick, D. L. and T. M. Wickizer (1995), "Community and Health," in Amick B. C. et al. (eds.), *Society and Health*, New York: Oxford University Press. Cited in Jonathon Lomas (1997), *Social Capital and Health: Implications for Public Health and Epidemiology*, Working Paper 97-6, Centre for Health Economics and Policy Analysis, Hamilton: McMaster University.

Remis, Robert (1997), "Modelled Estimates of the Plausible Limits of HIV Incidence and Prevalence: 1978-1996," developed in collaboration with CPRN for inclusion in The Economic Burden of HIV/AIDS in Canada (unpublished).

Schecter, Martin T. et al. (1994), "Higher Socioeconomic Status Is Associated with Slower Progression of HIV Infection Independent of Access to Health Care," *Journal of Clinical Epidemiology* 47:59-67.

Stoddart, Greg L. (1996), *The Challenge of Producing Health in Modern Economics*, Working Paper No. 46, CIAR Program in Population Health, Toronto: The Canadian Institute for Advanced Research.

Voight, Robert (1994), *Socioeconomic Characteristics Are Associated with Rate of Weight Loss in Homosexual Men*, Vancouver: BC Centre for Excellence in HIV/AIDS.

CPRN Funding Sources

CPRN projects are funded by a mix of federal, provincial, foundation and corporate sponsors.

CPRN Core Funders

- Canadian International Development Agency
- Citizenship and Immigration
- Environment Canada
- Fisheries and Oceans
- Health Canada
- Human Resources Development Canada
- Public Works and Government Services Canada (1998-2000)
- Transport Canada

CPRN Funding Sponsor

- The Royal Bank of Canada

CPRN Funding Supporters

- Hongkong Bank of Canada
- IPSCO Inc.
- The Mutual Group
- NOVA Corporation
- Power Corporation of Canada
- Scotiabank
- Sun Life Assurance Company of Canada
- The Toronto-Dominion Bank

Health Network Sponsor

- Max Bell Foundation

Project Funder

- Health Canada