

## Abstract

The Canadian Immigration and Refugee Protection Act of 2001 outlines conditions under which individuals may be granted or denied admission to Canada. The Act stipulates that applications for residence will be rejected if their health is expected to generate excessive demand on Canadian health or social services. The purpose of this paper is to derive a statistical definition of excessive demand and to apply that threshold to persons with HIV who are seeking admission to Canada. The paper demonstrates that the current threshold used by Citizenship and Immigration Canada is much lower than the thresholds that may be derived statistically.

**Key Words** economic burden of disease, health economics, HIV/AIDS, immigration policy

## When Does an Immigrant with HIV Represent an Excessive Demand on Canadian Health or Social Services?

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### Introduction

In 2005, the *Canada Communicable Disease Report* estimated that 58,000 people in Canada were living with HIV. [1] During that year it was estimated that between 2,300 and 4,600 new cases of HIV emerged, with the incidence rate relatively uniform since 2002.[2] The number of people worldwide living with HIV is approximately 33 million and increasing.[3] As the world HIV population expands, there is expected to be an increase in the number of HIV-positive immigrants applying for entry to Canada,[4] and accord-

ingly, it is important to critically review federal immigration policies that affect such applicants.

The *Canadian Immigration and Refugee Protection Act* (IRPA) states in Section 38(1) that:

A foreign national is inadmissible on health grounds if their health condition:

- (a) is likely to be a danger to public health;
- (b) is likely to be a danger to public safety; or
- (c) might reasonably be expected to cause excessive demand on health or social services.

While IRPA does not specifically mention HIV or related illnesses, Canada generally excludes people infected with HIV if they can be expected to place an “excessive demand” on publicly funded health or social services. It is important to note that entry restrictions to Canada based on HIV status do not apply to short-term visitors staying for less than six months.[5] This is indicative of the underlying assumption that HIV is not highly contagious and therefore is not reason in itself for a person to be denied entry to Canada. The extent to which an immigrant is likely to place an excessive

burden on the health care system is indicated as the primary concern and is evaluated based on whether an applicant's projected annual health care costs would exceed the annual health care costs of an average Canadian,[4] which in 2007 was \$4,867.40.[6] It is not specified what constitutes an 'average' Canadian, given the large within-group variation that exists among the general population, but it is likely that an HIV-positive person receiving antiretroviral treatment will incur expenses that exceed that threshold. While the law has resulted in denial of admission due to "excessive burden" to only 3.4% of all HIV-positive applicants between 2006 and 2007 (i.e. 36 of 1,050), the overwhelming majority of the HIV-positive applicants (94.7% or 994 of 1,050) were exempt from this condition as they were admitted as spouses or legal dependents under family-class sponsorship or as officially recognized refugees. Consequently, 64.3% of those HIV-positive applicants (i.e. 36 of 56) who were at potential risk of denial of admission due to the potential "excessive burden" attributable to their HIV status were denied admission between 2006 and 2007.

The purpose of this paper is twofold: first, to review the application of Canadian immigration law and jurisprudence as it pertains to persons with HIV and to place this review within a broader international context of restrictions on international mobility; and second, to derive a statistical definition of excessive demand and to apply that threshold to persons with HIV who are seeking admission to Canada. In Section 2.0, we review the application of Canadian immigration law as it pertains to persons with HIV. In Section 3.0, we review and assess the current threshold used to determine excessive demand on Canadian health or social services. Section 4.0 yields a synthesis of the clinical, epidemiological and economics literatures concerning the expected burden placed on health or social services by persons with HIV. In Section 5.0, we derive estimates of the economic burden of a new immigrant with HIV after stratifying for their underlying health state, age and sex at the time of admission. Section 6.0 affords a comparison between the thresholds derived to measure excessive demand with the expected economic burden that immigrants with HIV may place on Canadian health or social services in order to yield evidence-informed criteria for the determination of medical inadmissibility. We conclude with a brief summary of our findings.

### **Canadian and international experience with medical inadmissibility**

While international standards do not prohibit the practice of screening prospective immigrants for communicable dis-

eases prior to entry, the scope of restrictions on people with HIV is strictly constrained. According to the International Guidelines on HIV and Human Rights:

The right to liberty of movement encompasses the rights of everyone lawfully within a territory of a State to liberty of movement within that State and the freedom to choose his/her residence, as well as the rights of nationals to enter and leave their own country.... Where States prohibit people living with HIV from longer-term residency due to concerns about economic costs, States should not single out HIV, as opposed to comparable conditions, for such treatment and should establish that such costs would indeed be incurred in the case of the individual alien seeking residency.[7]

In the United Kingdom, Australia and the United States, it is common to deny admission to prospective immigrants with HIV. In the United Kingdom, denial of admission to HIV-positive immigration applicants has occurred on the basis that required treatments may be too expensive for the applicant to afford.[8] While a publicly funded National Health Service (NHS) allows citizens of the United Kingdom to seek health care treatment at minimal individual cost, the UK's immigration practice has been to stringently enforce its policy of medical inadmissibility to deter persons with HIV from engaging in 'treatment tourism'.[9]

In Australia, travelers wishing to stay temporarily in the country for short visits may do so but are required to sign a declaration of good health, or otherwise state the health problems with which they are currently living.[8] Based on the information provided, a person may be deemed inadmissible for even a temporary visit, although such cases are typically reserved for severe circumstances. In order to immigrate to Australia, each applicant must undergo HIV testing and if it is suspected that the cost of health care treatment will be excessive, or will subsequently deny Australian citizens access to limited health care resources, an applicant may be denied admission.[8]

In the United States, no person with HIV, in principle, may be admitted to the country as an immigrant.[8] Under exceptional circumstances a person may be admitted temporarily (30 days or less) to visit family, seek medical treatment or to conduct business.[8] While admission to the United States does not require one to undergo a medical examination, it is important to note that if a foreign national knowingly declares that he or she is HIV-negative and is found to have HIV in the United States after arrival, that person will be deported to his or her country of origin.[8]

Such strict international migration policies are not the global

standard, however, as in both Denmark and Sweden there are few entry restrictions for HIV-positive persons.[8] Many Western countries have denied medical treatment to persons with HIV who are often from countries in which access to antiretroviral (ARV) treatment is not readily available.[10] Further, the incidences of deportation which have been noted in both the United States and the United Kingdom,[11] on the grounds that HIV-positive persons tend to place excessive demands on health care services, has been questioned on the basis of health as a human right, while the act of deportation itself has been deplored as 'immoral'[9] and 'unjustifiable'.[11]

The financial burden of HIV on the general population is evaluated at the level of the individual and is typically based on a metric involving the calculation of hospitalization costs, ARV and drug treatment expenses as well as the use of other health care services.[11] In a 2001 study conducted by Chen et al.,[12] concerning the per capita costs of HIV based on medication and hospitalization expenditures in the United States, it was found that disbursements for highly active ARV therapy were relatively constant at \$10,500 USD across all CD4 cell count strata. However, patients with CD4 cell counts less than 50 cells/mm<sup>3</sup> incurred costs that were 2.6 times greater than the total annual expenditures of patients with CD4 cell counts less than 350 cells/mm<sup>3</sup>. [12] The study concluded that an increase in disease severity was positively correlated with increased health care costs.[12] The implications of this finding suggest that the use of health care services by persons with HIV increases over time and needs to be considered in the evaluation of applicants seeking to migrate to countries such as Canada. At present, Citizenship and Immigration Canada (CIC) uses an Operational Processing Instruction manual to assess the eligibility of HIV-positive applicants that may enter Canada. The manual indicates that certain applicants may be Excessive Demand Exempt (EDE), according to Section 38(2) of the IRPA, in cases where one,

- (a) has been determined to be a member of the family class and to be the spouse, common-law partner or child of a sponsor within the meaning of the regulations;
- (b) has applied for a permanent resident visa as a Convention refugee or a person in similar circumstances;
- (c) is a protected person; or
- (d) is, where prescribed by the regulations, the spouse, common-law partner, child or other family member of a foreign national [...]

Such applicants, as defined above, are assessed for entry based on whether or not they present a threat to public health or safety. Problematically, it is not clear from the IRPA

guidelines what may constitute a public health or safety threat. Moreover, non-EDE applicants must undergo testing to determine their CD4 cell count. If the test indicates that an applicant has a CD4 cell count below 350 cells/mm<sup>3</sup>, ARVs are required based on Canadian guidelines.[13] In such cases, an applicant is said to represent an excessive demand irrespective of the source of finance for such mediations.[13] The interpretation of excessive demand also includes those who may in the future require ARVs to mitigate the progression of the disease, substantially decreasing the possibility that any HIV-positive person would be found admissible without a separate claim to entry under family-class sponsorship or as a refugee.[4]

While the cost of ARVs may be a long-term financial burden on the Canadian public health care system, the results of sustained ARV treatment have led to a decrease in the frequency and duration of hospitalizations by HIV-positive persons.[14] In addition, the methods used by CIC to determine whether an applicant represents an excessive burden fail to account for the productivity that any given person might generate within Canada after immigrating.[10] As CIC has affirmed, immigration plays "an increasingly important role in supporting Canada's economic prosperity and competitiveness" and immigration is "a key source of labour force growth in the future." [15] Indeed, immigrants arriving in Canada between 1991 and 2001 represented 70 percent of the decade's total net labour force growth, and notably accounted for 24 percent of the labour force growth of the health and social services sector during that period.[16] Moreover, immigration makes an enormous contribution to the pool of people in Canada with post-secondary qualifications. In 2006, among new immigrants 15 years of age and over, almost 42 % of economic immigrants to Canada held a university degree and a further 15.5% held some other form of post-secondary credentials such as a non-university diploma or trade certificate.[17] Therefore, the relative contribution of HIV-positive individuals to Canadian society needs to be evaluated in addition to the health care costs he or she may accrue in managing the progression of HIV in order to yield a comprehensive assessment of net cost (or net benefit) associated with each immigration applicant.

Furthermore, on October 21st, 2005, in a landmark decision made by the Supreme Court of Canada in the cases of *Hilewitz v. Minister of Citizenship and Immigration* and *de Jong v. Minister of Citizenship and Immigration*, it was decided that persons with disabilities could contribute valuably to Canadian society.[18] Supreme Court Justice Abella wrote the majority decision in which CIC was directed to evaluate

immigration applications on an individualized basis, so as to incorporate into admissibility decision-making schemes the ability of each applicant to invest personal resources of time, money, and social support to sustain the livelihood of themselves or family members with disabilities.[18] The Supreme Court decision validated the concern that an objective metric for evaluating the eligibility of a prospective immigrant fails to account for important individualized circumstances, and it acknowledged the legitimate claim that an applicant's individual resources may offset the costs that would otherwise mean he or she would place an excessive burden on public costs in Canada. The *Hilewitz* decision concerned excessive demand in relation to social services; to date, no official court ruling has been made to extend the reasoning behind the *Hilewitz* decision to the context of health care services in Canada.

In sum, the literature suggests that fair treatment of people with HIV requires evidence-based policies at home and abroad. Immigration policies for persons with HIV will become increasingly important as legal, political and humanitarian concepts of access to health care services evolve. Presently, Canadian federal immigration policies reflect somewhat arbitrary and rigid standards for determining excessive demand for persons with HIV. These assessments are conducted without individualized assessments of those who are not exempt from IRPA's medical inadmissibility clause. Whether or not such standards serve to protect the Canadian health care system and the citizens of Canada has yet to be affirmed, given: the positive contributions HIV-positive persons may make to Canada; and the possibility that applicants' private financial and social resources may reduce their relative demand on publicly financed health care services.

### **Threshold for excessive demand on Canadian health or social services**

The current threshold used to determine excessive demand on Canadian health or social services is assessed in this section in light of Canadian health expenditure characteristics.

Although the provision of health care is a provincial concern in Canada, the federal government has influenced the development of policy. Since January 1, 1971, all ten provinces and the territories have had public health insurance plans covering all necessary medical and hospital services. Since the federal government covers a substantial portion of all health expenditures, it has been able to establish certain criteria that the provinces and territories must meet if they were to qualify for their full share of federal transfers. Reasonable access by all residents to the full range of insured services

without financial impediments to utilization captures the essence of the federal funding criteria.[19]

In 2007, average per capita Canadian health care expenditures were \$4,867.40.[6] These expenditures included various categories of health service expenditures whether financed publicly or privately. While the public share accounts (in 2007) for 70.6% of total expenditures, most services are delivered privately. For example, physicians are generally self-employed, but reimbursed by provincial health insurance plans on a fee-for-service basis; while hospitals, which are owned and operated on a not-for-profit basis by various organizations, receive prospective global budgets from provincial governments to finance ambulatory and inpatient services.

To assess whether a potential immigrant represents an "excessive" demand on Canadian health or social services, a threshold is required as stipulated in the legislation. Current practice by CIC has been to set the annual cost threshold at approximately the same value as that for average per capita Canadian health care expenditures. However, that threshold is arbitrary and may be shown to be neither a reasonable nor statistically appropriate interpretation of the term "excessive" demand used in IRPA.

We propose that "excessive" demand on Canadian health or social services be defined as a cost profile for a prospective immigrant that is *statistically greater* than that for Canadians. To establish this "excessive" demand threshold, a statistical test is used to determine how large costs need to be before a prospective immigrant "might reasonably be expected to cause "excessive" demand on health or social services" in accordance with Section 38(1) of the *Canadian Immigration and Refugee Protection Act* (IRPA) of 2001.

To operationalize this statistical test, the distribution of Canadian health care costs, the cost profile of a prospective immigrant, and the level of statistical significance all need to be established. Once acquired, tests may then be performed to assess whether the expected health care cost experience of an immigration applicant is the same as or is greater than that for Canadians. Specifically, a statistical test is constructed to determine how large costs might need to be before a prospective immigrant's cost profile is deemed to be "excessive", i.e. statistically different from that for a representative Canadian.

While average per capita health expenditures in Canada in 2007 were \$4,867.40, there is a paucity of data on the distribution of such costs across all Canadians. It may be convenient to hypothesize that health care costs follow a normal (or bell-shaped) distribution; however, experience

suggests that health care costs are non-negative and positively skewed, i.e. skewed towards the high end. A distribution that is consistent with such costs (i.e. non-negative and positively skewed) is a Gamma distribution. This distribution has been used previously in modeling health care costs,[20-23] and it is relatively simple to describe because it is defined in terms of scale and shape factors. These factors are the ratio of the variance of costs to average costs ( $s^2/\mu$ ) and the ratio of squared average cost to the variance of costs ( $\mu^2/s^2$ ), respectively. Consequently, the Gamma distribution is essentially based on two parameters: average costs; and the relative variance in costs (i.e. the coefficient of variation which is defined as the ratio of the standard deviation of costs to its mean,  $s/\mu$ ). A low relative variance yields cost observations concentrated around average costs, while observations are more dispersed when the relative variance is high.

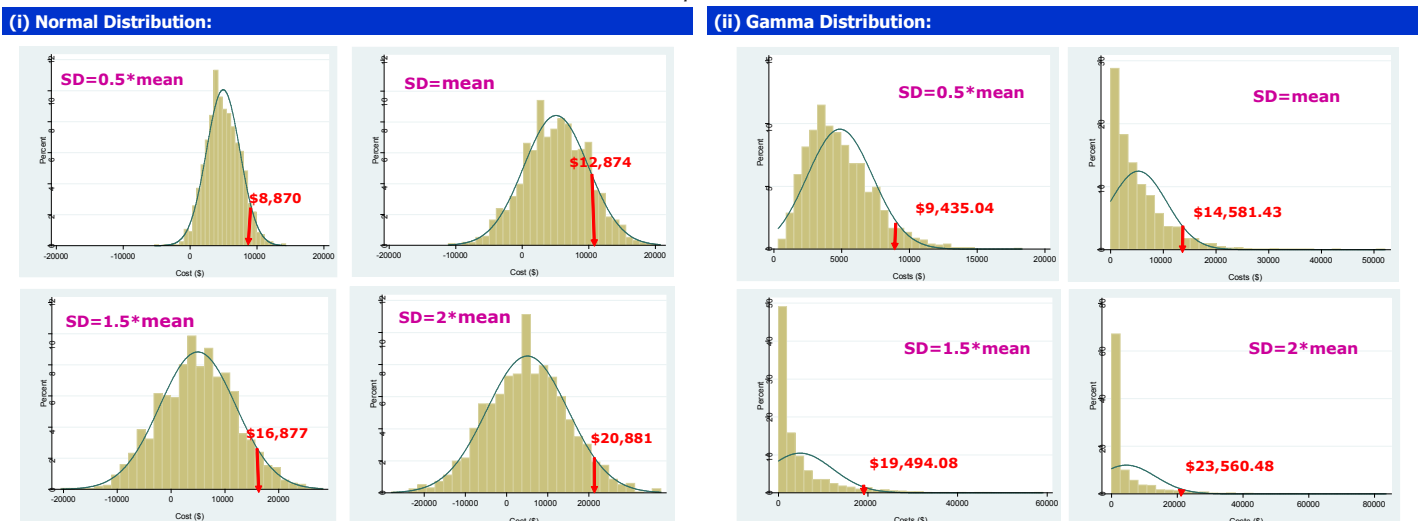
Once the cost distribution for Canadians and for a prospective immigrant have been established, the level of statistical significance used to test the null hypothesis that a prospective immigrant exhibits a cost profile that is the same as that for Canadians against the alternative that such costs are **greater** than those for Canadians needs to be established. While it is conventional in the research literature to use a 5% significance level (i.e. Fisher, 1925),[24] this level of significance is discretionary and depends on the confidence warranted in the test. Use of a 5% significance level implies that the statistical test correctly rejects the null hypothesis that a prospective immigrant has the same cost distribution as a Canadian 95% of the time. A less stringent requirement to be correct (i.e. only 90%) yields a significance level of 10%, while a more stringent requirement to be correct (i.e. 98%) yields a significance level of 2%. A less stringent require-

ment increases the chance that the null hypothesis is rejected when a prospective immigrant has the same cost distribution as a Canadian. Based on the distribution of costs for Canadians and for a prospective immigrant, the significance level invoked yields a unique “excessive” demand threshold as shown in Figures 1(i) and 1(ii).

Figures 1(i) and 1(ii) represent two sets of simulated distributions of Canadian health care expenditures when we know average per capita health care expenditures, but where assumptions are made about both their relative variance and proposed distribution. Figure 1(i) represents four possible normal (or bell-shaped) distributions for Canadian health care costs, while Figure 1(ii) offers equivalent Gamma distributions. The solid curves represent continuous probability density functions, while the bar charts represent the proportion of observations that fall within various intervals. The simulated distributions of health care costs become more dispersed when the relative variance increases from 0.5 to 2.0. The solid vertical lines represent the threshold of health care costs experienced by 5% or fewer Canadians. These upper values of health care costs are equivalent to the threshold used in hypothesis testing when a 5% significance level is considered. Moreover, these thresholds increase as the relative variance of costs increase.

Annual cost thresholds for excessive demand are reported in Table 1. These thresholds are dependent on the assumed cost distribution (normal or gamma), the relative variance of such costs (0, 0.5, 1, 1.5, or 2), and the significance level used to test the null hypothesis that an immigration applicant exhibits a cost profile that is the same as that for a Canadian or a cost profile that is higher. Three findings may be summarized. First, the Gamma distribution generally results

Figure 1: Annual cost thresholds for excessive demand (i) for a normal distribution; and (ii) for a gamma distribution reported in Table 1.



in a larger cost threshold than that obtained when using a normal distribution. This occurs because the Gamma distribution yields only positive values for health expenditures and incorporates a positive skew to such costs. In contrast, non-positive costs are possible under a normal distribution, with the distribution of costs symmetric around the mean of such costs. Second, for both the normal and the gamma distribution, and for each invoked level of statistical significance, the annual cost threshold for excessive demand consistently increases with the relative variance in costs. Only when the relative variance in costs is zero, i.e. all Canadians incur the same annual costs for health care, would the threshold be the same as that currently used by CIC. In all other instances, the cost threshold is higher. Finally, the annual cost threshold for “excessive” demand increases with a more stringent requirement for hypothesis testing, i.e. where the invoked significance level is lower. (If the statistical test is designed to be more likely to be correct in rejecting the null hypothesis that a prospective immigrant has the same cost profile as a Canadian, then the threshold needs to be higher.)

Table 1 yields wide variations in the cost threshold that may be used to determine “excessive” demand. Thresholds vary from a low of \$4,867.40 (the current threshold used by CIC) when the relative variance of costs is zero to a threshold of \$36,739.56, which is almost eight-fold greater. While there are circumstances in which each threshold is appropriate, there is compelling evidence to support a Gamma distribution in contrast to a Normal distribution. Moreover, for those who have studied the distribution of health care costs they have tended to invoke a Gamma distribution and have used unity as the relative variance of costs.[20-23] Moreover, use of a conventional level of statistical significance of 5%, yields a health care cost threshold for “excessive” demand as \$14,581.43, as reported in Table 1. If a potential immigrant were to exhibit a cost profile yielding higher costs, then the hypothesis that that potential immigrant had a cost profile that is the same as that for a representative Canadian would

be rejected. Consequently, this is how we interpret, in a statistical sense, the meaning of “excessive” demand within Section 38(1) of IRPA, i.e. statistically different from that for a representative Canadian.

### Potential economic burden on health or social services by persons with HIV

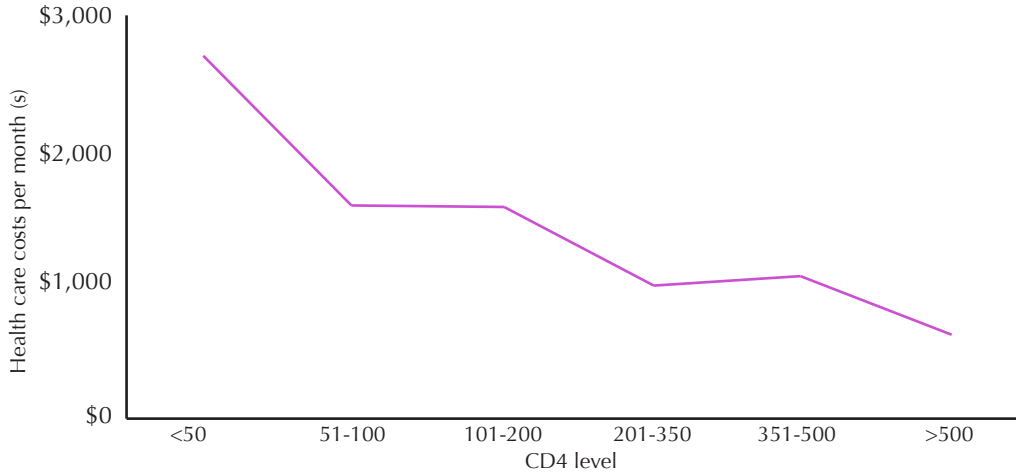
This Section reports on a synthesis of the clinical, epidemiological and economics literatures concerning the economic burden placed on health or social services by persons with HIV. In reviewing data for inclusion in our assessment of the relationship between disease progression and health care costs, studies reviewed in a publication by Levy et al.[25] were used. Only nine studies met three inclusion criteria: (i) peer-reviewed publication in English; (ii) original, patient-level data yielding mean monthly or annual direct estimates of medical costs of treating people with HIV, where anti-retroviral medication was included as routine clinical practice even when CD4 cell counts were over 500 cells/mm<sup>3</sup>; and (iii) medical cost estimates stratified by CD4 cell counts. A recent Canadian study, which was not included in the review by Levy et al, yields slightly lower cost estimates than those reported below.[26] Data from the studies reported by Levy et al were extracted from either the original article or directly from the author(s). Monthly health care costs in 2007 US dollars were presented after stratification by CD4 cell count categories as shown in Figure 2. A wide range of cost components were captured, including inpatient, outpatient, laboratory, and medication costs.

There is a general tendency for health care costs to increase with disease progression, but our confidence in some of the point estimates are limited by the underlying sample size. Specifically, while there are only 71 and 385 patients captured for the CD4 cell count categories 51-100 cells/mm<sup>3</sup> and 201-350 cells/mm<sup>3</sup>, respectively, all other cost estimates were based on samples of more than 23,000 patients.

Table 1: Annual cost thresholds for “excessive” demand contingent on the distribution of costs, the relative variance in costs, and significance levels

		Cost Threshold in 2007					
		Normal distribution			Gamma distribution		
		2%	5%	10%	2%	5%	10%
Relative variance (or coefficient of variation)	0	4,867.40	4,867.40	4,867.40	4,867.40	4,867.40	4,867.40
	0.5	9,866.22	8,870.84	7,987.40	11,054.01	9,435.04	8,129.51
	1	14,865.04	12,874.27	11,107.41	19,041.38	14,581.43	11,207.60
	1.5	19,863.86	16,877.71	14,227.41	27,879.94	19,494.08	13,483.14
	2	24,862.68	20,881.15	17,347.41	36,739.56	23,560.48	14,609.86

Figure 2: Disease progression and average monthly health care costs in 2007 (US\$)



**The economic burden of persons with HIV over various time horizons**

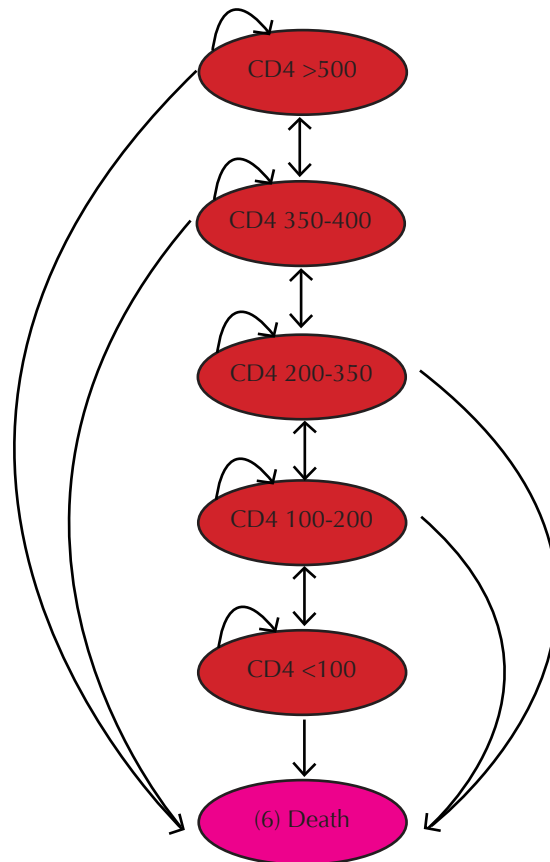
Estimates of the economic burden of new immigrants with HIV are derived over three different time horizons (5-years, 10-years, and their remaining lifetime) after stratifying for underlying health state, age and sex at the time of admission to Canada.

In order to derive estimates of the economic burden a Markov model was developed, as shown in Figure 3 that describes the

transition of a cohort of immigrants with HIV through various health states, here defined as CD4 cell count categories.

In Figure 3, a cohort of immigrants is classified into initial health states according to their CD4 count measured at the time of application for admission to Canada. Transitions between health states are assessed on an annual basis. Potential health state transitions are: death; progression to a lower CD4 cell count health state; disease improvement to a higher CD4 cell count health state; or the status quo in which individuals remain in their current health state. The

Figure 3: Health-state transition for the Markov Model



model tracks the proportion of individuals in each health state after each cycle. Transitions are based on conditional probabilities that depend on age, sex, and CD4 cell count. Table 2 reports transition probabilities for each CD4 cell count category were drawn from the literature as referenced.

Economic burden estimates for immigrant applicants with HIV depend crucially on the projected trajectory of disease, the anticipated incidence of mortality, health care cost estimates stratified by CD4 cell count categories, the rate at which future care costs are discounted to present values, and the time horizon over which cost are assessed. To derive economic burden estimates for each immigration applicant with HIV, costing weights (as discussed above) and reported in 2007 Canadian dollars in Table 3, are applied to each health state as represented by CD4 cell count categories.

Because standard practice in the economic evaluation requires adjustment for the timing of costs, the analysis follows current practice and invokes a discount rate of 3 percent to convert the annual stream of expected health care costs to present value terms.[29] Moreover, in order to assess the economic burden of immigrants with HIV, three separate time horizons are considered, 5-years, 10-years, and lifetime for both men and women using mortality rates derived from Canadian life tables.[30]

Application of the Markov model yields estimates of the economic burden of new immigrants with HIV that depend on: the time horizon used to assess the impact on health care costs (5-years, 10-years, and the remaining lifetime); baseline CD4 cell count; and the age and sex of individuals at the time of admission to Canada. These estimates are reported in Tables 4(i)-4(iii).

There are four notable findings regarding the economic burden of new immigrants. First, the economic burden of immigration applicants increases with disease progression, i.e. the burden is larger if immigration applicants have smaller CD4 cell counts, indicating more serious symptoms. This occurs because such immigrants present a higher cost profile than other immigrants. Second, the burden increases when the time horizon over which health care costs are assessed increases. This occurs because more years are included in the assessment of the burden on health or social services. Third, the burden is greater for women than for men, and particularly so if the time horizon for assessment is longer. This occurs because women face a lower mortality rate, and consequently a longer life expectancy. Forth, the burden falls with the age of the immigration applicant, because older immigrants face a higher mortality rate than younger immigrants.

Table 2: Transitional probabilities used in the Markov Model for immigration applicants with HIV

Input Parameters	Values	Source
Transition probabilities from "CD4 > 500" state		
Annual risk of having "CD4 350-500"	7.59%	#27
Relative risk of death	5.00	#28
Transition probabilities from "CD4 350-500" state		
Annual risk of having "CD4 200-350"	6.92%	#27
Annual risk of recovering to "CD4 > 500"	2.71%	#27
Relative risk of death	7.00	#28
Transition probabilities from "CD4 200-350" state		
Annual risk of having "CD4 100-200"	3.13%	#27
Annual risk of recovering to "CD4 350-500"	2.71%	#28
Relative risk of death	9.00	#28
Transition probabilities from "CD4 100-200" state		
Annual risk of having "CD4 < 100"	1.79%	#27
Annual risk of recovering to "CD4 200-350"	1.22%	#27
Relative risk of death	13.00	#28
Transition probabilities from "CD4 < 100" state		
Annual risk of recovering to "CD4 100-200"	1.22%	#27
Relative risk of death	20.00	#28



Table 4: Present value of health care expenditures in 2007 for  
 (i) Immigration Applicants aged 30 years with HIV;  
 (ii) Immigration Applicants aged 40 years with HIV;  
 (iii) Immigration Applicants aged 50 years with HIV.

Table 4(i)	Males			Females		
Baseline CD4	5-Year	10-Year	Lifetime	5-Year	10-Year	Lifetime
>500	\$36,151	\$71,384	\$183,612	\$36,339	\$72,263	\$205,176
351-500	\$55,945	\$100,969	\$222,100	\$56,320	\$102,503	\$247,959
201-350	\$55,562	\$104,361	\$233,254	\$56,055	\$106,477	\$264,464
101-200	\$85,181	\$155,631	\$311,042	\$86,263	\$160,089	\$356,852
<100	\$142,023	\$248,953	\$437,669	\$144,725	\$259,282	\$508,296

Table 4(ii)	Males			Females		
Baseline CD4	5-Year	10-Year	Lifetime	5-Year	10-Year	Lifetime
>500	\$35,871	\$69,725	\$144,155	\$36,117	\$71,024	\$165,621
351-500	\$55,393	\$98,151	\$175,847	\$55,881	\$100,374	\$201,258
201-350	\$54,836	\$100,494	\$179,028	\$55,476	\$103,536	\$208,807
101-200	\$83,599	\$147,659	\$234,983	\$84,995	\$153,932	\$277,205
<100	\$138,115	\$231,178	\$326,926	\$141,565	\$245,214	\$390,022

Table 4(iii)	Males			Females		
Baseline CD4	5-Year	10-Year	Lifetime	5-Year	10-Year	Lifetime
>500	\$35,005	\$65,028	\$102,997	\$35,541	\$67,872	\$124,277
351-500	\$53,687	\$90,283	\$126,832	\$54,742	\$95,027	\$152,061
201-350	\$52,608	\$89,965	\$122,940	\$53,983	\$96,265	\$151,367
101-200	\$78,807	\$126,838	\$156,726	\$81,754	\$139,139	\$195,700
<100	\$126,522	\$187,344	\$211,688	\$133,610	\$212,772	\$268,164

Table 5: Thresholds for the present value of health care costs by age, sex, and time horizon discounted in advance at 3% in 2007 (\$14,581.43)

	Males			Females		
Age	5-Year	10-Year	Lifetime	5-Year	10-Year	Lifetime
30 years	\$67,085	\$124,283	\$361,909	\$67,149	\$124,544	\$378,274
40 years	\$66,990	\$123,794	\$323,314	\$67,074	\$124,182	\$343,459
50 years	\$66,692	\$122,325	\$274,821	\$66,877	\$123,229	\$299,380

## Inadmissibility depends on an applicant's characteristics and time horizon

Thresholds used to define excessive demand are reported in this Section and applied to estimates of the economic burden of persons with HIV in order to identify which immigration applicants may be deemed to be inadmissible on medical grounds. In Section 3.0, we demonstrated that the current annual cost threshold used by CIC to determine whether an applicant is likely to pose "excessive" demand (\$4,867.40) is too low, and that there might be justification under some circumstances for a threshold that is almost eight-fold greater at \$36,739.56. Under these extreme positions either all individuals with HIV would be denied admission or all would be accepted. In Section 3.0, we proposed a middle position that we felt was a statistically more appropriate annual cost threshold at \$14,581.43 (or three-fold greater than the current CIC threshold). Application to various assessment periods and to Canadian mortality rates yields Table 5. This Table reports the present value of cost thresholds (in 2007 Canadian dollars) for representative Canadians based on their age, sex, and the time horizon for assessment. Consequently, in order to assess whether immigrant applicants present a cost profile that is higher than that for a matched representative Canadian warrants a comparison between the figure in each cell in Table 5 and an appropriate figure from Tables 4(i)-4(iii).

Comparison between the figures in Tables 4(i)-4(iii) and Table 5 yields the shaded regions in Tables 4(i)-4(iii). These shaded regions identify individuals who do not represent an excessive burden on Canadian health or social services. Classification as medically inadmissible depends on the unique characteristics of each potential immigrant including their age, sex and baseline CD4 cell count as well as on the time horizon over which an applicant is assessed to impact health or social services.

The baseline CD4 cell count category, at which immigration applicants with HIV are deemed to represent an excessive burden on Canadian health or social care, falls as the time horizon for assessment increases. Specifically, a five-year or ten-year time horizon generally warrants individuals with CD4 cell counts <200 cells/mm<sup>3</sup> to be deemed inadmissible, while a lifetime horizon provides for admission to all except for women and men aged 30 and 40 years with CD4 cell counts <100 cells/mm<sup>3</sup>. These finding occurs because persons with HIV are at a greater risk of death than the general population which lowers the present value of their potential economic burden when the time horizon increases. Similarly, as women have greater life expectancies than men,

their potential economic burden on Canadian health or social care is accordingly greater. While this does not make a difference in Table 4 when comparisons are made every ten years, it would make a difference if the age intervals were finer. Moreover, as the age of the applicant increases, their remaining life expectancy falls. This decline lowers their potential economic burden on health or social services, and accordingly, lowers the CD4 cell count threshold at which potential immigrants may be classified as being medically inadmissible. This effect is only noticeable when a lifetime time horizon is used whereby the threshold for being deemed medically inadmissible drops for women and men aged 40 to 50 from CD4 cell counts <100 cells/mm<sup>3</sup> to include all women and men irrespective of their CD4 cell count when aged 50 years. These are interesting age and sex related differences and suggest that women or younger applicants face a slightly greater likelihood of being deemed medically inadmissible than men or older applicants.

## Conclusions and limitations

There is a paucity of studies assessing thresholds used by immigration officials in the determination of medical inadmissibility. Despite the need for evidence informed immigration policy, and the findings contained in this paper, a number of limitations warrant discussion. First, the definition of "excessive" demand is inherently subjective. While this paper has offered a statistical definition of "excessive" demand, the paper has demonstrated that the precise threshold is discretionary; it depends on the confidence warranted in the test that a prospective immigrant has a cost profile that is the same as that for Canadians. A more stringent confidence requirement (i.e. that we are correct in rejecting this hypothesis) than the customarily 5% significance level, warrants a higher threshold. Second, while we have shown how the statistical threshold used to determine "excessive" demand depends on the underlying distribution of health care costs, unless precise estimates of that distribution are acquired the resulting threshold will always be an approximation. Third, present value estimates of the economic burden of illness are limited by the available literature and the sophistication in the modeling of the underlying health conditions. This is also true in the context of HIV and is crucially dependent not just on the unit cost of specific CD4 cell count health states, but also in the transition from one health state to another. We should never forget that the estimates reported herein are just point estimates, and furthermore, are dependent on current medical practices in the settings that yielded the original data. Fourth, in order to engineer an assessment of which HIV-positive individuals would be deemed to be medically

inadmissible, consideration of the trajectory of costs for both HIV-positive individuals and those for Canadians were converted to present value terms for particular assessment horizons. Variation in underlying assumptions concerning discounting practices, disease progression and relative rates of mortality influence the findings and should be considered in a comprehensive assessment of current policy. Finally, in order to have a balanced assessment of the costs and contributions of a prospective immigrant, there should also be an assessment of the potential contributions of a new immigrant.

Notwithstanding the limitations, three substantive findings are offered in this paper. First, the current cost threshold used by CIC in assessing whether an applicant is likely to pose “excessive” demand on Canadian health or social services is too low. A statistically more appropriate threshold is three-fold greater at \$14,581.43. Second, there is a close relationship between disease progression (measured by CD4 cell counts) and health care costs, with annual costs increasing from under C\$8,000 for CD4 >500 cells/mm<sup>3</sup> to over C\$35,000 for CD4 <100 cells/mm<sup>3</sup>. Third, application of these cost estimates to a revised cost threshold for inadmissibility indicates that classification depends on individual characteristics, including age, sex and baseline CD4 cell count as well as on the time horizon over which each applicant’s projected demand for health or social services is assessed. “Excessive” demand is more likely to occur for applicants with low CD4 cell counts and a shorter time horizon for assessment (i.e., 5-years versus their lifetime). Women and younger applicants are slightly more likely to be deemed inadmissible than men and older immigration applicants.

Our findings suggest that the adjudication guidelines and policies used by CIC warrant urgent review so that they are informed by the existing clinical, epidemiological and economics evidence, and that they conform to an appropriate statistical interpretation of “excessive” demand. In the absence of this review, current policy results in immigration denial on medical inadmissibility grounds and the consequent loss to Canadian society of some gifted individuals.

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