

**THE HIV/AIDS EPIDEMIC AMONG PERSONS FROM
HIV-ENDEMIC COUNTRIES IN ONTARIO, 1981-98:
SITUATION REPORT**

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EXECUTIVE SUMMARY

This report presents analyses of available data and statistical modeling techniques to describe the HIV epidemic among persons living in Ontario who were born in countries in the Caribbean or sub-Saharan Africa (HIV-endemic regions).

In general, since HIV data does not reliably capture data on birth or residence in an HIV-endemic country, it is difficult to draw precise conclusions about patterns of HIV diagnoses in this population or whether persons from HIV-endemic regions tend not to go for testing. The analysis of reported AIDS cases indicated that persons from HIV-endemic regions accounted for an increasing proportion of cases in Ontario, especially since 1996; this group represented 17% of AIDS cases in 1998. Most such cases were younger than 45 years at time of diagnosis. Further, an increasing number of AIDS cases in later years were among persons born in sub-Saharan Africa. The majority of deaths due to AIDS in this population occurred after 1990 and mainly among persons under 50 years old, though women tended to die at an earlier age than men. The majority of HIV-positive women in a database of HIV-infected mothers and their infants were born in the Caribbean or sub-Saharan Africa; further, over half the confirmed HIV-positive infants in the database were born to women from these regions.

Modeled estimates of HIV-infection among persons who immigrated from HIV-endemic regions and resident in Ontario suggested that approximately 2,346 of these persons were living with HIV infection as of December 1998 (1,491 from the Caribbean and 855 from sub-Saharan Africa). Modeled estimates further illustrated the HIV epidemic among this population dates primarily since 1990 for most countries modeled, with the exception of Jamaica where the epidemic appears to have been present earlier. More HIV-infected persons were born in the Caribbean, though prevalence rates were higher for the sub-Saharan African countries. The annual rate of increase of HIV infections approximated 12%, representing 250 new infections in the past few years. Though modeled figures were obtained using methodologies which have important limitations, the estimations represented a good fit with available reported data and were consistent with 1996 projections for HIV prevalence among this population. For these reasons, we are confident our results are a plausible indication of the extent of HIV infection among this population.

Persons who immigrate to Ontario from an HIV-endemic region represent an important part of the Ontario epidemic, preceded only by men who have sex with men (MSM) and injection drug users (IDUs). Whereas overall prevalence rates among immigrants from these regions may not appear substantial, they are about 50-fold higher than among other heterosexual non-injecting persons in Ontario. Furthermore, modeling techniques which estimated the number of HIV infections acquired in Canada revealed that considerable transmission may be occurring after residence is established here, suggesting that a substantial proportion (30-45%) of HIV infections are not "imported".

A proportion of HIV-infected men immigrating from HIV-endemic regions reported the additional risk of having sex with men. Though not the primary focus of the present study, we estimate there may be as many as 300 HIV-infected MSM from HIV-endemic countries and several thousand men at risk for infection. These persons represent an important segment of the immigrant population who until now have not been the focus of specific research or preventive interventions.

The results of this report highlight the need for epidemiologic research to validate results obtained through statistical modeling, specifically with regard to the substantial rate of HIV transmission in Canada. Social and behavioural studies are also needed to better understand the determinants of transmissions among immigrants from HIV-endemic regions. Political will at the community, provincial and national level is required to support further investigations of this public health problem and develop effective preventive interventions.

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1. BACKGROUND

Countries in sub-Saharan Africa and the Caribbean continue to be severely affected by the HIV epidemic. UNAIDS estimates that 70% of people infected with HIV in 1998 were living in sub-Saharan Africa <1>. Adult HIV prevalence (that is, the proportion of persons aged 15 to 49 years infected with HIV) in Botswana, Namibia and Zimbabwe was estimated to be from 20% to 26% <1>. HIV prevalence among pregnant women in Haiti and at one surveillance site in the Dominican Republic was estimated at 8% in that same year. In comparison, adult prevalence in North America during the same period was 0.56% <1>.

Each year, Ontario receives large numbers of immigrants from many countries throughout the world, including many from HIV-endemic countries in sub-Saharan Africa and the Caribbean (Appendix 1). (The term “HIV-endemic” refers to populations in which the prevalence of HIV infection is high [generally above 1% and sometimes much higher] and in which the predominant mode of spread is heterosexual intercourse, accounting for at least 50% of HIV infections. Strictly speaking, the epidemiologic designation of “hyperendemic” is used for such situations.) According to the latest Canadian census, approximately 94,000 persons born in sub-Saharan Africa and 256,000 persons born in the Caribbean resided in Ontario in 1996 <2>. Together, they represented about 3.1% of the Ontario population and 9.4% of the immigrant population <2>.

Until recently, the extent of the HIV epidemic among persons in Ontario who were born in an HIV-endemic country has not been fully appreciated. Data on AIDS incidence and from HIV diagnoses, for example, indicated that this population has become increasingly important in the Ontario HIV epidemic, preceded only by men who have sex with men (MSM) and injection drug users (IDUs) <3,4>. Trends in the number of AIDS cases over the last few years reflect this development; persons assigned HIV-endemic exposure category accounted for 14% of cases in 1997 and 1998, compared to 2.9% of cases from 1981 to 1995. In contrast, the proportion of AIDS cases constituted by MSM was 50% of those diagnosed in 1998, compared to 86% of cases in 1985 and 74% of cases in 1994 (73% overall).

As a result of the growing awareness about the importance of this problem, we were asked by the AIDS Bureau, Ontario Ministry of Health to undertake analyses to better determine the epidemiologic characteristics of HIV infection among persons living in the province who were born in sub-Saharan Africa or the Caribbean. Specifically, we wished to estimate current HIV prevalence and characterize trends in HIV prevalence and incidence among these persons over time. Further, our intent was to determine, to the degree possible, what proportion of HIV-infected persons from these regions were infected in their country of origin versus infection acquired since settling in Canada. These preliminary results will provide support and direction for preventive efforts to decrease spread of HIV in Ontario.

2. METHODS

2.1 Introduction

The first section of this report presents descriptive analyses, including the demographic characteristics of the population of interest and data from HIV testing, reported AIDS cases, AIDS-related mortality and perinatal HIV transmission. The second section of the report presents the results of a statistical model to quantify HIV infection in this population. The HIV model was developed in two stages: (1) the demographic model which incorporated immigration, census, birth and death data and (2) the statistical model which used HIV and AIDS data from several sources to obtain plausible estimates of the gender-specific incidence and prevalence of HIV, AIDS and AIDS-related mortality. HIV-endemic countries modeled in this manner are listed in Appendix 2. (Countries for which the number of persons in Ontario were too small to permit individual analysis were either aggregated or excluded; see Section 2.4 for details).

2.2 Population

Annual data for the immigrant population in Ontario from each of 74 HIV-endemic countries (26 Caribbean, 48 sub-Saharan African) was used to create a demographic profile. This, in turn, provided the foundation for the statistical model. The majority of persons who immigrate to Ontario reside in metropolitan Toronto and the Ottawa-Carleton regions. For this reason, the report describes the epidemic among this population according to the health regions of metropolitan Toronto (Metro Toronto), Ottawa-Carleton and the rest of Ontario (Other).

We used 1996 census data to estimate by sex the distribution throughout the province of persons who immigrated to Ontario from the Caribbean or sub-Saharan Africa <2>. Data available through Statistics Canada included census totals for Toronto, Ottawa-Hull (Ontario portion) and other cities in the province. The number of persons born in an HIV-endemic country and living in Metro Toronto health region was estimated using Toronto census data; Ottawa-Carleton was estimated by using the Ontario portion of Ottawa and the rest of the province (Other) was estimated by subtracting the totals for Toronto and Ottawa from the provincial total.

2.3 Descriptive analyses

The descriptive analyses in this report treats the population of interest in two ways: (1) all HIV-infected persons born in HIV-endemic countries and (2) HIV-infected persons presumed to be infected by heterosexual transmission. The second group is, of course, a subset of the first.

Most infected persons living in Ontario from these countries were infected by heterosexual transmission and, in the absence of other risk factors for HIV acquisition, may be presumed to have been infected by this route. Thus, the analyses in the first stage generally deal with all persons born or having resided in HIV-endemic countries. In the AIDS-related mortality database, no information on risk factors is available and analysis is possible only according to country of birth, which is generally and reliably available. In the AIDS database, persons born in an HIV-endemic country may be identified in one of two ways. For some, the country of birth

is indicated specifically. The variable "*HIV-endemic risk factor*" used in this database is also helpful. Thus, to capture AIDS cases born in an HIV-endemic country, we used a combination of country of birth and risk factor information (the algorithm used is specified in Section 2.3.2.1 below). Exposure category refers to the most likely route through which the person acquired the virus. A person may report numerous (or no) risk factors but will be assigned to only one exposure category. For the purposes of this report, in databases where this is possible (HIV and AIDS), we classify persons born in an HIV-endemic country without other risk factors in the HIV-endemic exposure category (presumed to have been infected by heterosexual transmission). For the AIDS-related mortality database and the HIV statistical model, we consider all HIV-infected persons born in an HIV-endemic country as a whole.

2.3.1 HIV diagnoses

Almost all HIV diagnostic tests in the province are performed at the HIV Laboratory, Central Public Health Laboratory (CPHL), Ontario Ministry of Health. Limited HIV testing is carried out by other laboratories in the province for reasons related to life insurance eligibility, visas for international travel and screening organ and tissue donors. In addition, large numbers of blood donations are tested every year (over 300,000) at one of five regional centres of the Canadian Blood Services in Ontario. Ontario residents may also be tested outside the province prior to establishing residence here, or may travel out of province for such testing.

Persons in Ontario requesting a test for HIV from their physician or an anonymous testing centre are tested free of charge. To December 1998, about 2.3 million HIV tests have been performed by the HIV Laboratory. Data on risk factors requested on the test requisition is not always provided. The LAByrinth computer system of the HIV database uses risk factor information to assign an exposure category to each HIV tester. The algorithm is based on a hierarchy of mutually exclusive categories such that testers who report multiple risk factors are assigned to the exposure category most likely responsible for their infection (or risk of infection). Test requisitions for which this information is missing may be coded as 'no identified risk (NIR)' or 'unknown'. Final exposure categories assigned by the LAByrinth algorithm appear in Appendix 5. A call-back study carried out in 1996 <5> evaluated the distribution by exposure category of tests for which such information was missing. Persons from HIV-endemic regions constituted 3.4% of diagnosed infections for which risk information was provided but 11.4% of cases for which it was not. Thus, the database seriously undercounts persons from these countries.

2.3.1.1. HIV diagnoses: Data source and selection of cases

The HIV Laboratory of the CPHL provided HIV diagnostic data for the years 1985 to 1998. Included with age group (<1, five-year age categories from five to 39, 10-year categories from 40 to 69, age unknown), year of diagnosis, sex and health region of residence were the original risk factors indicated on the test requisition and the resulting exposure category assigned to the tester by the LAByrinth algorithm.

We selected first-time HIV-positive diagnoses among testers assigned HIV-endemic exposure category by the LAByrinth algorithm; these cases represented the number of 'unadjusted' first-time positives. Adjustments in accordance with the call-back study results were then applied to

the data. Thus, the number of adjusted HIV-positive diagnoses combined positive tests of known exposure category and positive tests of cases with 'unknown' risk, 'NIR', and 'other' for which exposure category was assigned on an aggregate basis. These adjusted first-time positives were examined by year of HIV diagnosis only.

Persons diagnosed HIV-positive for the first time who lived in an endemic region (presumed to have been born there) with or without other risk factors were also examined by exposure category assigned by the LAByrinth algorithm. In addition to cases assigned to the HIV-endemic exposure category, additional cases selected for analyses were those who lived in an HIV-endemic region and had one or more of the following risk factors: MSM, MSM-IDU, IDU, transfusion and clotting factors.

2.3.1.2 HIV diagnoses: Data analysis

First-time HIV-positive diagnoses in the database were examined by LAByrinth assigned exposure category and year of HIV diagnosis. Adjustments in accordance with results of the call-back study were then applied to all cases ('unknowns', 'NIR', 'other' re-assigned) and re-examined by exposure category and year of diagnosis.

Cases born in an HIV-endemic country were examined by exposure category and analysed by year of diagnosis, health region of residence (Metro Toronto, Ottawa-Carleton, Other, Unknown) and sex (male, female, unknown). Analyses by HIV-endemic region of origin was not possible due to the fact that country of birth is rarely indicated on the HIV test requisition.

2.3.2 AIDS incidence

AIDS case reporting was initiated informally in 1982 and expanded into the Ontario AIDS Surveillance Program (OASP) when the syndrome became reportable in August 1983. AIDS cases are reported to local public health units and forwarded to the Public Health Branch, Ontario Ministry of Health. Provincial AIDS data is managed through the Reportable Disease Information System (RDIS) through which data is transferred electronically from the local public health units to the Ministry.

Risk factor information collected for each AIDS case reflects one or more routes through which HIV-infection may have been acquired. The RDIS algorithm uses a hierarchy based on this risk information to assign each case to one of 20 possible exposure categories (Appendix 5). Cases for which risk factor information has not been transmitted to the Ministry are classified in the exposure category of 'did not code', 'unknown' or 'NIR'.

2.3.2.1 AIDS incidence: Data source and selection of cases

The Public Health Branch, Ontario Ministry of Health provided data on AIDS cases diagnosed to December 31, 1998 and reported to March 11, 1999. All cases in the OASP had been assigned an exposure category by the RDIS algorithm, of which 76 cases were classified as '*HIV-endemic - Partner risk*' and 130 as '*HIV-endemic - Uncertain risk*'.

The RDIS exposure category algorithm utilizes country of birth information recorded for the AIDS case if this data has been provided to the Ministry. In 1998, a subset of client records for which country of birth was not reported in RDIS were reviewed, in part to see if this data could be extracted from case records held at the public health unit level <6>. The review found a number of charts with country of birth recorded and a portion of these belonged to persons born in an HIV-endemic country. As this data was not transmitted to the Ministry, the algorithm could not incorporate this information when assigning the case to an exposure category.

A further issue contributes to potential misclassification by the RDIS algorithm of cases in the OASP. The variable '*HIV-endemic risk factor*' is not consistently reported for persons born in sub-Saharan Africa or the Caribbean, despite the definition of the risk factor to apply to those who '*lived in or visited an endemic area*'. Misclassification of these cases occurs when the algorithm assigns an exposure category based on other (non-HIV-endemic) risk information which may not reflect the predominant route of infection.

Due to such constraints of the RDIS classification algorithm, AIDS cases selected for analyses in this report was comprised of those who (1) were born in a country in sub-Saharan Africa or the Caribbean or (2) reported HIV-endemic risk factor but data on their country of birth was missing. Although these criteria may have included cases not in fact born in an HIV-endemic country, we believe the misclassification rate according to this method to be less than that resulting from use of the RDIS algorithm.

2.3.2.2 AIDS incidence: Data analysis

We examined AIDS cases by exposure category and year of diagnosis. Cases reporting HIV-endemic risk factor or a country of birth in sub-Saharan Africa or the Caribbean were selected and analysed according to age at diagnosis (<15, five-year age categories from 15 to 59, 60+), HIV-endemic region of birth (sub-Saharan Africa, Caribbean), sex, year of AIDS diagnosis and health region of residence (Metro Toronto, Ottawa-Carleton, Other). Cases from HIV-endemic countries, including those assigned to the HIV-endemic exposure category and those assigned to other exposure categories, were analysed by age group, HIV-endemic region, sex, year of AIDS diagnosis and health region of residence. Year of AIDS diagnosis was defined as the date of earliest AIDS-defining illness, if available, or reported date of AIDS diagnosis otherwise. The mean age at diagnosis according to sex and HIV-endemic region of birth was also calculated. We used the chi-square statistic to test for differences in proportions and the chi-square for trends to test for differences over time.

2.3.3 AIDS-related mortality

The Vital Statistics office of the Ontario Registrar-General maintains mortality data for the province. Each death record received by Vital Statistics is assigned an International Classification of Disease (ICD) code describing the cause of death. Ascertainment of deaths in Ontario is virtually 100% whereas assignment of death due to AIDS is less complete.

The number of deaths among AIDS cases reported to RDIS is a less reliable source of death data for several reasons: neither physicians nor public health units are required to provide updates on vital status for reported cases, the person may die in the jurisdiction of another

health unit, or the death may occur out of province. For these reasons, mortality data maintained by Vital Statistics is more complete than death data contained in RDIS.

2.3.3.1 AIDS-related mortality: Data source and selection of cases

AIDS-related deaths from 1987 reported to December 20, 1997 were selected using ICD-9 codes 042, 043 and 044 by Vital Statistics, office of the Registrar-General. Age at time of death, health region of residence at time of death, sex and country of birth were also extracted (AIDS-related mortality data does not capture information on HIV risk factors).

2.3.3.2 AIDS-related mortality: Data analysis

The number and proportion of AIDS-related deaths were analysed according to age group at time of death (<20, 5-year age groups from 20 to 69, 70+), HIV-endemic region of birth (sub-Saharan Africa, Caribbean), sex, health region (Metro Toronto, Ottawa-Carleton and Other) and year of death.

2.3.4 Perinatal transmission of HIV

The Ontario HIV Pediatric Network was initiated in 1992 to collect information on children born to HIV-infected mothers and receiving specialized care at hospitals in Ontario. Five hospitals have contributed cases to the Network to date: Hospital for Sick Children (HSC) in Toronto, Children's Hospital in Eastern Ontario (CHEO) in Ottawa, McMaster University Medical Centre in Hamilton, St. Joseph's Health Centre in London and Hotel Dieu Hospital in Kingston. The Network is coordinated by Dr. Susan King at HSC and is part of the larger Canadian HIV Pediatric Network.

HIV-positive mothers may transmit the virus to their infant during pregnancy, delivery and post-partum breast-feeding. Physicians who provide care to these mothers during their pregnancy are encouraged to report information on each mother-infant pair to the Ontario HIV Pediatric Network. Each year, usually in December or January, Network staff solicit information on new mother-infant pairs diagnosed in the previous year as well as update information on the clinical status of previously reported cases. Data is extracted from medical charts by staff at each participating hospital who collect information on date of birth and sex of the infant, maternal country of birth, maternal risk factor(s) for HIV-infection, whether or not the mother received zidovudine prophylaxis during pregnancy and the infection status of the infant (confirmed infected, confirmed not infected, pending, unknown or lost to follow-up). Pending cases are, for the most part, infants for whom a final classification on infection status cannot yet be determined on the basis of laboratory analysis, including serial HIV antibody tests, polymerase chain reaction (PCR) and viral culture.

2.3.4.1 Perinatal transmission: Data source and selection of cases

The Ontario HIV Pediatric Network provided data on infants born to HIV-infected mothers during the years 1984 to 1998. Maternal risk factor(s) and country of birth information recorded

in the database were used to assign a unique exposure category to each mother-infant pair. Cases selected for analyses for the present report were women with heterosexual risk factor who were born in the Caribbean or sub-Saharan Africa and thus were assigned to the HIV-endemic exposure category.

2.3.4.2 Perinatal transmission: Data analysis

Mother-infant pairs in the database were examined by maternal exposure category and infant's year of birth. Next, mother-infant pairs assigned HIV-endemic exposure category were analysed by infants' year of birth, maternal HIV-endemic region of origin, confirmed infection status of the infant and location of reporting hospital.

2.4 HIV model

We developed a statistical model to characterize the HIV epidemic in the population from HIV-endemic countries by using the number of AIDS cases and AIDS-related deaths in combination with natural history and survival data to estimate, for example, annual HIV incidence and prevalence. The HIV model described in this report was constructed in two stages; the demographic model characterized the population from each selected country living in Ontario and provided the framework for the statistical model which generated estimates of HIV infection and AIDS among these persons. Both stages of the model were developed using spreadsheet software (Lotus 1-2-3 Release 5.01 for Windows, Lotus Corporation).

For the purposes of the demographic and statistical model, countries were classified into three categories: category 1 represented countries with a large population in Ontario or a large number of HIV-infected persons (generally at least 5% of the HIV-endemic regional total for one or the other) and were analyzed individually. In this way, we constructed separate models for six Caribbean and seven sub-Saharan African nations classified in this manner. Category 2 countries had smaller immigrant populations in Ontario and few AIDS cases or AIDS-related deaths; nevertheless, each had at least one HIV-related case. These countries were aggregated for the purposes of modeling to produce stability in the analyses. Eight Caribbean countries were aggregated to construct one model for these category 2 countries. Sub-Saharan African countries classified as category 2 were aggregated according to their geographic location on the continent. Hence, one model was constructed for each of the following: East Africa, Other (three countries aggregated); Central Africa, Other (two); West Africa, Other (eight); Southern Africa, Other (four). Category 3 countries had few persons who had immigrated to Ontario and no HIV-related cases and were therefore ignored for the purpose of modeling. We estimated category 3 countries (12 Caribbean, 24 sub-Saharan African) represented less than 2% of the Ontario immigrant population from HIV-endemic regions. Countries grouped by category appear in Appendix 2. In all, demographic and statistical models were created for Caribbean and sub-Saharan African countries which, collectively, reflected approximately 98% of the immigrant population in Ontario from HIV-endemic countries during the time period 1981 to 1997.

2.4.1 HIV demographic model

The first section of the HIV model describes the population in Ontario born in an HIV-endemic country. Beginning with an estimate of the immigrant population from that country living in the province in 1980, the model uses immigration data from 1981 to 1997, birth and death data and estimates of inter-provincial migration to generate annual populations, census populations, general fertility and crude mortality rates. For 1998, demographic values were based on trends, if apparent, or repeat 1997 values otherwise. Details of the demographic model and the method of calculation for each of its components are provided in Appendix 3. The model is gender-specific but not stratified by age group or health region of residence in Ontario.

2.4.1.1 HIV demographic model: Data sources

Data on the annual number of immigrants by sex and country of last permanent residence was obtained from Citizenship and Immigration Canada for the years 1980 to 1995 <7>. Immigration data for 1996 and 1997 was not available by gender at the time of this report and totals for those years were divided evenly between the sexes. The number of immigrants living in Ontario in 1980 for each HIV-endemic country was obtained from 1996 census Canada data <2>. Proportion of provincial in- and out- migration were both set at 12 per 1,000 in accordance with crude estimates for Canada as a whole <8>. Proportion female aged 15 to 44 years was based on 1996 census data. Data on the annual number of births in the province by maternal country of birth from 1980 to 1997 was obtained from Vital Statistics, office of the Registrar-General. Vital Statistics also provided the number of deaths in Ontario by sex and country of birth for these same years.

2.4.1.2 HIV demographic model: Data analysis

Immigration, birth and death data specific to the HIV-endemic country were entered into the demographic section of the model. Data available by gender (immigration, death) was entered in the sex-specific models and summed to provide values for the both sexes model. Data not available by gender (1996 and 1997 immigration, births) was entered in the both sexes model and interpolated equally between the genders. Inter-provincial migration was balanced due to lack of evidence indicating otherwise. AIDS-related deaths in the demographic model were generated by the statistical model for that country. Models generated for category 2 countries (Appendix 2) first combined immigrant, birth and death data for each country in the aggregate prior to entry in the model.

2.4.2 HIV statistical model

The statistical model was constructed beginning with the number of imported HIV infections based on the number of immigrants and HIV prevalence in the country of origin adjusted for possible selection biases. Subsequently, we factored in secondary sexual transmissions <9>. The analysis was carried out separately for men and women, based in part on the male:female ratios in the country of origin <1> and in country-specific Ontario data. Using data on progression from HIV to AIDS, survival following AIDS and rates of mother-infant HIV transmission, we derived estimates for HIV prevalence, AIDS incidence, AIDS-related mortality

and the number of HIV-infected mothers and infants. With respect to the lattermost, a model had already been developed for Ontario which provided a preliminary basis <10>. The statistical model then compared the preliminary outputs to observed, adjusted data on AIDS incidence, AIDS-related deaths, HIV prevalence, and HIV-infected infants and mothers. The fit of the model was refined primarily by varying the value of an adjustment factor for prevalence among immigrants. The goodness-of-fit (GOF) statistic was used to measure the degree of agreement between modeled estimates and the observed data and the HIV adjustment factor modified to minimize the GOF statistic.

2.4.2.1 HIV statistical model: Data sources

In addition to data required for the demographic model (Section 2.4.1.1), the statistical model incorporated country-specific UNAIDS 1997 HIV-prevalence estimates among women and adults aged 15 to 49 <1> and the Holmberg study for secondary HIV transmission rates <9>. Ontario data used to validate the initial model estimates included AIDS incidence adjusted for delayed reporting and under-reporting, AIDS-related deaths, HIV diagnoses (a minimum estimate) and the number of identified HIV-infected mothers and infants.

2.4.2.2 HIV statistical model: Data analysis

Estimates of HIV prevalence in the source country were adjusted to reflect HIV prevalence among immigrants to Ontario, then applied to the number of persons immigrating to Ontario. Inter-provincial migration accounted for persons arriving from other provinces and leaving Ontario to live elsewhere in Canada. New endogenous infections were a function of HIV prevalence and incidence. AIDS incidence was calculated as a function of HIV prevalence in previous years. AIDS-related deaths were modeled using AIDS incidence over the previous four years and estimates of survival following AIDS diagnosis. HIV prevalence, the proportion of women aged 15 to 44 years and the general fertility rate from the demographic model were used to estimate the number of infants born to HIV-positive women and the resulting number of HIV-infected infants (female HIV model only). Definitions for each component of the statistical model are shown in Appendix 4.

Components of the statistical model were verified using a goodness of fit statistic which compared estimates generated by the model to adjusted observed data. Modeled AIDS incidence was verified by the number of AIDS cases reported to the OASP (Section 2.3.2); modeled AIDS-related deaths by the number of AIDS-related deaths provided by Vital Statistics (Section 2.3.3); modeled HIV-infected infants by the number of HIV-infected infants identified by the Ontario HIV Pediatric Network (Section 2.3.4). The value of the HIV adjustment factor was altered to obtain the best possible fit of the model to the observed data.

3. RESULTS

3.1 Population

As described in Section 2.2, we used 1996 census data to estimate the number and distribution of persons who immigrated to Ontario from the Caribbean or sub-Saharan Africa. The number (Table 1.1) and proportion (Table 1.2) of immigrants by selected HIV-endemic countries are presented by region of residence in the province and sex to characterize the populations of interest.

Overall, of the 349,955 immigrants in Ontario in 1996 born in an HIV-endemic country, 256,035 (or 73%) were born in the Caribbean (Table 1.2). Jamaica, Guyana and Trinidad and Tobago accounted for the majority (85%) of the Caribbean immigrants with 39%, 27% and 19%, respectively. Immigrants from sub-Saharan African nations, who accounted for 27% of the population from HIV-endemic countries, were distributed among a greater number of countries; 17% were born in South Africa, 16% in Somalia, 14% in Ethiopia and Eritrea, 11% in Tanzania and 11% in Kenya. These six countries accounted for 67% of persons from sub-Saharan Africa.

Toronto was resident to 75% of immigrants from sub-Saharan Africa and the majority (85%) of those born in the Caribbean, although the remaining Caribbean immigrants tended to resided elsewhere in the province (11%) rather than in Ottawa (4%) (Table 1.2). Whereas Toronto was the region of residence for 68-90% or more of immigrants from these HIV-endemic regions, two countries did not fit this pattern: 20% of the Haitian population resided in Toronto compared to 74% living in Ottawa and 61% of Somalians lived in Toronto compared to 29% living in Ottawa.

Equal proportions of females and males immigrated from sub-Saharan Africa (49% female) whereas more females than males immigrated from the Caribbean (56% female). This pattern prevailed in all three regions of residence.

The census data refers only to those persons born in sub-Saharan Africa or the Caribbean. Our demographic model also included persons born to these persons (second generation) to attempt to estimate the "total" population. The results of these analyses are described in more detail below. For sub-Saharan Africa, we estimated a total population of 119,725 and for the Caribbean, 370,800 persons.

3.2 Descriptive analyses

3.2.1 HIV diagnoses

From 1985 to 1998, 19,459 persons tested HIV-positive in Ontario for the first time; 217 (1.1%) were assigned HIV-endemic exposure category by the LAByrinth algorithm (Table 2.1). When cases classified as 'other', 'unknown' or 'NIR' were re-assigned according to results of the call-back study, the estimated number of persons in the HIV-endemic exposure category increased to 1,350 (6.9%) of first-time diagnoses (Table 2.2).

Table 2.3 presents the number of persons who reported HIV-endemic country of birth alone or in conjunction with other risk factors by year of diagnosis. The number of cases among those

with HIV-endemic exposure category increased from 217 to 227 (two cases reported the additional risk of clotting factor, eight reported transfusion), 23 cases reported the additional risk of MSM, five cases MSM-IDU and seven IDU. Further analyses by exposure category were completed on these 262 cases. Overall, 87% of cases were assigned HIV-endemic exposure category, a proportion which fluctuated only slightly over the years 1985 to 1998. With the exception of five (38%) of the 13 cases diagnosed in 1985 and 1986, few diagnoses were made among those in the exposure categories of MSM, MSM-IDU or IDU.

Gender is requested but not always provided on the HIV test requisition. Among males from HIV-endemic countries receiving a positive diagnosis for the first time, 80% were assigned HIV-endemic exposure category; 14% reported also having sex with men (Table 2.4). Almost all (98%) female cases were among women assigned to the HIV-endemic exposure category. All 11 cases missing gender information were assigned HIV-endemic exposure category.

3.2.2 AIDS incidence

The 6,502 AIDS cases diagnosed from 1981 to 1998 and reported to March 11, 1999 were assigned an exposure category according to a hierarchy based on reported risk factors (Table 3.1). During the study period, 258 (or 4.0%) of the cases were classified as HIV-endemic exposure using this method.

Cases selected for further analyses included those born in the Caribbean or sub-Saharan Africa and those who had country of birth information missing but had reported HIV-endemic risk factor (see Section 2.3.2.1 for selection of AIDS cases). We report the analyses of the 404 AIDS cases meeting these criteria first, followed by descriptive analyses of these cases by their assigned exposure category (as defined in Section 2.3).

The proportion of male AIDS cases decreased during the study period: men accounted for 88% (58/66) of cases diagnosed from 1981 to 1988, 81% (207/257) from 1989 to 1995 and 65% (53/81) from 1996 to 1998 ($p=0.002$, chi-square) (Table 3.2). All three regions reported decreases in the proportion of male AIDS cases during the same periods, though this decrease was significant for cases reported only from Metro Toronto ($p<0.001$, chi-square).

An increasing number of cases occurred among persons born in sub-Saharan Africa during the study period (Table 3.2). Country of birth information was used to group cases by HIV-endemic region of origin (43 male and 26 female records were missing this data, representing 17% overall). Over half (61%) the cases were born in the Caribbean. Of cases diagnosed between 1981 and 1995, 34% were among those born in sub-Saharan Africa compared to 65% of those diagnosed between 1996 and 1998 ($p<0.001$, chi-square). This pattern was true for both sexes. Prior to 1996, men born in sub-Saharan Africa accounted for 30% of male cases and 59% of male cases between 1996 and 1998 ($p < 0.001$, chi-square). Among cases in women diagnosed before 1996, 56% occurred in women born in sub-Saharan Africa compared to 80% of female cases diagnosed between 1996 and 1998 ($p=0.17$).

Overall, male AIDS cases were older than female cases (Table 3.3). The mean age of males was 37.2 years (median 37.0) compared to 32.9 years (median 31.5) among females ($p<0.001$, t-test between means). Over half (59%) the AIDS cases among men occurred in those 35 years of age or older at time of diagnosis compared to 35% among women 35 years or older

when diagnosed. Persons born in sub-Saharan Africa were younger at time of AIDS diagnosis compared to those born in the Caribbean; 82% of those born in sub-Saharan Africa were under 40 compared to 62% of those born in the Caribbean ($p<0.001$, chi-square). This pattern remained evident for cases reported by Metro Toronto (83% of those born in sub-Saharan Africa were under 40 at time of diagnosis compared to 61% of those born in the Caribbean ($p<0.001$, chi-square)), Ottawa-Carleton (78% and 69%, respectively (chi-square invalid)) and the rest of the province (78% and 70%, respectively ($p=0.74$, chi-square)).

Whereas men accounted for the majority of AIDS cases overall, they comprised 89% of those among persons born in the Caribbean and 72% of those born in sub-Saharan Africa ($p<0.001$, chi-square). More men born in sub-Saharan Africa were under 40 at time of diagnosis than Caribbean-born men (79% versus 60%, $p<0.01$, chi-square). A similar pattern was found among female cases; 89% of women born in sub-Saharan Africa were under 40 at time of diagnosis compared to 78% of Caribbean-born women ($p=0.28$, chi-square).

Age group at time of diagnosis (< 35, 35+) for both male and female cases was relatively stable over the study period ($p=0.66$ and $p=0.67$, chi-square for trend, for male and female cases, respectively). Further, age at time of AIDS diagnosis for both male and female cases was not found to differ by health region of residence in the province (Metro Toronto, Ottawa-Carleton, Other).

Cases were compared by their HIV-endemic region of origin and health region of residence, though no difference was evident among the health regions. Public health units outside Metro Toronto and Ottawa-Carleton reported a total of 66 cases: 14 (21%) were reported by Peel health unit, eight (12%) by Hamilton-Wentworth, six (9%) cases each by Halton, Middlesex-London and York Region health units, and four (6%) cases each by Durham and Windsor-Essex. Three or fewer cases were reported by the remaining health units.

Metro Toronto health region reported more cases in later years (1995 to 1998) among persons born in sub-Saharan Africa than among those born in the Caribbean ($p<0.001$, chi-square for trend). Similar trends were not evident among cases reported by Ottawa-Carleton nor among those reported by the rest of the province.

Age at time of AIDS diagnosis did not appear to vary by year of diagnosis. This was true for Ontario as a whole (mean 36.3 years; median 35.0 years) as well as for each health region (Metro Toronto, mean age 35.7 years; Ottawa-Carleton, mean age 38.1; Other, mean age 37.4). Among cases reported by Metro Toronto, 48% were under 35 years compared to 41% of cases reported by Ottawa-Carleton and 41% reported by the rest of the province. When the latter two health regions were combined to compare age at time of diagnosis (< 35, 35+) among Metro Toronto cases to those reported from outside Metro Toronto, no significant difference was found ($p=0.26$, chi-square).

More male AIDS cases were reported by Metro Toronto and the rest of the province (84% and 74%, respectively) than by Ottawa-Carleton (54%) ($p<0.0001$, chi-square). However, when the analysis was repeated after grouping male cases by their HIV-endemic region of origin, no difference was found among the reporting health regions ($p=0.25$, chi-square). Similarly, no difference was found when female cases were grouped and compared in the same manner ($p=0.16$, chi-square).

Overall, 72% of reported AIDS cases diagnosed during the study period were reported from Metro Toronto, 16% from the rest of the province and 11% from Ottawa-Carleton. The proportion of cases from Metro Toronto varied over time. Metro Toronto accounted for 69% of cases diagnosed between 1981 and 1993, 83% of those diagnosed between 1994 and 1996 and 62% of cases during 1997 and 1998 ($p=0.007$, chi-square).

Table 3.4 presents all 404 cases born in HIV-endemic countries classified by exposure category, continent of origin and gender. Of the cases among men, 49% were assigned HIV-endemic exposure category, 48% MSM exposure category, 2% IDU, 1% MSM-IDU and 1% perinatal. Among female cases, 97% were assigned HIV-endemic exposure category, 1% IDU and 2% perinatal. Due to small numbers of cases in the exposure categories of MSM-IDU, IDU or perinatal, the remaining results discussed here compare cases classified as HIV-endemic exposure category to those classified as MSM. HIV-endemic exposure category may apply to either gender while MSM excludes women by definition. For this reason, cases in the HIV-endemic exposure category were first grouped by gender prior to analyses to remove the potential for female cases to mask differences among male cases related to MSM.

Age group (<35, 35+) at time of diagnosis among male and female cases with HIV-endemic exposure category remained stable during the study period ($p=0.443$, chi-square for linear trend). Similarly, no variation in age group at time of diagnosis was observed when male cases in the MSM exposure category were examined in the same manner ($p=0.38$).

More Caribbean-born men were in the MSM exposure category (63%) than HIV-endemic (34%) while the reverse was true among men born in sub-Saharan Africa (69% assigned HIV-endemic exposure, 28% MSM) (Table 3.4). Among male cases with available information on country of birth, 81% of those classified as MSM were born in the Caribbean compared to 49% of those with HIV-endemic exposure category ($p<0.001$, chi-square). Among female cases with country of birth information reported, 58 were assigned HIV-endemic exposure category and women born in sub-Saharan Africa accounted for 62% of these cases. The majority (83%) of female cases occurred in women under 40 at time of diagnosis. There was no apparent difference in age group (<35, 35+) at time of diagnosis among male cases in the HIV-endemic exposure category compared to those in the exposure category of MSM ($p=0.46$, M-H chi-square).

Table 3.5 shows the distribution of AIDS cases by year of AIDS diagnosis and exposure category. More male cases in later years (1995 to 1998) were classified as HIV-endemic exposure category compared to MSM ($p<0.001$, chi-square for linear trend). When cases were examined by HIV-endemic region of origin (Table 3.6), the following observations were made: MSM cases appeared to peak in the early 1990s for both groups and HIV-endemic exposure category cases increased in both regions and genders except for females from the Caribbean.

Less than half (42%) the cases among males reported by Metro Toronto were classified as HIV-endemic exposure category compared to 96% of male cases reported by Ottawa-Carleton and 59% reported by the rest of the province ($p<0.001$, chi-square) (Table 3.7). The majority of male cases in the MSM exposure category were reported by Metro Toronto (55%) and the rest of the province (35%) rather than Ottawa-Carleton (4%).

Table 3.8 presents AIDS cases by age group at time of diagnosis and exposure category. Male cases with HIV-endemic exposure category tended to be somewhat younger than MSM; 44% were less than 35 years of age at time of diagnosis compared to 36% of MSM. This difference was not statistically significant.

3.2.3 AIDS-related mortality

Overall, 311 deaths due to AIDS were identified among persons born in an HIV-endemic region (Table 4.1); 259 (83%) were among men. Sixty-three percent (195) of AIDS-related deaths occurred among males from the Caribbean. Over half (61%) the deaths among males born in sub-Saharan Africa were under age 40 whereas less than half (47%) the deaths among Caribbean-born men occurred in this age group ($p=0.07$, chi-square) (Table 4.1). Of deaths among women born in sub-Saharan Africa, 91% were under 40 compared to 68% for women born in the Caribbean ($p=0.09$, FET 2-tailed).

Two-thirds (67%) of AIDS-related deaths were reported from Metro Toronto (Table 4.2). Examined by gender and health region, 71% of deaths among males and 48% of those among females were reported from Metro Toronto compared to Ottawa-Carleton (7% and 21%, respectively) and the rest of the province (22% and 31%) ($p<0.001$). In Metro Toronto, deaths in both males and females appeared to increase gradually and peak in the early to mid 1990s.

Table 4.3 presents AIDS-related deaths by health region of residence, HIV-endemic region of origin and gender. Metro Toronto reported the majority of deaths among males (72% from the Caribbean and 67% from Africa) but slightly less than half the deaths among females.

3.2.4 Perinatal transmission

From 1984 to 1998, 281 HIV-infected mothers were reported to the Ontario HIV Pediatric Network, of which 116 (41%) infants were born to women assigned HIV-endemic exposure category (see Section 2.3.4.1 for definition) (Table 5.1). Of these 116 mother-infant pairs, 76% of mothers were born in sub-Saharan Africa, 24% in the Caribbean (Table 5.2). Over half (65%) the identified births to mothers from sub-Saharan Africa were from 1992 to 1996. Of the 116 infants born to HIV-positive mothers from an HIV-endemic region, 62 (or 53%) were infected, 38% were not infected and 7.8% were not classified (status pending). One infant died before HIV status was determined. The majority (56%) of infected infants were born during the five-year period from 1992 to 1996.

Almost all HIV-positive mothers from sub-Saharan Africa or the Caribbean were reported by the Hospital for Sick Children (HSC) or the Children's Hospital of Eastern Ontario (CHEO), each of which reported 66% and 26% of the cases, respectively (Table 5.3). The majority (76%) of HIV-infected infants were born to mothers who were born in sub-Saharan Africa. HSC reported 63% of the infected infants and CHEO reported 27%. Overall, 22 of the infants exposed to HIV died of AIDS, representing 19% overall and 35% of confirmed HIV-positive infants.

3.3 HIV model

The results of the HIV model described in Section 2.4 are presented in Tables 6.1 to 6.6. Summary results for both sexes, males and females for Caribbean category 1 and category 2 countries modeled appear in Tables 6.1 to 6.3, and for sub-Saharan Africa, in Tables 6.4 to 6.6. All summary tables display cumulative (1981 to 1998) and 1998 estimates for HIV-infected persons arriving from the country of origin, AIDS incidence, HIV prevalence, AIDS-related deaths and perinatal infections. HIV transmissions occurring after arrival in Ontario, that is, new "endogenous" infections, were also estimated.

In all, we estimate approximately 2,346 persons born in HIV-endemic countries and resident in Ontario were infected with HIV as of December 1998; 1,491 were born in the Caribbean (Table 6.1) and 855 in sub-Saharan Africa (Table 6.4), representing 64% and 36% of HIV-infections among persons from these regions, respectively. (Estimates for Caribbean-born males and females appear in Tables 6.2 and 6.3; for sub-Saharan African-born males and females in Tables 6.5 and 6.6.)

For the Caribbean region, we modeled six category 1 countries individually; Jamaica, Guyana, Trinidad and Tobago, Haiti, Barbados and Grenada. These countries accounted for 86% of the Caribbean-born population in Ontario and 94% of estimated prevalent HIV-infections among Caribbean-born persons living in the province. Four countries accounted for approximately 87% of HIV-infected persons: Jamaica, 544 persons; Guyana, 311; Trinidad and Tobago, 295; Haiti, 142. Overall, estimated HIV prevalence as of December 1998 among persons born in the Caribbean was 0.54%. This varied from 0.4% to 0.6% by country but was somewhat higher among persons from Grenada, with an estimated prevalence of 0.90%, and about eight times higher for persons from Haiti, at 3.8%.

Table 6.4 displays summary results for modeled category 1 and category 2 countries in sub-Saharan Africa. Country-specific estimates for 1998 of HIV-infected persons living in Ontario who were born in Ethiopia and Eritrea were 158 persons, Somalia 138, South Africa 133, Uganda 96, and Kenya 91. These five countries accounted for 63% of the African-born population in Ontario and 72% of HIV-infected Africans in 1998. Overall, estimated HIV prevalence among sub-Saharan African-born persons living in Ontario was 0.89%; this varied from approximately 0.6% to 1.2% for most countries, generally about twice that of persons from the Caribbean. However, HIV prevalence was higher among persons from three countries/regions: East African, Other (HIV prevalence 2.1%, slightly more than twice the Ontario average), Zaire (prevalence 4.3%, about five times the Ontario average) and Southern Africa, Other (HIV prevalence 4.5%, about five times greater than other Africans living in Ontario).

The model indicated that a substantial proportion of endogenous HIV-infections occurred among persons from the Caribbean after their arrival in Ontario. Of the approximately 1,682 HIV-infections from 1981 to 1998, 774 (or 46%) were estimated to have occurred in Canada. The situation in Africa was somewhat different; of the 933 cumulative HIV infections during this same time period, 284 (or 30%) were estimated to have been acquired in Ontario.

Country-specific models for Jamaica (Tables 6.7 to 6.9) and Ethiopia and Eritrea (Tables 6.10 to 6.12) are included in the present report to illustrate the development of the model (see Sections 2.4.1 and 2.4.2 for methodologic details). The demographic model for Jamaica for both sexes in Table 6.7 displays the annual number of immigrants arriving in Ontario during 1981 to 1998, which varied from 1,961 to 5,425 persons; immigration declined after reaching a peak in 1993. The annual number of HIV-infected persons immigrating from Jamaica fluctuated during the study period compared to the number of new endogenous infections which increased steadily and exceed "imported" infections each year after 1993. Table 6.10 displays the demographic and statistical model for Ethiopia and Eritrea for both sexes. As with Jamaica, the number of immigrants peaked in the early 1990s and declined thereafter to 535 persons in 1998. Few (two or less) HIV-infected persons arrived from Ethiopia and Eritrea prior to 1987, after which the number increased in 1988 and 1989 to approximately 11 persons each year thereafter (range, nine to 15 persons). The number of new endogenous HIV-infections was

less than one prior to 1989, after which they increased steadily and equaled “imported” infections in 1997 and 1998.

Figure 1 graphically displays modeled annual HIV prevalence for the category 1 countries in sub-Saharan Africa from 1980 to 1998. Prevalence increased after 1989, predominantly among immigrants from Ethiopia and Eritrea, Somalia, South Africa, Uganda and Kenya. Figure 2 graphically displays HIV prevalence for the six Caribbean countries modeled during the study period. Prevalence increased substantially after 1987 for all countries modeled with the exception of Jamaica, where the increase became evident beginning in 1986. Figure 3 presents annual HIV prevalence for the two HIV-endemic regions and illustrates the extent to which prevalence among persons born in the Caribbean exceeded that among persons born in sub-Saharan Africa during the study period.

4. DISCUSSION

In this report, we present data on population and HIV infection among persons from HIV-endemic regions from a variety of sources and integrate the data into an overall HIV model from 1981 to 1998. From the demographic model, we estimated this population to be 490,525 persons (370,800 from the Caribbean and 119,725 from sub-Saharan Africa), representing about 4.5% of the Ontario population. The number of persons born in these countries (first generation) was 96,337 from sub-Saharan African and 277,225 from the Caribbean for a total of 373,562 persons. Toronto is the primary location of residence for all persons arriving from these HIV-endemic regions, with the exception of Haitians who primarily reside in Ottawa-Carleton. Including second generation population estimates would increase this number to 490,000 persons (120,000 and 371,000, respectively). In the second stage of our HIV model, we simulated trends in HIV infection among persons from 38 (13 individually and 25 aggregated) of the 80 countries in these regions. As of 1998, approximately 2,346 persons from HIV-endemic regions were infected with HIV and HIV prevalence by country varied from 0.21% to 4.5%.

HIV diagnostic data alone provided limited insight into the epidemic among persons from HIV-endemic countries. Adjustments in accordance with call-back study results (which may no longer apply, since the study was carried out in 1996) may not fully compensate for under-representation of affected populations who test for HIV. For example, persons from HIV-endemic countries classified with MSM exposure in the AIDS database are not represented with the same proportion in the HIV database, even though records of HIV-positive diagnoses have been maintained since 1985. The lack of specific information from the HIV database implies persons from HIV-endemic countries tend not to test for HIV, or if they do, they may not indicate on the test requisition that they have lived in an endemic country.

Analyses of AIDS data provided a more informative epidemiologic description of persons born in an HIV-endemic country who were diagnosed with AIDS during the study period. Overall, more cases occurred among persons born in the Caribbean than in sub-Saharan Africa; more cases were diagnosed among men than women; more men were from the Caribbean than sub-Saharan Africa and persons from sub-Saharan Africa were younger at time of diagnosis than those born in the Caribbean. Changes were apparent over time; fewer cases were diagnosed among males in later years and more cases occurred among persons born in sub-Saharan Africa later in the study period.

Important differences in predominant routes through which infection may have been acquired became apparent when we examined AIDS cases among males by HIV-endemic region of origin; more Caribbean-born men reported the additional risk of having sex with men compared to male AIDS cases who were born in sub-Saharan Africa. Furthermore, changes in exposure category over time were evident later in the study period; more persons assigned HIV-endemic exposure category were diagnosed and more males had this exposure. Lastly, almost all cases residing in Ottawa-Carleton were assigned HIV-endemic exposure category while the concentration of men reporting having sex with men were in Metro Toronto.

Mortality data captures country of birth information but risk factors related to HIV-infection are not recorded. More deaths occurred among persons born in the Caribbean than sub-Saharan Africa and more deaths were among males than females. Persons born in sub-Saharan Africa died earlier (under 40 years of age) compared to those born in the Caribbean. The majority of deaths were reported from Metro Toronto.

Analyses of AIDS data brings to light an important sub-group of the Ontario population who may be at increased risk of acquiring the virus. Caribbean-born men who report the additional risk of having sex with men appear to constitute a group who, until now, have been obscured by the use of algorithms used to assign cases to a mutually exclusive exposure category. Persons reporting having been born in an HIV-endemic country who also report MSM as a risk factor would be assigned to MSM exposure category by the RDIS algorithm. However, interventions aimed at preventing HIV infection among MSM born in the Caribbean may differ from preventive approaches currently in place which target the majority of the MSM population. AIDS-related mortality data, though lacking risk factor information, clearly indicated the majority of deaths occurred among males who were born in the Caribbean. Though not specifically modeled for the present report, it is estimated that at least 300 Caribbean-born MSM may be HIV-infected and many more may be at increased risk of acquiring infection because they are not receiving culturally targeted and appropriate preventive interventions.

The perinatal database included 116 women who were born in an HIV-endemic region; 75% had a maternal country of birth in sub-Saharan Africa, 25% in the Caribbean. The majority of mother-infant pairs had been reported by HSC and CHEO, the two hospitals which have been contributing to the database for the longest period of time. Most mother-infant pairs were reported during 1990 to 1996 and it was during this time period that 74% of their newborns were confirmed infected. Data for 1997 appears to be incomplete given the number of mother-infant pairs reported that year compared to the number reported in 1996 and 1998.

Overall, there appeared to be an important concentration of cases in the Metro Toronto health region and, to a lesser extent, Ottawa-Carleton. Metro Toronto reported 48% of the first-time HIV-positive diagnoses (33% in Ottawa-Carleton), 72% of the AIDS cases (11% were reported by Ottawa-Carleton), 67% of AIDS-related deaths (9% reported by Ottawa-Carleton) and 66% of the mother-infant pairs (26% were reported by CHEO). Whereas the majority of persons who emigrated from the Caribbean or sub-Saharan Africa resided in Metro Toronto, an important concentration of the Haitian community resided in Ottawa-Carleton.

Based on the HIV model, approximately 2,346 persons were estimated to be living with HIV as of end-1998, 1,491 of whom were born in the Caribbean and 855 in sub-Saharan Africa. Of the 2,346 HIV-infected persons, 1,906 were male and 440 were female. The proportion female was significantly higher for Africa (26%) than for the Caribbean (14%). For Caribbean countries, 46% were endogenous infections, that is, acquired in Canada, compared to 30% for HIV-

infected persons from sub-Saharan Africa. This has important implications since these infections could potentially be prevented by policies and programs in place in Canada.

Within the Caribbean, the majority of infections were among persons from Jamaica (544 persons), Guyana (311), Trinidad and Tobago (295) and Haiti (142). These four countries accounted for about 87% of the infections from the Caribbean. From sub-Saharan Africa, the distribution included a greater number of nations, the most important countries being Ethiopia and Eritrea (158 persons), Somalia (138), South Africa (133), Uganda (96) and Kenya (91). These five countries accounted for approximately 72% of infections among persons from sub-Saharan Africa.

The majority of HIV infections, either imported or acquired in Canada, occurred since 1990 for most of the countries examined. One exception to this was Jamaica, where the epidemic appears to have been established since the 1980s. Overall, we noted a more rapid increase in the most recent years; the number of HIV infections estimated for 1997 and 1998 represented 12% annual increases over the previous year and approximately 250 new HIV infections were estimated for each of these two years. This represents 15-25% of all new infections estimated for the province of Ontario <4>.

The descriptive analyses of HIV, AIDS, AIDS-related mortality and perinatal data provided the parameters used to validate the HIV model. Initial values of HIV prevalence in the country of origin were introduced into the model and the adjustment factor varied so that model outputs approximated the observed parameters using the goodness-of-fit statistic. A statistical model such as the one we used here is subject to important limitations. Data for the demographic section of the model was relatively precise but errors may still have occurred. For example, immigration may count a person arriving in Ontario as coming from a country where they stayed temporarily or was the last country visited if they were in transit. Census data is subject to many limitations with respect to the ability to enumerate persons who may be in transit or otherwise subject to undercounting due to, for example, illegal immigration status. We also do not know the level of precision and accuracy of the databases we used, including births, deaths, migration and census data. Of all these, the death rate is likely the most precise followed by birth rates, census and finally immigration data.

The HIV statistical model was less precise and data on which it was based was subject to greater uncertainties. For example, AIDS incidence is subject to delayed reporting and under-reporting; it is not easy to quantify either of these, especially for subsets of AIDS cases. The ascertainment of mother-infant pairs infected with HIV is based on an informal, volunteer reporting system and no independent validation of reporting completeness has been carried out.

Perhaps the least precise aspect of the HIV model relates to the modeling of endogenous transmissions. Indirect methods were used to estimate this; a different method was used for male and female transmissions. These provide order-of-magnitude estimates only. Nevertheless, modeling was carried out on the overall HIV prevalence to fit observed indicators; thus, the overall numbers would not be subject to as much uncertainty as that between imported and endogenous transmissions. Another potential difficulty with the HIV model relates to the use of parameters for progression from HIV to AIDS and from AIDS to death; these may not be precise, especially for this poorly characterized sub-population. In spite of these many limitations, we were able to achieve excellent fits for almost all countries modeled, with the exception of Jamaica, Haiti and Somalia. Also reassuring is that results from the current

approach were comparable to those from a modeling exercise carried out in 1996 using largely independent methods for the Ontario situation report <4>. In that report, we estimated 1,860 prevalent infections among person from HIV-endemic countries to end 1996; this compares to 1,827 infections to the same year from the present model.

HIV prevalence among persons from HIV-endemic countries was 0.89% for sub-Saharan Africa and 0.54% for the Caribbean. This is substantially lower than the HIV prevalence in the countries of origin, perhaps for several reasons. First, there may be "selection bias" related to deciding to immigrate or being selected for immigration to Canada. HIV screening and differential acceptance may be an important factor as well. Though Canada apparently has no official policy requiring HIV testing of applicants for immigration, anecdotal evidence suggests that some HIV testing of a "discretionary" nature may be occurring in some countries.

The HIV prevalence we estimated is considerably lower than the estimated prevalence of HIV infection among homosexual men, estimated at 10-15%, and injection drug users, probably in the range of 5-10%, in Ontario. Nevertheless, the prevalence of HIV infection is substantially higher than other Ontario residents who are neither MSM nor IDU. Although it is difficult to make precise calculations, we estimate based on our results that the rate of HIV-infection among persons from the Caribbean is approximately 20 times greater than heterosexual non-injection drug using Ontarians and approximately 60-fold higher for those from Africa. Though one may question the precision of these relative risks, it remains that HIV infection is a preoccupying health problem for persons from HIV-endemic countries. To the best of our knowledge, few studies have been carried out among persons from Africa and the Caribbean who have immigrated to Western industrialized countries. A study in Montreal among women undergoing abortion observed a prevalence among women from Haiti of approximately 2% <11>. This is comparable to our estimated value of 2.2% for Haitian women in Ontario.

There are important implications to our observations. Since the current estimates should be considered as plausible hypotheses, further epidemiologic studies must be carried out to validate our findings. Equally important, additional studies are necessary to define the psychological, social and behavioural determinants of HIV transmission, especially regarding infections occurring in Canada as these are theoretically preventable. To date, the problem of HIV-infection among persons from HIV-endemic countries in Ontario has not been widely appreciated. The importance of HIV among women from these regions is underscored by a modeling study carried out by the present author among HIV-infected mothers delivering in Ontario from 1978 to 1998. In this study we observed, based on data from the HIV Pediatric Network, that 70% of mother-infant HIV transmissions in recent years were among women from sub-Saharan Africa and the Caribbean <10>.

New initiatives are necessary to confirm the findings of the present report and to undertake additional investigations to better understand this important health problem. We must also begin to take measures to prevent future transmissions. For example, it would be useful if this population were included in the next phase of the national AIDS strategy, much as the Aboriginal population was prioritized in the last strategy. Guidelines for HIV testing, condom use and partner notification, among other issues, need to be developed which are appropriate for this population with different needs than other populations affected by the HIV epidemic. At the provincial level, the Ontario government in collaboration with the involved communities and others interested in both research and intervention, must develop a high level of commitment to deploy the necessary resources to begin to deal with this important public health problem.

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APPENDIX 1

COUNTRIES CLASSIFIED AS HIV-ENDEMIC IN THE OASP DATABASE*†

<i>Caribbean:</i>	<i>Sub-Saharan Africa:</i>
Antigua	Africa
Bahamas	Angola
Barbados	Botswana
Bermuda	Burundi
Cayman Islands	Cameroon
Dominica	Cape Verde
Dominican Republic	Central African Republic
French Guyana	Chad
Grenada	Congo
Guadeloupe	Djibouti
Guyana	Equatorial Guinea
Haiti	Ethiopia
Jamaica	Gabon
Martinique	Gambia
Montserrat	Ghana
Netherlands Antilles	Guinea
Nevis-Anguilla	Guinea-Bissau
St Lucia	Ivory Coast
St Vincent	Kenya
Surinam	Lesotho
Trinidad-Tobago	Liberia
Turks and Caicos Islands	Malawi
UK Virgin Islands	Mali
US Virgin Islands	Mauritania
	Mozambique
	Namibia
	Niger
	Nigeria
	Rwanda
	Sao Tome
	Senegal
	Sierra Leone
	Somalia
	South Africa
	Sudan
	Swaziland
	Tanzania
	Togo
	Uganda
	Upper Volta
	Western Sahara
	Zaire
	Zambia
	Zimbabwe

* Country names are as coded in the Reportable Disease Information System, Ontario Ministry of Health

† HIV-endemic classification included northern regions of South America, the Caribbean and sub-Saharan Africa in accordance with +Remis (1995) and recent international estimates of adult HIV prevalence (WHO, 1994).

APPENDIX 2

HIV MODELED COUNTRIES

<i>Caribbean:</i>	<i>Sub-Saharan Africa:</i>
<i>Category 1 countries modeled:</i>	<i>Category 1 countries modeled:</i>
Barbados	Ethiopia and Eritrea
Grenada	Kenya
Guyana	Somalia
Haiti	Republic of South Africa
Jamaica	Tanzania
Trinidad-Tobago	Uganda
	Zaire
<i>Category 2 countries aggregated and modeled:</i>	<i>Category 2 countries aggregated and modeled:</i>
Caribbean, Other:	East Africa, Other:
Antigua and Barbuda	Burundi
Bahamas	Rwanda
Bermuda	Zimbabwe
Dominica	
Dominican Republic	Central Africa, Other:
St. Kitts and Nevis	Angola
St. Lucia	Cameroon
St. Vincent	
<i>Category 3 countries not modeled:</i>	<i>Category 3 countries not modeled:</i>
Anguilla	West Africa, Other:
Aruba	Gambia
Cayman Islands	Ghana
Guadeloupe	Guinea
Martinique	Ivory Coast
Montserrat	Liberia
Netherland Antilles	Nigeria
Turks and Caicos Islands	Senegal
Virgin Islands, British	Sierra Leone
Virgin Islands, US	
French Guiana	Southern Africa, Other;
Suriname	Botswana
	Lesotho
	Namibia
	Swaziland
	<i>Category 3 countries not modeled:</i>
	Benin, Burkina Faso, Cape Verde, Central African
	Republic, Chad, Comoros, Congo, Djibouti,
	Equatorial Guinea, Gabon, Guinea-Bissau,
	Madagascar, Malawi, Mali, Mauritania, Mayotte,
	Mozambique, Niger, St. Helena, Sao Tome &
	Principe, Sudan, Togo, Western Sahara, Zambia

APPENDIX 3

HIV MODEL, DEMOGRAPHIC SECTION: COLUMN DEFINITIONS

Sex-specific model

Column heading	Method of calculation
Immigrate from country of origin	Annual immigration data by sex, 1981 to 1997 1998 figures are estimated
Migrate from other province	Population in the previous year x proportion in-migrating
Migrate to other province	Population in the previous year x proportion out-migrating
AIDS-related deaths	<i>from statistical model</i> (AIDS incidence, same year x AIDS-related mortality rate, same year) + (AIDS incidence, previous year x AIDS-related mortality rate, first year) + (AIDS incidence, 2 years previous x AIDS-related mortality rate, second year) + (AIDS incidence, 3 years previous x AIDS-related mortality rate, third year) + (AIDS incidence, 4 years previous x AIDS-related mortality rate, fourth year)
Deaths other	Deaths total - AIDS-related deaths
Deaths total	Annual death data, 1981 to 1997 1998 deaths are estimated
Population	1980 Census Canada population data Subsequent years: Population, previous year + immigrate from country of origin, same year + migrate from other province, same year + births, same year - migrate to other province, same year - deaths total, same year
"Census" population	1980 Census Canada population data Subsequent years: "Census" population, previous year + immigrate from country of origin, same year + migrate from other province, same year - migrate to other province, same year - deaths total, same year
Births	Births, actual x 0.5
Census years' population	Census Canada population data for census years 1981, 1986, 1991, 1996 (if available for that country)

Both sexes model

Column heading	Method of calculation
Immigrate from country of origin	Immigrate from country of origin, females + immigrate from country of origin, males
Migrate from other province	Migrate from other province, females + migrate from other province, males
Migrate to other province	Migrate to other province, females + migrate to other province, males
AIDS-related deaths	AIDS-related deaths, females + AIDS-related deaths, males
Deaths other	Deaths other, females + deaths other, males
Deaths total	Deaths total, females + deaths total, males
Population	Population, females + population, males
"Census" population	"Census" population, females + "census" population, males
Births	Births, actual
Crude death rate (per 1,000)	Deaths total, same year / population, previous year x 1,000
General fertility rate (per 1,000)	Births actual, same year / ("census" population, females, same year x proportion female 15-44) x 1,000
Census years' population	Census Canada population data, females + Census Canada population data, males

APPENDIX 4

HIV MODEL, STATISTICAL SECTION: COLUMN DEFINITIONS

Sex-specific model

Column heading	Method of calculation
HIV prevalence in source country	HIV prevalence in source country, same year / $[0.5 \times (\text{male} : \text{female ratio} + 1)]$
HIV prevalence adjustment factor	HIV prevalence adjustment factor 1981 - 1983 1984 - 1986 1987 - 1989 1990 - 1992 1993 - 1995 1996 - 1998
HIV prevalence among immigrants	HIV prevalence, source country, same year x HIV prevalence adjustment factor, same year
HIV-infected (women, men) arriving from country of origin	Immigrate from country of origin, same year (<i>from demographic model</i>) x HIV prevalence among immigrants, same year
Migrate from other province	HIV prevalence, previous year x proportion in-migrating
Migrate to other province	HIV prevalence, previous year x proportion out-migrating
New endogenous infections	HIV prevalence among males, previous year x HIV incidence with respect to prevalence
AIDS incidence	HIV prevalence, previous years x HIV-AIDS progression
AIDS-related deaths	(AIDS incidence, same year x AIDS-related mortality rate, same year) + (AIDS incidence, previous year x AIDS-related mortality rate, first year) + (AIDS incidence, 2 years previous x AIDS-related mortality rate, second year) + (AIDS incidence, 3 years previous x AIDS-related mortality rate, third year) + (AIDS incidence, 4 years previous x AIDS-related mortality rate, fourth year)
HIV prevalence	fixed, 1980 Subsequent years: HIV prevalence, previous year + HIV-infected (women, men) arriving from country of origin, same year + migrate from other province, same year + new endogenous infections, same year + $(0.5 \times \text{HIV-infected infants, both sexes, same year})$ - migrate to other province, same year - AIDS-related deaths, same year
Cumulative imported infections	Sum, HIV-infected (women, men) arriving from country of origin
Cumulative endogenous infections	Sum, new endogenous infections
Proportion endogenous	Cumulative endogenous infections, same year / (cumulative imported infections, same year + cumulative endogenous infections, same year)
Births to HIV-infected mothers, both sexes (<i>female model only</i>)	HIV prevalence, previous year x proportion HIV+ female 15-44 x general fertility rate, same year (<i>demographic model</i>) / 1,000
HIV-infected infants, both sexes (<i>female model only</i>)	Births to HIV-infected mothers, both sexes, same year x mother-infant HIV transmission (1980-94, 1995-96, 1997-98)

Both sexes model

Column heading	Method of calculation
HIV prevalence in source country	HIV prevalence, source country 1981 - 1983 1984 - 1986 1987 - 1989 1990 - 1992 1993 - 1995 1996 - 1998
HIV prevalence adjustment factor	[(HIV prevalence adjustment factor, females, same year x HIV-infected women from country of origin, same year) + (HIV prevalence adjustment factor, males, same year x HIV-infected men from country of origin, same year)] / [HIV-infected women arriving from country of origin, same year + HIV-infected men arriving from country of origin, same year]
HIV prevalence among immigrants	HIV prevalence in source country, same year x HIV prevalence adjustment factor, same year
HIV-infected persons arriving from country of origin	HIV-infected women arriving from country of origin, same year + HIV-infected men arriving from country of origin, same year
Migrate from other province	Migrate from other province, females, same year + migrate from other province, males, same year
Migrate to other province	Migrate to other province, females, same year + migrate to other province, males, same year
New endogenous infections	New endogenous infections, females, same year + new endogenous infections, males, same year
AIDS incidence	AIDS incidence, females, same year + AIDS incidence, males, same year
Cumulative AIDS incidence	Sum, AIDS incidence
AIDS-related deaths	AIDS-related deaths, females, same year + AIDS-related deaths, males, same year
HIV prevalence	HIV prevalence, females, same year + HIV prevalence, males, same year
Cumulative imported infections	Cumulative imported infections, female, same year + cumulative imported infections, male, same year
Cumulative endogenous infections	Cumulative endogenous infections, female, same year + cumulative endogenous infections, male, same year
Proportion endogenous	Cumulative endogenous infections, same year / (cumulative imported infections, same year + cumulative endogenous infections)
HIV prevalence (%), 1998	HIV prevalence, 1998 / "Census" population, 1998 (<i>demographic model</i>) x 100

APPENDIX 5
EXPOSURE CATEGORY CLASSIFICATIONS

RDIS algorithm OASP	LAByrinth algorithm HIV Laboratory, CPHL
Blood products	
Blood transfusion	Transfused
Blood transfusion after 1985	
Child - blood products	
Child - blood transfusion	
Child - HIV-positive parent	Perinatal
Clotting factor after 1985	Clotting factor
Did not code	
Endemic area - partner risk	Endemic (<i>'HIV-endemic' in this report</i>)
Endemic area - uncertain risk	
Heterosexual partner	High risk heterosexual
Heterosexual - no indicated risk	Low risk heterosexual
Homosexual / bisexual	Men who have sex with men
Homosexual / bisexual / IV drug user	Men who have sex with men and IV drug user
IV drug user	IV drug user
No identifiable risk	No identifiable risk
Non-medical / non-occupational	
Occupational	Needlestick
Other	Other
Unknown	Unknown

TABLES

Legend

<i>MSM</i>	<i>Men who have sex with men</i>
<i>IDU</i>	<i>Injection drug use(r)</i>
<i>MSM-IDU</i>	<i>Men who have sex with men and use injection drugs</i>
<i>Clotting factor</i>	<i>Clotting factor recipient</i>
<i>Blood product</i>	<i>Blood product recipient</i>
<i>HIV-endemic</i>	<i>HIV-endemic country of origin</i>
<i>Transfusion</i>	<i>Transfusion recipient</i>
<i>Occupational</i>	<i>Occupational exposure</i>
<i>Perinatal</i>	<i>Perinatal exposure</i>
<i>LR hetero</i>	<i>Low risk heterosexual</i>
<i>HR hetero</i>	<i>High risk heterosexual</i>
<i>Heterosexual</i>	<i>Heterosexual transmission</i>
<i>NIR</i>	<i>No identified risk</i>
<i>Unk</i>	<i>Unknown exposure</i>

Table 1.1 Immigrant population by country of birth and region of residence, 1996 census, Ontario

Sub-region / country of birth	Toronto			Ottawa			Other ¹			Total		
	Males	Females	Total ³	Males	Females	Total ³	Males	Females	Total ³	Males	Females	Total ³
Sub-Saharan Africa:												
Ethiopia and Eritrea	4,870	4,305	9,180	1,170	1,125	2,295	805	660	1,455	6,845	6,090	12,930
Kenya	3,740	4,345	8,085	250	335	580	730	730	1,465	4,720	5,410	10,130
Somalia	4,300	4,590	8,890	2,040	2,215	4,250	715	715	1,435	7,055	7,520	14,575
South Africa	5,975	6,020	12,000	240	245	490	1,520	1,770	3,280	7,735	8,035	15,770
Tanzania	4,640	4,750	9,395	135	135	275	410	370	770	5,185	5,255	10,440
Uganda	1,960	1,920	3,875	260	295	555	630	635	1,265	2,850	2,850	5,695
Other Western Africa	6,730	5,325	12,055	440	355	795	805	620	1,430	7,975	6,300	14,280
Other Eastern Africa	2,580	2,615	5,200	420	435	860	715	655	1,360	3,715	3,705	7,420
Other Central and Southern Africa	890	685	1,575	305	225	530	330	240	570	1,525	1,150	2,675
Sub-total (Africa)	35,685	34,555	70,255	5,260	5,365	10,630	6,660	6,395	13,030	47,605	46,315	93,915
Caribbean²:												
Barbados	3,570	4,655	8,230	240	330	570	840	840	1,680	4,650	5,825	10,475
Guyana	28,150	32,545	60,705	765	895	1,660	3,330	3,510	6,840	32,245	36,950	69,195
Haiti	325	310	640	990	1,440	2,435	120	100	220	1,435	1,850	3,285
Jamaica	35,905	51,005	86,910	1,405	2,175	3,585	4,585	5,250	9,835	41,895	58,430	100,330
Trinidad and Tobago	18,645	22,410	41,050	655	745	1,400	2,780	3,165	5,945	22,080	26,320	48,400
Other Caribbean and Bermuda	7,820	11,080	18,895	775	905	1,680	1,725	2,050	3,775	10,320	14,035	24,355
Sub-total (Caribbean)	94,415	122,005	216,430	4,830	6,490	11,330	13,380	14,915	28,295	112,625	143,410	256,040
Total	130,100	156,560	286,685	10,090	11,855	21,960	20,040	21,310	41,325	160,230	189,725	349,955

¹ Ontario minus Toronto minus Ottawa.

² Although Grenada was modeled specifically, census data from Statistics Canada was not available for this country. Estimates of the population from 1980 to 1998 for Grenada (taken from the country-specific HIV-model) were: both sexes, 6,418; females, 3,669; males, 2,749.

³ Totals as per census Canada rather than strict sums by sex.

Table 1.2 Proportion* immigrant population by country of birth and region of residence, 1996 census, Ontario

Sub-region / country of birth	Toronto			Ottawa			Other ¹			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
Sub-Saharan Africa:	%	%	%	%	%	%	%	%	%	%	%	%
Ethiopia and Eritrea	53.1	46.9	71.0	51.0	49.0	17.7	55.3	45.4	11.3	52.9	47.1	13.8
Kenya	46.3	53.7	79.8	42.7	57.3	5.8	49.8	49.8	14.5	46.6	53.4	10.8
Somalia	48.4	51.6	61.0	47.9	52.1	29.2	49.8	49.8	9.8	48.4	51.6	15.5
South Africa	49.8	50.2	76.1	49.5	50.5	3.1	46.3	54.0	20.8	49.0	51.0	16.8
Tanzania	49.4	50.6	90.0	50.0	50.0	2.6	53.2	48.1	7.4	49.7	50.3	11.1
Uganda	50.6	49.5	68.0	46.8	53.2	9.7	49.8	50.2	22.2	50.0	50.0	6.1
Other Western Africa	55.8	44.2	84.4	55.3	44.7	5.6	56.3	43.4	10.0	55.9	44.1	15.2
Other Eastern Africa	49.6	50.3	70.1	49.1	50.9	11.5	52.6	48.2	18.3	50.1	49.9	7.9
Other Central and Southern Africa	56.5	43.5	58.9	57.5	42.5	19.8	57.9	42.1	21.3	57.0	43.0	2.8
Sub-total (Africa)	50.8	49.2	74.8	49.5	50.5	11.3	51.1	49.1	13.9	50.7	49.3	26.8
Caribbean:	%	%	%	%	%	%	%	%	%	%	%	%
Barbados	43.4	56.6	78.6	42.1	57.9	5.4	50.1	50.1	16.0	44.4	55.6	4.1
Guyana	46.4	53.6	87.7	46.1	53.9	2.4	48.8	51.4	9.9	46.6	53.4	27.0
Haiti	50.8	48.4	19.5	40.7	59.3	74.0	57.1	47.6	6.4	43.7	56.3	1.3
Jamaica	41.3	58.7	86.6	39.2	60.8	3.6	46.6	53.4	9.8	41.8	58.2	39.2
Trinidad and Tobago	45.4	54.6	84.8	46.8	53.2	2.9	46.7	53.2	12.3	45.6	54.4	18.9
Other Caribbean and Bermuda	41.4	58.6	77.6	46.1	53.9	6.9	45.6	54.2	15.5	42.4	57.6	9.5
Sub-total (Caribbean)	43.6	56.4	84.5	42.7	57.3	4.4	47.3	52.7	11.0	44.0	56.0	73.2
Total	45.4	54.6	81.9	46.0	54.0	6.3	48.5	51.6	11.8	45.8	54.2	100.0

¹ Ontario minus Toronto minus Ottawa.

- Male and female percents calculated as percent from that country living in Toronto, Ottawa or Other and percent male and female from that country living in Ontario (Total); Total percents under Toronto, Ottawa, Other calculated as percent of persons from that country living in that region; Total percent (in the far left column) calculated as the proportion of persons from that HIV-endemic region living in Ontario and sub-total (Africa) and sub-total (Caribbean) percents calculated as percent of persons from that HIV-endemic region living in Ontario.

Table 2.1 Number of first-time HIV-positive diagnoses (unadjusted) by LAByrinth assigned exposure category and year of diagnosis, Ontario, 1985 to 1998

Exposure category	Year of HIV diagnosis														Total
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
MSM	166	471	854	780	895	828	427	567	456	346	359	309	246	237	6,941
MSM-IDU	5	11	19	21	24	17	6	20	26	18	20	11	8	9	215
IDU	1	9	16	42	60	71	36	87	59	87	74	68	55	54	719
HIV-endemic	0	4	9	18	16	23	14	24	19	14	19	25	13	19	217
HR hetero	1	2	3	18	24	35	15	24	40	30	28	25	33	17	295
LR hetero	0	0	6	5	11	6	5	36	65	65	80	70	73	71	493
Clotting factor	10	28	48	50	35	48	16	15	16	6	9	6	5	2	294
Transfusion	5	8	31	34	20	7	1	9	13	12	9	7	7	7	170
Needlestick	0	0	0	0	0	0	0	0	0	2	2	2	2	4	12
Perinatal	0	0	2	8	7	20	8	7	16	33	25	33	11	22	192
Other	10	15	14	4	7	39	25	23	11	14	23	12	20	56	273
Unknown	135	807	505	406	550	909	1,236	932	748	697	686	491	479	471	9,052
NIR	2	10	44	69	62	90	51	85	36	26	33	22	24	32	586
Total	335	1,365	1,551	1,455	1,711	2,093	1,840	1,829	1,505	1,350	1,367	1,081	976	1,001	19,459

Source of data: HIV Laboratory, CPHL

Table 2.2 Number of first-time HIV-positive diagnoses by LAByrinth assigned exposure category and year of diagnosis with unknown exposure category reassigned*, Ontario, 1985 to 1998

Exposure category (% adjusted)	Year of HIV diagnosis														
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Total
MSM (55.7)	248	934	1,168	1,047	1,240	1,406	1,158	1,146	899	758	773	603	538	551	12,469
MSM-IDU (7.2)	16	71	60	55	69	92	100	95	83	71	74	49	46	50	931
IDU (10.5)	16	96	75	92	125	180	174	196	142	165	152	123	110	113	1,759
HIV-endemic (11.4)	17	99	73	73	87	141	164	143	110	98	104	85	73	83	1,350
Heterosexual ¹ (8.7)	14	74	58	65	89	131	134	150	174	159	173	141	152	137	1,651
Clotting factor (0.6)	11	33	51	53	39	54	24	21	21	10	13	9	8	5	352
Transfusion (2.7)	9	30	46	47	37	35	36	37	34	32	29	21	21	22	436
Perinatal (2.9)	4	24	18	22	25	50	46	37	39	54	47	48	26	38	478
Total (99.7)	335	1,361	1,549	1,454	1,711	2,089	1,836	1,825	1,502	1,347	1,365	1,079	974	999	19,426

* In accordance with call-back study results.

¹ HR and LR heterosexual, combined.

Source of data: HIV Laboratory, CPHL

Table 2.3 Number (and column percent) of first-time HIV-positive diagnoses (unadjusted) among persons born in an HIV-endemic country by exposure category and year of diagnosis, Ontario, 1985 to 1998

Exposure category	Year of HIV diagnosis														Total
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
MSM	1 (50.0)	4 (36.4)	0	0	1 (5.3)	1 (3.8)	0	7 (22.5)	4 (16.0)	1 (6.3)	0	1 (3.7)	3 (15.8)	0	23 (8.8)
MSM-IDU	1 (50.0)	2 (18.2)	0	0	0	1 (3.8)	0	0	0	0	0	1 (3.7)	0	0	5 (1.9)
IDU	0	1 (9.1)	0	1 (4.5)	1 (5.3)	0	0	0	0	0	0	0	2 (10.5)	2 (9.1)	7 (2.7)
HIV-endemic	0	4 (36.4)	9 (100)	21 (95.5)	17 (89.5)	24 (92.3)	14 (100)	24 (77.4)	21 (84.0)	15 (93.8)	19 (100)	25 (92.6)	14 (73.7)	20 (90.9)	227 (86.6)
Total	2	11	9	22	19	26	14	31	25	16	19	27	19	22	262

Source of data: HIV Laboratory, CPHL

Table 2.4 Number (and column percent) of first-time HIV-positive diagnoses (unadjusted) among persons born in an HIV-endemic country by exposure category, health region of residence and sex, Ontario, 1985 to 1998

Exposure category	Metro Toronto			Ottawa-Carleton			Other			Unknown			Total		
	Males	Females	Unk	Males	Females	Unk	Males	Females	Unk	Males	Females	Unk	Males	Females	Unk
MSM	16 (18.4)	--	0	2 (4.3)	--	0	3 (10.3)	--	0	2 (33.3)	--	0	23 (13.7)	--	0
MSM-IDU	2 (2.3)	--	0	1 (2.2)	--	0	2 (6.9)	--	0	0	--	0	5 (3.0)	--	0
IDU	2 (2.3)	2 (5.6)	0	1 (2.2)	0	0	1 (3.4)	0	0	1 (16.7)	0	0	5 (3.0)	2 (2.4)	0
HIV-endemic	67 (77.0)	34 (94.4)	4 (100)	42 (91.3)	33 (100)	7 (100)	23 (79.3)	13 (100)	0	3 (50.0)	1 (100)	0	135 (80.4)	81 (97.6)	11 (100)
Total	87	36	4	46	33	7	29	13	0	6	1	0	168	83	11

Source of data: HIV Laboratory, CPHL

Table 3.1 Number (and column percent) of AIDS cases by exposure category and year of AIDS diagnosis, Ontario, 1981 to 1998

Exposure category	Year of AIDS diagnosis																Total
	<1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
MSM	22 (78.6)	47 (82.5)	137 (85.6)	234 (83.6)	353 (79.7)	377 (79.7)	434 (77.0)	485 (75.8)	459 (76.0)	510 (71.1)	506 (72.7)	446 (73.5)	375 (67.6)	215 (61.1)	111 (56.1)	64 (50.0)	4,775 (73.4)
MSM-IDU	2 (7.1)	3 (5.3)	4 (2.5)	9 (3.2)	18 (4.1)	19 (4.0)	22 (3.9)	21 (3.3)	20 (3.3)	33 (4.6)	33 (4.7)	29 (4.8)	27 (4.9)	17 (4.8)	7 (3.5)	3 (2.3)	267 (4.1)
IDU	0	0	1 (0.6)	3 (1.1)	11 (2.5)	6 (1.3)	21 (3.7)	17 (2.7)	18 (3.0)	35 (4.9)	25 (3.6)	22 (3.6)	26 (4.7)	29 (8.2)	9 (4.5)	12 (9.4)	235 (3.6)
HIV-endemic	2 (7.1)	1 (1.8)	4 (2.5)	7 (2.5)	7 (1.6)	9 (1.9)	22 (3.9)	19 (3.0)	14 (2.3)	24 (3.3)	24 (3.4)	19 (3.1)	28 (5.0)	32 (9.1)	24 (12.1)	22 (17.2)	258 (4.0)
Heterosexual	0	3 (5.3)	2 (1.3)	4 (1.4)	18 (4.1)	33 (7.0)	37 (6.6)	56 (8.8)	39 (6.5)	61 (8.5)	69 (9.9)	56 (9.2)	60 (10.8)	35 (9.9)	28 (14.1)	19 (14.8)	520 (8.0)
Clotting factor	1 (3.6)	0	4 (2.5)	4 (1.4)	7 (1.6)	7 (1.5)	2 (0.4)	12 (1.9)	11 (1.8)	9 (1.3)	7 (1.0)	3 (0.5)	7 (1.3)	3 (0.9)	1 (0.5)	0	78 (1.2)
Transfusion	0	0	3 (1.9)	10 (3.6)	18 (4.1)	10 (2.1)	6 (1.1)	8 (1.3)	11 (1.8)	10 (1.4)	3 (0.4)	4 (0.7)	7 (1.3)	4 (1.1)	6 (3.0)	1 (0.8)	101 (1.6)
Perinatal	0	0	0	0	2 (0.5)	3 (0.6)	2 (0.4)	1 (0.2)	3 (0.5)	6 (0.8)	5 (0.7)	1 (0.2)	6 (1.1)	3 (0.9)	3 (1.5)	1 (0.8)	36 (0.6)
Occupational	0	0	0	0	0	1 (0.2)	1 (0.2)	0	0	0	0	0	0	0	0	0	2 (0.0)
NIR	1 (3.6)	3 (5.3)	5 (3.1)	9 (3.2)	9 (2.0)	8 (1.7)	17 (3.0)	21 (3.3)	29 (4.8)	29 (4.0)	24 (3.4)	27 (4.4)	19 (3.4)	14 (4.0)	9 (4.5)	6 (4.7)	230 (3.5)
Total	28	57	160	280	443	473	564	640	604	717	696	607	555	352	198	128	6,502

Source of data: Ontario AIDS Surveillance Program (cases reported to March 11, 1999)

Table 3.2 Number of AIDS cases among persons born in an HIV-endemic country by year of AIDS diagnosis, HIV-endemic region of origin and sex, Ontario, 1981 to 1998

Year of AIDS diagnosis	Caribbean			Sub-Saharan Africa			COB missing			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
<1984	0	0	0	0	0	0	1	1	2	1	1	2
1984	4	0	4	0	0	0	0	0	0	4	0	4
1985	5	1	6	2	0	2	0	0	0	7	1	8
1986	6	0	6	5	1	6	3	0	3	14	1	15
1987	8	2	10	2	1	3	1	0	1	11	3	14
1988	12	1	13	7	1	8	2	0	2	21	2	23
1989	14	3	17	6	3	9	4	0	4	24	6	30
1990	19	3	22	8	2	10	4	2	6	31	7	38
1991	17	1	18	6	1	7	3	4	7	26	6	32
1992	17	4	21	11	3	14	2	3	5	30	10	40
1993	24	1	25	6	3	9	1	2	3	31	6	37
1994	22	2	24	6	4	10	0	1	1	28	7	35
1995	18	2	20	11	6	17	8	0	8	37	8	45
1996	7	2	9	8	7	15	9	3	12	24	12	36
1997	5	0	5	7	3	10	3	4	7	15	7	22
1998	4	1	5	8	2	10	2	6	8	14	9	23
Total	182	23	205	93	37	130	43	26	69	318	86	404

Source of data: Ontario AIDS Surveillance Program (cases reported to March 11, 1999)

Table 3.3 Number of AIDS cases among persons born in an HIV-endemic country by age group, HIV-endemic region of origin and sex, Ontario, 1981 to 1998

Age group (years)	Caribbean			Sub-Saharan Africa			COB missing			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
<15	0	1	1	2	1	3	0	0	0	2	2	4
15-19	1	0	1	0	0	0	0	1	1	1	1	2
20-24	7	1	8	4	4	8	2	1	3	13	6	19
25-29	23	3	26	17	16	33	3	5	8	43	24	67
30-34	39	9	48	23	7	30	9	7	16	71	23	94
35-39	40	4	44	27	5	32	10	7	17	77	16	93
40-44	37	1	38	12	3	15	8	1	9	57	5	62
45-49	17	2	19	4	1	5	2	2	4	23	5	28
50-54	7	0	7	3	0	3	5	2	7	15	2	17
55-59	8	0	8	1	0	1	2	0	2	11	0	11
60+	3	2	5	0	0	0	2	0	2	5	2	7
Total	182	23	205	93	37	130	43	26	69	318	86	404

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 3.4 Number (and column percent) of AIDS cases among persons born in an HIV-endemic country by exposure category, HIV-endemic region of origin and sex, Ontario, 1981 to 1998

Exposure category	Caribbean			Sub-Saharan Africa			COB missing			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
MSM	114 (62.6)	-	114 (55.6)	26 (28.0)	-	26 (20.0)	11 (25.6)	-	11 (15.9)	151 (47.5)	-	151 (37.4)
MSM - IDU	3 (1.6)	-	3 (1.5)	1 (1.1)	-	1 (0.77)	0	-	0	4 (1.3)	-	4 (1.0)
IDU	4 (2.2)	0	4 (2.0)	0	0	0	2 (4.7)	1 (3.8)	3 (4.3)	6 (1.9)	1 (1.2)	7 (1.7)
Perinatal	0	1 (4.3)	1 (0.49)	2 (2.2)	1 (2.7)	3 (2.3)	0	0	0	2 (0.63)	2 (2.3)	4 (1.0)
HIV-endemic	61 (33.5)	22 (96)	83 (40.5)	64 (68.8)	36 (97.3)	100 (76.9)	30 (70.0)	25 (96.2)	55 (79.7)	155 (48.7)	83 (96.5)	238 (58.9)
Total	182	23	205	93	37	130	43	26	69	318	86	404

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 3.5 Number of AIDS cases among persons born in an HIV-endemic country by year of AIDS diagnosis and exposure category, Ontario, 1981 to 1998

Year of AIDS diagnosis	Exposure category							Total
	MSM	Endemic			MSM-IDU	IDU	Perinatal	
		Male	Female	Total				
< 1984	0	1	1	2	0	0	0	2
1984	3	1	0	1	0	0	0	4
1985	5	2	1	3	0	0	0	8
1986	8	6	1	7	0	0	0	15
1987	7	3	3	6	0	1	0	14
1988	15	6	2	8	0	0	0	23
1989	11	12	6	18	0	0	1	30
1990	20	10	7	17	0	1	0	38
1991	17	8	6	14	1	0	0	32
1992	13	15	9	24	0	2	1	40
1993	16	14	6	20	1	0	0	37
1994	18	10	7	17	0	0	0	35
1995	14	20	6	26	1	2	2	45
1996	2	20	12	32	1	1	0	36
1997	1	14	7	21	0	0	0	22
1998	1	13	9	22	0	0	0	23
Total	151	155	83	238	4	7	4	404

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 3.6 Number of AIDS cases among persons born in an HIV-endemic country by year of AIDS diagnosis, HIV-endemic region of origin, exposure category and sex, Ontario, 1981 to 1998

Year of AIDS diagnosis	Caribbean				Sub-Saharan Africa				Total
	MSM	Endemic			MSM	Endemic			
		Male	Female	Total		Male	Female	Total	
< 1984	0	0	0	0	0	0	0	0	0
1984	3	1	0	1	0	0	0	0	4
1985	4	1	1	2	1	1	0	1	8
1986	5	1	0	1	2	3	1	4	12
1987	6	2	2	4	1	1	1	2	13
1988	10	2	1	3	5	2	1	3	21
1989	9	5	3	8	1	4	3	7	25
1990	14	4	3	7	3	5	2	7	31
1991	13	4	1	5	3	2	1	3	24
1992	10	6	4	10	3	7	3	10	33
1993	14	9	1	10	2	4	3	7	33
1994	15	7	2	9	3	3	4	7	34
1995	9	7	1	8	1	10	5	15	33
1996	0	5	2	7	1	7	7	14	22
1997	1	4	0	4	0	7	3	10	15
1998	1	3	1	4	0	8	2	10	15
Total	114	61	22	83	26	64	36	100	323

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 3.7 Number (and column percent) of AIDS cases among persons born in an HIV-endemic country by exposure category, health region of residence and sex, Ontario, 1981 to 1998

Exposure category	Metro Toronto		Ottawa-Carleton		Other ¹		Total	
	Males	Females	Males	Females	Males	Females	Males	Females
MSM	133 (54.5)	--	1 (4.0)	--	17 (34.7)	--	151 (47.5)	--
MSM - IDU	3 (1.2)	--	0	--	1 (2.0)	--	4 (1.3)	--
IDU	5 (2.1)	1 (2.1)	0	0	1 (2.0)	0	6 (1.9)	1 (1.1)
Perinatal	1 (0.41)	2 (4.2)	0	0	1 (2.0)	0	2 (0.63)	2 (2.3)
HIV-endemic	102 (41.8)	45 (93.8)	24 (96.0)	21 (100)	29 (59.2)	17 (100)	155 (48.7)	83 (96.5)
Total	244	48	25	21	49	17	318	86

¹ Ontario minus Metro Toronto minus Ottawa-Carleton.

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 3.8 Number of AIDS cases among persons born in an HIV-endemic country by age group at time of diagnosis and exposure category, Ontario, 1981 to 1998

Age group at time of diagnosis	Exposure category							
	HIV-endemic				MSM-IDU	IDU	Perinatal	Total
	MSM	Male	Female	Total				
< 15	0	0	0	0	0	0	4	4
15 - 19	1	0	1	1	0	0	-	2
20 - 24	6	5	6	11	0	2	-	19
25 - 29	14	26	24	50	1	2	-	67
30 - 34	33	37	22	59	0	2	-	94
35 - 39	38	38	16	54	1	0	-	93
40 - 44	32	24	5	29	0	1	-	62
45 - 49	16	6	5	11	1	0	-	28
50 - 54	4	11	2	13	0	0	-	17
55 - 59	6	4	0	4	1	0	-	11
60 +	1	4	2	6	0	0	-	7
Total	151	155	83	238	4	7	4	404

Source of data: Ontario AIDS Surveillance System (cases reported to March 11, 1999)

Table 4.1 Number of AIDS-related deaths among persons born in an HIV-endemic region by sex and age group, Ontario, 1987 to 1997

Age group (years)	Caribbean			Sub-Saharan Africa			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
< 20	0	0	0	0	0	0	0	0	0
20-24	2	0	2	0	3	6	2	3	5
25-29	18	5	23	7	5	10	25	10	35
30-34	31	7	38	11	5	10	42	12	54
35-39	40	9	49	21	6	12	61	15	76
40-44	37	2	39	11	1	2	48	3	51
45-49	36	4	40	9	0	0	45	4	49
50-54	14	0	14	3	1	2	17	1	18
55-59	5	0	5	2	0	0	7	0	7
60-64	11	4	15	0	0	0	11	4	15
65-69	1	0	1	0	0	0	1	0	1
70+	0	0	0	0	0	0	0	0	0
Total	195	31	226	64	21	42	259	52	311

Source of data: Vital Statistics, office of the Registrar-General

Table 4.2 Number of AIDS-related deaths among persons born in an HIV-endemic region by year of death, health region of residence and sex, Ontario, 1987 to 1997

Year of death	Metro Toronto			Ottawa-Carleton			Other ¹			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
1987	8	3	11	3	0	3	3	1	4	14	4	18
1988	3	0	3	0	0	0	4	1	5	7	1	8
1989	12	1	13	0	1	1	4	2	6	16	4	20
1990	9	2	11	1	0	1	3	2	5	13	4	17
1991	15	0	15	2	3	5	3	1	4	20	4	24
1992	21	2	23	2	2	4	6	1	7	29	5	34
1993	25	3	28	5	1	6	3	1	4	33	5	38
1994	29	3	32	1	0	1	10	1	11	40	4	44
1995	30	3	33	2	3	5	9	2	11	41	8	49
1996	22	7	29	2	0	2	9	2	11	33	9	42
1997	9	1	10	0	1	1	4	2	6	13	4	17
Total	183	25	208	18	11	29	58	16	74	259	52	311

¹ Ontario minus Metro Toronto minus Ottawa-Carleton.

Source of data: Vital Statistics, office of the Registrar-General

Table 4.3 Number (and column percent) of AIDS-related deaths among persons born in an HIV-endemic region by health region of residence, HIV-endemic region of origin and sex, Ontario, 1987 to 1997

Health region of residence	Caribbean			Sub-Saharan Africa			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Metro Toronto	140 (71.8)	15 (48.4)	155 (68.6)	43 (67.2)	10 (47.6)	53 (62.4)	183 (70.7)	25 (48.1)	208 (66.9)
Ottawa-Carleton	14 (7.2)	7 (22.6)	21 (9.3)	4 (6.3)	4 (19.0)	8 (9.4)	18 (6.9)	11 (21.2)	29 (9.3)
Other ¹	41 (21.0)	9 (29.0)	50 (22.1)	17 (26.6)	7 (33.3)	24 (28.2)	58 (22.4)	16 (30.8)	74 (23.8)
Total	195	31	226	64	21	85	259	52	311

¹ Ontario minus Metro Toronto minus Ottawa-Carleton.

Source of data: Vital Statistics, office of the Registrar-General

Table 5.1 Number (and column percent) of infants born to HIV-positive mothers by maternal exposure category and infant's year of birth, Ontario, 1984 to 1998

Maternal exposure category	Infant's year of birth															Total
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
IDU	0	0	0	1 (14.3)	1 (11.1)	2 (13.3)	5 (23.8)	1 (6.3)	1 (5.3)	7 (21.2)	8 (22.9)	6 (17.6)	9 (31.0)	4 (33.3)	4 (12.5)	49 (17.4)
HIV-endemic	3 (50.0)	2 (66.7)	6 (60.0)	2 (28.6)	1 (11.1)	3 (20.0)	6 (28.6)	5 (31.3)	10 (52.6)	16 (48.5)	16 (45.7)	17 (50.0)	14 (48.3)	1 (8.3)	14 (43.8)	116 (41.3)
Heterosexual	1 (16.7)	0	3 (30.0)	4 (57.1)	7 (77.8)	7 (46.7)	8 (38.1)	9 (56.3)	6 (31.6)	6 (18.2)	8 (22.8)	10 (29.4)	6 (20.7)	7 (58.3)	12 (37.5)	94 (33.5)
Transfusion	1 (16.7)	0	0	0	0	2 (13.3)	0	1 (6.3)	0	0	1 (2.9)	0	0	0	0	5 (1.8)
Unknown	1 (16.7)	1 (33.3)	1 (10.0)	0	0	1 (6.7)	2 (9.5)	0	2 (10.5)	4 (12.1)	2 (5.7)	1 (2.9)	0	0	2 (6.3)	17 (6.0)
Total	6	3	10	7	9	15	21	16	19	33	35	34	29	12	32	281

Source of data: Dr. Susan King, HIV Pediatric Network

Table 5.2 Number of HIV-exposed and confirmed infected infants by year of birth and maternal HIV-endemic region of origin, Ontario, 1984 to 1998

Year of birth	Caribbean		Sub-Saharan Africa		Total	
	Exposed	Confirmed infected	Exposed	Confirmed infected	Exposed	Confirmed infected
1984	1	1	2	2	3	3
1985	0	0	2	2	2	2
1986	1	1	5	4	6	5
1987	1	1	1	1	2	2
1988	0	0	1	1	1	1
1989	2	2	1	1	3	3
1990	2	2	4	3	6	5
1991	2	2	3	2	5	4
1992	3	2	7	5	10	7
1993	6	2	10	7	16	9
1994	2	0	14	9	16	9
1995	4	1	13	5	17	6
1996	1	1	13	5	14	6
1997	0	0	1	0	1	0
1998	3	0	11	0	14	0
Total	28	15	88	47	116	62

Source of data: Dr. Susan King, HIV Pediatric Network

Table 5.3 Number (and column percent) of HIV-exposed and confirmed infected infants by location of reporting hospital and maternal HIV-endemic region of origin, Ontario, 1984 to 1998

Location of reporting hospital	Caribbean		Sub-Saharan Africa		Total	
	Exposed	Confirmed infected	Exposed	Confirmed infected	Exposed	Confirmed infected
Toronto	23 (82.1)	12 (80.0)	53 (60.2)	27 (57.4)	76 (65.5)	39 (62.9)
Ottawa-Carleton	4 (14.3)	2 (13.3)	26 (29.5)	15 (31.9)	30 (25.9)	17 (27.4)
Hamilton	1 (3.6)	1 (6.7)	5 (5.7)	2 (4.3)	6 (5.2)	3 (4.8)
Kingston	0	0	1 (1.1)	1 (2.1)	1 (0.86)	1 (1.6)
London	0	0	3 (3.4)	2 (4.3)	3 (2.6)	2 (3.2)
Total	28	15	88	47	116	62

Source of data: Dr. Susan King, HIV Pediatric Network

Table 6.1 HIV model of Caribbean countries, both sexes, cumulative (1981 to 1998) and 1998

Country	Total immigrants	Population modeled	“Census” population	HIV-infected persons arriving from country of origin		New endogenous infections		AIDS incidence		HIV prevalence number		AIDS-related deaths		Perinatal infections
	Cumul	1998	1998	1998	Cumul	1998	Cumul	1998	Cumul	1998	% 1998	1998	Cumul	Cumul
Jamaica	60,156	152,303	111,357	21.1	309.3	51.4	311.6	17.0	101.9	544.0	0.5	14.2	78.5	2.7
Guyana	49,026	99,561	74,892	10.8	180.8	30.1	168.9	9.7	53.5	310.5	0.4	8.0	40.1	1.4
Trinidad & Tobago	31,197	69,249	52,969	15.0	187.7	26.8	141.3	9.1	47.9	294.9	0.6	7.5	35.5	2.2
Haiti	2,654	5,016	3,716	6.1	99.8	10.5	60.0	4.5	26.6	141.8	3.8	3.8	20.3	3.8
Barbados	3,797	13,232	10,595	2.4	33.5	5.5	29.9	1.8	9.4	56.5	0.5	1.4	7.0	0.1
Grenada	3,841	8,966	6,418	5.8	42.8	4.2	20.1	1.6	7.6	57.6	0.9	1.3	6.0	1.2
Other	9,318	22,473	17,278	5.0	54.1	8.0	41.9	2.6	13.7	86.2	0.5	2.1	10.2	0.4
Total	160,349	370,800	277,225	66	908	136	774	46	261	1,491	0.54	38	198	12

Caribbean Other: Antigua & Barbuda, Bahamas, Bermuda, Dominica, Dominican Republic, St. Kitts & Nevis, St. Lucia, St. Vincent.

Table 6.2 HIV model of Caribbean countries, males, cumulative (1981 to 1998) and 1998

Country	Male	Population	“Census”	HIV-infected		New endogenous		AIDS incidence		HIV prevalence		AIDS-related	
	immigrants	modeled	population	males arriving from	country of origin	infections				number		deaths	
	Cumulative	1998	1998	1998	Cumulative	1998	Cumulative	1998	Cumulative	1998	% 1998	1998	Cumulative
Jamaica	27,292	68,675	48,202	19.8	288.5	42.8	259.6	15.0	90.9	477.9	1.0	12.6	70.2
Guyana	22,890	47,109	34,774	10.5	175.8	25.1	140.8	8.8	49.3	279.4	0.8	7.3	37.1
Trinidad & Tobago	14,526	32,393	24,253	13.3	165.2	22.3	117.8	7.8	41.2	252.5	1.0	6.4	30.6
Haiti	1,183	2,290	1,640	3.5	60.4	8.8	50.0	3.1	17.5	97.2	5.9	2.6	13.3
Barbados	1,754	6,097	4,778	2.4	33.0	4.6	25.0	1.6	8.7	51.4	1.1	1.3	6.5
Grenada	1,586	4,023	2,749	3.9	29.1	3.5	16.7	1.2	5.9	41.7	1.5	0.9	4.2
Other	4,016	10,042	7,444	4.6	49.8	6.6	34.9	2.3	12.2	75.7	1.0	1.9	9.1
Total	73,247	170,628	123,840	58	802	114	645	40	226	1,276	1.03	33	171

Caribbean Other: Antigua & Barbuda, Bahamas, Bermuda, Dominica, Dominican Republic, St. Kitts & Nevis, St. Lucia, St. Vincent.

Table 6.3 HIV model of Caribbean countries, females, cumulative (1981 to 1998) and 1998

Country	Female	Population	“Census” population	HIV-infected females arriving from country of origin		New endogenous infections		AIDS incidence		HIV prevalence number		AIDS-related deaths	
	immigrants Cumulative	modeled 1998		1998	Cumulative	1998	Cumulative	1998	Cumulative	1998	% 1998	1998	Cumulative
Jamaica	33,224	86,628	63,155	1.4	20.9	8.6	51.9	2.0	11.1	66.1	0.1	1.6	8.3
Guyana	26,136	52,453	40,118	0.3	5.0	5.0	28.2	0.9	4.2	31.0	0.1	0.7	3.0
Trinidad & Tobago	16,671	36,855	28,715	1.7	22.5	4.5	23.6	1.3	6.7	42.4	0.2	1.1	4.9
Haiti	1,471	2,726	2,076	2.6	39.4	1.8	10.0	1.4	9.0	44.6	2.2	1.3	7.0
Barbados	2,043	7,136	5,817	0.0	0.5	0.9	5.0	0.1	0.6	5.1	0.1	0.1	0.5
Grenada	2,255	4,943	3,669	1.8	13.6	0.7	3.3	0.4	1.7	16.0	0.4	0.4	1.7
Other	5,302	12,432	9,834	0.4	4.4	1.3	7.0	0.3	1.5	10.5	0.1	0.3	1.1
Total	87,102	200,172	153,384	8	106	23	129	7	35	216	0.14	5	27

Caribbean Other: Antigua & Barbuda, Bahamas, Bermuda, Dominica, Dominican Republic, St. Kitts & Nevis, St. Lucia, St. Vincent.

Table 6.4 HIV model of sub-Saharan African countries, both sexes, cumulative (1981 to 1998) and 1998

Country	Total immigrants	Population modeled	“Census” population	HIV-infected persons arriving from country of origin		New endogenous infections		AIDS incidence		HIV prevalence		AIDS-related deaths		Perinatal infections
	Cumul	1998	1998	1998	Cumul	1998	Cumul	1998	Cumul	1998	% 1998	1998	Cumul	Cumul
West Africa														
*Other	15,951	22,386	18,144	5.2	39.3	3.4	14.9	1.5	6.7	50.9	0.3	1.2	4.6	2.3
East Africa														
Ethiopia & Eritrea	12,872	16,452	13,132	10.8	114.1	11.6	57.7	4.9	23.4	158.0	1.2	3.9	16.9	4.6
Uganda	1,058	6,759	5,026	1.8	66.7	7.2	43.5	3.1	20.4	96.0	1.9	2.8	15.9	3.6
Somalia	15,024	21,267	15,036	9.8	118.9	6.6	30.0	4.4	19.5	138.0	0.9	3.6	13.5	4.5
Kenya	8,096	13,824	11,580	5.3	80.8	3.8	19.3	2.7	13.3	91.0	0.8	2.2	9.7	1.5
Tanzania	4,601	12,524	9,974	3.5	39.7	5.2	26.7	1.8	9.4	60.0	0.6	1.5	6.9	0.4
*Other	1,883	2,967	2,573	4.8	38.3	4.1	19.5	1.6	7.5	53.0	2.1	1.2	5.4	0.9
Central Africa														
Zaire	592	1,193	834	6.1	27.2	1.8	9.6	1.0	5.2	36.0	4.3	0.9	3.8	4.3
*Other	538	1,453	1,039	1.3	8.2	1.1	4.9	0.4	1.6	12.0	1.2	0.3	1.1	0.1
Southern Africa														
South Africa	12,982	20,279	18,401	13.9	95.6	11.1	48.6	3.9	16.9	132.5	0.7	2.9	11.8	0.2
*Other	526	621	598	3.3	20.6	1.8	9.5	0.8	4.2	27.1	4.5	0.6	3.2	0.3
Total	74,123	119,725	96,337	66	649	58	284	26	128	855	0.89	21	93	23

West Africa Other: Gambia, Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone.

East Africa Other: Burundi, Rwanda, Zimbabwe.

Central Africa Other: Angola, Cameroon.

Southern Africa Other: Botswana, Lesotho, Namibia, Swaziland.

Table 6.5 HIV model of sub-Saharan African countries, males, cumulative (1981 to 1998) and 1998

Country	Male immigrants	Population modeled	“Census” population	HIV-infected males arriving from country of origin		New endogenous infections		AIDS incidence		HIV prevalence number		AIDS-related deaths	
	Cumulative	1998	1998	1998	Cumulative	1998	Cumulative	1998	Cumulative	1998	% 1998	1998	Cumulative
West Africa													
*Other	8,863	12,174	10,079	3.0	23.6	2.8	12.4	1.0	4.3	32.9	0.3	0.8	3.0
East Africa													
Ethiopia and Eritrea	6,960	8,825	7,134	6.5	74.6	9.7	48.0	3.4	16.8	110.5	1.5	2.8	12.2
Uganda	595	3,487	2,619	1.0	38.4	6.0	36.3	2.1	12.7	64.9	2.5	1.8	9.8
Somalia	8,005	11,124	7,995	7.3	91.9	4.7	21.4	3.3	15.0	102.9	1.3	2.8	10.5
Kenya	3,937	6,563	5,442	3.5	52.8	2.7	13.8	1.9	9.6	59.6	1.1	1.6	7.0
Tanzania	2,325	6,232	4,964	2.9	32.7	4.3	22.2	1.5	7.8	49.2	1.0	1.2	5.7
*Other	1,000	1,574	1,384	3.6	28.4	3.4	16.3	1.2	5.7	40.5	2.9	0.9	4.1
Central Africa													
Zaire	382	662	502	3.4	13.9	1.5	8.0	0.5	2.8	19.8	4.0	0.5	2.0
*Other	310	783	581	1.2	7.6	0.9	4.0	0.3	1.4	10.6	1.8	0.2	1.0
Southern Africa													
South Africa	6,498	10,009	9,066	12.9	88.1	10.1	44.2	3.5	15.5	121.5	1.3	2.7	10.8
*Other	254	313	300	2.0	12.2	1.5	7.9	0.5	2.8	18.0	6.0	0.4	2.1
Total	39,129	61,744	50,065	47	464	48	235	19	94	630	1.26	16	68

West Africa Other: Gambia, Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone.

East Africa Other: Burundi, Rwanda, Zimbabwe.

Central Africa Other: Angola, Cameroon.

Southern Africa Other: Botswana, Lesotho, Namibia, Swaziland.

Table 6.6 HIV model of sub-Saharan African countries, females, cumulative (1981 to 1998) and 1998

Country	Female immigrants	Population modeled	“Census” population	HIV-infected females arriving from country of origin		New endogenous infections		AIDS incidence		HIV prevalence		AIDS-related deaths	
	Cumulative	1998	1998	1998	Cumulative	1998	Cumulative	1998	Cumulative	1998	% 1998	1998	Cumulative
West Africa													
*Other	7,088	10,213	8,065	2.2	15.7	0.6	2.5	0.5	2.3	17.9	0.2	0.4	1.6
East Africa													
Ethiopia and Eritrea	5,912	7,627	5,998	4.2	39.5	1.9	9.6	1.5	6.6	47.2	0.8	1.2	4.7
Uganda	463	3,273	2,407	0.8	28.3	1.2	7.3	1.1	7.7	31.4	1.3	1.0	6.2
Somalia	7,019	10,144	7,041	2.4	27.0	1.9	8.6	1.1	4.5	35.4	0.5	0.9	3.0
Kenya	4,159	7,260	6,139	1.8	28.1	1.1	5.5	0.7	3.7	31.8	0.5	0.6	2.7
Tanzania	2,276	6,293	5,010	0.6	7.0	0.9	4.4	0.3	1.7	10.5	0.2	0.3	1.2
*Other	883	1,393	1,189	1.2	9.9	0.7	3.3	0.4	1.8	12.4	1.0	0.3	1.3
Central Africa													
Zaire	210	532	332	2.7	13.3	0.3	1.6	0.5	2.4	16.0	4.8	0.4	1.8
*Other	228	670	458	0.1	0.6	0.2	0.8	0.0	0.2	1.3	0.3	0.0	0.1
Southern Africa													
South Africa	6,484	10,271	9,335	1.1	7.5	1.0	4.4	0.3	1.4	11.1	0.1	0.2	1.0
*Other	272	308	298	1.3	8.5	0.3	1.6	0.3	1.5	9.1	3.1	0.2	1.1
Total	34,994	57,982	46,272	18	185	10	50	7	34	224	0.48	5	25

West Africa Other: Gambia, Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone.

East Africa Other: Burundi, Rwanda, Zimbabwe.

Central Africa Other: Angola, Cameroon.

Southern Africa Other: Botswana, Lesotho, Namibia, Swaziland.

Table 6.7 HIV model of Jamaica, both sexes, 1981 to 1998

Population														
	Immigrate from country of origin	Migrate from other province	Migrate to other province	AIDS-related deaths	Deaths other	Deaths total	Population	"Census" population	Births, actual	Crude death rate (/ 1,000)	General fertility rate (/ 1,000)	Census years' population		
1980						138	55,350	55,350	1,827			-		
1981	2,082	664	664	0.0	133.0	133	59,219	57,299	1,920	2.4	106	64,200		
1982	2,046	711	711	0.0	139.0	139	63,107	59,206	1,981	2.3	106	-		
1983	1,961	757	757	0.1	132.9	133	66,866	61,034	1,931	2.1	100	-		
1984	1,980	802	802	0.3	154.7	155	70,720	62,859	2,029	2.3	102	-		
1985	2,465	849	849	0.5	167.5	168	74,922	65,156	1,905	2.4	93	-		
1986	3,937	899	899	0.8	177.2	178	80,699	68,915	2,018	2.4	92	73,650		
1987	4,744	968	968	1.2	184.8	186	87,112	73,473	1,855	2.3	80	-		
1988	3,400	1,045	1,045	1.7	212.3	214	92,349	76,659	2,051	2.5	85	-		
1989	3,376	1,108	1,108	2.3	246.7	249	97,843	79,786	2,367	2.7	94	-		
1990	4,294	1,174	1,174	3.0	265.0	268	104,379	83,812	2,510	2.7	96	-		
1991	4,489	1,253	1,253	3.9	274.1	278	111,243	88,023	2,653	2.7	97	86,465		
1992	5,415	1,335	1,335	4.9	301.1	306	119,075	93,132	2,723	2.8	94	-		
1993	5,425	1,429	1,429	6.0	309.0	315	126,896	98,242	2,711	2.6	89	-		
1994	3,490	1,523	1,523	7.4	306.6	314	132,754	101,418	2,682	2.5	85	-		
1995	3,284	1,593	1,593	9.0	371.0	380	138,377	104,322	2,719	2.9	84	-		
1996	2,976	1,661	1,661	10.7	356.3	367	143,385	106,931	2,399	2.7	73	100,325		
1997	2,576	1,721	1,721	12.4	350.6	363	147,844	109,144	2,246	2.5	67	-		
1998	2,576	1,774	1,774	14.2	348.8	363	152,303	111,357	2,246	2.5	65	-		
Cumulative	60,516	21,266	21,266	78.5	4430.5	4,509								
Proportion female 15-44				0.543										
HIV-infected persons (both sexes)														
	HIV prevalence in source country	HIV prevalence adjustment factor	HIV prevalence among immigrants	HIV-infected persons arriving from country of origin	Migrate from other province	Migrate to other province	New endogenous infections	AIDS incidence	Cumulative AIDS incidence	AIDS-related deaths	HIV prevalence	Cumulative imported infections	Cumulative endogenous infections	Proportion endogenous
1980											0			
1981	0.003	0.95	0.0029	5.1	0.0	0.0	0.0	0.0	0.0	0.0	5	5.1	0.0	0.00
1982	0.003	0.96	0.0029	5.3	0.1	0.1	0.6	0.2	0.2	0.0	11	10.4	0.6	0.05
1983	0.003	0.95	0.0028	4.6	0.1	0.1	1.2	0.4	0.6	0.1	17	15.0	1.8	0.11
1984	0.005	0.94	0.0047	7.1	0.2	0.2	1.8	0.6	1.1	0.3	25	22.1	3.6	0.14
1985	0.005	0.94	0.0047	9.2	0.3	0.3	2.8	0.9	2.0	0.5	37	31.3	6.4	0.17
1986	0.005	0.94	0.0047	13.6	0.4	0.4	4.0	1.3	3.3	0.8	54	44.8	10.4	0.19
1987	0.005	0.95	0.0047	18.1	0.6	0.6	5.8	1.9	5.2	1.2	76	63.0	16.2	0.20
1988	0.005	0.95	0.0048	14.0	0.9	0.9	8.3	2.7	7.9	1.7	97	77.0	24.5	0.24
1989	0.005	0.96	0.0048	14.5	1.2	1.2	10.5	3.4	11.2	2.3	120	91.5	34.9	0.28
1990	0.006	0.96	0.0057	22.2	1.4	1.4	12.9	4.2	15.4	3.0	152	113.7	47.9	0.30
1991	0.006	0.96	0.0057	22.5	1.8	1.8	16.4	5.3	20.7	3.9	187	136.2	64.2	0.32
1992	0.006	0.95	0.0057	26.1	2.2	2.2	20.1	6.5	27.3	4.9	228	162.2	84.4	0.34
1993	0.008	0.95	0.0076	35.6	2.7	2.7	24.5	8.0	35.3	6.0	283	197.9	108.9	0.35
1994	0.008	0.95	0.0076	23.0	3.4	3.4	30.3	9.9	45.2	7.4	329	220.9	139.2	0.39
1995	0.008	0.95	0.0076	21.7	3.9	3.9	35.1	11.5	56.7	9.0	377	242.6	174.4	0.42
1996	0.01	0.95	0.0095	24.4	4.5	4.5	40.1	13.2	69.9	10.7	431	267.1	214.5	0.45
1997	0.01	0.95	0.0095	21.1	5.2	5.2	45.7	15.1	84.9	12.4	485	288.2	260.2	0.47
1998	0.01	0.95	0.0095	21.1	5.8	5.8	51.4	17.0	101.9	14.2	544	309.3	311.6	0.50
Cumulative				309.3	34.9	34.9	311.6	101.9		78.5				
				HIV prevalence (%), 1998										
				0.49										
Period 1		1981-83	0.003											
Period 2		1984-86	0.005											
Period 3		1987-89	0.005											
Period 4		1990-92	0.006											
Period 5		1993-95	0.008											
Period 6		1996-98	0.010											
M:F ratio				5										

Population

HIV-infected males

HIV preval	HIV prevalence (%), 1998
adjustment	0.99

Proportion in-migrating	0.012
Proportion out-migrating	0.012

Incidence (wrt prevalence)	0.1
Endogenous HIV incidence	0.00015

AIDS incidence	0.035
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Table 6.9 HIV model of Jamaica, females, 1981 to 1998

Population															
	Immigrate from country of origin	Migrate from other province	Migrate to other province	AIDS-related deaths	Deaths other	Deaths total	Population	"Census" population	Births	Census years' population					
1980						80	32,355	32,355	914	32,355					
1981	1,126	388	388	0.0	64.0	64	34,377	33,417	960	36,035					
1982	1,057	413	413	0.0	82.0	82	36,343	34,392	991						
1983	1,106	436	436	0.0	78.0	78	38,336	35,420	966						
1984	1,201	460	460	0.0	75.0	75	40,477	36,546	1,015						
1985	1,450	486	486	0.0	83.0	83	42,796	37,913	953						
1986	2,454	514	514	0.1	86.9	87	46,172	40,280	1,009	41,615					
1987	2,735	554	554	0.1	102.9	103	49,732	42,912	928						
1988	1,827	597	597	0.2	109.8	110	52,474	44,629	1,026						
1989	1,735	630	630	0.2	136.8	137	55,256	46,227	1,184						
1990	2,211	663	663	0.3	152.7	153	58,569	48,285	1,255						
1991	2,382	703	703	0.4	143.6	144	62,133	50,523	1,327	49,635					
1992	2,988	746	746	0.5	158.5	159	66,324	53,352	1,362						
1993	2,927	796	796	0.6	180.4	181	70,425	56,098	1,356						
1994	1,875	845	845	0.8	161.2	162	73,479	57,811	1,341						
1995	1,761	882	882	1.0	206.0	207	76,393	59,365	1,360						
1996	1,607	917	917	1.2	205.8	207	78,992	60,765	1,200	58,430					
1997	1,391	948	948	1.4	194.6	196	81,310	61,960	1,123						
1998	1,391	976	976	1.6	194.4	196	83,628	63,155	1,123						
Cumulative	33,224	11,951	11,951	8.3	2415.7	2,424									
Proportion in-migrating				0.012											
Proportion out-migrating				0.012											
HIV-infected females															
	HIV prevalence in source country	HIV prevalence adjustment factor	HIV prevalence among immigrants	HIV-infected women arriving from country of origin	Migrate from other province	Migrate to other province	New endogenous infections	AIDS incidence	AIDS-related deaths	HIV prevalence	Cumulative imported infections	Cumulative endogenous infections	Proportion endogenous	Births to HIV- infected mothers, both sexes	HIV- infected infants, both sexes
1980										0					
1981	0.00100	0.30	0.0003	0.3	0.0	0.0	0.0	0.0	0.0	0	0.3	0.0	0.00	0.0	0.0
1982	0.00100	0.30	0.0003	0.3	0.0	0.0	0.1	0.0	0.0	1	0.7	0.1	0.13	0.0	0.0
1983	0.00100	0.30	0.0003	0.3	0.0	0.0	0.2	0.0	0.0	1	1.0	0.3	0.23	0.1	0.0
1984	0.00167	0.30	0.0005	0.6	0.0	0.0	0.3	0.0	0.0	2	1.6	0.6	0.28	0.1	0.0
1985	0.00167	0.30	0.0005	0.7	0.0	0.0	0.5	0.1	0.0	3	2.3	1.1	0.32	0.2	0.0
1986	0.00167	0.30	0.0005	1.2	0.0	0.0	0.7	0.1	0.1	5	3.5	1.7	0.33	0.3	0.0
1987	0.00167	0.30	0.0005	1.4	0.1	0.1	1.0	0.2	0.1	7	4.9	2.7	0.36	0.4	0.1
1988	0.00167	0.30	0.0005	0.9	0.1	0.1	1.4	0.3	0.2	10	5.8	4.1	0.41	0.5	0.1
1989	0.00167	0.30	0.0005	0.9	0.1	0.1	1.7	0.3	0.2	12	6.7	5.8	0.47	0.8	0.1
1990	0.00200	0.30	0.0006	1.3	0.1	0.1	2.2	0.4	0.3	15	8.0	8.0	0.50	1.0	0.1
1991	0.00200	0.30	0.0006	1.4	0.2	0.2	2.7	0.5	0.4	19	9.4	10.7	0.53	1.3	0.2
1992	0.00200	0.30	0.0006	1.8	0.2	0.2	3.4	0.7	0.5	24	11.2	14.1	0.56	1.5	0.2
1993	0.00267	0.30	0.0008	2.3	0.3	0.3	4.1	0.8	0.6	30	13.6	18.1	0.57	1.8	0.3
1994	0.00267	0.30	0.0008	1.5	0.4	0.4	5.1	1.0	0.8	36	15.1	23.2	0.61	2.2	0.3
1995	0.00267	0.30	0.0008	1.4	0.4	0.4	5.9	1.3	1.0	42	16.5	29.1	0.64	2.6	0.4
1996	0.00333	0.30	0.0010	1.6	0.5	0.5	6.7	1.5	1.2	50	18.1	35.7	0.66	2.6	0.4
1997	0.00333	0.30	0.0010	1.4	0.6	0.6	7.6	1.7	1.4	58	19.5	43.4	0.69	2.8	0.4
1998	0.00333	0.30	0.0010	1.4	0.7	0.7	8.6	2.0	1.6	66	20.9	51.9	0.71	3.2	0.5
Cumulative				20.9	3.8	3.8	51.9	11.1	8.3					18.0	2.7
			HIV preval adjustment factor	HIV prevalence (%), 1998 0.10											
Period 1	1981-83	0.30													
Period 2	1984-86	0.30													
Period 3	1987-89	0.30													
Period 4	1990-92	0.30													
Period 5	1993-95	0.30													
Period 6	1996-98	0.30													
		0.30													
Proportion HIV+female 15-44				0.85											
Proportion in-migrating				0.012											
Proportion out-migrating				0.012											
Mother-infant HIV transmission, 1980-94					0.150										
Mother-infant HIV transmission, 1995-96					0.150										
Mother-infant HIV transmission, 1997-98					0.150										
HIV incidence (wrt prevalence)				0.02											
Endogenous HIV incidence				0.0002											
AIDS incidence				0.035											

Table 6.10 HIV model of Ethiopia and Eritrea, both sexes, 1981 to 1998

Population														
	Immigrate from country of origin	Migrate from other province	Migrate to other province	AIDS-related deaths	Deaths other	Deaths total	Population	"Census" population	Births, actual	Crude death rate (/ 1,000)	General fertility rate (/ 1,000)	Census years' population		
1980						0	370	370	4			-		
1981	22	4	4	0.0	1.0	1	399	391	8	2.7	88	-	0	
1982	32	5	5	0.0	2.0	2	438	421	9	5.0	92	-		
1983	166	5	5	0.0	-0.0	0	614	587	10	0.0	74	-		
1984	291	7	7	0.0	2.0	2	922	876	19	3.3	94	-		
1985	308	11	11	0.0	1.0	1	1,257	1,183	28	1.1	105	-		
1986	436	15	15	0.0	1.0	1	1,727	1,618	35	0.8	95	-	1,120	
1987	553	21	21	0.0	4.0	4	2,331	2,167	55	2.3	111	-		
1988	911	28	28	0.1	1.9	2	3,341	3,076	101	0.9	139	-		
1989	1,530	40	40	0.1	4.9	5	4,998	4,601	132	1.5	118	-		
1990	1,581	60	60	0.3	3.7	4	6,781	6,178	206	0.8	132	-		
1991	1,415	81	81	0.5	7.5	8	8,458	7,585	270	1.2	138	-	7,665	
1992	1,309	101	101	0.8	11.2	12	10,090	8,882	335	1.4	142	-		
1993	1,089	121	121	1.2	8.8	10	11,607	9,961	438	1.0	159	-		
1994	812	139	139	1.7	15.3	17	12,946	10,756	544	1.5	178	-		
1995	672	155	155	2.2	7.8	10	14,157	11,418	549	0.8	165	-		
1996	675	170	170	2.7	6.3	9	15,368	12,084	545	0.6	153	-	12,930	
1997	535	184	184	3.3	7.7	11	16,452	12,608	560	0.7	149	-		
1998	535	197	197	3.9	7.1	11	17,536	13,132	560	0.7	141	-		
Cumulative	12,872	1,347	1,347	16.9	93.1	110								
Proportion female 15-44				0.66										
HIV-infected persons														
	HIV prevalence in source country	HIV prevalence adjustmen t factor	HIV prevalence among immigrants	HIV-infected persons arriving from country of origin	Migrate from other province	Migrate to other province	New endogenous infections	AIDS incidence	Cumulative AIDS incidence	AIDS-related deaths	HIV prevalence	Cumulative imported infections	Cumulative endogenous infections	Proportion endogenous
1980											0			
1981	0.001	0.35	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.00
1982	0.001	0.35	0.0004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.04
1983	0.001	0.35	0.0004	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0.1	0.0	0.03
1984	0.005	0.35	0.0018	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1	0.6	0.0	0.02
1985	0.005	0.35	0.0018	0.6	0.0	0.0	0.1	0.0	0.0	0.0	1	1.2	0.1	0.06
1986	0.005	0.35	0.0018	0.8	0.0	0.0	0.1	0.0	0.1	0.0	2	2.1	0.2	0.09
1987	0.01	0.35	0.0035	2.1	0.0	0.0	0.2	0.1	0.2	0.0	5	4.2	0.4	0.09
1988	0.01	0.35	0.0035	3.4	0.1	0.1	0.4	0.2	0.3	0.1	8	7.7	0.9	0.10
1989	0.01	0.35	0.0035	5.8	0.1	0.1	0.8	0.3	0.6	0.1	15	13.4	1.6	0.11
1990	0.02	0.35	0.0070	11.6	0.2	0.2	1.4	0.5	1.1	0.3	28	25.0	3.0	0.11
1991	0.02	0.35	0.0070	10.4	0.3	0.3	2.5	1.0	2.1	0.5	40	35.4	5.5	0.13
1992	0.02	0.35	0.0070	9.4	0.5	0.5	3.6	1.4	3.5	0.8	52	44.8	9.1	0.17
1993	0.04	0.35	0.0140	14.7	0.6	0.6	4.7	1.8	5.3	1.2	71	59.5	13.8	0.19
1994	0.04	0.35	0.0140	10.7	0.9	0.9	6.2	2.5	7.8	1.7	86	70.2	20.0	0.22
1995	0.04	0.35	0.0140	8.8	1.0	1.0	7.4	3.0	10.8	2.2	101	79.1	27.4	0.26
1996	0.06	0.35	0.0210	13.5	1.2	1.2	8.5	3.5	14.4	2.7	121	92.6	35.9	0.28
1997	0.06	0.35	0.0210	10.8	1.4	1.4	10.1	4.2	18.6	3.3	139	103.3	46.0	0.31
1998	0.06	0.35	0.0210	10.8	1.7	1.7	11.6	4.9	23.4	3.9	158	114.1	57.7	0.34
Cumulative				114.1	8.0	8.0	57.7	23.4		16.9				
HIV prevalence, country				HIV prevalence (%), 1998 1.2										
Period 1	1981-83	0.001												
Period 2	1984-86	0.005												
Period 3	1987-89	0.010												
Period 4	1990-92	0.020												
Period 5	1993-95	0.040												
Period 6	1996-98	0.060												
M:F ratio				2										
"Secondary HIV transmission" rate				0.0500										
AIDS incidence				0.035										
AIDS mortality rate, same year				0.200										
AIDS mortality rate, first year				0.400	Males	AIDS Deaths	22	16.8						
AIDS mortality rate, second year				0.200	Females	AIDS Deaths	14.3	6.6						
AIDS mortality rate, third year				0.100			3.5	4.7						
AIDS mortality rate, fourth year				0.100	Mothers		12	19.5						
					Infants		7	4.6						
11.2														

Table 6.11 HIV model of Ethiopia and Eritrea, males, 1981 to 1998

Population

	Immigrate from country of origin	Migrate from other province	Migrate to other province	AIDS-related deaths	Deaths other	Deaths total	Population	"Census" population	Births	Census years' population
1980						0	240	240	2	
1981	14	3	3	0.0	1.0	1	257	253	4	
1982	21	3	3	0.0	2.0	2	281	272	5	
1983	110	3	3	0.0	-0.0	0	396	382	5	
1984	189	5	5	0.0	1.0	1	593	570	10	
1985	209	7	7	0.0	1.0	1	815	778	14	
1986	280	10	10	0.0	1.0	1	1,112	1,057	18	715
1987	362	13	13	0.0	3.0	3	1,498	1,416	28	
1988	561	18	18	0.1	0.9	1	2,109	1,976	51	
1989	936	25	25	0.1	4.9	5	3,106	2,907	66	
1990	907	37	37	0.2	3.8	4	4,112	3,810	103	
1991	819	49	49	0.4	4.6	5	5,061	4,624	135	4,610
1992	697	61	61	0.6	8.4	9	5,916	5,312	168	
1993	490	71	71	0.9	5.1	6	6,619	5,796	219	
1994	333	79	79	1.2	7.8	9	7,215	6,120	272	
1995	274	87	87	1.6	5.4	7	7,757	6,387	275	
1996	292	93	93	2.0	5.0	7	8,314	6,672	273	6,845
1997	233	100	100	2.3	-0.3	2	8,825	6,903	280	
1998	233	106	106	2.8	-0.8	2	9,336	7,134	280	
Cumulative	6,960	771	771	12.2	53.8	66				

Proportion in-migrating 0.012
Proportion out-migrating 0.012

HIV-infected males

	HIV prevalence in source country	HIV prevalence adjustmen t factor	HIV prevalence among immigrants	HIV-infected men arriving from country of origin	Migrate from other province	Migrate to other province	New endogenous infections	AIDS incidence	AIDS- related deaths	HIV prevalence	Cumulative imported infections	Cumulative endogenous infections	Proportion endogenous
1980										0			
1981	0.00133	0.35	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.00
1982	0.00133	0.35	0.0005	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.04
1983	0.00133	0.35	0.0005	0.1	0.0	0.0	0.0	0.0	0.0	0	0.1	0.0	0.03
1984	0.00667	0.35	0.0023	0.4	0.0	0.0	0.0	0.0	0.0	1	0.5	0.0	0.02
1985	0.00667	0.35	0.0023	0.5	0.0	0.0	0.1	0.0	0.0	1	1.0	0.1	0.06
1986	0.00667	0.35	0.0023	0.7	0.0	0.0	0.1	0.0	0.0	2	1.6	0.2	0.09
1987	0.01333	0.35	0.0047	1.7	0.0	0.0	0.2	0.1	0.0	4	3.3	0.3	0.09
1988	0.01333	0.35	0.0047	2.6	0.0	0.0	0.4	0.1	0.1	7	6.0	0.7	0.11
1989	0.01333	0.35	0.0047	4.4	0.1	0.1	0.7	0.2	0.1	11	10.3	1.4	0.12
1990	0.02667	0.35	0.0093	8.5	0.1	0.1	1.1	0.4	0.2	21	18.8	2.5	0.12
1991	0.02667	0.35	0.0093	7.6	0.3	0.3	2.1	0.7	0.4	30	26.4	4.6	0.15
1992	0.02667	0.35	0.0093	6.5	0.4	0.4	3.0	1.1	0.6	39	32.9	7.6	0.19
1993	0.05333	0.35	0.0187	9.1	0.5	0.5	3.9	1.4	0.9	51	42.1	11.5	0.22
1994	0.05333	0.35	0.0187	6.2	0.6	0.6	5.1	1.8	1.2	61	48.3	16.7	0.26
1995	0.05333	0.35	0.0187	5.1	0.7	0.7	6.1	2.1	1.6	71	53.4	22.8	0.30
1996	0.08000	0.35	0.0280	8.2	0.9	0.9	7.1	2.5	2.0	84	61.6	29.9	0.33
1997	0.08000	0.35	0.0280	6.5	1.0	1.0	8.4	3.0	2.3	97	68.1	38.3	0.36
1998	0.08000	0.35	0.0280	6.5	1.2	1.2	9.7	3.4	2.8	110	74.6	48.0	0.39
Cumulative				74.6	5.8	5.8	48.0	16.8	12.2				

HIV preval
adjustment
factor

HIV prevalence (%), 1998
1.55

Period 1 1981-83 0.35
Period 2 1984-86 0.35
Period 3 1987-89 0.35
Period 4 1990-92 0.35
Period 5 1993-95 0.35
Period 6 1996-98 0.35

Proportion in-migrating 0.012
Proportion out-migrating 0.012

Incidence (wrt prevalence) 0.1
Endogenous HIV incidence 0.00015

AIDS incidence 0.035

Population															
	Immigrate from country of origin	Migrate from other province	Migrate to other province	AIDS-related deaths	Deaths other	Deaths total	Population	"Census" population	Births	Census years' population					
1980						0	130	130	2						
1981	8	2	2	0.0	0.0	0	142	138	4						
1982	11	2	2	0.0	-0.0	0	158	149	5						
1983	56	2	2	0.0	-0.0	0	219	205	5						
1984	102	3	3	0.0	1.0	1	329	306	10						
1985	99	4	4	0.0	-0.0	0	442	405	14						
1986	156	5	5	0.0	-0.0	0	616	561	18	405					
1987	191	7	7	0.0	1.0	1	833	751	28						
1988	350	10	10	0.0	1.0	1	1,233	1,100	51						
1989	594	15	15	0.0	-0.0	0	1,893	1,694	66						
1990	674	23	23	0.1	-0.1	0	2,670	2,368	103						
1991	596	32	32	0.1	2.9	3	3,398	2,961	135	3,055					
1992	612	41	41	0.2	2.8	3	4,174	3,570	168						
1993	599	50	50	0.3	3.7	4	4,988	4,165	219						
1994	479	60	60	0.4	7.6	8	5,731	4,636	272						
1995	398	69	69	0.6	2.4	3	6,401	5,031	275						
1996	383	77	77	0.8	1.2	2	7,054	5,412	273	6,085					
1997	302	85	85	1.0	8.0	9	7,627	5,705	280						
1998	302	92	92	1.2	7.8	9	8,200	5,998	280						
Cumulative	5,912	576	576	4.7	39.3	44									
Proportion in-migrating				0.012											
Proportion out-migrating				0.012											
HIV-infected females															
	HIV prevalence in source country	HIV prevalence adjustment factor	HIV prevalence among immigrants	HIV-infected women arriving from country of origin	Migrate from other province	Migrate to other province	New endogenous infections	AIDS incidence	AIDS-related deaths	HIV prevalence	Cumulative imported infections	Cumulative endogenous infections	Proportion endogenous	Births to HIV-infected mothers, both sexes	HIV-infected infants, both sexes
1980										0					
1981	0.00067	0.35	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.00	0.0	0.0
1982	0.00067	0.35	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.03	0.0	0.0
1983	0.00067	0.35	0.0002	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.03	0.0	0.0
1984	0.00333	0.35	0.0012	0.1	0.0	0.0	0.0	0.0	0.0	0	0.1	0.0	0.01	0.0	0.0
1985	0.00333	0.35	0.0012	0.1	0.0	0.0	0.0	0.0	0.0	0	0.3	0.0	0.05	0.0	0.0
1986	0.00333	0.35	0.0012	0.2	0.0	0.0	0.0	0.0	0.0	0	0.4	0.0	0.07	0.0	0.0
1987	0.00667	0.35	0.0023	0.4	0.0	0.0	0.0	0.0	0.0	1	0.9	0.1	0.07	0.0	0.0
1988	0.00667	0.35	0.0023	0.8	0.0	0.0	0.1	0.0	0.0	2	1.7	0.1	0.08	0.1	0.0
1989	0.00667	0.35	0.0023	1.4	0.0	0.0	0.1	0.1	0.0	3	3.1	0.3	0.08	0.2	0.0
1990	0.0133	0.35	0.0047	3.1	0.0	0.0	0.2	0.1	0.1	7	6.2	0.5	0.07	0.4	0.1
1991	0.0133	0.35	0.0047	2.8	0.1	0.1	0.4	0.2	0.1	10	9.0	0.9	0.09	0.8	0.2
1992	0.0133	0.35	0.0047	2.9	0.1	0.1	0.6	0.3	0.2	13	11.9	1.5	0.11	1.2	0.3
1993	0.0267	0.35	0.0093	5.6	0.2	0.2	0.8	0.5	0.3	20	17.5	2.3	0.12	1.8	0.5
1994	0.0														

Figure 1 Modeled HIV prevalence for Ontario residents born in selected sub-Saharan African countries, 1981-98

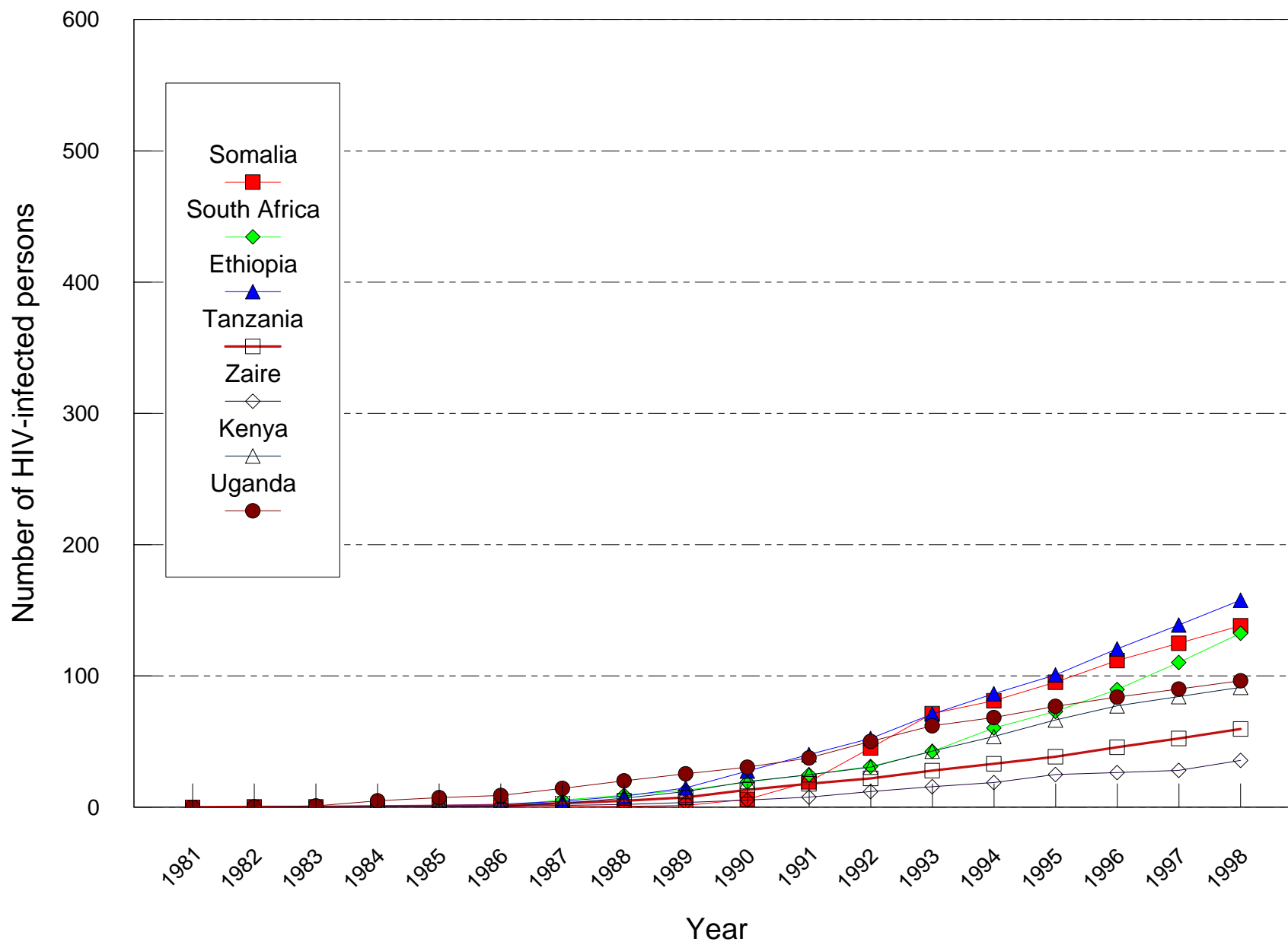


Figure 2 Modeled HIV prevalence for Ontario residents born in selected Caribbean countries, 1981-98

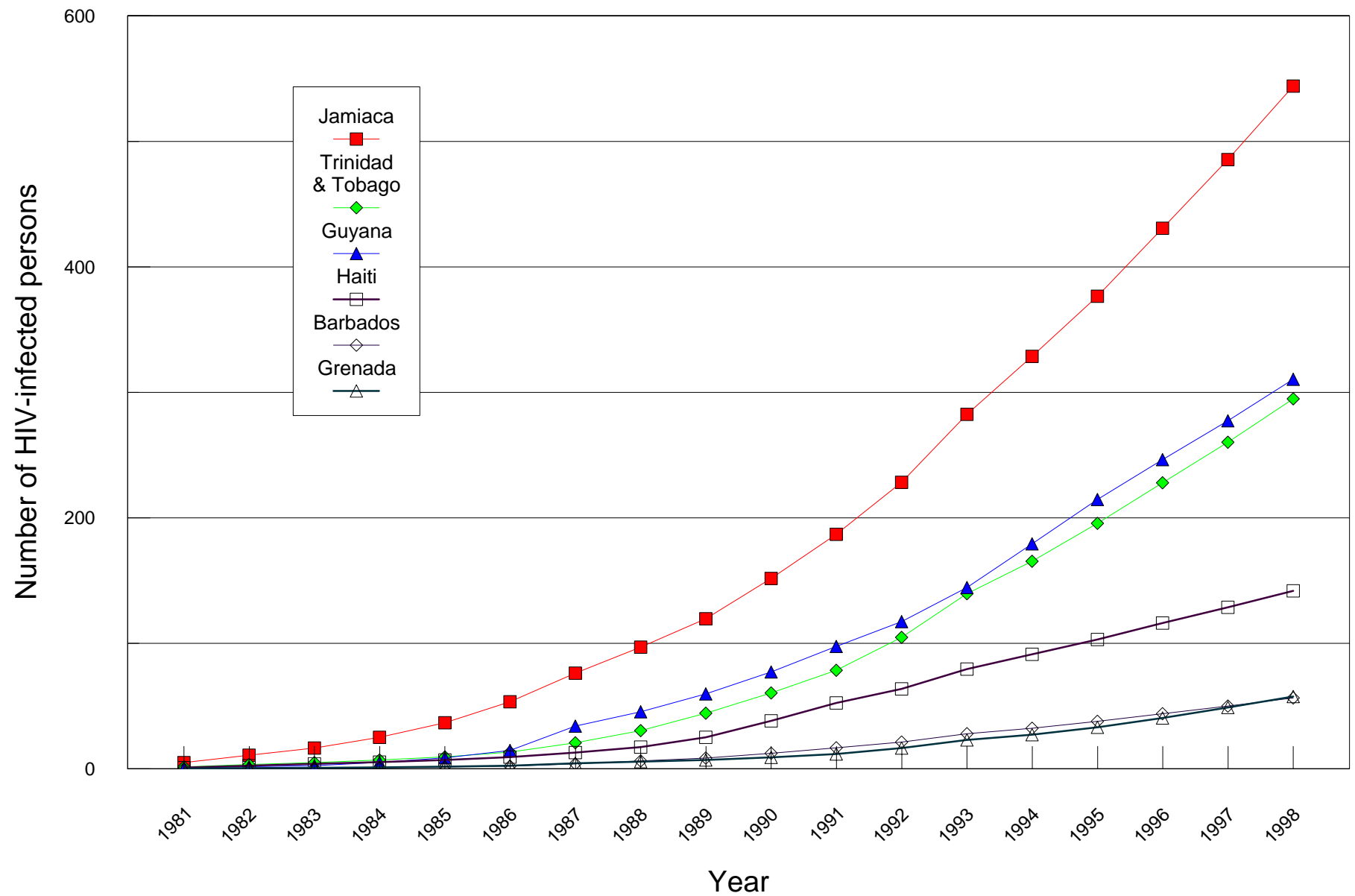


Figure 3 Modeled HIV prevalence for Ontario residents born in sub-Saharan Africa or the Caribbean, 1981 to 1998

