Understanding the reasons for decline of HIV prevalence in Haiti

E M Gaillard, L-M Boulos, M P André Cayemittes, L Eustache, J D Van Onacker, N Duval, E Louissaint, G Thimoté

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See end of article for authors' affiliations

Correspondence to: E M Gaillard, PO Box 1314, Port-au-Prince, Haiti; egaillard@msn.com

Objectives: HIV sero-surveillance rounds and projection estimates suggest a decline of HIV prevalence among pregnant women and the general population in Haiti. This study aimed to evaluate the decline of HIV prevalence and understand the reasons for the decline.

Methods: Following an epidemiological analysis, three mathematical models were used to re-create the national epidemic, calculate HIV incidence, and confirm the decline of HIV prevalence. Declining trends in prevalence data were compared with observed trends in behavioural data.

Results: HIV progressed rapidly from initial infection to AIDS and death, with people dying twice as fast as in developed countries. With the rapid progression of the disease and the early intervention efforts in securing the blood supply, prevalence among commercial sex workers and blood donors peaked in the late 1980s followed by a decline in the mid-1990s in the general population. The observed decline among pregnant women and in the general population was confirmed after controlling for confounding variables. The Haitians are well informed: there is an increase in condom use with occasional partners at last contact and in abstinence and fidelity, and a decrease in the number of occasional partners. However, the age of sexual debut is lower and the proportion of sexually active youth has increased.

Conclusions: There is evidence of decline in HIV prevalence among pregnant women, specifically among pregnant women living in urban areas and pregnant women 25 years and older, but not among pregnant women living in rural areas and pregnant women 24 years and younger. Although many factors have acted in synergy to halt the AIDS epidemic in Haiti, the main reasons for decline seem to point to mortality and blood safety intervention efforts in the early stages of the epidemic.

Haiti is among the first countries to have reported HIV/AIDS cases in the early 1980s, and has been identified as having the highest prevalence in the Americas and the largest number of people living with HIV/AIDS in the Caribbean.¹ Nevertheless, in spite of having the profile of a generalised epidemic, HIV prevalence has not reached the levels of Africa.

The first AIDS cases in Haiti were reported in 1982. The epidemic started in the capital, Port-au-Prince, and then spread to rural areas.² In 1982, there were five times more males living with AIDS than females. By 1992, the male to female ratio of AIDS cases was 1.5:1.³ In 1992, the Ministry of Health adopted a policy of not tracking and not reporting AIDS cases, while at the same time establishing a surveillance system of HIV, syphilis, and hepatitis B among pregnant women. Since 1993, Haiti has had four rounds of sentinel surveillance surveys among pregnant women attending antenatal care. There were 5 sentinel sites in 1993, 7 in 1996, 12 in 2000, and 17 in 2004.^{4–7} These surveys, as well as modelling estimates, suggest a decline of HIV prevalence among pregnant women and in the general population. However, the results of the surveys may be flawed due to confounding variables.

The objective of the present analysis is to evaluate and provide some plausible explanation for the decline.

METHODS

Firstly, we conducted an epidemiological analysis of database records of the sentinel sites to explore HIV trends among comparable sites, by place of residence (urban and rural) and by age group.³ HIV prevalence trends among commercial sex workers and blood donors were also noted. Secondly, we

used mathematical models to re-create the curve of the epidemic, evaluate if the decline of HIV prevalence was real, and calculate HIV incidence. Thirdly, we undertook a review of biological data related to risk factors, disease progression, and mode of transmission to understand the natural history of AIDS in Haiti. Fourthly, we consulted the literature and historical records related to demographics and health to evaluate knowledge and changes of behavior. Finally, we compared trends in incidence and prevalence with data on knowledge and observed trends in behavior among commercial sex workers,⁸ men who have sex with men,⁹ and males and females of reproductive age.^{10–11}

Mathematical models

Estimation and Projection Package

The Estimation and Projection Package model (EPP)¹² assisted in re-creating the national epidemic by fitting an epidemiological model¹³ to the four rounds of surveillance data among pregnant women attending antenatal care to obtain national year by year HIV prevalence estimates.

Spectrum

We used the Spectrum AIDS Impact Model (AIM) to calculate annual HIV incidence. Contrary to most simulation models which start with incidence as the input and then calculate prevalence as a result, AIM starts with HIV prevalence as the input from EPP and then estimates

Abbreviations: AIDS, acquired immune deficiency syndrome; BSS, Knowledge and Behavioral Surveillance Surveys; DHS, Demographic and Health Surveys; EPP, Estimation and Projection Package; FCSW, female commercial sex worker; HIV, human immunodeficiency virus; STI, sexually transmitted infection

incidence as a result.¹⁴ This calculation is done through a process of reversed engineering. Estimates of annual incidence are extremely important for the analysis as they allow matching incidence with specific events in time.

SPSS

We applied the SPSS Binary Logistic Regression Model to the database records of the four rounds of urban and rural prevalence data. The model, based on the goodness of fit χ^2 statistics test (Hosmer–Lemeshow), with a *p* value equal to or greater than 0.20, assesses the fitness of the data (that is, the higher the *p* value, the better the fit). The model was used to compare HIV prevalence over time and adjust for confounding variables, each variable adjusting for the others.

The logistic model allowed comparison of HIV prevalence among the four rounds of prevalence surveys and included three dummy variables, T_1 , T_2 , and T_3 , to represent the four rounds of prevalence surveys for calculating the odds ratio (OR). Dummy variable T_1 compared 2004 prevalence to 1993 prevalence; dummy variable T_2 compared 2004 prevalence to 1996 prevalence; and dummy variable T_3 compared 2004 prevalence to 2000 prevalence (see table 3 Results section). In addition to survey rounds, the model included other confounding variables: survey sites, woman's age, place of residence, and syphilis status. Other variables studied were not related to the outcome (HIV status) or to other predictors. Furthermore they were not important in the logistic model which may be schematised as follows:

$$\ln(p/1-p) = 4.3 - 0.5 T_1 - 0.4 T_2 - 0.2 T_3 - 0.5 \text{ RESIDENCE} - 0.3 S_1 - 0.2 S_2 - 0.8 S_3 - 0.2 S_4 + 0.2 S_5 - 0.3 S_6 + 0.2 S_7 - 0.3 S_8 - 0.2 S_9 + 0.3 S_{10} + 0.2 S_{11} - 0.7 S_{12} + 0.4 S_{13} + 0.6 S_{14} - 0.7 S_{15} - 1.1 S_{16} - 0.7 \text{ SYPH} - 0 \text{ AGE}$$

The modelling process used was as follows:

- (1) Each studied variable was forced separately in a specific model. Its importance was evaluated by the goodness of fit χ^2 and by improvement χ^2 .
- (2) A series of tentative models were evaluated by forcing, firstly, groups of two variables together, then groups of three variables, and so on.
- (3) Evaluation of forward and backward logistic models.
- (4) Lastly, variables thought to be of great importance were forced in the final model.

The Hosmer–Lemeshow test was used instead of regular goodness of fit χ^2 statistics because women's age was treated as a continuous variable whereas the remaining variables were considered categorical. The Hosmer–Lemeshow χ^2 statistics are shown in table 2 (see Results section). The models fitted the data well and the generated statistics were valid.

RESULTS

Trends of HIV prevalence

Pregnant women

The crude prevalence of HIV infection among all pregnant women decreased from 6.2% (95% CI 5.9% to 6.5%) in 1993 (*n* = 1354) to 5.9% (CI 5.7% to 6.1%) in 1996 (*n* = 2468), 4.5% (CI 3.0% to 6.0%) in 2000 (*n* = 2873), and 3.1% (CI 3.0% to 3.2%) in 2004 (*n* = 6779). HIV prevalence among pregnant women living in urban areas also showed declines from 9.4% (CI 9.1% to 9.7%) in 1993 (*n* = 617) to 7.9% (CI 7.5% to 8.3%) in 1996 (*n* = 1318), 6.7% (CI 6.2% to 7.2%) in 2000 (*n* = 1082), and 3.3% (CI 3.2% to 3.4%) in 2004 (*n* = 2908). For pregnant women living in rural areas, HIV prevalence was 3.5% (CI 3.0% to 4.0%) in 1993 (*n* = 737) and 3.7% (CI 3.4% to 4.0%) in 1996 (*n* = 1129), and declined to 2.9% (CI 2.7% to 3.1%) in 2000 (*n* = 1715) and 2.8% (CI 2.7% to 2.9%) in 2004 (*n* = 3831).

HIV prevalence among pregnant women 24 years and younger increased from 4.5% (CI 4.4% to 4.6%) in 1993 (*n* = 488) to 4.7% (CI 4.3% to 5.1%) in 1996 (*n* = 1020), and then fell to 3.7% (CI 3.4% to 4.0%) in 2000 (*n* = 1252) and 2.6% (CI 2.5% to 2.7%) in 2004 (*n* = 2929). For pregnant women 25 years and older, it fell from 7.2% (CI 6.6% to 7.8%) in 1993 (*n* = 846) to 6.8% (CI 6.5% to 7.1%) in 1996 (*n* = 1416), 5.1% (CI 4.8% to 5.4%) in 2000 (*n* = 1600) and 4.6% (CI 4.1% to 4.7%) in 2004 (*n* = 3746). The crude prevalence of serological syphilis, a cofactor of HIV infection, decreased from 6.5% in 1993 to 6.1% in 1996, then slightly increased to 6.8% in 2000 and fell to 3.7% in 2004.

Female commercial sex workers

A study conducted among Haitian and migrating Dominican female commercial sex workers attending the HIV voluntary counseling and testing GHESKIO Center in Port-au-Prince, between 1985 and 2003, showed a decline of the prevalence of HIV and serologic syphilis during the 18 year period. The prevalence of HIV among Haitian female commercial sex workers (table 1), of whom 55% worked in brothels and 45% in the streets, rose from 50% (CI 41% to 59%) in 1985 (*n* = 117) to a peak of 63% (CI 45% to 81%) in 1987 (*n* = 27) and 1988 (*n* = 57). It then declined to 22% (CI 18% to 26%) in 1999 and 2003 (*n* = 361). The prevalence of serologic syphilis, a known cofactor of HIV infection, fell from 50% (CI 41% to 59%) in 1985 (*n* = 115) to 25% (CI 21% to 29%) in 1999 and 2003 (*n* = 353).¹⁵

Prevalence of HIV among Dominican female commercial sex workers, all working in brothels, was 10% (CI 7% to 13%) in 1985 (*n* = 381), 10% (CI 3% to 17%) in 1987 (*n* = 67), and 10% (CI 4% to 16%) in 1988 (*n* = 101). It then declined to 8% (CI 3% to 11%) in 1999 and 2003 (*n* = 100). The prevalence of serological syphilis fell from 30% (CI 25% to 35%) in 1985 (*n* = 382) to 6% (5.3% to 6.7%) in 1999 and 2003 (*n* = 70).¹⁵

Blood donors

HIV prevalence among blood donors (table 1) in metropolitan Port-au-Prince rose from 3.5% (CI 2.7% to 4.3%) in 1986 (*n* = 1900) to 5.7% (CI 5% to 6.4%) in 1987 (*n* = 4001), and peaked at 6.8% (CI 6.1% to 7.5%) in 1988 (*n* = 4550). It then decreased to 5.7% (CI 5% to 6.4%) in 1989 (*n* = 4004), 4.8% (CI 3.6% to 6%) in 1990 (*n* = 3163),¹⁶ 1.7% in 2003, and 1.8% in 2004.

Modelling the AIDS epidemic

Trends of prevalence and incidence

In re-creating the national epidemic, EPP fitted an epidemiological model to the data points of the sentinel sites, and estimates that national prevalence started at 0.2% in 1982, peaked at 5% in 1994 and 1995, and then declined to 3.9% in 2001 and 3.8% in 2004. From prevalence estimates provided by EPP as an input, Spectrum¹⁴ calculated that national incidence rose from 0.1% in 1982 to a peak of 1.1% in 1989, and then declined to 0.6% in 1994, approximately a twofold decrease in five years, where it stabilised (fig 1).

Evidence of decline of HIV prevalence

Tables 2 and 3 show the statistics for goodness of fit (χ^2 ; Hosmer–Lemeshow) and associated degrees of freedom for the selected model, the *p* value, odds ratios, and confidence intervals for dummy variables T_1 , T_2 , and T_3 adjusted for the other variables in the chosen model. These statistics are for all pregnant women, those living in urban areas and in rural areas, those 24 years and younger, and those 25 years and older.

When comparing prevalence in 2004 with prevalence in 1993, the results for the decline of HIV prevalence among all pregnant women adjusted for site, woman's age, syphilis

Table 1 HIV prevalence (%) from empirical data and national estimates from EPP

Year	Empirical data					National estimates				
	Commercial sex workers	Blood donors			Pregnant women attending antenatal care			EPP curve		
		Male	Female	Total	≤ 24y	≥ 25y	Urban	Rural	Total	Prevalence Incidence
1982										0.2 0.1
1983										0.3 0.1
1984										0.5 0.2
1985	50.0									0.8 0.4
1986		3.9	2.2	3.5						1.2 0.5
1987	63.0	6.0	3.8	5.7						1.8 0.8
1988	63.0	6.9	6.2	6.8						2.5 1.0
1989		6.0	4.1	5.7						3.3 1.1
1990		5.0	3.3	4.8						4.0 1.1
1991										4.5 1.0
1992										4.8 0.8
1993					4.5	7.2	9.4	3.5	6.2	5.0 0.7
1994										5.0 0.6
1995										4.9 0.5
1996					4.7	6.8	7.9	3.7	5.9	4.7 0.5
1997										4.5 0.5
1998										4.4 0.5
1999	22.0									4.2 0.5
2000					3.7	5.1	6.7	2.9	4.5	4.1 0.6
2001										3.9 0.6
2002										3.9 0.6
2003	22.0			1.7						3.8 0.6
2004				1.8	2.6	4.6	3.3	2.8	3.1	3.8 0.6

EPP, Estimation and Projection Package

status, and place of residence showed that for T_1 : OR (Exp β) = 0.63; Ward statistics = 16.1; CI 0.46 to 0.856; $p = 0.002$. Since the confidence interval around the odds ratio did not include 1, $OR_{2004 \text{ v } 1993}$ was statistically significant. The HIV prevalence captured in the testing sites was approximately two times lower in 2004 than in 1993. When comparing prevalence in 2004 with prevalence in 1996, the results for the decline of HIV prevalence among all pregnant women adjusted for site, women's age, syphilis status, and place of residence, showed that for T_2 : OR (Exp β) = 0.62; Ward statistics = 17.1; CI 0.48 to 0.79; $p = 0.000$. Since the confidence interval around the odds ratio did not include 1, $OR_{2004 \text{ v } 1996}$ was statistically significant. The HIV prevalence in pregnant women captured in the testing sites was about two times lower in 2004 than in 1996. Similarly, when

comparing prevalence in 2004 with prevalence in 2000 the results for the decline of HIV prevalence among all pregnant women adjusted for site, women's age, syphilis status and place of residence, show that for T_3 : $OR_{2004 \text{ v } 2000} = 0.69$. This OR was also significant. Therefore, it is unlikely that the decline of HIV prevalence among all pregnant women occurred only by chance.

Following the procedures described above, the logistic model was applied and adjusted for confounders to assess the decline of HIV prevalence among pregnant women living in urban areas and among women 25 years and older. For T_1 : $OR_{2004 \text{ v } 1993}$ was significant; for T_2 : $OR_{2004 \text{ v } 1996}$ was significant; and for T_3 : $OR_{2004 \text{ v } 2000}$ was significant. Therefore, it is unlikely that the decline of HIV prevalence either among pregnant women living in urban areas or among those 25 years and older occurred by chance.

Once again, the logistic model was applied and adjusted for confounders to assess the decline of HIV prevalence among women living in rural areas and among women 24 years and younger. For T_1 , $OR_{2004 \text{ v } 1993}$ was not significant; for T_2 , $OR_{2004 \text{ v } 1996}$ was not significant; and for T_3 , $OR_{2004 \text{ v } 2000}$ was not significant. Therefore, it is probable that the observed decline of HIV prevalence both among pregnant women living in rural areas and among those 24 years and younger occurred by chance.

Figure 1 National estimates of HIV inferred incidence.**Table 2** Goodness of fit, associated degrees of freedom, and p value by age and place of residence

Pregnant women attending antenatal care	n	Goodness of fit		
		χ^2	df	p value
All women	13 202	9.3	8	0.32
Urban	5979	4.1	8	0.84
Rural	7471	4.9	8	0.77
≤ 24 years	5663	5.1	8	0.75
≥ 25 years	7539	8.0	8	0.43

Table 3 Odd ratios (OR), significance, and confidence intervals (CI) for rounds of prevalence surveys by age and place of residence

Pregnant women attending antenatal care	OR	Significance	OR	95% CI
All women	2004 v 1993	0.002	0.63	0.46 to 0.85
	2004 v 1996	0.000	0.62	0.48 to 0.79
	2004 v 2000	0.003	0.69	0.54 to 0.88
Urban	2004 v 1993	0.000	0.36	0.24 to 0.55
	2004 v 1996	0.000	0.54	0.40 to 0.77
	2004 v 2000	0.000	0.55	0.40 to 0.77
Rural	2004 v 1993	0.690	1.10	0.67 to 1.84
	2004 v 1996	0.380	0.82	0.54 to 1.27
	2004 v 2000	0.860	0.96	0.65 to 1.44
≤ 24 years	2004 v 1993	0.160	0.68	0.40 to 1.16
	2004 v 1996	0.050	0.66	0.44 to 0.99
	2004 v 2000	0.040	0.66	0.44 to 0.98
≥ 25 years	2004 v 1993	0.007	0.60	0.41 to 0.87
	2004 v 1996	0.001	0.60	0.44 to 0.81
	2004 v 2000	0.003	0.71	0.52 to 0.98

The observed trend of HIV prevalence was therefore confirmed after controlling for confounding variables. Whereas there was evidence of decline of prevalence among all pregnant women, those 25 years and older, and those living in urban areas, there was no evidence of decline of prevalence among those 24 years old and younger or those living in rural areas.

Disease progression

The median time from infection to death without highly active antiretroviral therapy (HAART) is assumed to be 9 years in developing countries and 10 years in industrialised countries.¹⁴ A small study conducted in Haiti shows that HIV “progresses rapidly from initial infection to AIDS and to death”. Between 1985 and 1997, 42 patients with documented dates of HIV seroconversion were followed by the GHESKIO Center in Port-au-Prince.¹⁷ “The median time from sero-conversion to first HIV symptoms was 3 years, the median time to AIDS was 5.2 years, and the median time to death was 7.4 years. HIV destruction of the immune system progressed at a rapid pace, with 50% of the cohort’s CD4 cell counts falling below 200 at 6.8 years”.¹⁷

Considering that the reproductive number of an infection is determined by the rate of contact, the efficiency of transmission, and the duration of infectivity,¹⁸ it can therefore be inferred that a shorter incubation period reduces the incidence of HIV.

Risk factors

A study conducted among 61 patients (85% males) who attended the GHESKIO Center in Port-au-Prince between 1979 and 1982, showed that potential risk factors, bisexual activity or blood transfusion, were identified in 17% of males and 22% of females. There was a 2.7-fold greater prevalence of opportunistic infection among male patients residing in Carrefour, a red district area of the city well known for prostitution, than in men residing in Port-au-Prince.¹⁹ Another study conducted at the GHESKIO Center in Port-au-Prince between 1979 and 1983 showed that risk factors for HIV, identified among 65% of 34 patients evaluated, included bisexuality (38%) and blood transfusion (21%).²⁰

In a study conducted between 1988 and 1992 among 475 HIV-positive patients and their non-infected regular sex partners by the GHESKIO Center in Port-au-Prince, only one seroconversion (2.5%) occurred among 42 sexually active

couples who always used condoms. Incidence among those who infrequently used or did not use condoms was 6.8%. In spite of counseling and provision of free condoms, 55% of discordant heterosexual couples continued to have unprotected sex.²¹

Recent knowledge and behavioural data

The data in Table 4 are based on the Demographic and Health Surveys (DHS)¹¹ of 2003 and other recent studies.¹¹ These data show the changes in the proportion of public vehicle drivers (n = 540), male street youth (n = 509), female commercial sex workers (n = 495), men who have sex with men (n = 244), 15–24 year old male (n = 2737) and female (n = 2448) youth, and 25–49 year old women (n = 650) living around the 17 sentinel sites, who had had two or more partners in the past 12 months, could cite three main methods of HIV prevention, had complete and correct knowledge of HIV, used a condom at the last contact, had had an HIV test, and had history of other STI.

In addition, a study conducted between 1999 and 2003 among 361 female commercial sex workers by the GHESKIO Center in Port-au-Prince showed that 82% consistently used condoms with clients, 63% had experienced torn condoms, 93% had had clients offer more money for unprotected sex, and 32% had accepted more money to have unprotected sex.⁸ A previous study conducted in 1999 among 132 men who have sex with men, established in the Port-au-Prince area, had indicated that only 7% used a condom at the last contact.⁹

Observed trends in behavioural data

Knowledge and Behavioral Surveillance Surveys (BSS), conducted in 1999⁹ and 2003¹¹ among 15–24 year olds living in Port-au-Prince, revealed that the proportion of males and females in the age groups of 15–19 and 20–24 years with excellent knowledge of AIDS increased between 1999 and 2003 (see table 5). The proportion of those who had sexual contacts with occasional partners decreased, whereas the proportion who had used condoms at the last contact with occasional partners increased among the 20–24 year olds but decreased among the 15–19 year old females.

Males and females of reproductive age

The DHS of 1994/1995 and 2000 (see table 6) indicated that, from 1994 to 2000, the proportion of 15–19 year olds who had never had sex declined. Primary abstinence showed little change in both males and females. Fidelity among females increased more than among males from 1994 to 2000. The percentage of men having more than one sexual partner in the last 12 months decreased from 1994 to 2000, and so did the mean number of men’s sexual partners. The proportion of male STI patients declaring seeking treatment or medical advice increased from 46% in 1994 to 81% in 2000 and among females it decreased from 81% in 1994 to 63% in 2000 (table 6).

Age difference in couples

The age difference between women and their partners was 6.5 years in 1995 and 5.8 years in 2000. The age difference was even greater among the younger population: 7.3 years for ages 15–19 and 7.7 years for the 20–29 year olds.^{10 22 23}

Mortality trends

There are no published data on mortality trends. Furthermore, it was not possible to review mortality records at hospitals or funeral homes.

DISCUSSION

The historical records consulted indicated that, at the beginning of the AIDS epidemic, men were five times more

Table 4 Knowledge and behavioural data (%) in 2003 among public transportation drivers, street youth, female commercial sex workers (CSW), men who have sex with men (MSM), male and female youth, and women 25–49 years old

Indicator	Public drivers	Street youth	CSW	MSM	Males 15–24 years	Females 15–24 years	Women 25–49 years
2 or more partners: past 12 months	44	61		65	35	0.6	2
Exchanged sex for money	23	41		43	9		
Cite 3 main methods of prevention	70	77	80	38	82	79	83
Complete/correct knowledge of HIV	35	31	34	32	56	41	41
Used condom at last contact	27	32	98	38	37	23	10
Had HIV test	15	6	51	9	4	4	23
History of other STI	19	44	39	4	8	20	18

likely to be living with AIDS than women. Men living in the red zone district of Port-au-Prince, where two thirds of female commercial sex workers with HIV live, were three times more likely to have an opportunistic infection than men living in other areas of Port-au-Prince. Risk factors, particularly bisexuality/homosexuality and blood transfusion, were present among most patients with AIDS in Haiti. Thus, the epidemic was concentrated among the more at risk population.

Since 1970, blood transfusions were provided by two centres, the “Hôpital de l’Université d’Etat d’Haiti” (HUEH), where donors were remunerated, and the “Centre de Transfusion Sanguine de la Croix-Rouge”, where donors were not remunerated.¹⁶ To stop the spread of HIV, the government closed down the blood bank at HUEH in 1986. Since then, a behavioural screening policy for blood donors has been instituted, and the Red Cross is the only organisation authorised to provide blood transfusions. Donors are recruited from among a patient’s family members, and screened and tested for HIV. Donors are not remunerated.¹⁶ This policy eliminated blood transfusion as a mode of transmission by limiting exposure to infected blood, therefore reducing the incidence of HIV infection.¹⁸

The natural history of HIV in Haiti shows that the disease progressed rapidly from initial infection to AIDS and death, with people dying twice as fast as in developed countries. As the epidemic in the early to mid-1980s was concentrated among the more at risk groups, it can be inferred that with high mortality among people with HIV/AIDS (due to a shorter duration of infectivity) and with the early intervention efforts in securing the blood supply, prevalence among commercial sex workers and among blood donors peaked in the late 1980 and then declined.

Evidence of decline of HIV prevalence

As the epidemic spread from more at risk groups living in urban areas to women and rural areas, incidence in the general population doubled every other year and reached a peak in the early 1990s (see table 1). With a shorter duration

of infectivity and a secured blood supply, incidence, as calculated by Spectrum, declined and was followed by a decrease in prevalence in the mid-1990s.

The observed decline of HIV prevalence among pregnant women, as well as the decline of national estimates fitted by EPP, was confirmed after controlling for confounding variables.

Key indicators of behaviour change

Has the high mortality among female commercial sex workers contributed to a change of behaviour among their peers, such as increased condom use? Recent studies indicate that 9 out of 10 commercial sex workers in Port-au-Prince used a condom at the last contact.

The DHS, BSS, and others studies from the last five years indicate that Haitians are well informed about HIV/AIDS. Three out of four people can cite three main methods of HIV prevention. One out of three of men who have sex with men, commercial sex workers, public transportation drivers, and street youth, and about half of the general population, have complete and correct knowledge of HIV.

In spite of this increased knowledge and provision for condoms, a third of female sex workers continue to accept more money for unprotected sex and half of discordant couples continue to have unprotected sex. Approximately half of men who have sex with men and street youth, and one out of four public transportation drivers have exchanged sex for money. Two out of three of the most at risk and of the general population have not used a condom at the last contact and more than two out of 10 people have a history of STI. In spite of this, the epidemic is being fuelled at a lower pace among these groups than it was in the 1980s.

Nevertheless in the general population, there is an increase in condom use with occasional partners at last contact, an increase in abstinence and fidelity, and a decrease in the number of occasional partners. However, the age of sexual onset has gone down and the proportion of sexually active youth has increased.

Table 5 Observed trends in behavioural data (%) among male and female youth 15–24 years old and males and females of reproductive age between 1999 and 2003

	Males 15–19 years		Females 15–19 years		Males 20–24 years		Females 20–24 years	
	1999	2003	1999	2003	1999	2003	1999	2003
Excellent knowledge of AIDS	24	54	26	45	29	60	33	54
Sex with occasional partners	50	12	31	2	60	20	52	2
Condom use at last contact	50	52	37	25	48	63	36	88

Table 6 Observed trends in behavioural data (% except mean number of partners) among male and female youth 15–24 years old, and males and females of reproductive age between 1994 and 2000

	Males 15–19 years		Females 15–19 years		Males		Females	
	1994	2000	1994	2000	1994	2000	1994	2000
Never had sex	53	48	71	66				
Primary abstinence					16	16	24	21
Fidelity					33	36	16	27
More than one partner					28	23		
Number of partners (mean)					1.4	1.2		
Seek STI treatment					46	81	81	63

Other positive elements that have acted in synergy²⁴ include: the leadership role of the National AIDS Control Program; sustained advocacy efforts in improving the policy environment; engagement of past and current governments; improved capacity at all levels; public/private sector partnerships; transparency and accountability of programmes; scientific research within the country; mobilisation of financial resources; implications of the press, faith based organisations, communities, and people living with AIDS; commitments of key stakeholders; improved STI case management; better access to services, voluntary counseling, testing, care, and treatment; and indications of behaviour change in recent years.²

Limitations of the study

There are several limitations of this analysis. Firstly, total fertility rates, life expectancy at birth, and all other demographic variables required for the demographic projections and incidence calculations are only available nationwide. Therefore Spectrum analysis for Port-au-Prince or for urban and rural areas was not possible. Secondly, HIV prevalence reproduced by the EPP and incidence modelled by Spectrum are nationwide estimates. Most trends of behavioural data are available for Port-au-Prince or other major urban areas and are only documented for the last five years, many years after incidence declined. Thirdly, there are unexplained variations of prevalence in some sentinel sites and a lack of comparability of indicators in behavioural studies over time. Fourthly, not all confounding factors are considered in the logistic regression. Lastly, the analysis may be clouded due to the following:

- the small sample size of some surveys

Key messages

- After more than 20 years of a generalised epidemic in Haiti, there is evidence of decline of HIV prevalence among all pregnant women, pregnant women living in urban areas and pregnant women 25 years and older, but there is no evidence of decline among pregnant women living in rural areas or pregnant women 24 years and younger.
- There is evidence of behaviour change in recent years, mostly in Port-au-Prince. However, the timeframe of this change does not match the earlier decline in HIV incidence.
- The reasons for decline seem to point to mortality and blood safety intervention efforts in the early stages of the epidemic.

- most studies were done in Port-au-Prince and in major urban areas only
- no incidence data were available from studies
- the impact of political instability and violence on internally displaced people was not known
- there is no instrument to quantify and test if blood safety practices and mortality are sufficient to justify the rapid decline of HIV prevalence.

CONCLUSIONS

There is evidence of decline of HIV prevalence in Haiti among all pregnant women, pregnant women living in urban areas, and pregnant women 25 years and older. There is also evidence of behaviour change in recent years, but mainly in Port-au-Prince and other urban areas. However, the timeframe of this change does not match the earlier decline of HIV incidence which started about 15 years ago. Factors that may have contributed to the decline of HIV prevalence in urban areas are double migration (from rural to urban for economic reasons; and from urban to rural to seek family home based care), and the presence of key factors operating mainly in urban areas and facilitating access to primary and secondary prevention activities. Overall, people died at a faster rate than others became infected.

However, there is no evidence of decline among pregnant women living in rural areas and among pregnant women 24 years and younger, which presents a serious concern with regard to the future trend of the epidemic. The reasons for no evidence of decline may be double migration and other factors. Important considerations include:

- Haiti is located on an island with restricted opportunities for international migration.
- The Dominican Republic, which shares the island with Haiti, and the Caribbean and Latin American region have lower HIV prevalence.
- The main mode of HIV transmission is sexual.
- There is no reported injection drug use.
- The most vulnerable and most at risk became infected early on, and without access to treatment, were sick within three to five years and died within two years of getting sick.
- Blood safety policy and practices were implemented in 1986.
- The National AIDS Control Program was created in 1987.
- When incidence reached a peak in the late 1980s and started declining, intervention programmes were just being implemented.

It can be inferred that, in the pre-antiretroviral era, the reasons for decline of national HIV prevalence seems to point

to mortality and to blood safety intervention efforts at an early stage of the epidemic. This assumption of natural dynamics cannot be proved, but it should be considered.

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AUTHORS' CONTRIBUTIONS

E Gaillard was responsible for implementing the EPP and Spectrum models. L-M Boulos and M Cayemittes were responsible for implementing the SPSS logistic regression model. The paper was written by E Gaillard and L-M Boulos, and redrafted by E Gaillard, L-M Boulos, and M Cayemittes with assistance from S Smith, E Sonneveldt, and N Jewell of the POLICY Project, Futures Group International. The study was jointly conceived by all of the authors and all contributed to the analysis of the data.

Authors' affiliations

E M Gaillard, The POLICY Project/Futures Group International, Port-au-Prince, Haiti

L-M Boulos, Centre d'Évaluation et de Recherche Appliquée (CERA), Port-au-Prince, Haiti

M P A Cayemittes, Institut Haitien de l'Enfance, Port-au-Prince, Haiti

L Eustache, The POLICY Project/Futures Group International, Port-au-Prince, Haiti

J D V Onacker, **N Duval**, **E Louissaint**, **G Thimoté**, Ministère de la Santé Publique – UCC, Port-au-Prince, Haiti

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