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REVIEW ARTICLE

THE HIV EPIDEMIC AND THE STATE OF ITS SURVEILLANCE IN ETHIOPIA

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Summary: *A review of the information on the HIV epidemic in Ethiopia is important to guide policy and action. Published and unpublished reports and surveillance data from records of governmental and non-governmental institutions were examined to assess the extent of the epidemic. It appears that the HIV/AIDS epidemic has affected a large segment of the urban population. Surveillance data from pregnant women attending antenatal clinics indicate a decreasing trend in the prevalence of HIV in Addis Ababa. Similarly, data from blood donors from the majority of transfusion centres in the country indicate a decrease in prevalence. However, further studies will be required to establish the validity of these findings. Currently available data are not adequate to accurately measure the level of infection in rural areas where 85% of the population live. Outside of Addis Ababa, in places where ANC-based sentinel surveillance are operational, the systems are not fully supported by quality control. Thus, there are concerns regarding the validity of reported results. The impact of HIV/AIDS epidemic in Ethiopia needs to be further quantified both in its burden of diseases and its impact on the urban and rural economy and society. It is, therefore, important that effort and adequate resources are put into strengthening surveillance systems.*

INTRODUCTION

It is now almost 16 years since the HIV/AIDS epidemic started in Ethiopia (1). The national response to the epidemic was promptly initiated with the establishment of a task force on HIV/AIDS in 1985. The establishment of the Department of AIDS Control in the Ministry of Health and the

launching of a national programme to prevent and control HIV/AIDS were undertaken in 1987. This was soon followed by a number of sero-surveys across the country to map out the extent of the epidemic (2). Major social and political changes occurred soon after these initial activities. These changes, which included the devolution of political power to regional states and the

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creation of a federal system of government, economic liberalization and the growth of the private and non-government sector, offered regional states, the NGOs and civil society a potentially conducive environment to tackle the spreading epidemic.

In a country in which poverty, ignorance, natural and man-made disasters are widespread, it is almost inevitable that the HIV/AIDS epidemic grows and expands relentlessly in spite of the efforts of all concerned. Indications are that the epidemic has affected a large segment of society. As a result the Government has endorsed a national policy on HIV/AIDS in August 1998 (3) and has established a national HIV Prevention and Control Council in April 2000 (4). The Ministry of Health and regional health bureau, in collaboration with all stakeholders, have also drafted multi-sectoral strategic five-year plans (5,6,7).

At this juncture of time, it is important that the current HIV/AIDS situation be appraised, with a view to assess what we know, and do not know, about the extent and progression of the epidemic and the information requirements to monitor it. Such an exercise is important to guide policy and action, and would assist in the assessment and evaluation of prevention and control efforts in the future. This review was thus undertaken with the following objectives a) to take stock of the available information on the current epidemiological situation of HIV/AIDS in Ethiopia; b) to identify information gaps and data requirements to fully describe the epidemic; and c) to assess the strength and weaknesses of current surveillance guidelines and practices and recommend on ways to improve the systems.

METHODS

A search of the bibliographic archives of the National Library of Medicine on HIV (MEDLINE and AIDSLINE) was conducted. Citations of studies dealing with the epidemiology of HIV/AIDS in Ethiopia were included. Additional published materials in local journals were also searched and included in the review. A relatively large body of information that is not published in peer-reviewed publications was also reviewed. These were obtained from federal, regional, non-governmental and international organizations. Surveillance records from these organizations were also solicited and included in this review. Citations and publications (peer reviewed or not) dealing with subjects of pure biomedical nature were excluded.

A number of key individuals involved in surveillance activities in various institutions were also interviewed to assess the state of surveillance systems. The conclusions and recommendations stated in this report were raised and discussed with representatives of regional health bureau and the Ministry of Health in a workshop held on March 19, 2000. A number of suggestions and recommendations forwarded by participants of this workshop are included in this report.

In this report we have used the term *surveillance* to mean 'the continued watchfulness over the distribution and trends of incidence [and prevalence] through the systematic collection and evaluation of morbidity reports and other relevant data together with timely and regular dissemination to those who need to know' (8) 'generally using methods distinguished by their practicality, uniformity, and rapidity rather than

by accuracy and completeness [for] appropriate action including investigative and control measures. Sources of data may relate directly to disease or to factors influencing disease' (9).

THE CURRENT EXTENT OF THE EPIDEMIC:

Results of sero-surveys conducted among blood donors and pregnant women attending antenatal clinics are often used to describe the magnitude of HIV infections in developing countries as they are more likely to represent the 'general population', are feasible to undertake and are within the resource means of the countries. This is in spite of their questionable validity due to pre-screening procedures that tend to partially exclude high-risk groups from donating blood and sampling biases related to ANC-based surveillance systems (10).

Results from the most recent sero-surveys among these groups are presented in Table 1. In Addis Ababa, the prevalence of HIV among blood donors was 6.4% in 1999. The prevalence among ANC attendees was 15.0% in 1999/00 (11). Another self-selected group of individuals for whom data on HIV prevalence is available is visa applicants (9.1% in 1999) (12). Data on the residence source of this group is not available, but most are expected to be from Addis Ababa. The prevalence in this group is higher than similar estimates from blood donors but is lower than that of ANC attendees from Addis Ababa. The prevalence estimates from a population-based survey in 1994 was compared to that of the ANC-based surveillance system and a high level of discrepancy was noted (13). Although several reasons were forwarded to explain for this disparity (14,15), it is not clear yet whether the ANC-based estimates overes-

timate the prevalence rate for the city.

Outside of Addis Ababa, recent prevalence data is available for few regions. Prevalence among blood donors from eight regional centres varied between 3.8% and 7.9%. Prevalence data from ANC sentinel surveillance sites are available for even fewer regions. In 1999, prevalence among ANC attendees was 19% in Gambella town. Similarly high prevalence estimates are also reported for Amhara (20.8%) and Dire Dawa (13.6%). For several regions (Tigray, Afar, Somali, Benishangul-Gumuz and Harari) prevalence estimates of HIV are unavailable. Only two regions, Oromia and Southern Nations, Nationalities and Peoples Region (SNPPR), have estimates of prevalence at the zonal level (albeit partially). Furthermore, all of the ANC-based surveillance data (except for Atat Hospital in SNNPR and Gambo Hospital in Oromia) come from services that cater to a predominantly urban population. The prevalence among rural ANC attendees and thus the extent of the epidemic in the rural population of other zones is unknown. The prevalence from Atat (4%), where 88% of the tested women were from rural areas, indicates that HIV prevalence level is fairly low in that area. In Gambo (another rural site) the prevalence was 0.7%.

Thus the HIV/AIDS epidemic has affected a large segment of the urban population. Currently available data are not adequate to accurately measure the level of infection in the general population particularly in rural areas where 85% of the population live.

THE MAGNITUDE OF HIV INFECTION AMONG POPULATION SUB-GROUPS

Women: Sero-prevalence data based on

ANC surveillance in both Addis Ababa and the regions indicate a fairly high prevalence of HIV (Table 1). Among blood donors in Addis Ababa, the prevalence for women was 6.9% in 1999, higher than that of men (6.4%). This is also true for Gondar, where 11.5% of women were infected compared to 8.4% men. Sex specific

prevalence data from visa applicants are not reported. In any case, prevalence data available for Addis Ababa and other regional towns indicate that the epidemic has affected a sizable proportion of women. The picture among rural women is not well known.

Table 1. Recent sero-surveys on HIV conducted among blood donors and pregnant women in Ethiopia.

Year	Place	Population	Sample size	Prevalence (%)	Source
1999-00	Addis Ababa	ANC attendees	879	14.3	(11)
1999	Gambella	ANC attendees	300	19.0	"
1999-00	Oromia	ANC attendees			
	Gambo		416	0.7	"
	Metu		260	3.0	"
	Shashemene		414	14.3	"
1999-90	SNNP Region	ANC attendees			
	Atat		400	4.0	"
	Hosaana		400	4.8	"
	Sodo		307	10.7	"
	Awassa		400	11.5	"
	Dila		400	11.8	"
1999	Dire Dawa	ANC attendees	375	13.6	"
1999	Bahirdar	ANC attendees	260	20.8	"
1999	Addis Ababa	Blood donors	11,587	6.4	(ERCS-BTS records)
1999	8 urban centres	Blood donors		3.8-7.9	"
1999	Addis Ababa	Visa applicants	10,930	9.1	(12)

SNNP = Southern Nations, Nationalities and Peoples; ERCS-BTS = Ethiopian Red Cross Society-Blood Transfusion Service. For earlier reports of sero-surveys refer to (76-88).

Children, adolescent and young adults: Although it is known that over 90% of HIV/AIDS in children is acquired through mother-to-child transmission (MTCT), there are no data to describe the magnitude of MTCT in Ethiopia, except for one study that crudely estimated the rate of vertical transmission to be over 29% (16). This was also the conclusion of a recent national review on the subject (17). A large intervention trial studying the effect of a short-term regimen of Nevirapine on MTCT is expected to start soon in Addis Ababa.

The level of HIV infection and its progression among adolescents and young adults is also well known. In Dire Dawa the prevalence of HIV among young women attending ANC (15-24 years of age) was 14%. Infection in this group accounted for 57% of the total infected women. In Gambella prevalence was 12.1%, accounting for 65.6% of all infections in ANC attendees (Surveillance records, Ministry of Health). Data available from blood donors (Figure 1) also indicated that this group accounts for a sizable proportion of infections among the general population.

Sex workers and other high-risk groups: At the early stage of the HIV epidemic in Ethiopia, it was important to describe the level of infections among high-risk groups. A major effort was thus put into conducting such targeted sero-surveys in Addis Ababa and 23 other major urban centres. Fairly high levels of prevalence were reported and these were increasing in the years following the baseline surveys. For the period after 1990 there are virtually no data to indicate the level or progression of the epidemic among sex workers and other high-risk groups such as truck drivers, merchants and the military. A 1998 survey among sex workers in Addis Ababa has reported a prevalence of 73.4% (18). In

that survey, participants were selected from women attending to two health centres mostly for STD-related symptoms. This was thus a self-selected group of sex workers in the city.

The progression of the epidemic: The HIV/AIDS epidemic in Ethiopia probably started at around 1984. Sera collected from patients and blood donors in 1983 did not test positive for HIV. Whereas sera collected in 1984 from 167 patients with Bell's palsy showed the first two HIV positive sera reported from Ethiopia (1).

Work done by Abebe *et al* and Hussein *et al* has shown that the vast majority of HIV strains were of subtype C: 98% among blood donors, pregnant women and sex workers of Addis Ababa (1995); 99% among sex workers of Addis Ababa (1997); 100% among AIDS patients of Addis Ababa (1997); and 96% among blood donors of six Ethiopian towns (1997) (19,20,21). Phylogenetic analysis of HIV-1 genomic material recovered from specimens obtained in 1984 and 1985 demonstrated that the viruses clustered with the main subtype C cluster strongly suggesting the founding of the subtype C epidemic in Ethiopia in the early 1980s (22).

Serial prevalence data from blood donors in Addis Ababa for the period 1987-91 and from 1994-99 show an increase from the baseline of 2.3% to 9.1% in 1995 followed by a decline to 6.4% in 1999 (Figure 1). Between 1994 and 1999 there are indications that the prevalence has slightly decreased in younger age groups among both sexes and the total population of blood donors. Pre-screening procedures to exclude high-risk donors was instituted at the Ethiopian Red Cross Society-Blood Transfusion Service (ERCS-BTS) in and around 1987 (23) and have been practiced continuously ever since. It is possible that

these pre-screening procedures are getting more effective in time, and could be responsible for the observed declining trend of HIV prevalence among blood donors.

Although there have been a number of reports of prevalence among ANC attendees from Addis Ababa spanning the ten-year period from 1989 to 1999, these were conducted in differing geographic locations and populations and thus comparisons among these data should be undertaken with caution. The data for the three years of testing (1996-1999/00) are, however, comparable as they were done in the same locations using similar methods. These data show a decline in prevalence among pregnant women attending ANC in Addis Ababa. This decreasing trend has recently been examined in detail (24). The trend has been shown to be statistically significant and particularly pronounced among the younger (under 25 years) age group.

Serial prevalence data have also been reported from Addis Ababa among visa applicants. Prevalence among this group decreased between 1996 and 1998 but peaked again in 1999. Prevalence data disaggregated by age are not available for visa applicants. Another serial prevalence data include population-based surveys on city wide random sample completed in 1994 (14) and from various districts in the city in 1996 (25,26), but these figures are not strictly comparable.

Prevalence estimates for younger age groups are better indicators of progression than the prevalence of the whole population as they measure the frequency of relatively recent infections and thus approximate incidence rates. A decreasing trend among younger blood donors and pregnant women is also shown in Figure 1 although for ANC attendees it is only available for a limited period of time.

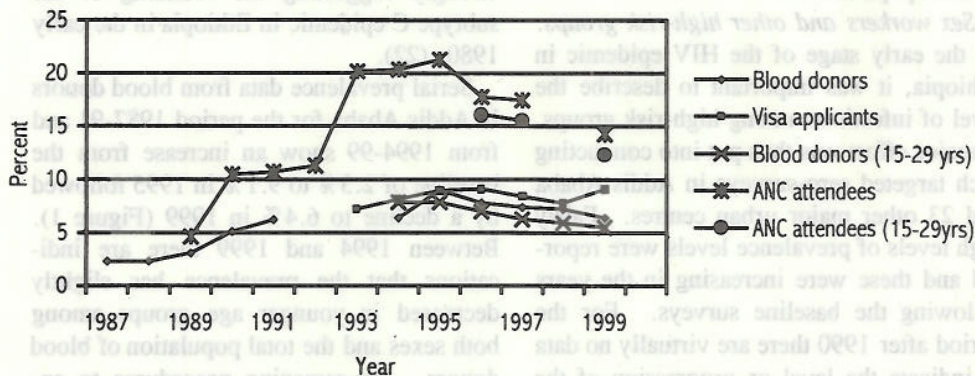


Figure 1. HIV prevalence trends among ANC attendees, blood donors, and visa applicants in Addis Ababa.

Data from areas outside of Addis Ababa are patchy and incomplete. Interestingly, for all places where data from blood donors are available there has been a progressive decline in prevalence (Figure 2). Here again it is difficult to state whether the observed trends are accurate measures of the trends in the population or are merely due to increasingly effective pre-screening procedures in the transfusion services.

Thus, surveillance data from pregnant women attending antenatal clinics indicate a decreasing trend in the prevalence of HIV in Addis Ababa. Similarly, data from blood donors from the majority of transfusion centres in the country indicate a decrease in prevalence.

Trends of changes in sexual behaviour: There is a growing consensus on the need

to assess the trend of changes (if there are any) in sexual behaviour among population subgroups to better understand the progression of the epidemic (27,28). Serial data on the proportion of students who use condoms are available for Addis Ababa and Gondar only. The proportion of high-school students reporting condom use in Addis Ababa increased from 6.6% in 1990 to 27.7% in 1993. Thirty four percent of college students in Addis Ababa reported condom use in 1993 (Table 2). In Gondar the proportion increased from 24.0% to 45.9% between 1990 and 1996. The proportion of students in Gondar reporting sex with a non-regular partner decreased from 47% in 1990 to 9.3% in 1996. In Addis Ababa it decreased from 36.2% in 1990 to 10.3% in 1993.

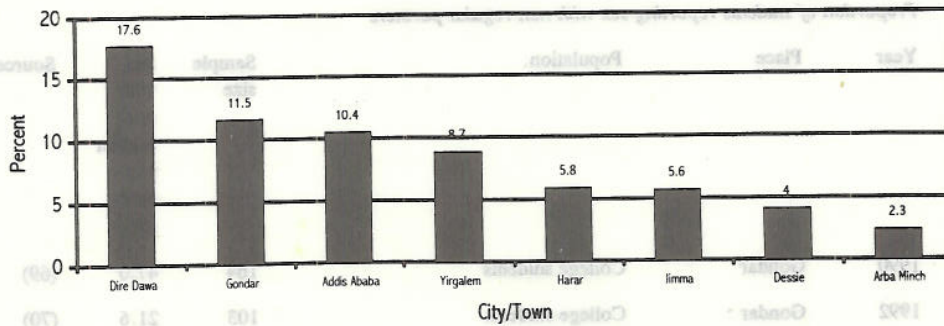


Figure 2: Average percent reduction in prevalence of HIV among male blood donors aged 15 to 29 years in eight transfusion centres in Ethiopia: 1995 to 1999 (Note: the figure for females is not shown because women accounted for a very low number of blood donors in centres outside of Addis Ababa).

Table 2. Serial data on behavioural surveys on HIV/AIDS in Ethiopia: 1983-99. Proportion of students reporting condom use

Year	Place	Population	Sample size	Condom use (%)	Sources
1987-88	8 cities	Adult population	2,919	3.6	(29)
1993	4 cities	Adult population	6,885	47.5	(30)
1990	Gondar	College students	164	24.0	(69)
1992	Gondar	College students	103	33.0	(70)
1993	Gondar	College students	391	47.8	(71)
1996	Gondar	College students	383	45.9	(72)
1990	Addis Ababa	High school students	116	6.6	(73)
1993	Addis Ababa	High school students	755	27.7	(74)
1993	Addis Ababa	College students	1,214	34.0	(75)

Proportion of students reporting sex with non-regular partners

Year	Place	Population	Sample size	Sex with non-regular partners (%)	Sources
1990	Gondar	College students	164	47.0	(69)
1992	Gondar	College students	103	21.6	(70)
1993	Gondar	College students	391	23.2	(71)
1996	Gondar	College students	383	9.3	(72)
1990	Addis Ababa	High school students	116	36.2	(73)
1993	Addis Ababa	High school students	755	10.0	(74)
1993	Addis Ababa	College students	1,214	10.3	(75)
1993	4 cities	Adult population	6,885	10.3	(30)

For earlier behavioural surveys on HIV/AIDS refer to (89-95).

Although the data indicate the youth and high-risk groups in Addis Ababa and Gondar (and presumably other cities) are increasingly changing their behaviour and adopting safe-sex practices, there are several limitations to the reported data. The various studies did not follow similar methods, did not use similar standardized questions and represent a small group of individuals sampled from only two cities. Two large-scale nation-wide studies on sexual behaviour were conducted in 1987/88 and 1993 (29,30). Their enquiries into condom use were not similar although the difference in response rates between the two periods (3.6% and 47.5%) is too high to be dismissed on methodological grounds.

Trends over time in the availability of condoms are also important indicators of changes in sexual behaviour. There has been a progressive increase in the sale and distribution of condoms since 1990 from a baseline figure of 700 thousands to 41.8 million in 1999. Close to 20% of all sales and distribution are for the population of Addis Ababa (Christopher Purdy, Personal communication).

Another important set of indicators of changes in sexual behaviour is data on the occurrence of sexually transmitted diseases or infections (STD). Serial prevalence data on these are, however, available only for Addis Ababa. Serological tests for syphilis antibodies (TPPA) indicate that the prevalence decreased from 12.3% in 1995 to 6.8% in 2000. The trend was also shown to be statistically significant (24).

The burden of disease:

AIDS morbidity: AIDS case reporting has started in 1986 with a report of 2 cases (31,32,33). By March 2000 a total of 83,487 cases has been reported to the Ministry of Health (11). Of these, Tigray region has reported 3,322 cases, Amhara

12,129, Oromiya 21,002, SNNPR 6,628 Harari 2,692, Dire Dawa 3,322, Benishangul-Gumuz 503, Gambella 244, Somali region 17, and Addis Ababa region has reported 33,626 cases. Data on the number of reported AIDS cases (not estimates) disaggregated by age, sex, residence and presumed risk groups is only available for the years up to and including 1994 (34). A recently released report from the Ministry of Health (11) has included age and sex breakdown for cases reported up to March 2000. However, for a third of the cases age and sex were not reported. Because of under diagnosis, under reporting and delayed reporting, AIDS case reporting is inaccurate in Ethiopia as is the case in most of the developing world (35). However, because of its use in estimating the number of HIV infections, related deaths and other impacts of the epidemic, AIDS case surveillance continues to be practiced in Ethiopia and has been the bases of several estimates and projections for Addis Ababa (36,37,38) and for the country (39,40,41).

AIDS mortality: There have been three studies on burden of diseases based on verbal autopsies (42,43,44). In all HIV has been identified as one of the most important cause of mortality in adults, accounting for a large proportion of adult deaths in Ethiopia, particularly in the cities. Experience elsewhere has shown significant increases in infant and child mortality due to HIV/AIDS. Although a couple of studies have described paediatric AIDS cases in Ethiopia (16,45) the impact of the disease on infant and childhood mortality has yet to be studied.

There are reports that, presumably because of the HIV epidemic, the rate of tuberculosis is rising (46,47). The association of tuberculosis and HIV have been noted early in the epidemic (48). A study

from Shashemene has reported that 44.4% of patients with tuberculosis were infected with HIV in 1995 (49). Increased resistance to anti-tuberculosis drugs as a result of concurrent HIV infection has also been reported from a study conducted in Harar in 1996 (50). The result of an ongoing study on HIV and tuberculosis in Addis Ababa (51) is being awaited. Thus, although an increase in the disease burden of tuberculosis due the HIV/AIDS epidemic is expected, there have not been studies that have attempted to quantify it. Likewise the possible role of the epidemic on the resurgence of other infectious and parasitic diseases has been studied by only a small number of studies that have looked in to schistosomiasis (52), toxoplasmosis (53,54) and other parasites (55,56).

Impact on the health sector and the economy: There are no published reports on the proportion of hospital beds occupied by AIDS patients in health care facilities.

The direct and indirect cost of medical and preventive services and lost earnings due to HIV/AIDS have been studied and reported by Kello in 1998 (57). For the period 1997-2000, the costs were estimated to be between 32-49 million US Dollars in the low cost scenario in addition to the cost of preventive services valued at 56 million USD. The indirect cost (in terms of income loss due to premature deaths) was estimated to be equivalent to 23-42% of the national income per year. Since this study was completed in 1994/95 there have not been other studies that have looked at this issue. There are no published reports from Ethiopia on the effect of the epidemic on loss of skilled or unskilled labour, lost work-days to illness or to attend funerals, or increased health care cost to industries. Also not known is the impact of AIDS on the rural economy. Questions have been

raised on whether it would be possible to accurately quantify the economic impact of HIV/AIDS in developing countries where the level of poverty and inflation is high, conflicts and population displacements are common, and where spending on health and education is below that allotted to the military (58).

Social impacts: There are no reports on the impacts of AIDS on families, particularly its effect on the extended family system. The extent of orphan-hood in the regions or in Addis Ababa is not known, although there is one report of a study from Addis Ababa conducted in 1993 (59). A sizable proportion of orphans were shown to have dropped out of school, faced abandonment and displacement.

The current state of surveillance systems:

ANC-based sentinel surveillance: The establishment of a sentinel surveillance system based on ANC attendees was effected in four urban sites (Addis Ababa, Metu, Bahir Dar and Dire Dawa) between 1992 and 1993 (40). These sites were subsequently discontinued. In Addis Ababa ANC surveillance was re-established in 1995 (51). Following a workshop in October 1998, an agreement was reached between regional health bureaux and the Ministry of Health to restart the sentinel surveillance system in all regions. Furthermore, this was to be implemented according to a national guideline endorsed by the Ministry of Health (60).

The guidelines required that sites should be selected on the basis of availability of functional laboratories, equipment, supplies, personnel and an adequate patient volume (250-400) in a 12 week period. This effectively meant that virtually all rural areas and a significant number of urban areas without these facilities were excluded. Ex-

cept for Atat hospital (in SNNPR) and Gambo Hospital (in Oromia) all surveillance systems are currently cited in urban areas.

The number of sites to be established was also limited in number. Thus for large regional states like Amhara (pop: 15 million) and Oromiya (pop: 20 million) only two and four sites were planned, respectively (61,62). For SNNP region that includes 45 distinct and unique indigenous ethnic population groups in nine zones and five special districts only four zones have established sites (63). It is interesting to note that Uganda (pop: 21 million) started with six sentinel sites in 1989 and now has 20 sites to cover the whole country (28).

Currently, Amhara, Oromia, SNNP, Gambella and Dire Dawa regions have reported prevalence data from their respective areas (Table 1). Tigrai and Harari regions have started surveillance activities but have yet to report to the Ministry. Afar, Somali, and Benishangul-Gumuz regions have not yet started surveillance activities.

The nation-wide surveillance system has not yet been evaluated. It does not have a functioning in-built quality control system. Thus, there are concerns regarding the quality of surveillance data collected. This underscores the importance of studies describing the rates of ANC attendance, as well as studies comparing the socio-demographic composition of ANC attendees with the general population of pregnant women.

Thus HIV sentinel surveillance based on ANC attendees currently faces major problems related to inadequate coverage of large population groups, and, quality control in terms of both laboratory tests and data management.

Blood donors: The ERCS-BTS has been collecting and reporting HIV prevalence data among blood donors since 1987.

Other than Addis Ababa, there are nine regional blood transfusion services in six regions. Four regional states (Afar, Somali, Gambella and Benishangul-Gumuz) do not have services. Regional transfusion services send their reports to the ERCS-BTS, although these have yet to be sent to the Ministry of Health. Serial prevalence data are available for the ten centres starting from 1989. The service has instituted a donor screening system aimed at eliminating potentially infectious donors before they give blood (Zewdie *et al* 1992). Although this is expected to decrease the HIV prevalence in donors compared to the general population, serial prevalence data from this group continues to be important to monitor the progression of the epidemic. Studies need to be initiated to quantify the degree (if any) by which pre-screening procedures cause the declining trend of prevalence among blood donors.

Laboratory reports: Addis Ababa Regional Health Bureau regularly collects, analyses and reports HIV prevalence data among visa applicants to the Ministry of Health. For the period between 1994 and 1997 testing and reporting was done at the national referral laboratory, when it was subsequently transferred to the Addis Ababa Regional Laboratory. Reporting of the prevalence data disaggregated by age and sex started in July 1997.

The Ministry of Health and regional health bureaux have recently licensed a number of private commercial clinics and laboratories to undertake HIV testing and counselling. In addition, the National HIV/AIDS Referral Laboratory at the Ethiopian Health and Nutrition Research Institute and regional public laboratories conduct HIV testing. Periodic reporting of the statistics in these public and commercial labs is a requirement but has not yet started.

ted.

Ad-hoc sero-surveys: A number of sero-surveys were conducted among sex workers and other risk groups in several urban centres in 1988 and 1989 (64,65). These were followed by sero-surveys among the general population in six rural sites in 1992-93 (40). Sera collected in a city-wide sero-survey in Addis Ababa were also utilized to report on the prevalence of HIV in the general population (14). A smaller survey among residents of a district in Addis Ababa was also completed in 1996 (26). Subsequently, similar surveys were conducted among factory workers in Akaki and Wonji (26). There have not been reports of sero-surveys in rural areas based on random samples of the general population since 1993. Such a survey in Butajira district is currently ongoing among a predominantly rural population under a continuous demographic surveillance since 1987 (66).

As stated earlier for a large segment of the rural population not covered by current surveillance systems, it is important that data be collected through ad-hoc surveys. Under the leadership and participation of regional health bureaux, staff of research and academic institutions can contribute in assuring the quality and timely collection, analysis, and reporting of survey data.

Behavioural surveillance: The need for such systems as an adjunct to HIV sero-surveillance systems has been stated earlier. The two large studies conducted to date are the one conducted among 2,900 adults in eight major cities in 1988 (29) and the other conducted among 6,585 adults in four major cities (30). A national demographic and health survey is currently underway. There are also plans to undertake large-scale prevention indicator surveys in four regions.

STD surveillance: There are plans to ini-

tiate STD surveillance based on the syndromic approach of case reporting (67) in several regions. In Addis Ababa such a system has been initiated since 1999. STD case reporting (not based on the syndromic approach) is in place in many regions. Because of problems related to diagnosis and reporting the accuracy of this system is questionable. For many regions reports are available for only 1999. Thus additional serial data are needed to monitor the progress of the epidemic.

AIDS case reporting: Surveillance reports based on AIDS case reporting started soon after the establishment of the Department of AIDS Control in the Ministry in 1987 (68). With the exception of Afar region, which has yet to report a case, all regions report to the Ministry. Afar region did not have HIV testing facilities until recently. Incomplete and delayed reports by regions are common.

Dissemination of surveillance information: the importance of timely reporting and dissemination of surveillance results to all stakeholders has been emphasised in all guideline documents and has been agreed upon by all regions. Unfortunately, the practice has not materialized. The Ministry of Health has not issued annual surveillance reports, newsletters, fact sheets, or press releases since 1994. Thus, major stakeholders such as health professionals, policy makers, NGOs, religious institutions, community groups, and international organizations do not have access to continuous and timely surveillance information.

CONCLUSIONS

The HIV/AIDS epidemic has affected a large segment of the urban population. Surveillance data from pregnant women attending antenatal clinics indicate a de-

creasing trend in the prevalence of HIV in Addis Ababa. Similarly, data from blood donors from the majority of transfusion centres in the country indicate a decrease in prevalence. However, further studies will be required to establish the validity of these findings.

Currently available data are not adequate to accurately measure the level of infection in the general population particularly in rural areas where 85% of the population live. It is also not adequate to correctly characterize the progression of the epidemic or its impact on the economy and society in urban, rural, regional and zonal areas. HIV sentinel surveillance systems on ANC attendees have not been operational in several regions. In areas where they are functional they are limited to urban centres and thus the rural areas are not adequately covered by these systems. Outside of Addis Ababa, in places where ANC-based sentinel surveillance are operational, the systems are not fully supported by quality control. Thus, there are concerns regarding the validity of reported results. Timely and continuous dissemination of currently available surveillance data by regional and federal health bureaux have not been maintained because of resource limitations.

Serial data on changes in sexual behaviour are lacking. Surveys on behaviour have been based on small sample sizes and did not use comparable methods or questions on sexual behaviour. STD surveillance systems are not well established to track changes in sexual behaviour. However, condom sale and distribution figures indicate an increasing trend of availability of condoms in Addis Ababa and the regions.

The impact of HIV/AIDS epidemic in Ethiopia needs to be further quantified both in its burden of diseases and its impact on

the urban and rural economy and society. It is therefore important that effort and adequate resources are put into collecting data on the following: 1) The prevalence of HIV among urban areas where recent estimates are not available; among the rural population especially at the zonal level; and among high risk groups such as sex workers. Data collection should be repeated every year to give serial prevalence estimates. 2) Important indicators of change of sexual behaviour, particularly the proportion of individuals with non-regular partners and the proportion using condoms with non-regular partners. Data on the frequency of STDs. 3) The validity and reliability of sentinel surveillance data, particularly those from ANC attendees, and data from blood donors and visa applicants. 4) AIDS mortality, and the interaction of HIV/AIDS with tuberculosis and other major infectious and parasitic diseases. Hospital bed utilization, number of orphans and their well-being. Impact data from industries, the agricultural sector and rural and urban households. 5) Socio-cultural and economic circumstances that prompt people to adopt high-risk behaviours be studied. Small-scale in-depth studies at various regions can be usefully utilized for the purpose. Other underlying disease determinants (such as anthropological, developmental and immunological factors) should also be studied.

In regions where ANC-based sentinel surveillance is not operational immediate steps should be taken to assist these regions establish the systems with assistance from the National Reference AIDS Laboratory at EHNRI. Regions where ANC-based sentinel surveillance is operational need to strengthen their systems by soliciting the support of the lab at EHNRI and the expertise available at various academic and research institutions in laboratory testing and

data management procedures. Considerations need to be given to increase the number of sentinel surveillance sites in large regional states with large or diverse population groups. For rural areas where ANC-based surveillance cannot be established, resources need to be allocated soon to conduct ad-hoc sero-surveys to measure the extent of the epidemic. Personnel involved in surveillance work in the various centres should be trained in laboratory procedures and data management, and, that should be followed by frequent supervisions from the centre. Periodic evaluations of all operations surveillance systems need to be undertaken to ensure the quality of existing systems and avoid poor testing procedures. The Ministry of Health and regional health bureaux should issue annual reports on the state of the epidemic. These should be followed by more frequent newsletters, facts sheets, and press releases based on the most current surveillance data.

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REFERENCES

1. Tsega E, Mengesha B, Nordenfelt E, *et al.* Serological survey of human immunodeficiency virus infection in Ethiopia. *Ethiop Med J* 1988;26(4):179-84.
2. Eshete H, Sahlu T. The progression of HIV/AIDS in Ethiopia. *Ethiopia J Health Dev* 1996;10(3):179-90.
3. GFRE, Government of the Federal Republic of Ethiopian. Policy on HIV/AIDS of the Federal Republic of Ethiopia, Addis Ababa August 1998.
4. GFRE, Government of the Federal Republic of Ethiopia. Establishment of HIV/AIDS Prevention and Control Council. Discussion paper for the consensus building workshop. February 10-11, 2000. Addis Ababa.
5. MOH. Strategic Framework for the National Response to HIV/AIDS in Ethiopia for 2000-2004. Ministry of Health, Addis Ababa, Sept: 1999.
6. MOH. Summary. Federal level Multisectoral HIV/AIDS Strategic plan 2000-2004. Ministry of Health Addis Ababa. Sept. 1999.
7. MOH. Summary. Regional Multisectoral HIV/AIDS strategic plans 2000-2004.

- Ministry of Health, Addis Ababa. Sept. 1999.
8. Berkelman RL, Beuhler JW. Surveillance. In Holland WW, Detels R, Knox G, eds, Oxford Textbook of Public Health, Volume 2, Second Edition, Oxford University Press, Oxford, 1991:161-76.
 9. Last JM (ed). A dictionary of epidemiology, third edition. Oxford University Press, New York, 1995.
 10. UNAIDS. Trends in HIV incidence and prevalence: natural course of the epidemic or the results of behavioural change? Geneva, Switzerland, June 1999.
 11. MOH. Current status of HIV sentinel surveillance data and AIDS case reporting in Ethiopia. Ministry of Health, Disease Prevention and Control Department, Addis Ababa, June 2000.
 12. Tegbaru B, Fisseha B, Tessema Z, Fontanet A. The prevalence of HIV-1 among visa applicants between 1993 and 1999 in Addis Ababa, Ethiopia. First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999 (Abstract).
 13. Tsegaye A, Kamil E, Negassa H, *et al.* Sentinel surveillance of HIV infection in Addis Ababa: how representative are pregnant women of the general population? First International Conference on HIV/AIDS in Ethiopia; Addis Ababa, November 1999 (Abstract). *Ethiop Med J* 1999;37(Suppl 1):110.
 14. Fontanet A, Messele T, Dejene A, *et al.* Age- and sex-specific HIV-1 prevalence in the urban community setting of Addis Ababa, Ethiopia. *AIDS* 1998;12:315-22.
 15. Mekonnen Y, Tsegay A, de Wit R, *et al.* Age-adjusted HIV-1 prevalence among pregnant women, Addis Ababa, Ethiopia: sentinel surveillance, 1995-2000 (Abstract). XIII International AIDS Conference, Durban, South Africa. July 2000.
 16. Muhe L. A four-year cohort study of HIV seropositive Ethiopian infants and children: clinical course and disease patterns. *Ethiop Med J* 1997;35(2):103-15.
 17. MOH/UNICEF. A situation assessment report on mother to child transmission of HIV in Ethiopia. Ministry of Health and UNICEF, Addis Ababa, March 2000.
 18. Aklilu M, Messele T, Biru T, *et al.* Factors associated with HIV infection among sex workers of Addis Ababa, 1998. First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999. (Abstract). *Ethiop Med J* 1999;37(Suppl 1):109.
 19. Abebe A, Kuiken CL, Goudsmit J, *et al.* HIV-1 subtype C in Addis Ababa, Ethiopia. *AIDS Res Hum Retrovir* 1997;13:1071-5.
 20. Abebe A, Demissie D, Goudsmit J, *et al.* SI-NSI phenotype and co-receptor usage among Ethiopian AIDS patients. *AIDS* 1999;13:1305-11.
 21. Hussien M, Abebe A, Pollakis G, *et al.* HIV-1 subtype C amongst commercial sex workers in Addis Ababa, Ethiopia. *J Acquir Immune Defic Syndr Hum Retrovirol* 2000;in press.
 22. Almaz A, Lukashov V, Georgios P, *et al.* Genetic characterisation of HIV-1 subtype C viruses recovered from the early phase of the Ethiopian AIDS epidemic. (2000, submitted for publication).
 23. Zewdie D, Sisay Y, Kebede D, Mamo D. HIV infection in Ethiopian blood donors: prevalence, trends and future projections. *Ethiop J Health Dev* 1992;6(2):1-8.
 24. Tsegaye A, Rinke de Wit T, Mekonnen Y, *et al.* Decline in HIV infection among

- ANC attenders in Addis Ababa; Ethiopia: evidence from sentinel surveillance studies (Abstract), Annual Conference of the Ethiopian Medical Association. Addis Ababa, May 2000.
25. Afework KW, Tesfaye D, Mesfine K, *et al.* HIV infection among residents of urban slums of Addis Ababa. *Mitt Osterr Ges Tropenmed Parasitol* 1997;19:43-8.
 26. Fontanet A, Suhl T, Messele T, *et al.* Factors associated with HIV infection in Ethiopia: results from four cross-sectional surveys in 1995-6 (n=2,526). First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999 (Abstract). *Ethiop Med J* 1999;37(Suppl 1):107.
 27. UNAIDS. Reaching regional consensus on improved behavioral and serosurveillance for HIV. Report from a regional conference in East Africa. Geneva, Switzerland. June 1998.
 28. UNAIDS. A measure of success is Uganda. The value of monitoring both HIV prevalence and sexual behaviour. UNAIDS case study. Geneva, Switzerland. May 1998.
 29. Gebresellassie S. National KAPB study on HIV/AIDS Addis Ababa (Unpublished Report), 1988.
 30. Mehret M, Mertens TE, Carael M, *et al.* Baseline for the evaluation of an AIDS programme using prevention indicators: a case study in Ethiopia. *Bull World Health Organ* 1996;74(5):509-16.
 31. Lester FT, Aychunie S, Zewdie D. Acquired immunodeficiency syndrome: seven cases in an Addis Ababa Hospital. *Ethiop Med J* 1988;26(3):139-45.
 32. Negassa H, Kefenie H, Kodakivich L, *et al.* Profile of AIDS cases in Ethiopia. *Ethiop J Health Dev* 1990;4(2):213-7.
 33. Negassa H, Khodakevich L, Kefenie H, *et al.* Surveillance of AIDS cases in Ethiopia. *Ethiop J Health Dev* 1990;4(2):107-13.
 34. MOH. National HIV/AIDS update. *Ethiop J Health Dev* 1995;9(1):63-6.
 35. UNAIDS. The status and trends of the global HIV/AIDS pandemic. Report of a symposium held in Vancouver, Canada on 5-6 July 1996.
 36. Abdurehman A. The demographic impact of HIV/AIDS in Addis Ababa (MPH Dissertation). Addis Ababa University, December 1998.
 37. Addis Ababa Regional Health Bureau. HIV/AIDS in Addis Ababa. Background, projections, impacts and intervention. City Administration Health Bureau, Addis Ababa, January 1999.
 38. Mekonnen Y, Jegou R, Medley G, *et al.* Predicting the course of the HIV/AIDS epidemic in Addis Ababa and its potential demographic input. First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999 (Abstract). *Ethiop Med J* 1999;37(Suppl 1):111.
 39. Khodakevich L, Mehret M, Negassa H, Shanko B. Projections on the development of HIV/AIDS epidemics in Ethiopia. *Ethiop J Health Dev* 1990;4(2):191-5.
 40. MOH. AIDS in Ethiopia. Background, projections, impacts, intervention. Second Edition. Ministry of Health, Addis Ababa, 1998.
 41. UNAIDS. On the global HIV/AIDS epidemic June 1998. Geneva, Switzerland.
 42. PHRD. Ethiopia Social Sector Study Report: The Burden of Disease. Policy and

- Human Resource Development Project, Addis Ababa, September 1996.
43. PHRD. Ethiopia' Social Sector Study Report: The Burden of Disease. Policy and Human Resource Development Project, Addis Ababa, February 1998.
 44. Abdulahi H. Burden of disease in Butajira, Southern Ethiopia (MPH Dissertation). Addis Ababa University, December 1998.
 45. Beyene H, Moss W. Clinical and epidemiological features of HIV-Seropositive hospitalized Ethiopian children. *Ethiop Med J* 1991;29(2):57-61.
 46. Eyob G, Goshu S, Girma M, *et al.* Increase in tuberculosis incidence among the staff working at the TB Demonstration and Training Center (TBDTC) in Addis Ababa, Ethiopia: a retrospective study (1989-1998) First International Conference on HIV/AIDS in Ethiopia. Addis Ababa, November 1999 (Abstract). *Ethiop Med J* 1999;37(Suppl 1):133.
 47. Eyob G, Mebratu T, Tegbaru B, *et al.* Trends in Tuberculosis disease and HIV prevalence among Tuberculosis cases diagnosed between 1993 and 1998 at the TB Demonstration Training Center Addis Ababa, Ethiopia. First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999 (Abstract). *Ethiop Med J* 1999;37(Suppl 1):134.
 48. Kefenie H, Zewdie D, Desta B, *et al.* The prevalence of HIV-1 antibodies in 106 Tuberculosis patients. *Ethiop J Health Dev* 1990;4(2):197-200.
 49. Gellete A, Kebede D, Berhane Y. Tuberculosis and HIV infection in southern Ethiopia, 1996. *Ethiop J Health Dev* 1997;11(1):51-9.
 50. Mitike G, Kebede D, Yeneneh H. HIV infection and anti tuberculosis drug resistance among pulmonary tuberculosis patients in Harar Tuberculosis center, Ethiopia. *East Afr Med J* 1997;74(3):154-7.
 51. Fontanet A, W/Michael T. The Ethio-Netherlands AIDS Research Project (ENARP): descriptions and major findings after four years of activities. *Ethiop Med J* 1990;37(Suppl 1):9-24.
 52. Fontanet A, W/Michael T, Sahleu T, *et al.* Epidemiology of HIV and *Schistosoma mansoni* infections among sugar estate residents in Ethiopia. *Ann Trop Med Parasitol* 2000;94:145-55.
 53. Guebre-Xabier M, Nurilign A, Gebre-Hiwot A, *et al.* Sero-epidemiological survey of *Toxoplasma gondii* infection in Ethiopia. *Ethiop Med J* 1993;31(3):201-8.
 54. Woldemichael T, Fontanet A, Tefera S, *et al.* Evaluation of the Eiken Latex Agglutination test for anti-*Toxoplasma* antibodies and seroprevalence of *Toxoplasma* infection among factory workers in Addis Ababa, Ethiopia. *Trans R Soc Trop Med Hyg* 1998;92:401-3.
 55. Woldemichael T, Tsegaye A, Rinke de Wit T, *et al.* Increased incidence of intestinal parasitic infections in HIV-positives when compared to HIV-negative individuals: results from a two-year prospective study. First International Conference on HIV/AIDS in Ethiopia, Addis Ababa, November 1999. (Abstract). *Ethiop Med J* 1999;37(Suppl 1):124.
 56. Fontanet A, Sahlu T, de Wit R, *et al.* Epidemiology of infections with intestinal parasites and human immunodeficiency virus (HIV) among sugar-estate residents in Ethiopia. *Ann Trop Med Parasitol* 2000;94:269-78.

57. Kello AB. Impact of AIDS on the economy and health care services in Ethiopia. *Ethiop J Health Dev* 1998;12(3):191-201.
58. UNAIDS/WHO. AIDS epidemic update: December 1999. Geneva, Switzerland.
59. Bedri A, Kebede S, Negassa H. Sociodemographic profiles of children affected by AIDS in Addis Ababa. *Ethiop Med J* 1995;33(4):227-34.
60. MOH. National sentinel surveillance guideline for Ethiopia. Ministry of Health, Addis Ababa, March 1999d.
61. Amhara Regional Health Bureau. HIV/AIDS strategic plans for Amhara National Regional State: 1998-2002. Report submitted to a workshop, Nazareth January 1998.
62. Oromiya Regional Health Bureau. HIV/AIDS Strategic plans for Oromiya National Regional State: 1998-2002. Report submitted to a workshop, Nazareth January 1998.
63. SNNPR Health Bureau. HIV/AIDS strategic plan for SNNPR state: 1998-2002. Report submitted to a workshop, Nazareth, January 1998.
64. Mehret M, Khodakevich L, Zewdie D, *et al.* HIV-1 infection and related risk factors among female sex workers in urban areas of Ethiopia. *Ethiop J Health Dev* 1990;4(2):163-170.
65. Mehret M, Khodakevich L, Zewde D, *et al.* HIV-1 infection and some related risk factors among female sex workers in Addis Ababa. *Ethiop J Health Dev* 1990;4(2):171-176.
66. Berhane Y, Wall S, Kebede D, *et al.* Establishing an epidemiological field laboratory in rural areas-potentials for public health research and interventions: the Butajira Rural Health Programme 1987-99. *Ethiop J Health Dev* 1993;13(Special issue):1-19.
67. WHO/UNAIDS. Guidelines for sexually transmitted infections surveillance. UNAIDS/WHO working Group on Global HIV/AIDS/STI surveillance 1999, Geneva, Switzerland.
68. MOH. Guidelines for AIDS case surveillance. Ministry of Health, Addis Ababa, 1992.
69. Teka T. College students attitudes and knowledge of AIDS. *Ethiop Med J* 1993;31(4):233-7.
70. Teka T. AIDS related knowledge and behaviours among college students, Gondar, Ethiopian: a comparative study. *Ethiop Med J* 1997;35(3):185-90.
71. Gebre Kidan K, Azeze B. Survey of condom use among college students. *Ethiop J Health Dev* 1995;9(1):7-11.
72. Ismail S, Bitsunamlak H, Alemu K, *et al.* High risk sexual behaviours for STD/HIV, pregnancies and contraception among high school students in a rural town, north western Ethiopia. *Ethiop J Health Dev* 1997;11(1):29-36.
73. Gebre S. Sexual behaviour and knowledge of AIDS and other STDs: a survey of senior high school students. *Ethiop J Health Dev* 1990;4(2):123-31.
74. Eshetu F, Zakus D, Kebede D. The attitude of students, parents and teachers towards the promotion and provision of condoms for adolescents in Addis Ababa, Ethiopia. *Ethiop J Health Dev* 1997;11(1):7-16.
75. Petros B, Belayneh S, Mekonnen Y. AIDS and college students in Addis Ababa: a study of knowledge, attitude and behavior. *Ethiop J Health Dev* 1997;11(2):115-23.
76. Assefa A, Rahlenbeck S, Molla K, Alemu S. Seroprevalence of HIV-I and syphilis

- antibodies in blood donors in Gondar, Ethiopia, 1989-1993. *J Acqr Immune Defic Syndr* 1994;7(12):1282-5.
77. Rahlenbeck SI, Yohannes G, Molla K, *et al.* Infection with HIV syphilis and hepatitis B in Ethiopia: a survey in blood donors. *Int J STD AIDS* 1997;8(4):261-4.
 78. Somali Regional Health Bureau. HIV/AIDS strategic plans for Somali National Regional State: 1998-2002. Report submitted to a workshop, Nazareth, January 1998.
 79. Chamiso B. Pregnancy outcome in HIV-1 positive women in Ghandi Memorial Hospital Addis Ababa, Ethiopia. *East Afr Med J* 1996;73(12):805-9.
 80. Kidane KG, Fantahun M, Azeze B. Seroprevalence of human immunodeficiency virus infection and its association with syphilis seropositivity among antenatal clinic attenders at Debreabor Rural Hospital, Ethiopia. *East Afr Med J* 1995;72(9):579-83.
 81. Kidane KG, Ishak A, Stevens R, *et al.* Prevalence of HIV, syphilis and genital chlamydial infection among women in north-west Ethiopia. *Epidemiol Infect* 1998 120(2):171-7.
 82. Mehret M, Knodakevich L, Zewdie D, Shanko B. Progression of human immunodeficiency virus epidemic in Ethiopia. *Ethiop J Health Dev* 1990;4(2):183-90.
 83. Gizaw G, Ayhunie S, Zewde D, Adal G. Prevalence of HIV infection in a group of lumpen individuals in Addis Ababa-Ethiopia. Fourth International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988 (Abstract).
 84. Mehret M, Khodakevich L, Zewdie D, *et al.* HIV infection among employees of the Ethiopian Freight Transport Corporation. *Ethiop J Health Dev* 1990;4(2):177-82.
 85. Sisay Y, Sentjens REJH, Vrieling H, *et al.* Prevalence of and risk factors for HIV infection in blood donors and various population subsets in Ethiopia, 1992 (Unpublished).
 86. Kebede Y, Pickering J, McDonald JC, Wotton K, Zewdie D. HIV infection in an Ethiopian prison. *Am J Public Health* 1991;81(5):625-7.
 87. Demissie K, Amre D, Tsega E. HIV-I infection in relation to educational status, use of hypodermic infections and other risk behaviours in Ethiopian sailors. *East Afr Med J* 73(12):819-22.
 88. Kefenie H, Desta B, Mengesha S, Zewdie D, Kebede T. Prevalence of HIV-I antibodies in patients with sexually transmitted disease. *Ethiop Med J* 1991;29(2):63-9.
 89. Ismail S, H/Giorgis F, Legesse D, *et al.* Knowledge, attitude and practice on high risk factors pertaining to HIV/AIDS in a rural community. *Ethiop Med J* 1995;33(1):1-6.
 90. Shabbir I, Larson CP. Urban to rural routes of HIV infection spread in Ethiopia. *J Trop Med Hyg* 1995;98(5):338-42.
 91. Korra A, Haile M. Sexual behaviour and level of awareness on reproductive health among youths: evidence from Harar, Eastern Ethiopia. *Ethiop J Health Dev* 1999;13(2):107-13.
 92. Sahlu T, Kassa E, Agonafer T, *et al.* Sexual behaviours, perception of risk of HIV infection and factors associated with attending HIV post-test counseling in Ethiopia. *AIDS* 1999;13:1263-72.

93. Ashebir DZ. HIV/AIDS awareness, knowledge and practice in patients with sexually transmitted diseases. *Ethiop Med J* 1996;34(1):25-32.
94. Fantahun M, Chala F. Sexual behaviours, and knowledge and attitude towards HIV/AIDS among out of school youth in Bahir Dar Town, northwest Ethiopia. *Ethiop Med J* 1996;34(4):233-42.
95. Taffa N. Sexual activity of out-of-school youth, and their knowledge and altitude about STDS and HIV/AIDS in southern Ethiopia. *Ethiop J Health Dev* 1998;12(1):17-22.

79. Chansio B. Pregnancy outcome in HIV-1 positive women in Gambella Hospital Addis Ababa, Ethiopia. *Ethiop J Health Dev* 1998;12(1):802-9.
80. Kidanemariam KG, Fantahun M, Assef B. Seroprevalence of human immunodeficiency virus infection and its association with syphilis seropositivity among antenatal clinic attendees at Debreberhan Rural Hospital, Ethiopia. *Ethiop J Health Dev* 1995;7(2):279-83.
81. Kidanemariam KG, Isak A, Stevens R, et al. Prevalence of HIV, syphilis and genital chlamydial infection among women in north-west Ethiopia. *Epidemiol Infect* 1998;120(2):171-7.
82. Meher M, Khabakciwib L, Zewdie D, Shanno B. Progression of human immunodeficiency virus epidemic in Ethiopia. *Ethiop J Health Dev* 1990;4(2):183-90.
83. Gizaw G, Aynalem S, Zewdie D, Adal G. Prevalence of HIV infection in a group of lumpy individuals in Addis Ababa-Ethiopia. Fourth International Conference on AIDS, Stockholm, Sweden, June 12-16, 1988 (Abstract).
84. Meher M, Khabakciwib L, Zewdie D, et al. HIV infection among employees of the Ethiopian Freight Transport Corporation. *Ethiop J Health Dev* 1990;4(2):177-82.
85. Sisy Y, Senjema RBH, Virsik H, et al. Prevalence of and risk factors for HIV infection in blood donors and various population subsets in Ethiopia, 1992 (Unpublished).
86. Kebede Y, Pickering J, McDonald K, Wotoma K, Zewdie D. HIV infection in an Ethiopian prison. *Am J Public Health* 1991;81(5):622-7.
87. Demissie K, Amare D, Tesfaye E. HIV-1 infection in relation to educational status, use of pyrodermic infections and other risk behaviours in Ethiopian sailors. *Ethiop J Health Dev* 1991;7(12):819-22.
88. Kelemis H, Geza B, Mengesha S, Zewdie D, Kebede T. Prevalence of HIV-1 antibodies in patients with sexually transmitted disease. *Ethiop Med J* 1991;29(2):63-9.
89. Ismail S, HADJIGEORGIS F, LAGOSIS D, et al. Knowledge, attitude and practice on high risk factors pertaining to HIV/AIDS in a rural community. *Ethiop Med J* 1992;33(1):1-6.
90. Shabbir I, Larson CP. Urban to rural routes of HIV infection spread in Ethiopia. *J Trop Med Hyg* 1992;98(2):338-42.
91. Korta A, Halle M. Sexual behaviour and level of awareness on reproductive health among youths: evidence from Harar, Eastern Ethiopia. *Ethiop J Health Dev* 1999;13(2):107-13.
92. Saitu T, Kasasa E, Agonster T, et al. Sexual behaviours, perception of risk of HIV infection and factors associated with attending HIV post-test counselling in Ethiopia. *AIDS* 1999;13:1263-72.