Declining HIV prevalence among young pregnant women in Lusaka, Zambia

Elizabeth M Stringer, Namwinga T Chintu, Jens W Levy, Moses Sinkala, Benjamin H Chi, Jubra Muyanga, Marc Bulterys, Maximilian Bweupe, Karen Megazzini & Jeffrey SA Stringer

Objective  HIV prevention has been ongoing in Lusaka for many years. Recent reports suggest a possible decline in HIV sero-incidence in Zambia and some neighbouring countries. This study aimed to examine trends in HIV seroprevalence among pregnant and parturient women between 2002 and 2006.

Methods We analysed HIV seroprevalence trends from two Lusaka sources: (i) antenatal data from a city-wide programme to prevent mother-to-child HIV transmission, and (ii) delivery data from two anonymous unlinked cord-blood surveillances performed in 2003 and again in 2005–2006, where specimens from >97% of public-sector births in each period were obtained and analysed.

Findings Between July 2002 and December 2006, the Lusaka district tested 243 302 antenatal women for HIV; 54 853 (22.5%) were HIV infected. Over this period, the HIV seroprevalence among antenatal attendees who were tested declined steadily from 24.5% in the third quarter of 2002 to 21.4% in the last quarter of 2006 (P < 0.001). The cord-blood surveillances were conducted between June and August 2003 and again between October 2005 and January 2006. Overall HIV seroprevalence declined from 25.7% in 2003 to 21.8% in 2005–2006 (P = 0.001). Among women ≤ 17 years of age, seroprevalence declined from 12.1% to 7.7% (P = 0.015).

Conclusion HIV seroprevalence appears to be declining among antenatal and parturient women in Lusaka. The decline is most dramatic among women ≤ 17 years of age, suggesting a reduction in sero-incidence in this important age group.

Introduction

Lusaka is the largest city in Zambia and is among those places most heavily burdened by HIV. Public-sector antenatal and delivery care occurs in 24 government clinics that are spread throughout the city. Each year, there are approximately 45 000 births in this system. In late 2001, the Zambian government began implementing services to prevent mother-to-child HIV transmission (PMTCT) in Lusaka and expanded this to all facilities in just over 2 years. Using data available from all Lusaka public-sector obstetrical facilities, we examined trends in HIV seroprevalence among pregnant and parturient women between 2002 and 2006.

Methods

Data sources

We examined data from two sources. The first comprised routinely collected PMTCT data from the Lusaka Urban Health District. In 2002, nine clinics were offering PMTCT services. By January 2004, all clinics were covered. For this analysis, we used data collected between July 2002 and December 2006 from public-sector clinics offering PMTCT. Routine indicators collected at these facilities include: number of new antenatal attendees, number of women counselled for HIV testing, number of women tested for HIV, number of women with positive test results, and numbers of women and infants receiving antiretroviral prophylaxis for PMTCT. These indicators are collected in facility-based log books and aggregated periodically for government reporting. Age data are not routinely collected.

The second data source comes from two anonymous cord-blood surveillance exercises performed in Lusaka to evaluate the effectiveness of PMTCT services. Details of the surveillance methodology have been described elsewhere. Since maternal IgG (gamma globulin) anti-HIV antibodies cross the placenta freely throughout pregnancy, seropositivity of umbilical-cord blood indicates maternal HIV infection. The first surveillance was conducted for 12 weeks between 7 June 2003 and
31 August 2003. The second surveillance was conducted for 10 weeks between 12 October 2005 and 15 January 2006, with a hiatus between 12 November and 2 December 2005 during which time no specimens were collected. In each surveillance exercise, cord blood was obtained from discarded placentas of almost all liveborn infants (> 97% of births) in all Lusaka public-sector delivery facilities. Specimens were analysed for maternal HIV serostatus using a single rapid HIV antibody test ( Determine HIV1/2; Abbott Laboratories, Abbott Park, IL, United States of America).

**Ethical approval**

Cord-blood surveillance activities received ethical approval from both the University of Zambia Research Ethics Committee and the University of Alabama at Birmingham Institutional Review Board for Human Use. The programmatic analysis of the Lusaka District PMTCT programme was deemed exempt from human subjects review by the same two committees.

**Analysis**

Programmatic data on HIV prevalence were aggregated over periods of 3 months to provide stability for individual period estimates. We used the Cochran-Armitage test to evaluate the trend in HIV prevalence over time and used logistic regression to produce predicted probabilities of maternal HIV-positive status over the course of the programme. Since HIV-prevalence rates may vary geographically, and not all sites had PMTCT services until the beginning of 2004, we also evaluated site-specific estimates by examining each site separately over time and by employing generalized linear mixed models with random coefficient analysis.6

For analysis of the cord-blood surveillances, we restricted the data to women who received their antenatal care in Lusaka to maximize comparability with the antenatal data. We used the χ² test to compare HIV prevalence rates (overall and stratified by age) between the two surveillance exercises. We used Wilson’s method6 to generate confidence intervals around prevalence estimates in both the programmatic data and the cord-blood surveillance. Analyses were performed with SAS 9.1 (SAS Institute, Cary, NC, USA) and S-Plus 6.1 (Insightful Corporation, Seattle, WA, USA).

**Results**

**Programmatic PMTCT data**

From July 2002 to December 2006, the proportion of women attending antenatal care clinics who accepted HIV testing increased steadily over the evaluation period (71% to 94%; P < 0.001; Fig. 1). During that same period, the absolute number of women testing positive for HIV also increased. However, as a proportion of those accepting testing, the number testing positive declined from approximately 24.5% (3rd quarter 2002) to 21.4% (4th quarter 2006; Cochran-Armitage trend test < 0.001). Yearly seroprevalences were 24.8% (2002); 24.0% (2003); 23.0% (2004); 22.3% (2005); and 21.6% (2006). In a site-specific analysis, we observed a decreasing seroprevalence in 21 of 24 sites (Table 1). These site-specific declines were statistically significant (P < 0.05) in 11 sites. In three sites, the trend was slightly positive, but did not achieve statistical significance.

The generalized linear mixed models with random coefficients analysis estimated the average decline in the site-specific HIV prevalence rates of about 1% per year (0.988%, P < 0.001). This rate of decline is slightly greater than that estimated by the logistical model, which does not consider site variation in its estimate (Fig. 2).

**Cord-blood surveillance data**

The first cord-blood survey occurred between 7 June 2003 and 31 August 2003. Over this period, 10 384 women gave birth to liveborn infants in public-sector facilities in Lusaka and 10 194 (98%) analysable specimens were obtained. Of these, 8787 (86%) received antenatal care in Lusaka, of which 2255 (25.7%) were seropositive. The second
surveillance was conducted between 12 October 2005 and 12 November 2005 and then again between 3 December 2005 and 15 January 2006. Over the period of the 2005–2006 cord-blood surveillance, 7665 women gave birth to liveborn infants in public-sector facilities in Lusaka and 7438 (97%) analysable specimens were obtained. Of these, 6756 (88%) received antenatal care in Lusaka, of which 1473 (21.8%) were seropositive (Fig. 1).

In women ≤ 17 years of age, the HIV seroprevalence declined 37% between the two surveillance periods, from 12.1% (77/635) in 2003 to 7.7% (37/481) in 2005–2006 (P = 0.015). Similarly, HIV seroprevalence declined among women aged 20–24 from 25.8% (833/3234) to 20.3% (499/2455) (P < 0.001) and among women aged 25–29 from 31.8% (677/2126) to 27.8% (499/1794) (P = 0.006). The HIV seroprevalence did not change significantly in women aged 18–19, 30–34, or ≥ 35 years (Table 2).

**Discussion**

These data clearly indicate a decline in HIV seroprevalence among pregnant women in Lusaka between 2002 and 2006. The most notable decline occurred among the youngest women (≤ 17 years of age). HIV in this age group declined from 12.1% to 7.7% over a 28-month period. HIV prevalence among adolescents has been proposed as a reasonable surrogate for HIV incidence since this population can be presumed to have become sexually active recently. Use of HIV seroprevalence among adolescents to estimate incidence is particularly useful in settings where more accurate measures of HIV incidence (e.g. detuned antibody assays, pooled RNA testing) are not yet part of widespread surveillance activities. Other investigators in Zambia corroborate our findings with notable declines in the youngest age groups and in Lusaka in general.

The primary strength of this analysis lies in the very high ascertainment...
of samples. The cord-blood surveillance exercises each achieved > 97% specimen ascertainment and, as such, are essentially census surveys of all public-sector births. The antenatal data represent increasing specimen ascertainment over time. When the programme began, not all antenatal sites were offering services yet and testing uptake was around 70%. However, testing rates have steadily increased and, since mid-2005, more than 90% of new antenatal attendees are being tested (N Chintu, unpublished). We also know from the cord-blood surveillances that women who refused testing in 2003 were more likely to be seropositive than those who accepted. In light of this, it is likely that the decline in seroprevalence represented by the regression line in Fig. 2 may actually under-represent the real decline.

Since these data derive from populations of pregnant women, we should be careful not to make broad generalizations about HIV trends among all adolescents or all women. However, we would anticipate that the HIV seroprevalence among pregnant adolescents would be higher than among adolescents in the general population. Michelo et al. have reported that HIV seroprevalence among urban-dwelling women in Zambia aged 15–19 years declined from 12.3% in 1995 to 7.7% in 2003. In addition, the results of the 2003 Zambian Sexual Behaviour Study indicate that the median age of sexual debut declined from 18.5 years to 16.5 years between 2003 and 2005.

In the oldest age groups of women, the HIV seroprevalence declined only modestly or not at all. This may represent a cohort effect, where HIV-infected women become older between sampling periods and move from one age group to another, but also, we suspect that the slight decline in the older populations may be due to death of infected women. As highly active antiretroviral therapy becomes more widespread, and there are potentially fewer people dying from AIDS, we might expect over time that the overall HIV seroprevalence would increase in the older populations.

With over 37 million adults infected worldwide, and 5.3 million new cases each year, the ultimate solution to the epidemic is to prevent new cases of HIV, especially among young people. Ecological data from Uganda suggest that prevention campaigns are working: condom usage and preventive sexual behaviour has increased simultaneously as the HIV prevalence among the antenatal population has continued to decline. As countries work hard to curb the HIV epidemics, these results from the youngest age groups in urban Zambia are encouraging, given the large investments in prevention of HIV.

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El objetivo de este estudio fue examinar las tendencias de la seroprevalencia de VIH en Zambia y en algunos países vecinos. Algunos datos recientes parecen indicar que se ha producido una disminución de la seroincidencia de VIH en Zambia y en algunos países vecinos. El objetivo de este estudio fue examinar las tendencias de la seroprevalencia de VIH entre las mujeres embarazadas y parturientas entre 2002 y 2006.

Métodos Analizamos las tendencias de la seroprevalencia de VIH en Lusaka a partir de dos fuentes: (i) datos prenatales de un programa de prevención de la transmisión del VIH del padre al niño que abarcaba toda la ciudad, y (ii) datos sobre partos extraídos de dos sistemas anónimos independientes de vigilancia de la sangre de cordón umbilical aplicados en 2003 y de nuevo en 2005–2006, que permitieron obtener y analizar muestras en más del 97% de los nacimientos registrados en el sector público en cada periodo.

Resultados Entre julio de 2002 y diciembre de 2006, el distrito de Lusaka analizó la serología VIH de 243 302 mujeres que recibieron atención prenatal: 54 853 (22.5%) estaban infectadas por el virus. Durante este periodo, la seroprevalencia del VIH en Zambia disminuyó del 25.7% en 2003 al 21.8% en 2005–2006 (p = 0.001). Entre las mujeres ≤ 17 años, la seroprevalencia disminuyó del 12.1% al 7.7% (p = 0.015).

Conclusion La seroprevalencia del VIH parece estar disminuyendo entre las mujeres en fase prenatal y parturientas en Lusaka. La reducción es especialmente acusada entre las muchachas ≤ 17 años, lo que lleva a pensar en una reducción de la seroincidence en ese importante grupo de edad.
References


