Trends in HIV prevalence and sexual behaviour among young people aged 15–24 years in countries most affected by HIV

The International Group on Analysis of Trends in HIV Prevalence and Behaviours in Young People in Countries most Affected by HIV

ABSTRACT

Background The 2001 United Nations (UN) Declaration of Commitment goal to reduce HIV prevalence among young people by 25% by 2010 was signed by 189 countries. Progress towards this goal is assessed. Changes in reported sexual behaviour among young people aged 15–24 years are also investigated.

Methods Thirty countries were invited to participate in the study. HIV prevalence trends were assessed using data from antenatal clinic (ANC) surveillance and from repeat national surveys between 2000 and 2008. Regression analysis was used to determine if the UN target has been reached. Trends in sexual behaviour were analysed using data from repeat national surveys between 1990 and 2008.

Results Seven countries showed significant prevalence declines of 25% or more among ANC attendees by 2008, in rural or urban areas or both. Three further countries showed a significant decline in prevalence among young women or men in national surveys. Four countries are unlikely to reach the UN target. Nine countries did not have adequate data to assess prevalence trends. Favorable changes in sexual behaviour were observed in the majority of countries. In eight countries with significant declines in HIV prevalence, significant changes were also observed in sexual behaviour among either men or women.

Conclusions Declines in HIV prevalence among young people were documented in the majority of countries with adequate data and in most cases were accompanied by changes in sexual behaviour. Further data and more rigorous analysis are needed to understand associations between interventions, behavioural changes and changes in HIV prevalence/ incidence.

Considerable progress has been made towards scaling up access to HIV treatment, care and support with approximately 1 million people newly receiving antiretroviral therapy (ART) in low and middle income countries in 2008. However, the estimated global number of new infections remains unacceptably high at approximately 2.7 million in 2008. A primary goal of the global response to HIV is to prevent new infections. To date, HIV prevalence data have been used to monitor trends in the HIV epidemic, but the rapid improvements in providing ART to people in need and the resulting increase in survival times are making it more difficult to rely on prevalence data only. Incidence data (or the rate at which new infections occur) are more valuable as it provides a more sensitive measure for evaluating changes in the HIV epidemic over time and for measuring the impact of interventions on infection levels.

There are three main approaches to determine HIV incidence in populations: direct measurement in cohort studies; mathematical inference from prevalence data; or using biological assays for recent infection in cross-sectional surveys. Following cohorts of uninfected individuals until seroconversion is often regarded as the ‘gold standard’ for measuring the incidence of infection or disease. However, these studies are typically conducted in small areas only, are logistically difficult to carry out, and are subject to bias because of the selection of initial participants and those remaining in the cohort and because of the effect of intensified interventions in the cohort. Several statistical and mathematical models to estimate HIV incidence using prevalence data and assumptions about mortality have been described and are regularly applied in countries. Several biological assays and testing strategies based on HIV antigen, RNA or antibody measurement have also been developed over recent years to distinguish recent from established HIV infections. Whereas some of these methods have been used in several settings across the world, work still needs to be done to validate and calibrate assays and algorithms for estimating incidence from cross-sectional collection of blood specimens.

Trends in HIV prevalence in a population of newly exposed individuals could be regarded as a reasonable proxy for assessing trends in HIV incidence, despite several limitations. Prevalent infections among young people aged 15–24 years are assumed to be recent because the onset of sexual activity in this age group is recent. In addition, mortality effects in this age group are typically small so that trends in HIV prevalence are more likely to reflect trends in incidence rather than trends in mortality.

In 2001, 189 member states signed the Declaration of Commitment at the United Nations General Assembly Special Session (UNGASS) on AIDS, and committed to achieving a 25% reduction in HIV prevalence among 15–24-year-old people in the 25 most affected countries by 2005 and globally by 2010 (UNGASS indicator number 22).

This study assesses progress towards this UNGASS target. In countries most affected by the epidemic, changes in HIV prevalence among young pregnant women aged 15–24 years attending
antenatal clinics (ANC) are analysed, as recommended in the guidelines for monitoring the UNGASS indicators. In addition, changes in HIV prevalence among 15–24-year-old women and men participating in repeated national population-based surveys (referred to as ‘HIV prevalence surveys’ in the remainder of this paper) are analysed. Changes in sexual behaviour among young people, as reported in national population-based behavioural surveys conducted over time (referred to as ‘behavioural surveys’ in the remainder of this paper), are also analysed and an assessment is made of the concordance of HIV prevalence trends and sexual behaviour trends.

**METHODS**

**Prevalence data**

All countries with an estimated national adult HIV prevalence of greater than 2% in the general population in 2007 were invited to participate in this study. Data on HIV prevalence among 15–24-year-old pregnant women included in ANC surveillance were collated for statistical analysis of prevalence trends. To avoid potential bias as a result of expanding ANC surveillance over time, only data from those sites that were consistently included in surveillance between 2000 and 2008 were included in the analysis. In South Africa, data were only available aggregated at the provincial level and not by individual site, so that the provincial level trend data were included in the analysis.

Exponential trend lines were fitted to prevalence data for each country using data collected from sites that were consistently included in sentinel surveillance during the period of interest (2000–8), first to assess whether there have been changes in HIV prevalence over recent years and second to assess if these changes are statistically significant. The regression analysis was done only for those countries where prevalence data were available from ANC surveillance: years included in sentinel surveillance during the period of interest.

**Table 1** Available data on HIV prevalence and behaviour among young people aged 15–24 years over time in countries with national adult prevalence of 2% or greater in 2007

| Country       | Adult HIV prevalence in 2007 (%) (as per the 2008 Global Report) | Repeat national HIV prevalence surveys conducted since 2000 | Prevalence available from ANC surveillance: years in which surveillance was done | No of sites that were consistently included in ANC surveillance urban/rural | Behaviours data collected from young men and women (15–24 years) in national surveys | Age of first sex by the age of 15 years (among those aged 15–19 years) | Condom use during last sex act among those with multiple partners in past 12 months | Sexual intercourse with more than one partner in past 12 months |
|---------------|--------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------|
| Angola        | 2.1                                                                | 2004, 2005, 2007                                           | 18 (national)                                                                  | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Bahamas       | 3.0                                                                | Every year 2000–8                                          | 8                                                                               | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Belize        | 2.1                                                                | NA                                                        | NA                                                                              | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Botswana      | 23.9                                                               | 2001, 2002, 2003, 2005, 2006                               | 10                                                                              | 13                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Burundi       | 2.0                                                                | Every year 2000–7                                          | 4                                                                               | 4                                                                                | 1987, 2005                                                                      | NA                                                                       | 1998, 2004                                                        | 1998, 2004                                                        |
| Cameroon      | 5.1                                                                | NA                                                        | NA                                                                              | NA                                                                               | 1998, 2004, 2006                                                                | 2006                                                                     | 1998, 2004                                                        | 1998, 2004                                                        |
| CAR           | 6.3                                                                | 2006                                                      | 2000                                                                            | 1994, 2006                                                                      | 2007                                                                             | 2005                                                                     | 2005                                                              | 2005                                                             |
| Chad          | 3.5                                                                | 2002, 2003                                                | 2001                                                                            | 1997                                                                              | 2005                                                                             | 2005                                                                     | 2005                                                              | 2005                                                             |
| Congo         | 3.5                                                                | NA                                                        | NA                                                                              | NA                                                                               | 2005                                                                             | 2005                                                                     | 2005                                                              | 2005                                                             |
| Cote d’Ivoire | 3.9                                                                | 2000, 2001, 2002, 2004, 2005                               | 11                                                                              | 16                                                                               | 1994, 1998, 2005                                                                | 1998, 2005                                                               | 1998, 2005                                                        | 1998, 2005                                                        |
| Djibouti      | 3.1                                                                | NA by site                                                | NA                                                                              | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Ethiopia      | 2.1                                                                | 2001, 2002, 2003, 2005                                     | 20                                                                              | 9                                                                                | 2000, 2005                                                                      | 2000, 2005                                                               | 2000, 2005                                                        | 2000, 2005                                                        |
| Gabon         | 5.9                                                                | 2003, 2007                                                | 2000                                                                            | 2000                                                                              | 2000                                                                             | 2000                                                                     | 2000                                                              | 2000                                                             |
| Guyana        | 2.5                                                                | NA                                                        | NA                                                                              | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Haiti         | 2.2                                                                | 2000, 2004, 2007                                          | 8                                                                               | 9                                                                                | 1994, 2000, 2005                                                                | 2000, 2005                                                               | 2000, 2005                                                        | 2000, 2005                                                        |
| Kenya         | 7.1–8.5                                                            | Every year 2000–5                                         | 21                                                                              | 13                                                                               | 1993, 1998, 2003                                                                | 1988, 2003                                                               | 1998, 2003                                                        | 1998, 2003                                                        |
| Lesotho       | 23.2                                                               | 2003, 2005, 2007                                          | 2                                                                               | 8                                                                                | 2004                                                                             | 2004                                                                     | 2004                                                              | 2004                                                             |
| Malawi        | 11.9                                                               | 1999, 2002, 2003, 2005, 2007                              | 11                                                                              | 8                                                                                | 2000, 2004, 2006                                                                | 2000, 2004                                                               | 2000, 2004                                                        | 2000, 2004                                                        |
| Mozambique    | 12.5                                                               | 2001, 2002, 2004, 2007                                     | 11 (south), 16 (central), 11 (north)                                           | NA                                                                               | 1997, 2003                                                                      | 2003                                                                     | 2003                                                              | 2003                                                             |
| Namibia       | 15.3                                                               | 2002, 2004, 2006, 2008                                     | 13                                                                              | 8                                                                                | 1992, 2000, 2006                                                                | 2000, 2006                                                               | 2000, 2006                                                        | 2000, 2006                                                        |
| Nigeria       | 3.1                                                                | 2003, 2005, 2008                                          | 87                                                                              | 75                                                                               | 1990, 1999, 2003                                                                | 2003                                                                     | 2003                                                              | 2003                                                             |
| Rwanda        | 2.8                                                                | 2002, 2003, 2005, 2007                                     | 11                                                                              | 13                                                                               | 1992, 2000, 2005                                                                | NA                                                                       | 2000, 2005                                                        | 2000, 2005                                                        |
| South Africa  | 18.1                                                               | Every year 2000–7                                         | Aggregated for nine provinces                                                  | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Suriname      | 2.4                                                                | NA                                                        | NA                                                                              | NA                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Swaziland     | 26.1                                                               | 2002, 2004, 2006, 2008                                     | 9                                                                               | 8                                                                                | 2007                                                                            | 2007                                                                     | 2007                                                              | 2007                                                             |
| Togo          | 3.3                                                                | 2003, 2004, 2006, 2008                                     | 18                                                                              | 16                                                                               | NA                                                                               | NA                                                                       | NA                                                                 | NA                                                               |
| Uganda        | 5.4                                                                | 2000, 2001, 2002, 2005, 2006                              | 9                                                                               | 11                                                                               | 1995, 2000, 2004, 2006                                                         | 1995, 2000, 2006                                                        | 1995, 2000, 2006                                                   | 1995, 2000, 2006                                                   |
| UR Tanzania   | 6.2                                                                | 2003–4, 2007                                             | 24                                                                              | 33                                                                               | 1992, 1996, 1999, 2004                                                         | 1996, 1999, 2004                                                        | 1996, 1999, 2004                                                   | 1996, 1999, 2004                                                   |
| Zambia        | 15.2                                                               | 2002, 2007                                                | 11                                                                              | 11                                                                               | 1992, 1996, 2002, 2007                                                         | 1996, 2002, 2007                                                        | 1996, 2002, 2007                                                   | 1996, 2002, 2007                                                   |
| Zimbabwe      | 15.3                                                               | 2002, 2006                                                | 7                                                                               | 7                                                                                | 1994, 1999, 2005                                                                | 1998, 2005                                                               | 1998, 2005                                                        | 1999, 2005                                                        |

ANC, antenatal clinic; NA, not available.
Figure 1  Trends in HIV prevalence and selected sexual behaviour indicators among young men and women aged 15–24 years in (A) southern Africa, (B) east Africa, (C) central Africa, (D) west Africa and (E) the Caribbean.
Figure 1 (Continued).
available for a minimum of three points in time during the 2000–8 period. The analysis was conducted separately for urban and rural sites whenever data were available. For two countries (Angola and South Africa) the analysis was done at the national level only, whereas for Mozambique it was done for each of the three regions (south, central, north). For each country, the percentage change in fitted prevalence was calculated between the first and last year for which data were available. The slope of the curve was considered significantly different from zero for a p-value of less than 0.05. Country data are shown for a selection of countries in the technical annexe and are available from the authors on request.

For countries that have conducted two or more national HIV prevalence surveys between 2000 and 2008, the HIV prevalence among 15–24-year-old men and women was taken from the published survey reports and compared between the different regions.
survey years. Prevalence surveys included AIDS indicator surveys (Botswana, Kenya and Tanzania; available at http://www.measuredhs.com), demographic and health surveys (Kenya, Zambia and Zimbabwe; available at http://www.measuredhs.com), large national household surveys (Burundi, South Africa),15–19 and a national survey on HIV and sexual health among young adults in Zimbabwe in 2001/2.20 χ² Tests were performed to assess whether differences in prevalence were statistically significant at p<0.05.

Behavioural data

Three indicators on sexual behaviour recommended for monitoring and reporting of the 2001 UNGASS14 were analysed to assess changes in behaviour over time. These indicators are: (1) the percentage of young people aged 15–19 years who reported having had sexual intercourse by the age of 15 years; (2) the percentage of young men and women aged 15–24 years who reported having had sexual intercourse with more than one partner in the past 12 months; (3) the percentage of those young men and women aged 15–24 years who had more than one partner in the past 12 months and reported having used a condom during the last sex act.

Data for the above indicators were obtained from behavioural surveys conducted between 1990 and 2008. The period for assessment of trends in behavioural indicators was longer than that for assessment of HIV prevalence trends as current changes in HIV prevalence might be associated with behaviour change some years earlier. To ensure consistency of the data collection

Table 2 Analysis of HIV prevalence data from young women aged 15–24 years attending ANC using sites that were consistently included in surveillance over time

| Region          | Country | Period of assessment* | Predicted prevalence † | % Change in predicted prevalence from first to last year of assessment period | p Value |
|-----------------|---------|-----------------------|------------------------|---------------------------------------------------------------------------------|---------|
| East Africa     | Burundi | Urban 2000–2007       | First year: 9.9 %; Last year: 5.0 % | 49.2 % | 0.065 |
|                 |         | Rural 2000–2007       | First year: 1.8 %; Last year: 1.7 % | 5.2 % | 0.928 |
|                 | Ethiopia| Urban 2001–2005       | First year: 13.2 %; Last year: 6.0 % | 54.5 % | <0.001 |
|                 |         | Rural 2001–2005       | First year: 2.7 %; Last year: 1.7 % | 35.0 % | 0.347 |
|                 | Kenya   | Urban 2000–2005       | First year: 14.2 %; Last year: 5.4 % | 62.2 % | <0.001 |
|                 |         | Rural 2000–2005       | First year: 9.2 %; Last year: 3.6 % | 61.0 % | 0.001 |
|                 | Tanzania| Urban 2002–2006       | First year: 8.0 %; Last year: 6.8 % | 15.5 % | 0.204 |
|                 |         | Rural 2002–2006       | First year: 3.5 %; Last year: 4.2 % | 17.9 % | 0.487 |
|                 | Rwanda  | Urban 2002–2007       | First year: 5.5 %; Last year: 4.1 % | 26.2 % | 0.199 |
|                 | Uganda  | Urban 2000–2007       | First year: 2.3 %; Last year: 1.9 % | 14.2 % | 0.517 |
| Southern Africa | Botswana| Urban 2001–2006       | First year: 32.9 %; Last year: 24.8 % | 28.1 % | 0.003 |
|                 |         | Rural 2001–2006       | First year: 33.6 %; Last year: 23.6 % | 29.9 % | <0.001 |
|                 | Lesotho | Urban 2003–2007       | First year: 25.8 %; Last year: 24.7 % | 4.0 % | 0.704 |
|                 |         | Rural 2003–2007       | First year: 23.1 %; Last year: 14.3 % | 32.3 % | 0.090 |
|                 | Malawi  | Urban 1999–2007       | First year: 27.6 %; Last year: 12.2 % | 55.8 % | <0.001 |
|                 |         | Rural 2001–2007       | First year: 8.2 %; Last year: 10.1 % | 22.6 % | 0.443 |
|                 | Mozambique| South 2001–2007      | First year: 12.9 %; Last year: 17.1 % | 32.2 % | 0.166 |
|                 |         | Rural 2001–2007       | First year: 15.9 %; Last year: 15.2 % | 4.6 % | 0.774 |
|                 | North  | 2001–2007             | First year: 7.3 %; Last year: 8.1 % | 10.9 % | 0.588 |
|                 | Namibia | Urban 2002–2006       | First year: 16.9 %; Last year: 10.6 % | 37.1 % | 0.007 |
|                 |         | Rural 2002–2008       | First year: 16.4 %; Last year: 8.5 % | 48.0 % | <0.001 |
|                 | South Africa| National 2000–2007 | First year: 20.5 %; Last year: 20.4 % | 0.3 % | 0.983 |
|                 | Swaziland| Urban 2002–2008       | First year: 40.8 %; Last year: 33.9 % | 16.9 % | 0.058 |
|                 |         | Rural 2002–2008       | First year: 36.6 %; Last year: 34.7 % | 5.1 % | 0.600 |
|                 | Zambia  | Urban 2002–2006       | First year: 24.5 %; Last year: 23.2 % | 5.6 % | 0.545 |
|                 |         | Rural 2002–2006       | First year: 11.2 %; Last year: 9.3 % | 17.3 % | 0.301 |
|                 | Zimbabwe| Urban 2000–2006       | First year: 28.9 %; Last year: 16.4 % | 43.1 % | <0.001 |
|                 |         | Rural 2000–2006       | First year: 23.4 %; Last year: 15.9 % | 31.7 % | 0.044 |
|                 | Other   | 2000–2006             | First year: 31.9 %; Last year: 20.2 % | 36.8 % | 0.001 |
| Central Africa  | Angola  | National 2004–2007    | First year: 1.8 %; Last year: 2.2 % | 22.1 % | 0.440 |
| West Africa     | Cote d’Ivoire | Urban 2000–2008 | First year: 9.1 %; Last year: 4.9 % | 56.0 % | <0.001 |
|                 |         | Rural 2001–2008       | First year: 5.0 %; Last year: 3.3 % | 34.8 % | 0.028 |
|                 | Nigeria | Urban 2003–2008       | First year: 4.4 %; Last year: 3.7 % | 15.2 % | 0.151 |
|                 |         | Rural 2003–2008       | First year: 4.8 %; Last year: 3.5 % | 27.4 % | 0.110 |
|                 | Togo    | Urban 2003–2008       | First year: 3.8 %; Last year: 3.7 % | 9.2 % | 0.872 |
|                 |         | Rural 2003–2008       | First year: 2.7 %; Last year: 2.2 % | 18.8 % | 0.576 |
| Caribbean       | Bahamas | Urban 2000–2008       | First year: 2.0 %; Last year: 1.2 % | 37.1 % | 0.090 |
|                 | Haiti   | Urban 2000–2007       | First year: 4.7 %; Last year: 2.6 % | 44.6 % | 0.061 |
|                 |         | Rural 2000–2007       | First year: 2.3 %; Last year: 3.8 % | 67.2 % | 0.080 |

*The period of assessment indicates the period for which country-specific surveillance data were available between 2000 and 2008.
†Predicted prevalence from regression analysis.
ANC, antenatal clinic.

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methodology and the definition of the indicators, only data from demographic and health surveys (available at http://www.measuredhs.com) or multiple indicator cluster surveys (available at http://www.unicef.org), or the repeated national population-based surveys conducted by the Human Sciences Research Council in South Africa\textsuperscript{17--19} were used in this analysis.

For countries with more than one behavioural survey, the average annual rate of decline/increase was calculated for each behaviour indicator by country. The statistical significance of changes over time was assessed using a $\chi^2$ test of association for those countries where only two surveys had been conducted, or a $t$ test for trend for those countries where more than two surveys had been conducted during the time period of interest. A p-value of less than 0.05 was considered statistically significant.

**RESULTS**

**Available data**

Available data are summarised in table 1. Thirty countries with estimated adult prevalence greater than 2% in 2007 were invited to contribute HIV prevalence data for 15–24-year-old pregnant women attending ANC, of which 26 responded positively. Five of the countries that responded either did not have the required site-specific data for young women (Cameroon and Djibouti) or did not have data for at least three points in time during the 2000–8 period (Central African Republic, Chad and Gabon) and were therefore not eligible for the regression analysis. Among the 21 eligible countries, the overall time period for which HIV prevalence data were available ranged from 9 years (eg, Bahamas, Malawi, Côte d’Ivoire) to 4 years (Angola). The number of times surveillance was done in a country over the 2000–8 period (yearly data points), varied from a minimum of three to a maximum of nine times. In addition, table 1 shows the variation between countries in the number of sites that were consistently included in surveillance efforts over time.

Seven countries (Botswana, Burundi, Kenya, South Africa, United Republic of Tanzania, Zambia and Zimbabwe) had repeated national HIV prevalence surveys for which HIV prevalence data were available on 15–24-year-old men and women. Repeat behavioural survey data were available to conduct trend analysis of the three behavioural indicators for 17, 14, and 12 countries, respectively (table 1). Information was available for all three indicators in 12 countries. In Rwanda, the sample sizes were too small to compare condom use among those who reported having had multiple sex partners in the past year. In South Africa, data were only available on the percentage of young people reported having had multiple sex partners, whereas in Mozambique trend data were only available on the percentage of young people reported to have had sex by the age of 15 years. In Burundi and the Central African Republic, additional multiple indicator cluster surveys allowed comparison of the percentage of young people reported to have had sex by age 15 years.

**HIV prevalence trends**

HIV prevalence trends among 15–24-year-old pregnant women showed a decline in either urban or rural areas in 17 of the 21 participating countries (figure 1, table 2). Thirteen countries showed a reduction in HIV prevalence of 25% or more between 2000 and 2008 in either urban or rural areas or both, with statistically significant results in Kenya between 2000 and 2005 (more than 60% change in both urban and rural areas, p<0.01), urban Ethiopia between 2001 and 2005 (55% change, p<0.01), urban Malawi between 1999 and 2007 (56% change, p<0.01), Namibia between 2002 and 2008 (urban change 37%, p<0.01; rural change 48%, p<0.01), Zimbabwe between 2000 and 2006 (urban change 43%, p<0.01; rural change 52%, p<0.05), Botswana between 2001 and 2006 (urban change 25%, p<0.01; rural change 50%, p<0.01) and Côte d’Ivoire between 2000 and 2008 (urban change 56%, p<0.01; rural change 55%, p<0.05).

Of the seven countries with repeated HIV prevalence surveys, all except South Africa showed a decline in HIV prevalence among young women over time, whereas only four showed a decline among young men (table 3). In Botswana, Zambia and Zimbabwe, the prevalence decline among women was statistically significant (Botswana from 18.2% in 2004 to 10.7% in 2008, p<0.0001; Zambia from 11.2% in 2002 to 8.5% in 2007, p<0.01; Zimbabwe from 17.4% in 2002 to 10.9% in 2006, p<0.0001), whereas in Tanzania and South Africa the decline among young men was statistically significant (Tanzania from 5% in 2005 to 1.1% in 2007, p<0.001; South Africa from 6.1% in 2005 to 3.6% in 2008, p<0.005). In most instances the significant reductions exceeded 25%. In South Africa, the overall trend in prevalence observed among young women participating in national surveys between 2002 and 2008 was not statistically significant. However, prevalence during this period first increased from 12% in 2002 to 16.7% in 2005, then declined to

**Table 3**

| Country              | Year of survey | Type of survey | Females 15–24 years | Males 15–24 years |
|----------------------|----------------|----------------|---------------------|------------------|
|                      |                |                | n       | Prevalence (%) | SE | p Value | n       | Prevalence (%) | SE | p Value |
| Botswana             | 2004           | BAS II         | 1593    | 18.2     | 1.93         | <0.001 | 1480    | 5.8     | 1.22 | 0.225 |
| 2008                 | BAS III        | 1476          | 10.7    | 1.61    |             |        | 1338    | 4.8     | 1.17 |       |
| Burundi              | 2002           | Household      | 923     | 3.8     | 1.26        | 0.737  | 871     | 1.7     | 0.88 | 0.119 |
| 2007                 | Household      | 1306          | 3.5     | 1.02    |             |        | 1736    | 2.7     | 0.78 |       |
| Kenya                | 2003           | DHS            | 1369    | 5.9     | 1.27        | 0.681  | 1311    | 1.2     | 0.60 | 0.647 |
| 2007                 | AIS            | 2926          | 5.6     | 0.85    |             |        | 2209    | 1.4     | 0.50 |       |
| South Africa         | 2002           | HSRC           | 1123    | 12      | 1.94        | 0.825  | 976     | 6.1     | 1.53 | 0.005 |
| 2005                 | HSRC           | 2334          | 16.7    | 1.55    |             |        | 1785    | 4.4     | 0.97 |       |
| 2008                 | HSRC           | 1986          | 13.9    | 1.55    |             |        | 1631    | 3.6     | 0.92 |       |
| UR Tanzania          | 2003.5         | AIS            | 2388    | 4       | 0.80        | 0.402  | 2084    | 3       | 0.75 | <0.001 |
| 2007.5               | AIS            | 3286          | 3.6     | 0.65    |             |        | 2940    | 1.1     | 0.38 |       |
| Zambia               | 2002           | DHS            | 940     | 11.2    | 2.06        | 0.018  | 675     | 3       | 1.31 | 0.125 |
| 2007                 | DHS            | 2225          | 8.5     | 1.18    |             |        | 2027    | 4.3     | 0.90 |       |
| Zimbabwe             | 2001.5         | Young adult survey | 3197 | 17.4 | 1.34        | <0.001 | 2760    | 5       | 0.83 | 0.179 |
| 2005.5               | DHS            | 3200          | 10.9    | 1.10    |             |        | 2939    | 4.3     | 0.74 |       |

AIS, AIDS indicator survey; BASI, Botswana AIDS Indicator Survey; DHS, demographic and health survey; HSRC, Human Sciences Research Council.
13.9% in 2008, and could therefore suggest a decline in incidence as shown elsewhere.21

**Behavioural trends**

A reduction in the proportion of 15—19-year olds with early sexual debut was observed among women and men in 13/17 (statistically significant in eight) and 11/16 (statistically significant in seven) countries, respectively, as shown in table 4 and figure 1. In four countries (Cameroon, Ethiopia, Malawi and Zambia), the decrease was significant in both women and men.

A reduction in the proportion of 15—24-year olds with multiple partners in the past 12 months was found in 10/14 (significant in seven) and 13/14 (significant in 10) countries for women and men, respectively (table 5, figure 1). In seven countries (Cameroon, Côte d’Ivoire, Ethiopia, Kenya, Tanzania, Zambia and Zimbabwe) there was a significant reduction in both men and women.

### Table 4 Percentage of young people aged 15—19 years who reported having had sexual intercourse by the age of 15 years

| Country            | Year of survey | Females | Males |
|--------------------|----------------|---------|-------|
| Burundi            | 1987           | 1000    |       |
| Cameroon           | 1998           | 1282    | 26.0  |
| 2004               | 2685           | 18.0    | 1224  |
| 2006*              | 2016           | 13.4    | 6.2   |
| Central African Republic | 1994*   | 1288    | 24.6  |
| 2006*              | 2572           | 27.0    | 3.73  |
| Chad               | 1997           | 1716    | 21.9  |
| 2004               | 1381           | 19.0    | 2.03  |
| 2006*              |                |         | 0.045 |
| Côte D’Ivoire      | 1994           | 1961    | 31.9  |
| 1998               | 775            | 22.1    |       |
| 2005               | 1232           | 20.4    | 3.73  |
| 2006*              |                |         | 0.001 |
| Chad               | 1997           | 1716    | 21.9  |
| 2004               | 1381           | 19.0    | 2.03  |
| 2006*              |                |         | 0.045 |
| Haiti              | 1994           | 1290    | 8.4   |
| 2000               | 2342           | 12.0    |       |
| 2005               | 2701           | 15.3    |       |
| 2006*              |                |         | 0.001 |
| Kenya              | 1993           | 1754    | 14.9  |
| 1998               | 1851           | 15.0    |       |
| 2003               | 1856           | 14.5    | 0.27  |
| 2004               | 2067           | 16.5    |       |
| Malawi             | 2000           | 3710    | 13.5  |
| 2005               | 3266           | 11.1    | 3.91  |
| 2006*              |                |         | 0.002 |
| Mozambique         | 1997           | 1836    | 28.6  |
| 2003               | 2454           | 27.7    | 0.35  |
| 2006               | 5196           | 13.9    | 2.01  |
| 2006*              |                |         | 0.001 |
| Namibia            | 1992           | 1259    | 7.7   |
| 2000               | 1499           | 9.8     |       |
| 2006               | 2246           | 7.4     | 0.11  |
| 2006*              |                |         | 0.001 |
| Nigeria            | 1990           | 1612    | 24.4  |
| 1999               | 1775           | 16.2    |       |
| 2003               | 1716           | 20.3    | 1.90  |
| 2006               | 2246           | 7.4     | 0.11  |
| 2006*              |                |         | 0.001 |
| Rwanda             | 1992           | 1464    | 2.1   |
| 2000               | 2617           | 3.0     |       |
| 2005               | 2585           | 5.2     | 6.7   |
| 2005*              |                |         | 0.001 |
| UR Tanzania        | 1992           | 2183    | 11.4  |
| 1996               | 1732           | 12.3    |       |
| 1999               | 909            | 14.5    |       |
| 2004               | 2245           | 11.4    |       |
| 2007               | 1984           | 10.7    | 0.62  |
| 2007*              |                |         | 0.085 |
| Uganda             | 1995           | 1606    | 23.8  |
| 2000.5             | 1615           | 14.2    |       |
| 2004.5             | 2186           | 12.2    |       |
| 2006               | 1936           | 11.8    | 6.48  |
| 2006*              |                |         | 0.001 |
| Zambia             | 1992           | 1984    | 19.4  |
| 1996               | 2003           | 21.7    |       |
| 2001.5             | 1811           | 17.5    |       |
| 2007               | 1574           | 12.3    | 3.30  |
| 2007*              |                |         | 0.001 |
| Zimbabwe           | 1994           | 1472    | 5.2   |
| 1999               | 1447           | 3.2     |       |
| 2005.5             | 2152           | 4.9     | 0.17  |

*Results from multiple indicator cluster survey.
Finally, a reduced proportion of young people not using condoms was seen in six out of 11 (significant in six) and 11/12 (significant in five) countries for women and men, respectively (table 6, and figure 1). Significant increases in condom use in both sexes occurred in Cameroon, Tanzania and Uganda.

**Association of prevalence and behavioural trends**

Of the 11 countries that had trends established for both HIV prevalence and behaviour (for at least two indicators), eight countries showed a significant HIV prevalence reduction whereas three did not. All eight of the countries with a decline in prevalence and behaviour (for at least two of the three behavioural indicators) that overlapped or started before the period of prevalence decline: Côte d’Ivoire, Ethiopia, Kenya, Malawi, Namibia, Tanzania, Zambia and Zimbabwe. Of the three countries that did not have a significant decline in HIV prevalence, Uganda showed favourable trends in behaviours whereas Haiti and Rwanda did not.

**DISCUSSION**

The UNGASS target for a significant reduction in HIV prevalence of 25% or more among 15—24-year-old ANC attendees by 2010 was reached by Botswana, Côte d’Ivoire (urban areas), Ethiopia (urban areas), Kenya, Malawi (urban areas) and Zimbabwe, as well as by South African men included in the 2002 and 2005 surveys. By 2008, Namibia and Côte d’Ivoire (rural areas) also showed a significant reduction in HIV prevalence of over 25% among ANC attendees, as did Tanzanian men and Zambian women included in national surveys. Seven other countries (Burundi (urban areas), Lesotho (rural areas), Nigeria (rural areas), Rwanda, Swaziland (urban areas), Bahamas and Haiti (urban areas)) seem to be on track to reach the UNGASS target of a significant 25% reduction by 2010. Two countries seem unlikely to achieve a 25% reduction in prevalence by 2010 as HIV prevalence did not show a decline during the study period (Angola, Mozambique).

In addition, Uganda, after significant declines in prevalence in the 1990s, showed an increase, although not statistically significant, in HIV prevalence among young women attending ANC between 2000 and 2007. Finally, five of the 26 countries that responded to the invitation to participate in this study currently do not have enough data to allow an assessment of the HIV prevalence trends.

Mathematical modelling suggests that trends in HIV prevalence in 15—24-year-old ANC attendees approximate trends in this age group in the general population, although the former may be slow to reflect declines in the latter when there is a concomitant increase in age at first sex.11 A recent study in

### Table 5 Percentage of young men and women aged 15—24 years who reported having had sexual intercourse with more than one partner in the past 12 months

| Country       | Year of survey | Females |         |         |          | Males |         |          |
|---------------|----------------|---------|---------|---------|----------|-------|---------|----------|
|               |                | n   | %      | Decline per year (%) | p Value | n   | %      | Decline per year (%) | p Value |
| Cameroon      | 1998           | 2409 | 10.6   | <0.001  | 1067 | 38.3 |
|               | 2004           | 4837 | 6.6    | 7.90    | 2177 | 22.4 |
| Chad          | 1997           | 3084 | 1.2    |         | 663  | 22.9 |
|               | 2004           | 2432 | 1.0    | 2.60    | 677  | 12.0 |
| Côte d’Ivoire | 1998           | 1353 | 6.7    | 0.453   | 308  | 17.5 |
|               | 2005           | 2360 | 4.5    | 5.69    | 1436 | 19.7 |
| Ethiopia      | 2000           | 6570 | 1.1    |         | 1007 | 4.3  |
|               | 2005           | 5813 | 0.1    | 47.96   | 2399 | 9.0  |
| Haiti         | 2000           | 4260 | 1.2    |         | 1280 | 21.2 |
|               | 2005           | 4704 | 1.5    | –4.46   | 2104 | 19.8 |
| Kenya         | 1998           | 3399 | 3.4    |         | 1400 | 29.5 |
|               | 2003           | 3547 | 1.6    | 15.07   | 1537 | 11.3 |
| Malawi        | 2000           | 5825 | 1.0    |         | 5259 | 11.8 |
|               | 2004           | 5262 | 1.1    | –2.38   | 5236 | 13.6 |
| Namibia       | 2000           | 2388 | 2.8    |         | 1304 | 14.8 |
|               | 2006           | 4101 | 2.2    | 0.74    | 1661 | 11.1 |
| Rwanda        | 2000           | 4524 | 0.3    |         | 1195 | 1.2  |
|               | 2005           | 4938 | 0.3    | 0.0     | 2048 | 1.0  |
| South Africa  | 2002           | 634  | 8.8    |         | 517  | 23.0 |
|               | 2005           | 1397 | 6.0    |         | 972  | 27.2 |
| Tanzania      | 1996           | 3408 | 4.7    |         | 859  | 19.8 |
|               | 1999           | 1720 | 9.8    |         | 1330 | 25.2 |
|               | 2004           | 4252 | 3.1    |         | 1130 | 17.2 |
|               | 2007.5         | 3730 | 2.5    | 8.42    | 2196 | 9.3  |
| Uganda        | 1995           | 3162 | 1.1    |         | 754  | 9.7  |
|               | 2000.5         | 3119 | 2.3    |         | 762  | 11.1 |
|               | 2006           | 3646 | 1.7    | –3.10   | 996  | 9.3  |
| Zambia        | 1996           | 3833 | 4.6    |         | 863  | 31.8 |
|               | 2002           | 3476 | 2.4    |         | 804  | 17.6 |
|               | 2007           | 2944 | 1.5    | 10.21   | 2482 | 8.8  |
| Zimbabwe      | 1999           | 2741 | 1.8    |         | 1219 | 10.8 |
|               | 2005.5         | 4104 | 0.9    | 10.5    | 3358 | 7.1  |

*Denominators not available. Significant levels as reported in 2008 Human Sciences Research Council survey report.*
Table 6 Percentage of young people aged 15–24 years who had more than one partner in the past 12 months and reported having used a condom during the last sex act

| Country | Year of survey | Females | Males |
|---------|---------------|---------|-------|
|         | n  | %   | Decline per year (%) | p Value | n  | %   | Decline per year (%) | p Value |
| Cameroon | 1998 | 255 | 17 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2004 | 328 | 41.6 | 14.91 | <0.001 | 408 | 30 | - | - | - | - | - | - | - | - | - |
| Chad     | 1997 | 36 | 17.4 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2004 | 50 | 9.1 | -9.26 | 0.334 | 163 | 26.3 | 2.68 | 0.313 | 197 | 21.8 | - | - | - | - | - |
| Cote D’Ivoire | 1998 | 91 | 25.8 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2005 | 106 | 45.1 | 7.98 | 0.004 | 361 | 61.8 | 0.61 | 0.638 | - | - | - | - | - | - | - |
| Ethiopia  | 2000 | 74 | 18 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2005 | 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Haiti     | 2000 | 51 | 38 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2005 | 70 | 22.6 | -10.39 | 0.072 | 418 | 50.5 | 10.62 | <0.001 | - | - | - | - | - | - | - |
| Kenya     | 1998 | 117 | 11.9 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2003 | 57 | 9.1 | -5.37 | 0.526 | 174 | 52.1 | 4.99 | 0.009 | - | - | - | - | - | - | - |
| Malawi    | 2000 | 60 | 20.3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2004 | 60 | 19.9 | -0.50 | 1 | 87 | 34.5 | 6.31 | 0.215 | - | - | - | - | - | - | - |
| Namibia   | 2000 | 66 | 57.4 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2006 | 91 | 73.7 | 4.17 | 0.035 | 184 | 82.2 | 1.80 | 0.058 | - | - | - | - | - | - | - |
| Tanzania  | 1996 | 159 | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 1999 | 168 | 18.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2004 | 130 | 25.8 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Uganda    | 1995 | 35 | 4.5 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2000 | 53 | 33.8 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2006 | 63 | 39.4 | 19.72 | 0.001 | 93 | 45.2 | 4.82 | 0.022 | - | - | - | - | - | - | - |
| Zambia    | 1996 | 176 | 23.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2001 | 85 | 25.3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2007 | 43 | 41.5 | 5.38 | 0.026 | 218 | 43.1 | 1.96 | 0.056 | - | - | - | - | - | - | - |
| Zimbabwe  | 1999 | 50 | 40.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | 2005.5 | 37 | 37.9 | -0.91 | 0.838 | 237 | 59.4 | 0.34 | 0.782 | - | - | - | - | - | - | - |

Manicaland, Zimbabwe (unpublished data), provides the first empirical evidence corroborating this relationship. Modelling work also indicates that trends in HIV prevalence in 15–24-year olds can approximate trends in HIV incidence in the same age group. If so, the declines in HIV prevalence in ANC attendees observed in this study may reflect declines in HIV incidence in the general community. In the current study, Botswana and Zimbabwe show significant (>25%) declines in HIV prevalence among women in both ANC surveillance and HIV prevalence surveys. In Zimbabwe, the downward trend in prevalence in young people has also been observed in a cohort study in Manicaland province and modelling of national prevalence data suggests that there have been important reductions in incidence during the early part of the current decade. In Botswana, a decline in prevalence among young women attending ANC was recently also reported elsewhere, but unfortunately Botswana does not have the benefit of an independent community-based cohort study. Other countries show significant declines in only one source of prevalence data, suggesting that infection rates may have been decreasing less strongly. In some instances, declines were observed only among one of the sexes or only in urban or rural areas. In Zambia and Tanzania, independent application of a mathematical model to HIV prevalence data from repeat national surveys also showed significant declines in incidence among women and men, respectively.

While the restriction of the prevalence analysis to young people aged 15–24 years allows the interpretation of HIV prevalence trends being parallel to trends in incidence in this age group, the same restriction prevents any inference about incidence trends in other age groups. Data from several community-based studies in sub-Saharan Africa grouped in the ALPHA network suggest that recent patterns in HIV incidence among older people may be different from those among young people. Neither can HIV prevalence data among 15–24-year olds inform trends in HIV incidence among children, although independent analyses indicate that incidence among children has also been declining in recent years, mainly as a result of increased access to prevention of mother-to-child-transmission services. It is possible that a small percentage of children infected with HIV through mother-to-child transmission survive into their teens and become part of the HIV prevalence among 15–24-year olds. However, the scale-up of prevention of mother-to-child-transmission programmes is too recent to have contributed to a decrease in prevalence among 15–24-year olds during 2000–8.

Declines in HIV incidence can occur as part of the natural course of an HIV epidemic. Individuals with the highest risk behaviour in a population are usually infected rapidly during the early years of an epidemic. Subsequently, HIV incidence falls because those who have not been infected previously typically have relatively less risky behaviour. However, the scale-up of prevention of mother-to-child-transmission programmes is too recent to have contributed to a decrease in prevalence among 15–24-year olds during 2000–8.

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The current analysis has focused on comparable behavioural indicators by restricting the analysis to data of standardised surveys, which are believed to allow a reliable assessment of trends in behaviour. Behavioural indicators can provide corroboration of changes in HIV incidence and assist in attributing changes to particular aspects of risk. Because of data limitations and the analytical approach, the current analysis cannot establish a causal association between changes in sexual behaviour and trends in HIV prevalence. However, it is encouraging that in the current analysis, most countries with HIV prevalence declines also show positive changes in sexual behaviour. Data collected on sexual behaviour over time may be subject to reporting bias, including social desirability bias, as prevention programmes can change the social norms regarding sexual behaviour. In addition, where there is mixing across age groups, behaviour changes in older people, particularly men, could cause reductions in prevalence in young people. The extent to which changes in HIV prevalence have been brought about by behavioural change programmes is beyond the scope of this paper, but needs to be investigated through further in-depth research and modelling, as has been done for Zimbabwe.

In conclusion, this multicountry analysis of data from the 50 countries most affected by the AIDS epidemic reveals several important findings. First, of the 21 countries that have data to assess national trends in HIV prevalence among 15–24-year-olds in recent years, the majority show declines in HIV prevalence, and in 10 countries statistically significant declines of more than 25% have occurred. Second, the declines in HIV prevalence are likely to be the result of declines in HIV incidence. Third, in most countries with prevalence declines, declines in risky sexual behaviours were also observed. Fourth, looking towards the 2010 UNGASS targets, there is a need to strengthen programmes to monitor trends in HIV prevalence, incidence and sexual behaviours, both in countries that have solid surveillance systems, and more urgently in countries that currently have insufficient data. All countries included in this analysis should consider conducting national surveys that measure both HIV prevalence and sexual behaviours at regular time intervals (eg, every 4 or 5 years). Finally, country-based evaluations should be conducted, drawing on an even larger set of quantitative and qualitative data sources to corroborate the trends found in this analysis and to study the relation between programmatic efforts and the observed behavioural and epidemiological changes.
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