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

Correspondence to
Dr Eleanor Gouws, Strategic Intelligence and Analysis Division, UNAIDS, 20 Avenue Appia, 1211 Geneva, Switzerland;
gouwse@unaids.org

The International Group on Analysis of Trends in HIV Prevalence and Behaviours in Young People in Countries most Affected by HIV: PD Ghys, E Gouws, R Lyerla (UNAIDS Geneva); JM Garcia-Calleja (WHO Geneva); B Barrerre (ICF Macro: Measure DHS, Maryland, USA); D Serrano, C Velasquez (Angola); C Deleveaux (Bahamas); W Gill, M Mmelesi (Botswana); A Niyongere (Burundi); E Mboui Bilon (Cameroun); J de D Longo, M Massanga (Central African Republic); D Guidaoussou (Chad); JP Konan Diby (Côte d'Ivoire); N Kibangou (Djibouti); Aseged Woldu (Ethiopia); F Bikoma (Gabon); N Duval, K Spring (Haiti); A Barsigo (Kenya); J Nkonyana (Lesotho); N Wandonda (Malawi). Mozambique Multisectoral Technical Group (Mozambique): A Jonas (Namibia); I Kawu (Nigeria); M Mutagoma (Rwanda); T Mosala (South Africa); S Mndzebele, H Odido (Swaziland); YD Agbogan (Togo); J Musinguzi (Uganda); G Somi (UR Tanzania); M Gboun, D Phiri (Zambia); E Gonese, S Gregson, O Mugurungi (Zimbabwe).

ABSTRACT

Objectives In 2001 the United Nations (UN) Declaration of Commitment was signed by 189 countries with a goal to reduce HIV prevalence among young people by 25% by 2010. Progress towards this target is assessed. In addition, changes in reported sexual behaviour among young people aged 15—24 years are investigated.

Methods Thirty countries most affected by HIV were invited to participate in the study. Trends in HIV prevalence among young antenatal clinic (ANC) attendees were analysed using data from sites that were consistently included in surveillance between 2000 and 2008. Regression analysis was used to determine if the UN target had been reached. Trends in prevalence data from repeat national population-based surveys were also analysed. Trends in sexual behaviour were analysed using data from repeat standardised national population-based surveys between 1990 and 2008.

Results Seven countries showed a statistically significant decline of 25% or more in HIV prevalence among young ANC attendees by 2008, in rural or urban areas or in both: Botswana, Côte d'Ivoire, Ethiopia, Kenya, Malawi, Namibia and Zimbabwe. Three further countries showed a significant decline in HIV prevalence among young women (Zambia) or men (South Africa, Tanzania) in national surveys. Seven other countries are on track, whereas four are unlikely to reach the goal by 2010. Nine countries did not have adequate data to assess prevalence trends. Indications suggestive of changes towards less risky 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 in either men or women for at least two of the three sexual behaviour indicators.

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, research and more rigorous analysis at country level are needed to understand the associations between programmatic efforts, reported behavioural changes and changes in prevalence and incidence of HIV.

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.[1] However, the estimated global number of new infections remains unacceptably high at approximately 2.7 million in 2008.[2]

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 they provide 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 measurements; 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.[3–7] 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.[8 9] 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.[10]

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.[11] 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.[12]

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).[13]

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.[14] 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[2] 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

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

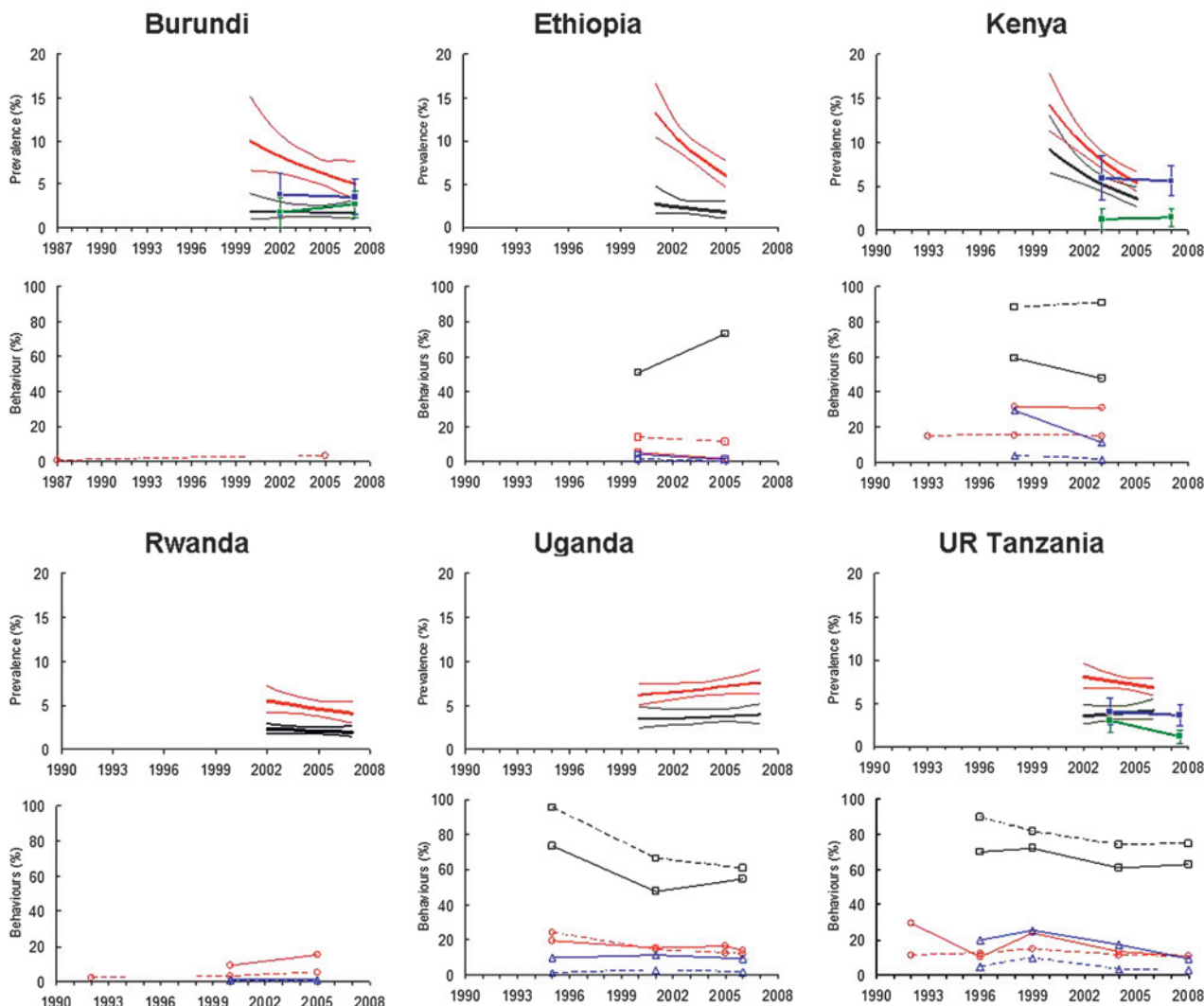| Country	Adult HIV prevalence in 2007 (%) (as per the 2008 Global Report)[2]	Repeat national HIV prevalence surveys conducted since 2000	Prevalence available from ANC surveillance: years in which surveillance was done	No of sites that were consistently included in ANC surveillance urban/rural		Behavioural 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
Bahamas	3.0		Every year 2000—8	8	—	NA	NA	NA
Belize	2.1		NA			NA	NA	NA
Botswana	23.9	2004, 2008	2001, 2002, 2003, 2005, 2006	10	13	NA	NA	NA
Burundi	2.0	2002, 2007	Every year 2000—7	4	4	1987, 2005	NA	NA
Cameroon	5.1		NA			1998, 2004, 2006	1998, 2004	1998, 2004
CAR	6.3		2006			1994, 2006	2006	2006
Chad	3.5		2002, 2003			1997, 2004	1997, 2004	1997, 2004
Congo	3.5		NA			2005	2005	2005
Cote d'Ivoire	3.9		2000, 2001, 2002, 2004, 2005, 2008	11	16	1994, 1998, 2005	1998, 2005	1998, 2005
Djibouti	3.1		NA by site			NA	NA	NA
Ethiopia	2.1		2001, 2002, 2003, 2005	20	9	2000, 2005	2000, 2005	2000, 2005
Gabon	5.9		2003, 2007			2000	2000	2000
Guyana	2.5		NA			NA	NA	NA
Haiti	2.2		2000, 2004, 2007	8	9	1994, 2000, 2005	2000, 2005	2000, 2005
Kenya	7.1—8.5	2003, 2007	Every year 2000—5	21	13	1993, 1998, 2003	1998, 2003	1998, 2003
Lesotho	23.2		2003, 2005, 2007	2	8	2004	2004	2004
Malawi	11.9		1999, 2002, 2003, 2005, 2007	11	8	2000, 2004, 2006	2000, 2004	2000, 2004
Mozambique	12.5		2001, 2002, 2004, 2007	11 (south), 16 (central), 11 (north)	1997, 2003	2003	2003	
Namibia	15.3		2002, 2004, 2006, 2008	13	8	1992, 2000, 2006	2000, 2006	2000, 2006
Nigeria	3.1		2003, 2005, 2008	87	75	1990, 1999, 2003	2003	2003
Rwanda	2.8		2002, 2003, 2005, 2007	11	13	1992, 2000, 2005	NA	2000, 2005
South Africa	18.1	2002, 2005, 2008	Every year 2000—7	Aggregated for nine provinces	NA	2002, 2005, 2008	2002, 2005, 2008	
Suriname	2.4		NA			NA	NA	NA
Swaziland	26.1		2002, 2004, 2006, 2008	9	8	2007	2007	2007
Togo	3.3		2003, 2004, 2006, 2008	18	16	NA	NA	NA
Uganda	5.4		2000, 2001, 2002, 2005, 2006, 2007	9	11	1995, 2000, 2004, 2006	1995, 2000, 2006	1995, 2000, 2006
UR Tanzania	6.2	2003—4, 2007	2002, 2004, 2006	24	33	1992, 1996, 1999, 2004, 2007	1996, 1999, 2004, 2007	1996, 1999, 2004, 2007
Zambia	15.2	2002, 2007	2002, 2004, 2006	11	11	1992, 1996, 2002, 2007	1996, 2002, 2007	1996, 2002, 2007
Zimbabwe	15.3	2002, 2006	2000, 2001, 2002, 2004, 2006	7	7	1994, 1999, 2005	1999, 2005	1999, 2005

ANC, antenatal clinic; NA, not available.
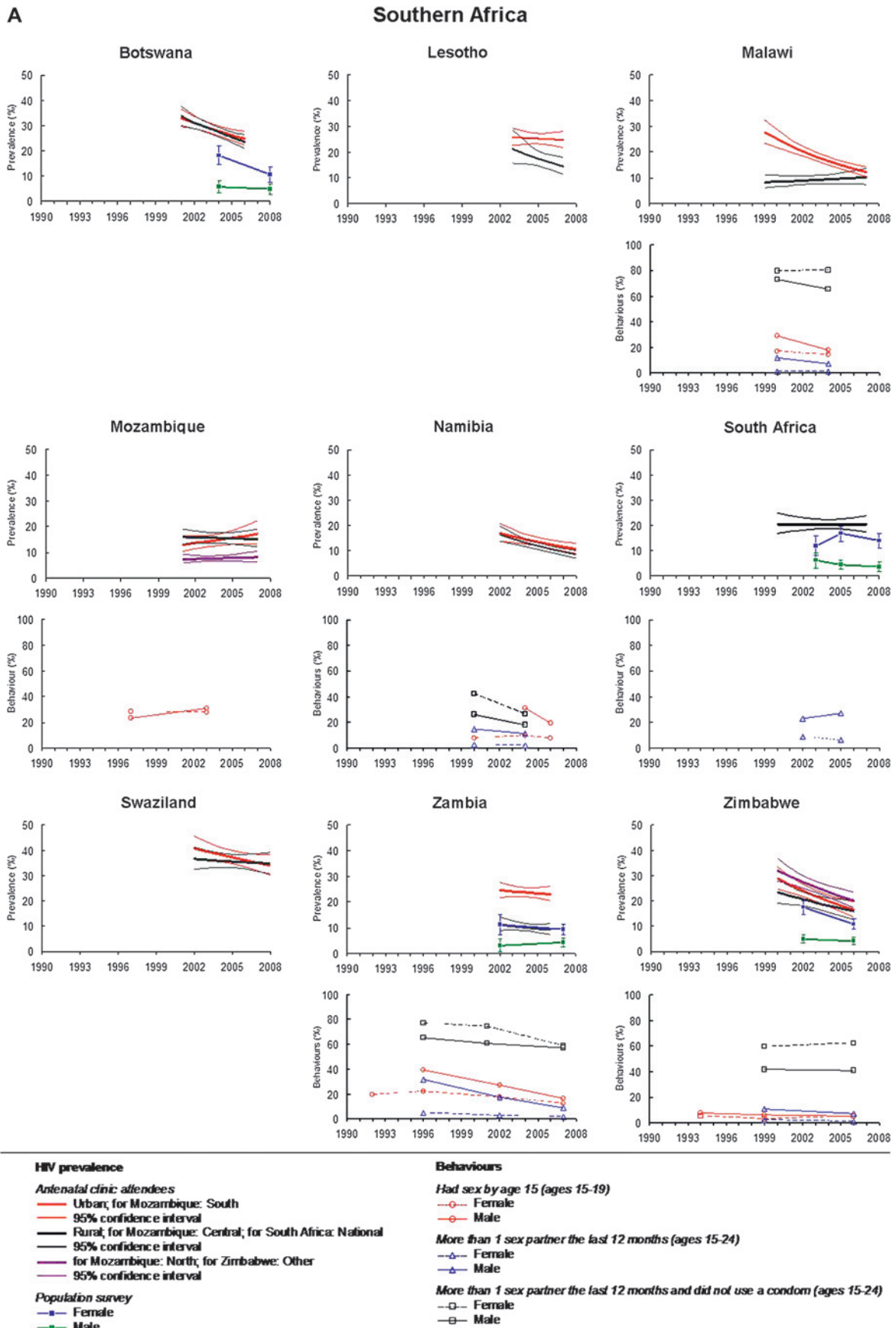
Figure 1 Trends in HIV prevalence and selected sexual behaviour indicators among young men and women aged 15—24 years in (A) southern Africa, (B) east Africa, (C) central Africa, (D) west Africa and (E) the Caribbean.
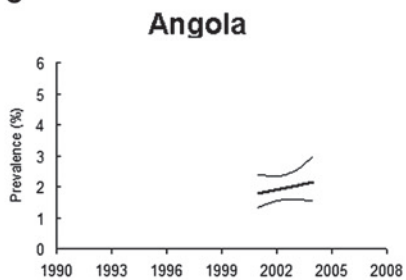
B

Eastern Africa

Figure panels for Burundi, Ethiopia, Kenya, Rwanda, Uganda, and UR Tanzania showing HIV prevalence (%) and Behaviours (%) over years.

C

Central Africa

Angola panel showing Prevalence (%) over years.

HIV prevalence

Antenatal clinic attendees
- Urban
- 95% confidence interval
- Rural; for Angola: National
- 95% confidence interval

Population survey
- Female
- Male

Behaviours

Had sex by age 15 (ages 15-19)
- Female
- Male

More than 1 sex partner the last 12 months (ages 15-24)
- Female
- Male

More than 1 sex partner the last 12 months and did not use a condom (ages 15-24)
- Female
- Male

Figure 1 (Continued).

D

West Africa

Côte d'Ivoire

Nigeria

Togo

Cameroon

E

Caribbean

Bahamas

Haiti

HIV prevalence

Antenatal clinic attendees
— Urban
— 95% confidence interval
— Rural
— 95% confidence interval

Population survey
—■— Female
—■— Male

Behaviours

Had sex by age 15 (ages 15-19)
--○-- Female
—○— Male

More than 1 sex partner the last 12 months (ages 15-24)
--△-- Female
—△— Male

More than 1 sex partner the last 12 months and did not use a condom (ages 15-24)
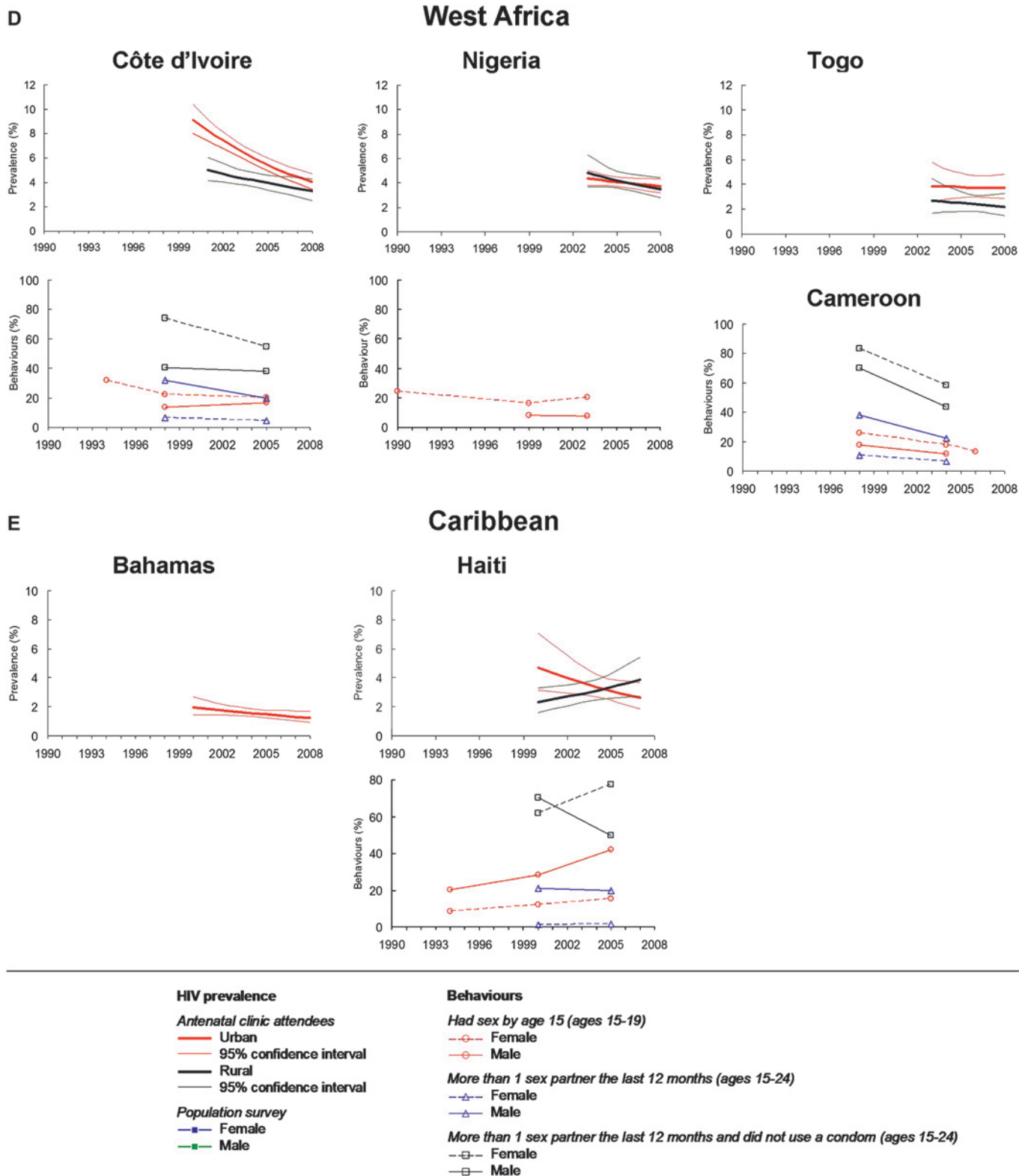--□-- Female
—□— Male

Figure 1 (Continued).

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 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 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] χ^2 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 UNGASS[14] 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

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
			First year	Last year	First year	Last year		
East Africa	Burundi	Urban	2000	2007	9.9	5.0	49.2	0.065
		Rural	2000	2007	1.8	1.7	5.2	0.928
	Ethiopia	Urban	2001	2005	13.2	6.0	54.5	<0.001
		Rural	2001	2005	2.7	1.7	35.0	0.347
	Kenya	Urban	2000	2005	14.2	5.4	62.2	<0.001
		Rural	2000	2005	9.2	3.6	61.0	0.001
	Tanzania	Urban	2002	2006	8.0	6.8	15.5	0.204
		Rural	2002	2006	3.5	4.2	−17.9	0.487
	Rwanda	Urban	2002	2007	5.5	4.1	26.2	0.199
		Rural	2002	2007	2.3	1.9	14.2	0.517
	Uganda	Urban	2000	2007	6.1	7.6	−23.3	0.183
		Rural	2000	2007	3.4	3.9	−15.7	0.581
Southern Africa	Botswana	Urban	2001	2006	32.9	24.8	24.8	0.003
		Rural	2001	2006	33.6	23.6	29.9	<0.001
	Lesotho	Urban	2003	2007	25.8	24.7	4.0	0.704
		Rural	2003	2007	21.1	14.3	32.3	0.090
	Malawi	Urban	1999	2007	27.6	12.2	55.8	<0.001
		Rural	1999	2007	8.2	10.1	−22.6	0.443
	Mozambique	South	2001	2007	12.9	17.1	−32.2	0.166
		Central	2001	2007	15.9	15.2	4.6	0.774
		North	2001	2007	7.3	8.1	−10.9	0.588
	Namibia	Urban	2002	2008	16.9	10.6	37.1	0.007
		Rural	2002	2008	16.4	8.5	48.0	<0.001
	South Africa	National	2000	2007	20.5	20.4	0.3	0.983
	Swaziland	Urban	2002	2008	40.8	33.9	16.9	0.058
		Rural	2002	2008	36.6	34.7	5.1	0.600
	Zambia	Urban	2002	2006	24.5	23.2	5.6	0.545
		Rural	2002	2006	11.2	9.3	17.3	0.301
	Zimbabwe	Urban	2000	2006	28.9	16.4	43.1	<0.001
		Rural	2000	2006	23.4	15.9	31.7	0.044
		Other	2000	2006	31.9	20.2	36.8	0.001
Central Africa	Angola	National	2004	2007	1.8	2.2	−21.2	0.440
West Africa	Cote d'Ivoire	Urban	2000	2008	9.1	4.9	56.0	<0.001
		Rural	2001	2008	5.0	3.3	34.8	0.028
	Nigeria	Urban	2003	2008	4.4	3.7	15.2	0.151
		Rural	2003	2008	4.8	3.5	27.4	0.110
	Togo	Urban	2003	2008	3.8	3.7	3.9	0.872
		Rural	2003	2008	2.7	2.2	18.8	0.576
Caribbean	Bahamas	Urban	2000	2008	2.0	1.2	37.1	0.090
	Haiti	Urban	2000	2007	4.7	2.6	44.6	0.061
		Rural	2000	2007	2.3	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.

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 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[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 χ^2 test of association for those countries where only two surveys had been conducted, or a χ^2 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 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 32%, p<0.05), Botswana between 2001 and 2006 (urban change 25%, p<0.01; rural change 30%, p<0.01) and Côte d'Ivoire between 2000 and 2008 (urban change 56%, p<0.01; rural change 35%, 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=0.018; Zimbabwe from 17.4% in 2002 to 10.9% in 2006,

Table 3 HIV prevalence among young men and women aged 15—24 years from repeat national population-based surveys

| 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	BAIS II	1593	18.2	1.93	<0.001	1480	5.8	1.22	0.225
	2008	BAIS 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; BAIS, ; DHS, demographic and health survey; HSRC, Human Sciences Research Council.

p<0.001), whereas in Tanzania and South Africa the decline among young men was statistically significant (Tanzania from 3% in 2003 to 1.1% in 2007, p<0.001; South Africa from 6.1% in 2003 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 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

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			
		n	%	Decline per year (%)	p Value	n	%	Decline per year (%)	p Value
Burundi	1987	1000	0.7						
	2005*	2357	3.1	−8.27	<0.001				
Cameroon	1998	1282	26.0			539	17.8		
	2004	2685	18.0			1224	11.5	7.28	0.0004
	2006*	2016	13.4	7.79	<0.001				
Central African Republic	1994*	1288	24.6			321	16.0		
	2006*	2572	27.0	−0.78	0.114	860	11.7	2.61	0.056
Chad	1997	1716	21.9			490	7.9		
	2004	1361	19.0	2.03	0.045	406	10.7	−4.33	0.174
Cote D'Ivoire	1994	1961	31.9						
	1998	775	22.1			180	13.8		
	2005	1232	20.4	3.73	<0.001	898	16.7	−2.72	0.349
Ethiopia	2000	3710	13.5			600	5.1		
	2005	3266	11.1	3.91	0.002	1335	1.7	21.97	<0.001
Haiti	1994	1290	8.4			350	20.1		
	2000	2342	12.0			768	28.3		
	2005	2701	15.3	−5.47	<0.001	1211	41.9	−6.65	<0.001
Kenya	1993	1754	14.9						
	1998	1851	15.0			811	31.7		
	2003	1856	14.5	0.27	0.739	856	30.9	0.51	0.747
Malawi	2000	2867	16.5			660	29.1		
	2004	2392	14.1			650	18.0	12.01	<0.001
	2006*	5196	13.9	3.01	0.001				
Mozambique	1997	1836	28.6			382	23.5		
	2003	2454	27.7	0.35	0.666	673	31.1	−4.62	0.009
Namibia	1992	1259	7.7						
	2000	1499	9.8			694	31.3		
	2006	2246	7.4	0.11	0.589	910	19.2	8.15	<0.001
Nigeria	1990	1612	24.4						
	1999	1775	16.2			511	8.3		
	2003	1716	20.3	1.90	<0.001	453	7.9	1.23	0.877
Rwanda	1992	1464	2.1						
	2000	2617	3.0			762	9.3		
	2005	2585	5.2	−6.7	<0.001	1102	15.3	−9.96	<0.001
UR Tanzania	1992	2183	11.4			499	29.6		
	1996	1732	12.3			488	10.4		
	1999	909	14.5			790	23.9		
	2004	2245	11.4			637	13.0		
	2007.5	1984	10.7	0.62	0.285	1768	10.8	4.83	<0.001
Uganda	1995	1606	23.8			387	19.2		
	2000.5	1615	14.2			441	15.5		
	2004.5	2186	12.2			2069	16.3		
	2006	1936	11.8	6.48	<0.001	595	13.9	2.39	0.096
Zambia	1992	1984	19.4						
	1996	2003	21.7			460	39.3		
	2001.5	1811	17.5			459	27.2		
	2007	1574	12.3	3.30	<0.001	1416	16.2	8.06	<0.001
Zimbabwe	1994	1472	5.2			604	7.9		
	1999	1447	3.2			713	6.3		
	2005.5	2152	4.9	0.17	0.994	1899	5.2	3.60	0.013

*Results from multiple indicator cluster survey.

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 old 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.

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 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 also had favourable trends in behaviours (defined as a significant trend in either men or women 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 ANC clinic attendees by 2005 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

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			1067	38.3		
	2004	4937	6.6	7.90	<0.001	2177	22.4	8.94	<0.001
Chad	1997	3084	1.2			863	22.9		
	2004	2432	1.0	2.60	0.453	673	12.0	9.23	<0.001
Cote D'Ivoire	1998	1353	6.7			338	32.1		
	2005	2360	4.5	5.69	0.003	1836	19.7	6.97	<0.001
Ethiopia	2000	6570	1.1			1007	4.3		
	2005	5813	0.1	47.96	<0.001	2399	0.9	31.28	<0.001
Haiti	2000	4260	1.2			1280	21.2		
	2005	4704	1.5	−4.46	0.203	2104	19.8	1.37	0.343
Kenya	1998	3399	3.4			1400	29.5		
	2003	3547	1.6	15.08	<0.001	1537	11.3	19.19	<0.001
Malawi	2000	5825	1.0			1259	11.8		
	2004	5262	1.1	−2.38	0.583	1237	7.0	13.05	<0.001
Namibia	2000	2838	2.3			1304	14.8		
	2006	4101	2.2	0.74	0.791	1661	11.1	4.79	0.0025
Rwanda	2000	4524	0.3			1195	1.2		
	2005	4938	0.3	0.0	0.960	2048	1.0	3.65	0.599
South Africa	2002	634	8.8			517	23.0		
	2005	1397	6.0			972	27.2		
	2008	NA	6.0	6.4	NS*	NA	30.8	−4.9	NS*
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	<0.001	2196	9.3	6.87	<0.001
Uganda	1995	3162	1.1			754	9.7		
	2000.5	3119	2.3			762	11.1		
	2006	3646	1.7	−3.96	0.078	996	9.3	0.38	0.738
Zambia	1996	3834	4.6			863	31.8		
	2002	3476	2.4			804	17.6		
	2007	2944	1.5	10.21	<0.001	2482	8.8	11.62	<0.001
Zimbabwe	1999	2741	1.8			1219	10.8		
	2005.5	4104	0.9	10.5	0.001	3358	7.1	6.45	<0.001

*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			408	30		
	2004	328	41.6	14.91	<0.001	489	56.3	10.49	<0.001
Chad	1997	36	17.4			197	21.8		
	2004	50	9.1	−9.26	0.334	163	26.3	2.68	0.313
Cote D'Ivoire	1998	91	25.8			109	59.2		
	2005	106	45.1	7.98	0.004	361	61.8	0.61	0.638
Ethiopia	2000	74	18			44	49.3		
	2005	6				22	27	−12.04	0.078
Haiti	2000	51	38			271	29.7		
	2005	70	22.6	−10.39	0.072	418	50.5	10.62	<0.001
Kenya	1998	117	11.9			413	40.6		
	2003	57	9.1	−5.37	0.526	174	52.1	4.99	0.009
Malawi	2000	60	20.3			148	26.8		
	2004	60	19.9	−0.50	1	87	34.5	6.31	0.215
Namibia	2000	66	57.4			192	73.8		
	2006	91	73.7	4.17	0.035	184	82.2	1.80	0.058
Tanzania	1996	159	10			170	29.9		
	1999	168	18.2			335	28.1		
	2004	130	25.8			195	39.2		
	2007.5	93	25.4	7.82	<0.001	272	36.9	2.60	0.012
Uganda	1995	35	4.5			73	26.6		
	2000.5	53	33.8			85	52.8		
	2006	63	39.4	19.72	0.001	93	45.2	4.82	0.022
Zambia	1996	176	23.2			274	34.7		
	2001	85	25.3			141	39.1		
	2007	43	41.5	5.38	0.026	218	43.1	1.96	0.056
Zimbabwe	1999	50	40.2			132	58.1		
	2005.5	37	37.9	−0.91	0.838	237	59.4	0.34	0.782

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 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.[11] 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.[22 23] In Botswana, a decline in prevalence among young women attending ANC was recently also reported elsewhere,[24] 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.[25]

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.[26] 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,[2] 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[27] 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[1] 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.[28 29] By focussing the current HIV prevalence analysis on 15—24-year olds and on the period

2000–8, which for most countries is at least a decade after the start of the epidemic, these natural history effects should largely have been avoided—ie, because those aged 15–24 years during 2000–8 were from a different birth cohort to those aged 15–24 years during the first decade of the epidemic. The HIV incidence declines implied by the reductions in HIV prevalence among 15–24-year olds recorded here are unlikely to be due to the natural history of the epidemic.

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.[30] Behavioural indicators can provide corroboration of changes in HIV incidence and assist in attributing changes to particular aspects of risk.[31 32] 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.[33] 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.[23 34]

In conclusion, this multicountry analysis of data from the 30 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).[35] 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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Key messages

▶ HIV prevalence among young people aged 15–24 years declined significantly between 2000 and 2008 in 10 of 21 high burden countries.

▶ Changes towards less risky sexual behaviour have been observed among young men and women in the majority of countries included in this analysis.

▶ In the majority of countries with significant declines in HIV prevalence, significant changes were also observed in sexual behaviour in either men or women.

▶ Programmes to monitor trends in HIV prevalence, incidence and sexual behaviour should be strengthened.

▶ More data and further analysis are needed to understand the associations between prevention efforts, behavioural changes and changes in the prevalence and incidence of HIV.

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