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Original article

Epidemiology of HIV and AIDS among Adolescents and Young Adults in the United States

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Abstract

Purpose: To describe the current status of the human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) epidemic among adolescents and young adults in the United States. Despite reported declines in sexual risk behaviors among adolescents in the past decade, little has been published about the epidemiology of HIV and AIDS among adolescents and young adults in the United States.

Methods: We analyzed cases of HIV or AIDS diagnosed among persons aged 13 to 24 years and reported to the national HIV/AIDS Reporting System. We used AIDS cases diagnosed from 1985 through 2003 from the 50 states, the District of Columbia, and the U.S. trusts and territories, and we used HIV cases diagnosed in 2003 from 32 states and the U.S. Virgin Islands. We present five-year trends in HIV diagnoses from 1999 through 2003 from 33 surveillance areas that have stable name-based HIV reporting. The data were adjusted for reporting delays and unreported risk factors.

Results: At the end of 2003, 7074 adolescents and young adults, aged 13 to 24 years at the time of diagnosis, were living with AIDS in the United States. Of these, 63% were aged 20 to 24 years. AIDS rates were highest among black persons (63 per 100,000) and youth living in the South (22 per 100,000) and Northeast (18 per 100,000). Among females, the number of diagnosed HIV cases decreased from 1611 cases in 1999 to 1454 in 2003. Among males, the number increased significantly from 1763 in 1999 to 2443 in 2003. The observed increase in the number of HIV diagnoses among males was driven by an increase in HIV diagnoses among young men who have sex with men.

Conclusions: National case surveillance data for persons aged 13 to 24 years revealed that the burden of HIV and AIDS falls most heavily upon the Southern region of the United States and disproportionately upon black and Hispanic youth. The observed increases in the number of HIV cases among men who have sex with men are congruent with recent reports that suggest a resurgence of HIV among these young men. Our findings highlight the need for intensified HIV prevention efforts within minority communities and among men who have sex with men as well as strengthened efforts to encourage at-risk youth to get tested for HIV.

Keywords: Adolescent; HIV; AIDS; Surveillance

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More than 20 years into the epidemic, human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) continues to cause substantial illness and death among adolescents and young adults in the United States. In 2003, young persons aged 13–24 years constituted 12.2% of all cases of HIV/AIDS reported to the Centers for Disease Control and Prevention (CDC) from surveillance areas that have reliable reporting of both HIV and AIDS [1]. In 2002, HIV/AIDS was among the top 10 causes of death in several groups of youth: all races and both genders aged 20 to 24 years, black males and females aged 15 to 24, American Indian males aged 20 to 24, and Asian/Pacific Islander males aged 15 to 19 [2].

During the past decade, several events may have affected the HIV/AIDS epidemic among youth. First, since the mid-1990s, advances in treatment with antiretroviral medications have greatly extended life and decreased mortality rates for people living with HIV/AIDS, including youth [3,4]. Second, youth in the United States have shown substantial changes in sexual behavior. For example, the Youth Risk Behavior Survey showed that from 1991 to 2001 the proportion of high school students who had ever had sex decreased by 16% and that the proportion who had had four or more sex partners decreased by 24% [5]. From 1990 to 2000, changes in sexual behavior contributed to a 27% decrease in teenage pregnancies [6,7].

Despite declines in sexual risk behavior at the population level, there is evidence that during this period subgroups of youth continued to have high rates of HIV infection. For example, a study in the mid-1990s among young men who have sex with men (MSM) showed an HIV prevalence of 7.2% and an estimated annual incidence of 2.6% [8]. Research in inner-city neighborhoods in three U.S. cities during 1991–1992 found an HIV prevalence of 15.7% among young crack cocaine users [9]. Furthermore, two HIV outbreaks—one among heterosexually infected young males and females in a small town in rural Mississippi in 1999 [10] and another among male college students in North Carolina in 2003 [11]—demonstrate that youth continue to be affected by the epidemic.

The apparent conflict between decreases in reported sexual risk behavior and continued evidence of HIV transmission indicates the need for a detailed and updated analysis of the patterns of HIV and AIDS among adolescents and young adults in the United States. We used national HIV/AIDS case surveillance data for persons aged 13 to 24 years to describe the HIV and AIDS epidemic in this population by gender, mode of exposure, race/ethnicity, age group, and region of residence. Additionally, we summarized trends in HIV diagnoses over the five-year period of 1999 through 2003 for surveillance areas with stable name-based HIV reporting for that time frame.

Methods

We analyzed data from the national HIV/AIDS Reporting System, which comprise diagnoses of both AIDS and HIV reported to the Centers for Disease Control and Prevention (CDC) by states and U.S. territories. The data collection methods used for national HIV surveillance have been described previously [12]. Briefly, state and local health departments collect demographic and clinical information about new diagnoses of HIV and AIDS from laboratories and health care providers. Health departments abstract data about demographics, mode of exposure, and laboratory and clinical findings from medical records and forward these data, without personal identifiers, to CDC, where they are aggregated and de-duplicated. AIDS diagnoses are reported from all 50 states, the District of Columbia, and U.S. trusts and territories. HIV diagnoses, regardless of AIDS status at the time of HIV diagnosis, are reported from 41 surveillance areas that have confidential name-based HIV infection reporting [1].

We analyzed cumulative AIDS cases in adolescents and young adults aged 13 to 24 for whom AIDS was diagnosed between 1985 and 2003 and reported by June 2004 from the 50 states, the District of Columbia, and U.S. dependencies, possessions and associated nations. We also analyzed reported HIV cases diagnosed in 2003 from 33 of the 41 surveillance areas that have had HIV infection reporting since at least 1999 (Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Idaho, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming, and the U.S. Virgin Islands) [1]. Finally, we examined trends in new HIV infection for the years 1999 through 2003 from these 33 surveillance areas.

The number of persons living with AIDS was estimated by subtracting the number of persons with AIDS who died from the number of persons who had an AIDS diagnosis [13]. AIDS prevalence rates were calculated by dividing the total number of cases diagnosed in specific age subpopulations in 2003 by the estimated number of persons in those subpopulations in 2003. Population estimates for age subgroups and race/ethnicity were obtained from the U.S. Census Bureau. Persons were assigned to an age group on the basis of age at first documented positive antibody test for HIV infection or age at diagnosis of AIDS. Persons' race/ethnicity was established by providers' report and categorized according to standards established by the Federal Office of Management and Budget (OMB) in 1997 [14]. To stratify by mode of exposure category, we statistically adjusted the data to account for the reclassification of cases that were initially reported without risk exposure [15]. Data reported through June 2004 were adjusted for reporting delays (time between diagnosis of HIV infection or AIDS

Table 1
Estimated number and percentage of persons aged 13–24 years living with AIDS at the end of 2003, by gender and mode of exposure, United States[a]

	Age groups (years)							
	13–15		16–19		20–24		Total	
	No.	%	No.	%	No.	%	No.	%
Male								
Male-to-male sex	16	3	194	27	1632	61	1842	47
Injection drug use	12	2	37	5	254	10	303	8
Male-to-male sex and injection drug use	2	0	9	1	118	4	129	3
Adult hemophilia	0	0	3	< 1	96	4	99	3
Heterosexual contact	8	1	43	6	359	13	410	10
Perinatal exposure	478	86	320	45	67	3	865	22
Other	38	7	109	15	144	5	291	7
Total	554	100	715	100	2670	100	3939	100
Female								
IDU	7	1	48	7	260	14	315	10
Adult hemophilia	0	0	1	< 1	5	< 1	6	< 1
Heterosexual contact	20	3	199	28	1371	75	1590	51
Perinatal exposure	511	86	352	50	60	3	923	29
Other	53	9	107	15	141	8	301	10
Total	591	100	707	100	1837	100	3135	100

[a] These numbers do not represent reported case counts. Rather, these numbers are point estimates, which result from adjustments for reporting delays and for redistribution of cases in persons initially reported without an identified risk factor.

and report to CDC). To test the significance of the annual percent change in the estimated number of annual HIV diagnoses from 1999 through 2003, we fit a linear regression line to the natural logarithm of the number of diagnoses using calendar year as the independent variable. We used SAS/STAT® software (Version 8, 2002; SAS Institute Inc., Cary, North Carolina) for the statistical analysis.

Results

AIDS diagnoses

At the end of 2003, an estimated 7074 U.S. adolescents and young adults aged 13 to 24 years were living with AIDS. Of those, 63% were aged 20 to 24 years, 20% were 16 to 19, and 16% were 13 to 15. Table 1 shows the distribution of these adolescents and young adults by age group, gender, and mode of exposure. Overall, 3939 (56%) of the cases occurred in males. However, this proportion varied according to age group. In the younger age groups (13–15 and 16–19 years), the proportion of cases was approximately 50% for males and females, and the predominant mode of exposure was perinatal. In the oldest age group (20–24 years), approximately 60% of cases occurred in males, and sexual activity was the predominant mode of exposure. The most common mode of exposure among males aged 20–24 years was male-to-male sex (61%). Further stratification of mode of exposure by race/ethnicity (data not shown in Table 1) revealed that 83% of the young MSM living with AIDS in 2003 were black or Hispanic. Among females aged 20 to 24 years, heterosexual contact was the most common exposure mode (75%). The proportion of adolescents and young adults who reported injection drug use increased with age from a range of 1–2% among persons aged 13 to 15, to 10–14% among persons aged 20 to 24.

Table 2 shows the prevalence rates of new AIDS diagnoses in 2003 per 100,000 by age group, race/ethnicity, and region of residence. Overall and in every age group, the highest AIDS rates were for black persons. The total AIDS rate for black persons (63 per 100 000) is 3.3 times the rate for Hispanics (19 per 100 000) and 21 times that for white persons (3 per 100 000). Rates of AIDS diagnoses differ markedly for each by age group within a racial/ethnic group. In particular, the rate of AIDS diagnosis for black persons aged 20 to 24 years was 21 times the rate for black persons aged 13 to 15, and six times the rate for those aged 16 to 19. Similar patterns were observed for whites and Hispanics.

When analyzed by region of residence, the rate of new AIDS diagnoses in 2003 was highest in the South (22 per 100,000 population), followed by the Northeast (18 per 100,000 population).

HIV diagnoses

In 2003, an estimated 3896 cases of HIV were diagnosed among adolescents and young adults in the 33 U.S. surveillance areas that have well established confidential name-based HIV reporting. Table 3 shows that 75% (2936) of cases were diagnosed in those aged 20 to 24 years, 22% (874) in those aged 16 to 19, and 2% (86) in those aged 13 to 15. Overall, a greater proportion of HIV infections (63%) were diagnosed in

Table 2
Estimated number and rate (per 100,000 population) of AIDS diagnoses among persons aged 13–24 years, by race/ethnicity and region of residence, United States, 2003

	Age groups (years)							
	13–15		16–19		20–24		Total	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Race/ethnicity								
White	11	.5	20	.8	211	8.6	243	3.2
Black	48	7.6	156	26.0	920	163.8	1124	62.6
Hispanic	11	1.6	53	8.0	329	42.7	392	18.8
Asian	–[a]		3	1.5	16	7.9	19	3.4
American Indian	–[a]		–[a]		12	32.8	12	9.5
Region								
Northeast	19	2.6	49	6.8	325	46.2	392	18.2
North Central	5	.5	33	3.5	181	19.9	219	7.9
South	33	2.2	124	8.5	801	54.6	958	21.7
West	14	1.4	27	2.8	186	19.7	227	7.9
Total		1.7		5.7		37.1		14.7

[a] Numbers were too small for rate calculation.

males. This pattern, however, varied according to age group. Among those aged 13 to 15 years, the highest proportion of HIV infections (77%) was diagnosed among females; among those aged 16 to 19, the proportion of HIV diagnoses was almost identical for each gender (48% in males vs. 52% in females); and among those aged 20 to 24, the highest proportion (67%) was among males.

Among males with new diagnoses in the 33 areas, male-to-male sexual contact was the major mode of transmission for all three age groups. Overall, 74% of all males diag-

Table 3
Estimated number and percentage of HIV diagnoses among persons aged 13–24 years in 33 U.S. areas[a] with confidential name-based HIV reporting, 2003

	Age groups (years)							
	13–15		16–19		20–24		Total	
	No.	%	No.	%	No.	%	No.	%
Sex								
Male	20	23	456	52	1966	67	2442	63
Female	66	77	418	48	970	33	1454	37
Mode of exposure–male								
Male-to-male sex	14	68	345	76	1440	73	1799	74
Heterosexual contact	3	14	63	14	249	13	315	13
Injection drug use	2	12	34	8	173	9	209	8
Male-to-male sex and injection drug use	1	3	12	3	100	5	113	5
Other[b]	0	0	1	< 1	3	1	4	< 1
Mode of exposure–female								
Heterosexual contact	57	87	364	87	820	85	1241	85
Injection drug use	8	12	51	12	139	14	198	14
Other[b]	0	0	3	< 1	10	1	13	10
Race/ethnicity								
Black	67	78	623	71	1675	57	2366	61
White	12	14	140	16	733	25	885	23
Hispanic	7	7	96	11	456	15	558	14
Asian	0	0	1	< 1	26	1	27	1
Indian	0	0	6	1	22	1	28	1
Unknown	0	0	7	1	25	1	26	1
Total	86	2	874	22	2936	75	3896	100

[a] These numbers do not represent reported case counts. Rather, these numbers are point estimates, which result from adjustments of reported case counts. The reported case counts are adjusted for reporting delays and for redistribution of cases in persons initially reported without an identified risk factor.
[b] Other transmission means only adult hemophilia and undetermined mode.

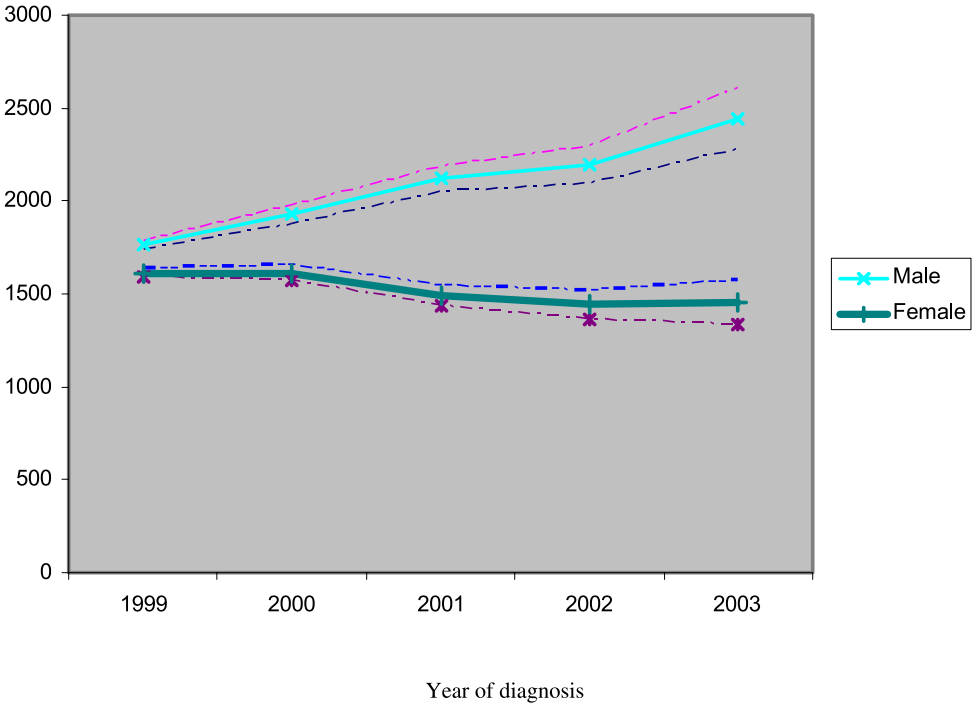

Figure 1. Estimated number of HIV diagnoses in men and women aged 13–24 years from 33 U.S. areas with HIV reporting, 1999–2003. Dotted lines are upper and lower confidence limits.

nosed with HIV in 2003 were exposed through male-to-male sexual contact, 13% were exposed through heterosexual contact, and 9% through injection drug use. Among females, 85% were exposed through heterosexual contact and 14% through injection drug use. Heterosexual transmission was the major mode of transmission among all three age groups of females.

Overall, three-quarters of newly diagnosed HIV infections in the 33 areas occurred among black and Hispanic youth. The proportion of cases that occurred in minority youth varied by age group; for example, 78% of persons aged 13 to 15 years were black compared with 57% of persons aged 20 to 24.

Trends in HIV diagnoses

Trends in HIV diagnoses for males and females aged 13 to 24 years in the 33 reporting areas are shown in Figure 1. Among females, the number of HIV diagnoses decreased significantly over the five-year period, from 1611 new diagnoses in 1999 to 1454 in 2003 (p for trend = .027). In contrast, the number of new HIV diagnoses among males increased significantly, from 1763 cases in 1999 to 2443 in 2003 (p for trend < .005).

During the five-year period, HIV trends among males varied by age group, mode of exposure, and race (Table 4). There were increases in the number of cases among all age groups, although the increase was steeper in some age groups than in others. Among those aged 16 to 19 and 20 to 24 years, the number of new HIV diagnoses increased significantly from 1999 to 2003. The youngest group of males, aged 13 to 15, accounted for approximately 15–26 cases per year during the five-year period. Also among males, the number of HIV diagnoses for all modes of exposure remained constant except for male-to-male sexual contact. Cases diagnosed among MSM increased significantly during the five-year period. When trends are viewed by race/ethnicity, the number of HIV diagnoses increased most dramatically among black males, from 954 in 1999 to 1333 in 2003, but there were also increases in the number of cases reported in white and Hispanic males.

The five-year trend in HIV diagnoses among females also varied by age group, mode of transmission, and race/ethnicity. All three age groups had slight decreases in the number of cases over the analysis period. However, none of the five-year trends was statistically significant. Although cases among black females constituted the largest proportion of all HIV diagnoses among females, the number of HIV diagnoses among black females declined significantly over the analysis period (p for trend = .037). Although the number of HIV diagnoses among females attributed to all other modes of exposure was relatively stable, the number due to heterosexual transmission with a high-risk individual decreased significantly during the five years of analysis (p for trend = .029).

Discussion

HIV/AIDS statistics have traditionally combined all persons aged 13 and older and treated them as a single group.

Table 4
Estimated number of HIV diagnoses among persons aged 13–24 years in 33 U.S. areas with confidential name-based HIV infection reporting, by year of diagnosis and selected characteristics, 1999–2003

	Year of diagnosis					*p* Value for trend
	1999	2000	2001	2002	2003	1999–2003
Males						
Age at diagnosis (years)						
13–15	17	15	16	26	20	.257
16–19	290	352	388	439	456	.004
20–24	1456	1559	1714	1730	1968	.004
Transmission category						
Male-to-male sex	1219	1336	1470	1613	1801	< .0001
Heterosexual contact	264	302	326	298	314	.226
Injection drug use	149	172	189	173	210	.059
Male-to-male sex and injection drug use	117	102	122	101	114	.838
Blood transfusion as adult	6	3	4	4	1	
Other[a]	9	10	7	6	3	> .05
Race/ethnicity						
Black	954	1098	1206	1184	1333	.015
White	506	477	527	572	639	.037
Hispanic	260	317	358	403	412	.007
Other races[b]	43	35	27	35	59	.583
Females						
Age at diagnosis (years)						
13–15	76	61	64	50	66	.383
16–19	482	436	411	398	418	.103
20–24	1053	1114	1019	994	970	.090
Transmission category						
Heterosexual contact	1348	1363	1278	1243	1242	.029
Injecting drug use	246	228	197	183	198	.066
Blood transfusion as adult	7	10	9	3	4	.936
Other[a]	10	11	10	13	9	> .05
Race/ethnicity						
Black	1162	1156	1068	1005	1035	.037
White	285	275	249	257	246	.037
Hispanic	142	145	155	152	146	.414
Other races[b]	21	36	22	29	27	.737

[a] Other transmission means only adult hemophilia and undetermined mode.
[b] American Indians, Asian Pacific Islanders and unknown race.

Yet the years from 13 through 24 represent a period of rapid developmental changes, and the data presented in this article provide evidence that the epidemiology of HIV and AIDS in persons aged 13 to 24 varies by subgroup. During the past five years, the number of new HIV cases in the 33 surveillance areas included in this analysis increased sharply among young MSM, particularly among those aged 20 to 24 years. Overall, estimates of the number of new HIV cases among young women in the same 33 areas appear to be stable or to have declined since 1999. The burden of HIV and AIDS falls most heavily upon the southern and northeastern regions of the United States and disproportionately upon black and Hispanic youth. Perinatal transmission is the major mode of transmission for persons living with AIDS in the 13–15-year age group and will account for an increasingly large proportion of cases among older adolescents as the exposed cohort ages.

These findings have several implications for HIV/AIDS prevention, care, research, and policies. The recent increases in diagnosed HIV among young MSM are of particular concern. It is not possible to determine from HIV/AIDS surveillance data alone whether these trends result from increased testing and reporting among MSM or from a true increase in the number of new HIV infections. However, increases in the number of syphilis cases among MSM in several major cities and the increases in numbers of newly diagnosed HIV cases among males observed since 1998 coincide with the introduction of highly active antiretroviral therapy, which suggests that the availability of effective treatment for HIV may have contributed to the perception of AIDS as a less severe disease and decreased sexual inhibition in young MSM [16]. Strengthened prevention efforts, encouraging abstinence, a reduction in the number of partners, and increased condom use are needed.

During the past five years, trends of HIV infection in females aged 13 to 24 years have followed a distinctly

different pattern than those observed in MSM; trends in young women parallel national decreases in sexual behavior and pregnancy rates [2,6]. These findings are extremely positive. Nevertheless, HIV trends in females should be monitored carefully, and efforts to ensure more rapid declines should be strengthened. Further, in 2003, among females aged 13 to 15, there were four times as many cases of new HIV as in males of the same age. Almost all the adolescent girls in the 33 areas were infected through heterosexual contact, and most infections occurred among black girls. A recent epidemiologic study among black females living in the South concluded that a variety of socioeconomic factors—financial dependence on male partners, feeling invincible, low self-esteem, and alcohol/drug use—place girls at risk and underscore the need for enhanced HIV prevention strategies for this population [17].

Our data highlight the enormous disparities that exist with regard to race and ethnicity and point to the need for intensified HIV prevention efforts within communities of color and MSM. Rates of AIDS are greater in black and Hispanic than in white youth, and three-quarters of new HIV infections occur in minority populations. Young men of color have experienced substantial increases in HIV infections over the past few years, and efforts to prevent HIV transmission should focus on these youth and their sexual partners. Similarly, the geographic distribution of cases suggests that southern and northeastern states should be priority targets for prevention efforts. Regional inferences will be aided when new HIV diagnoses from surveillance areas not included in our analysis can be added.

The aging into adolescence of the approximately 10,000 perinatally infected children will increase the number of youth living with AIDS and HIV who are in care over the next 5 to 10 years [18]. Existing research has shown that a substantial proportion of infected youth engage in unprotected sexual intercourse [19,20], so it will be important to engage this cohort of perinatally infected youth, as well as all infected youth, in effective and sustained efforts to prevent HIV transmission as they reach sexual maturity and reproductive age.

Adolescents face many barriers to HIV testing and may be more likely than other population groups to forgo HIV testing [21]. For example, among young HIV-positive MSM in a recent HIV study, only 18% indicated that they knew they were infected before enrollment in the study [22]. Further, data from the 2002 National Survey of Family Growth has shown that of those aged 15 to 19 years, only 19% had ever been tested for HIV, compared with 60% of adults over 25 years of age [23]. Adolescents are generally healthy and usually have limited interaction with the medical care system; they rarely have routine exams unless they engage in sports, enroll in college or the military, or have an injury. Other barriers to HIV testing include limited use of HIV testing during routine health visits [24,25], the relatively long delay in the development of symptomatic illness [26], the tendency to deny high-risk behaviors [27], limited access to HIV testing and treatment services in settings where at-risk youth can be readily reached (such as schools or adolescent drug treatment programs) [28] and the influence of parental consent and notification policies [29].

As the nation's youth continue to be affected by the HIV/AIDS epidemic, programmatic responses are needed to help control its spread. Future efforts should be focused on encouraging sexually active youth to get tested for HIV or re-tested if new risk occurs. Finally, prevention programs for infected and high-risk youth should be expanded as part of comprehensive health education programs that encourage abstinence, reduction in the number of sexual partners, and condom use for sexually active adolescents and young adults

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