Review article

The Epidemiology of HIV Among Young People in Sub-Saharan Africa: Know Your Local Epidemic and Its Implications for Prevention

Sue Napierala Mavedzenge, M.P.H. a,*, Rick Olson, M.A. b, Aoife M. Doyle, M. Phil., Ph.D. a, John Changalucha, M.Sc. c, and David A. Ross, B.M., B.Ch., Ph.D. a

a Department of Infectious Disease Epidemiology, London School of Hygiene and Tropical Medicine, London, UK
b UNICEF, East and Southern Africa Regional Office, Johannesburg, South Africa
c National Institute for Medical Research, Mwanza Research Centre, Mwanza, United Republic of Tanzania

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ABSTRACT

Background: Broad patterns of HIV epidemiology are frequently used to design generic HIV programs in sub-Saharan Africa.

Methods: We reviewed the epidemiology of HIV among young people in sub-Saharan Africa, and explored the unique dynamics of infection in its different regions.

Results: In 2009, HIV prevalence among youth in sub-Saharan Africa was an estimated 1.4% in males and 3.4% in females, but these values mask wide variation at regional and national levels. Within countries there are further major differences in HIV prevalence, such as by sex, urban/rural location, economic status, education, or ethnic group. Within this highly nuanced context, HIV prevention programs targeting youth must consider both where new infections are occurring and where they are coming from.

Conclusions: Given the epidemiology, one-size-fits-all HIV prevention programs are usually inappropriate at regional and national levels. Consideration of local context and risk associated with life transitions, such as leaving school or getting married, is imperative to successful programming for young people.

The aims of this review were to summarize the epidemiology and unique dynamics of HIV among young people in sub-Saharan Africa and to identify target age groups and subgroups important for HIV programming. We focused on data collected between 2000 and 2010, the period allocated to achieving the global goals for young people [3, 4]. HIV prevalence data were available from Demographic and Health Surveys (DHS) and other national population-based surveys, which are reproducibly collected [5]. We also included HIV incidence data from several large rigorously conducted research studies (1990–2010). These data were also used to investigate the association between HIV and key sociodemographic variables, and to describe the epidemiology of HIV in important subgroups often not adequately represented in national surveys.

Globally, four types of HIV epidemics have been identified, each requiring a different approach to programming [6, 7]. All four types are found in sub-Saharan Africa. In low-level epidemics, HIV may have been present for many years, but prevalence has not consistently exceeded 5% in any major subpopulation. In
concentrated epidemics, HIV is well established in high-risk subpopulations, such as injecting drug users, men who have sex with men, or sex workers. In concentrated epidemics, HIV consistently exceeds 5% in at least one of these subpopulations, but there is no substantial spread into the general population. Epidemics in countries where HIV has spread to the general population, with prevalence of more than 1% in pregnant women, are defined as generalized epidemics. Finally, hyperendemic areas have an HIV prevalence exceeding 15% in the adult population. While most countries in sub-Saharan Africa have generalized epidemics, prevalence varies considerably by region, with the highest prevalence being in Southern Africa, exceeding 10% in all nine countries of this region [8]. HIV prevalence is low to moderate in an additional six countries in Central and Eastern Africa, and is lowest in West Africa and some countries in the Horn of Africa and East Africa, ranging from <1% to 5% [3]. The HIV epidemic is constantly evolving, therefore, arbitrary classifications by type of epidemic must be viewed with caution. However, these classifications are useful for focusing on the primary transmission routes driving an epidemic, and are critical for developing appropriate responses.

**HIV among young people in sub-Saharan Africa**

Globally, an estimated 5 million youth (15–24 years) were living with HIV in 2008, of whom approximately 4 million (80%) were in sub-Saharan Africa [4]. In 2009, the overall HIV prevalence among youth in sub-Saharan Africa was an estimated 1.4% in males and 3.4% in females [3]. The prevalence of HIV among youth varies across the region (Table 1). As would be expected, given the long duration of HIV infection, the prevalence among youth is highest in those countries affected by a generalized epidemic, particularly where incidence is increasing or has plateaued, and lower in countries that are in a declining epidemic phase [11]. As the background prevalence and phase of the HIV epidemics differ substantially across sub-Saharan Africa, the risk of acquiring HIV during youth also differs, depending on whether you live in one of the hyperendemic countries of Southern Africa, a high prevalence country in Central or Eastern Africa, or a relatively lower prevalence country of Eastern and Western Africa.

Variation across regions and within countries is primarily because of sociodemographic, biological, and behavioral factors.

**Socio-demographic.** In sub-Saharan Africa, the majority of transmission is through unprotected heterosexual intercourse. HIV prevalence is higher among young women than men, with the exception of the Democratic Republic of Congo [1,12], and in urban versus rural communities, with Senegal being the exception [12,13]. These subgroups are described in more detail later in the text. HIV prevalence also differs by marital status. Widowed, separated, or divorced women generally have higher HIV prevalence than those who are married, or cohabiting age-mates [2,14–17]. Again, however, exceptions exist; in Lesotho, for example, never-married women who are sexually active have the highest rate of HIV infection [18]. HIV prevalence is usually higher among mobile individuals and among some occupational groups [19,20].
Biological. One of the most influential factors affecting HIV prevalence is male circumcision status, which is often associated with religious affiliation and/or ethnicity [21,22]. Male circumcision reduces the risk of HIV acquisition among males by as much as 60%, thus indirectly (and possibly directly) reducing risk among females [23–27]. In Ethiopia, however, despite almost universal male circumcision [9], adult HIV prevalence rose to 14% among the urban population by 1998, although it has declined to an estimated 9% in 2010 [28]. Once more, such exceptions emphasize the importance of local programs knowing and acting on local epidemiological and sociological data. The presence of other sexually transmitted infections, especially HSV-2, varies substantially between countries and also affects HIV prevalence [29,30].

Behavioral. Even among groups of the same age, sex, ethnic group, religion, marital status, occupation, and mobility, living within the same area, HIV prevalence differs substantially by individual risk behaviors, such as numbers, types and patterns of sexual partnerships, and frequency and type of sexual intercourse [31].

Southern and Eastern Africa

National HIV prevalence among youth varies widely between the countries of Eastern and Southern Africa, from 0.7% in Ethiopia to 6.0% in Malawi to 11.3% in Lesotho [1,10,32], and there is further wide variation within countries. For example, a 2008 population-based survey in South Africa reported an overall HIV prevalence of 8.7% among young people. However, this aggregate prevalence masked substantial provincial differences, ranging from 3.0% among youth in the Western Cape to 15.3% in KwaZulu-Natal [33]. Furthermore, although prevalence in this age group had decreased in the Western Cape by 73% between 2002 and 2008, the prevalence in KwaZulu-Natal had doubled in the same period [33]. Repeated data from the same population improve our ability to monitor trends and provide evidence for the effectiveness of, or gaps in, programming to aid in future planning. For example, nationally representative population surveys were conducted in the United Republic of Tanzania in 2003 and 2007, demonstrating a decrease in HIV prevalence by approximately 50% in young people aged 15–19 years and by 60% in males aged 20–24 years [34]. However, the prevalence among females aged 20–24 years had not decreased, being 6.0% in 2003 and 6.3% in 2007 [34,35]. Another example of the importance of repeated, up-to-date, and disaggregated local data comes from a comparison of population-based survey data in Zimbabwe and South Africa, where there was an increase in HIV prevalence between 2002 and 2005 among Zimbabwean male youth but a decrease in female youth, whereas these sex-specific trends were reversed in South Africa [10].

In Eastern and Southern Africa, between 2000 and 2008, HIV prevalence among young people declined by at least 25% in relative terms in Botswana, Ethiopia, Kenya, Malawi, Namibia, and Zimbabwe, and although most of the other countries in the region also seem to have declining prevalence among youth, this is not true of all (e.g., Uganda, Mozambique) [4,36]. Although encouraging, these regions of Africa still maintain an unacceptably high HIV prevalence. Several countries in Southern and Eastern Africa have the highest rates of education, income, and social services in the region, and still there are generalized and hyperendemic HIV epidemics in these countries. This could be partly due to the legacy of apartheid, which led to mass migration of men and disruption of family structures across much of the region [37]. There may also simply be lack of access to or utilization of services among young people.

West and Central Africa

The West and Central African regions are unique because male circumcision is near universal [17] and because of the presence of the HIV-2 strain of the virus, which has lower transmissibility and slower disease progression as compared with HIV-1 [38]. However, incidence of HIV-1 has increased and HIV-2 decreased, thus the relative importance of HIV-2 versus HIV-1 is decreasing [39,40].

In West Africa, HIV prevalence in 2007 among 15–24-year-olds ranged from 0.2% (Gambia) to 0.9% (Niger) in young men, and 0.5% (Niger) to 2.4% (Côte d’Ivoire and Togo) in young women. The country with the highest HIV prevalence among the 15 West African countries is Côte d’Ivoire, where 2.4% of females and 0.8% of males aged 15–24 are HIV positive [1]. In West and Central Africa, there has been a statistically significant decline between 2000 and 2008 by >25% in HIV prevalence among youth in Côte d’Ivoire, but this is not true in any other country in the region, and prevalence has even increased in some countries, although not statistically significantly [4,9].

Clearly, HIV prevalence is low in West and Central Africa in comparison with Eastern and Southern Africa, but there is no room for complacency. The absolute numbers of HIV-positive individuals are considerable. Because of relatively large populations, West and Central Africa are home to one-third of the 22 million infections in sub-Saharan Africa. Approximately 63% of the population are >24 years of age, and nearly half of all new infections are in young people [41,42]. Furthermore, several factors make this region potentially vulnerable to HIV. West and Central Africa is one of the poorest parts of the world, including eight of the ten lowest ranked countries on the human development index [17,43]. West and Central Africa are disproportionately affected by conflict and emergencies, which present obstacles to government efforts to combat inequalities and other development problems, including HIV [44]. Educational attainment is particularly low in this region, where only 60% of children attend school. The gender gap in education is particularly wide; in Chad and Niger, for example, 70% of girls are out of school [44]. Future increases in HIV prevalence cannot be ruled out in the region, despite the protective effects of male circumcision [45].

Target age groups for HIV transmission and for HIV acquisition

HIV prevalence is a measure of the burden of infection within the population. Those infected with HIV act as the reservoir of infection, so efforts to prevent HIV transmission need to focus on them to stop transmission to others—often called “positive prevention.” Even in areas where the rate of new infections is declining, the number of people living with HIV may continue to rise as a result of increased access to treatment [2]. Positive prevention is a well-established concept, with several efficacious strategies [46], and should benefit from understanding where to target our efforts. Age-disaggregated prevalence data from national population-based surveys in Uganda [14], South Africa
and Côte d’Ivoire \cite{48} (Figure 1) show that efforts to reduce transmission in these countries should be largely targeted at men aged ≥25 years and women aged ≥20 years, in whom prevalence is highest.

Understanding modes of transmission, as well as which age, sex, and other groups to target, is important for informing HIV prevention programs. The relative importance of different partnerships for transmission varies between countries. For example, recent work for the Know Your Epidemic initiative suggests that at least half of new transmissions in Kenya and Zambia occurred within casual heterosexual partnerships. However, in Swaziland and Lesotho, the majority of transmission seems to occur in “low-risk” heterosexual sex with regular partners (R. Olson, personal communication, 2010). It is important to highlight that these data are often imprecise and are based on models which have incomplete information on prevalence and size of most-at-risk populations. However, they do illustrate potential areas of intervention and reemphasize that HIV programs need to know the contexts where infections are taking place and target prevention interventions where most infections are occurring.

Prevalence data are useful for targeted positive prevention strategies, but we need to examine HIV incidence to know where efforts should be focused to reduce acquisition of HIV. Because HIV prevalence is cumulative, it is slower to change, and as more people access highly active antiretroviral therapy (HAART) and survival increases, prevalence will increase unless new infections (HIV acquisition) are reduced. HIV incidence data by age are more useful for targeting interventions to prevent HIV acquisition, for monitoring progress, and for identifying emerging trends. However, incidence data are much more difficult to measure because they usually require following large numbers of individuals over time. Increasingly, attempts have been made to estimate HIV incidence within population-based cross-sectional surveys using “detuned” HIV tests such as BED IgG-Capture Enzyme Immunoassay (BED assay) \cite{49}, but attempts to estimate HIV incidence by age and sex have been shown to yield potentially misleading results \cite{50,51}.

Direct population incidence data are rare. Figure 2A, B shows the incidence of HIV by age and sex in a cohort in rural Uganda, which has been under long-term serosurveillance through annual population surveys \cite{52}. Ideally, interventions to prevent HIV acquisition must be focused on age groups immediately before HIV incidence starts to rise substantially, and then be sustained throughout the age range where HIV incidence remains high. During the years 2000–2005, the incidence rate peaked in males in the 25–29-year age group, but was high (≥5 per 1,000 person-years) throughout the wide age range from 20 to 49 years; in females, the incidence peaked in the 20–24-year age group, and was similarly high for those aged between 20 and 34 years. This would imply that interventions to prevent HIV acquisition among both men and women must start before the age of 20 years.

Importantly, the same Figure 2A, B shows two earlier periods (1990–1994 and 1995–1999) superimposed. This illustrates that the HIV incidence pattern by age seems to have changed over time in males, from a fairly even and very high incidence (7–12 per 1,000 person-years) across the broad age range from 20 to 54 years during 1990–1994, to a monophasic distribution with a very high peak incidence (22 per 1,000 person-years) among the
25–29-year-olds during 1995–1999, to a biphasic incidence with peaks at 25–29 years and at 40–44 years in 2000–2005. In females, the pattern has remained fairly constant throughout the 16 years of follow-up, with a monophasic peak at 20–24 years, although the peak incidence was lower in 1995–1999 and 2000–2005 than in the earlier period (1990–1994). Although such incidence data are critical for targeting interventions to reduce HIV acquisition, where possible, the 5-year age bands should be further disaggregated, for example, to show that the incidence among 15-year-olds is far lower than that among 19-year-olds.

**Subgroups of young people most vulnerable to, or at risk of, HIV acquisition**

Although disaggregating national or subregional data to look at HIV prevalence and incidence among young people is essential, this may still mask substantial variations between subgroups within and between countries that are important for programming. Understanding the difference between vulnerability and risk is important when targeting programming at subgroups of young people. Vulnerability results from a range of factors that reduce the ability of individuals and communities to avoid HIV infection. Approaches to decreasing vulnerability may include policies and programs to decrease gender-based violence, to increase age of marriage, or to change social values and norms that support age-disparate sex. Risk is the probability that a person may acquire HIV infection, and approaches to decrease risk may include individual behavior change strategies as well as engaging, mobilizing, and empowering affected communities to ensure a supportive environment for risk-reduction interventions to be effectively implemented.

**Young women**

Throughout sub-Saharan Africa, the rise in HIV incidence among young women starts earlier and is far more precipitous.
than among young men (Figure 2) [2,10], and 15–24-year-old females are as much as eight times more likely to be infected than males (Table 1) [9]. Young women are biologically susceptible to HIV acquisition because of their immature cervix [53]. In addition, some young women are vulnerable because of highly gendered power structures, having less ability to decide whom they have sex with, the type of sex they have, and whether that sex is protected [54]. This may be particularly evident in relationships with a substantial age differential (see later in the text). These power structures can have implications for both acquisition of HIV by young women and subsequent transmission of infection to their partners.

**Older young people**

Young people (10–24 years) are part of a transitional group between older children (2–9 years) who have a very low risk of acquiring HIV, either through sexual or through parenteral routes, and adults (≥25 years). As young people progress through this transitional period, the great majority become sexually active. In most societies, youth aged 15–24 years have the highest rates of sexual partner change [55]. As young people age, they are more likely to engage in behaviors that put them at risk for HIV; therefore, HIV incidence increases dramatically as they become older. This was illustrated in data from a 1997–1998 study in rural Mwanza Region, the United Republic of Tanzania, where HIV prevalence increased threefold in both males (0.2%–0.6%) and females (0.9%–2.4%) between the ages of 15 and 19 years [56]. Similarly, in Swaziland, in 2006–2007, HIV prevalence was 6.2% in females aged 15–17 years, and it increased to 43.3% in those aged 23–24 years (a 7-fold increase). In males, HIV prevalence was 1.4% in those aged 15–17 years and increased to 19.1% in those aged 23–24 years (a 13-fold increase) [32].

**Urban versus rural**

Within a single country, risk of HIV acquisition can vary substantially between urban and rural areas. Early in the epidemic, often young people living in major cities were at least five times more likely to acquire HIV before they reached the age of 25 years than young people living in remote rural areas. More recently, urban/rural imbalances have tended to be less dramatic across the subcontinent [4,9].

**Poverty**

The relationship between poverty and HIV is not the same in all countries in sub-Saharan Africa (Figure 3A), and may well be changing with time. Although not universally true, in many sub-Saharan African countries, wealthier groups had higher prevalence of HIV early in the epidemic. While countries such as Zambia and the United Republic of Tanzania continue to have higher HIV prevalence in the wealthiest groups, the balance has shifted in other countries [9,57–59]. In Kenya, for example, we now see higher HIV prevalence in the poorer groups, though the opposite was true earlier in the epidemic [9].

**Educational attainment**

The association between educational attainment and HIV prevalence also seems to vary between countries (Figure 3B). In some countries, trend data suggest that prevalence is stable among less educated people (who are usually also less wealthy), and decreasing among more educated people [53,57,60,61]. In Kenya and the United Republic of Tanzania, for example, HIV prevalence is higher among those with less education, whereas the opposite was true earlier in the epidemic [9]. The association between HIV, education, and wealth is difficult to disentangle because there is a very strong relationship between wealth and educational attainment. Their relationship with HIV may be further confounded by other factors such as mobility or living in urban areas, for example, which are also associated with wealth and education.

**Partnerships**

Substantial age differentials between sexual partners are common in sub-Saharan Africa [54], with the male partner frequently being an average of about 5 years older than the woman [18,33,62]. Given the pattern of HIV prevalence by age, young people whose sexual partners are several years older than themselves are usually at higher risk of acquiring HIV than those whose partners are age matched [63]. Such age differentials reinforce gendered power structures and increase young women’s vulnerability to HIV [53,54].

Multiple concurrent relationships in linked and overlapping sexual networks with limited condom use are also associated with increased risk of HIV transmission [64–67]. Trends in multiple partnerships among young people seem to vary by country. Among 14 of the worst-affected countries, all with HIV prevalence of >2%, 13 countries have shown a decline in their reporting of multiple partnerships in the past 12 months among young men, and 10 countries have reported a decline among young women. Seven of these countries have demonstrated a significant decrease in multiple partnerships reported by both young men and women [4]. Although these trends toward safer sexual behavior are encouraging, reported behavior can be subject to several biases (recall, social desirability) and the extent of these biases can change over time in response to increased knowledge, education, and/or social norms in relation to the behavior [68–70].

**Vertically infected adolescents**

Because of its long incubation period, HIV is a long-wave epidemic. Recent data indicate that it is more common than previously thought for vertically infected children to live into adolescence, even without access to HAART, and often being unaware of their HIV status [71]. This proportion may increase as more infants and children access HAART, though this may be balanced by better access to treatment for the prevention of vertical transmission. Nonetheless, this is a subgroup of young people who have largely been ignored in HIV programming to date.

**Other high-risk/vulnerable groups**

Young people are often disproportionately represented in subgroups of the population who are at high risk of acquiring HIV, such as individuals involved in sex work, those who share injecting drug equipment, prisoners who engage in unprotected anal sex, and adolescent orphans who are at risk of forced or unsafe sex owing to limited self-efficacy or lack of family supervision. Young women who are victims of domestic violence rep-
resent another vulnerable group [72], and as mentioned previously, risk of HIV also differs by marital status among young women in most countries.

A transitional period

The second decade of life is a time of rapid physical, psychological, and social development. It is the time when puberty occurs and when most people are first exposed to sexual interest and become sexually active. How adolescents receive and act on information, and the skills they have to use the information that they access, often differ significantly from both younger children and adults. This can also vary considerably between individuals and within the same individual over a relatively short period. Several major life transitions that influence a person’s HIV risk often occur during adolescence, such as leaving school/college, leaving home, and getting married. Such life transitions can greatly and suddenly alter a young person’s risk of HIV, and HIV prevention programs need to actively plan for them, by both preparing the young person in advance for the risks they may bring and responding to them as they occur.

Progress is being made

Encouragingly, progress is being made in terms of reductions in HIV incidence and prevalence among young people in some areas of sub-Saharan Africa. Prevalence of HIV infection seems to be declining among young people, including in 16 of 21 worst-affected countries [1,4]. Eleven of 19 countries with available antenatal clinic data showed a reduction in HIV prevalence between 2000 and 2008, in either urban or rural areas, or both [36]. In seven countries, this reduction was statistically significant. Of seven countries with repeat population-based survey data, six showed a reduction in HIV prevalence among either males or females [36]. Importantly, at the population level, drops in HIV prevalence have been associated with delayed sexual debut, increased condom use, and reductions in multiple partnerships [36,73].

Conclusions

Youth are at the center of the epidemic and reducing their risk of HIV acquisition will be pivotal in determining the future course of
the various epidemics in sub-Saharan Africa. Interventions that target youth will need to be of high quality and coverage and must be sustained because there are new generations continuously entering this age group. HIV prevention interventions will also need to be sustained into older age groups because risk does not suddenly disappear after people pass a certain arbitrary age threshold, and in some cases the HIV risk is even higher among young adults (e.g., 25–34-year-old men) than in youth.

Interventions to prevent new infections among young people must be designed both to reduce their own risk of acquiring HIV, and the risk of older adults transmitting the virus to them (“positive prevention”). This may require different approaches and target groups, with mode of transmission being an important consideration. For example, in some settings, this will require a focus on HIV serodiscordance in regular partners, where a large proportion of transmission takes place. HIV incidence is key to knowing where HIV acquisition is occurring, whereas HIV prevalence is key to knowing where the virus is coming from. There is an urgent need for joined-up thinking and joined-up programs that span both sides of the HIV prevention process—acquisition and transmission.

We need to develop better combination interventions that address both individual capacity to assess and act around risk and the structural factors which inhibit or enable HIV risk reduction. Successful combination interventions have been used in several sub-Saharan African countries [3,6,17,21,22,30]. On an individual level, scaling up of male circumcision among young men should be a priority because modeling suggests large benefits in the range of one HIV infection averted for every five to 15 circumcisions performed in hyperendemic countries and a 30%–50% reduction in HIV incidence [76]. Interventions to increase condom use and age of sexual debut, and to reduce partner change, have been successful in some countries [33,36,74]. Sexual health and other services for young people should be made not only accessible, but also more youth friendly. Furthermore, there is a need to better understand the links between HIV and key transitions in the lives of young people (e.g., leaving school). These efforts should be combined with an emphasis on addressing community norms in relation to young people’s sexuality. Finally, intervention programs for young people are unlikely to make a difference unless they target high-risk and vulnerable groups. Given that young people are disproportionately represented among most, if not all, of the highest risk subgroups of the population (sex workers, injecting drug users, men who have sex with men, prisoners), interventions addressing high-risk behaviors among these groups may need to be tailored to the needs of young people. Effective interventions among these groups should have a disproportionate beneficial effect on HIV acquisition among young people as a whole.

Efforts are being made, for example, with the UNAIDS Know Your Epidemic initiative, to tailor HIV programming to the specific country context [77]. There are important differences in the epidemiology of HIV among young people in sub-Saharan Africa, between and within regions and countries and by subgroup, such as by sex, age, economic status, educational attainment, and specific risk behaviors. Similar interventions can result in different outcomes depending on the setting [78], thus tailoring interventions to the unique epidemiology is critical.

HIV prevention programs need to move beyond simplistic analyses and remain current in their knowledge of the epidemic because it is constantly changing. Efforts to prevent HIV among young people need to be based on a detailed understanding of disaggregated data on who is acquiring and transmitting the infection, where, and why, to give a comprehensive understanding of the current epidemic and to anticipate its future course. This should be combined with an in-depth analysis of the local context. No single intervention will be able to reduce HIV acquisition and transmission, and the intervention packages chosen must be evidence-informed and tailored to the specific epidemic and social context.

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References


