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Original article

Why Are Orphaned Adolescents More Likely to Be HIV Positive? Distinguishing Between Maternal and Sexual HIV Transmission Using 17 Nationally Representative Data Sets in Africa

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A B S T R A C T

Purpose: Why do orphans have higher rates of HIV infection than nonorphaned peers? Research consistently assumes that orphans acquire HIV primarily through sexual behavior, but infections may instead be due to maternal transmission. Although these two pathways have very different implications for HIV programs and policies, their relative contribution has not been previously examined. In this research, we compare the contribution of maternal and sexual transmission to HIV infection among orphans in Africa.
Methods: We use Demographic and Health Survey data for 21,463 women and 18,359 men from 17 countries. We propose a conceptual framework linking orphanhood to HIV, and use mediation analysis and structural equation modeling to compare the potential contribution of maternal transmission (measured through direct pathways from orphanhood to HIV) and sexual transmission (measured through reports of risky sexual behavior) to orphan HIV infection.
Results: Our results suggest that maternal transmission is the predominant pathway of HIV infection among orphaned adolescents: there is strong evidence for a direct pathway from maternal (odds ratio [OR]: 2.45; 95% confidence interval [CI]: 1.72–3.51 for females and OR: 2.45; 95% CI: 1.53–3.90 for males) and double orphanhood (OR: 2.69; 95% CI: 1.97–3.66 and OR: 2.53; 95% CI: 1.68–3.82, respectively) to HIV; greater excess HIV risk in maternal versus paternal orphans. The contribution of sexual behavior is largely not significant. We do not observe correspondingly high orphan disparities in other sexually transmitted diseases.
Conclusions: Maternal transmission is a more likely explanation than sexual transmission for heightened HIV infection among orphans. These results suggest that programs designed to address HIV infection among adolescents should focus on reducing maternal transmission and on identifying and testing undiagnosed HIV among orphans.

IMPLICATIONS AND CONTRIBUTION

Adolescent orphans are a high-risk group for HIV in Africa, and explanations focus on heightened sexual risk taken during adolescence. However, these results show that maternal transmission is a more likely explanation. New efforts to identify and test undiagnosed HIV among orphans are key to reducing adolescent AIDS mortality.

HIV infection among adolescents and young adults remains a critical issue. Despite steep declines among every other age group, AIDS mortality has tripled among adolescents (aged 10–19 years) since 2000, and AIDS is now the leading cause of death among this age group in Sub-Saharan Africa [1]. Another quarter million adolescents are newly infected every year [2].

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Throughout the HIV/AIDS epidemic, research in Sub-Saharan Africa has consistently assumed that HIV transmission for adolescents and young adults occurred primarily through sexual behavior [3–5]. As a result, programs for this population have primarily aimed at sexual transmission, focusing on increasing condom use and male circumcision, reducing multiple sexual partners and transactional sex, and delaying age at sexual debut [3].

Among adolescents and young adults, there is particular concern for orphans. A growing number of studies have identified adolescent orphans as a high-risk group for HIV; several studies have found that orphans are two to three times more likely to have acquired HIV by the time they reach adolescence than nonorphaned peers [6,7]. Humanitarian groups, governments, and donors have specifically targeted orphans in HIV prevention initiatives [8,9].

Whether such investments have the intended impact on HIV incidence, however, depends on when and how orphans acquire HIV. As with other populations, it is widely assumed that orphaned adolescents acquire HIV primarily through behavioral transmission [9,10]. There is evidence that orphans experience greater economic hardship, mental distress, and sexual victimization [11], and such extreme social vulnerability may predispose orphans to greater sexual risk taking. However, the empirical evidence on this is not definitive [7]. Despite the ambiguity, the implicit assumption that orphans acquire HIV sexually appears frequently in research, policies, and programs.

But what if this basic assumption is wrong? For much of the epidemic, antiretroviral treatment was largely unavailable or inaccessible, and the chance of an infected infant surviving to adolescence was thought to be very low. However, recent research has found that HIV infection progresses slowly among some infants and a substantial proportion survive to adolescence and beyond [12,13]. Moreover, recent research in Kenya [14] and Ethiopia [15] has found substantial HIV prevalence for older children (younger than 15 years), the majority of whom were presumably not infected through sexual transmission due to low rates of sexual activity for these age groups. In addition, an intervention to reduce HIV among Zimbabwean adolescents had no impact on orphan HIV disparities, leading the authors to suggest that excess risk among orphans is likely due to maternal transmission [16]. These studies challenge long-held assumptions about the predominant mode of transmission, although this has not been explicitly tested.

Compared with sexual transmission, maternal transmission has important implications for HIV and orphanhood programming, including a shift toward greater surveillance to identify undiagnosed HIV and related morbidity among orphans. Owing to the predominant focus on sexual transmission, HIV testing efforts are typically not directed toward this population [15]. As a result, many of these HIV-positive children are undiagnosed and not linked to treatment [14,15]. As these “missing children” mature into adolescents, they may alter the future course of the HIV epidemic. The goal of this study was to clarify the etiology of orphan HIV disparities and in doing so provide essential guidance for our response.

Methods

Sample

Data are derived from Demographics and Health Surveys (DHS) in 17 Sub-Saharan African countries (Table 1). DHS are nationally representative and have high response rates. For more detail on DHS methods and scope see [17]. For this study, surveys were included if they were publicly available at the time of analyses, collected parental survival information, conducted HIV testing, and had at least one HIV-positive adolescent (see Table 1). For females, secondary analyses are further restricted to surveys in which sexual violence data were also collected. Data are pooled across all eligible surveys. Secondary research on this data source was exempted from the need for human subjects review by Stony Brook University.

Table 1
DHS sample size included in analyses, by country and survey year

Country (year)	Females (15–17 y) with HIV data	Females (15–17 y) with HIV and sexual violence data	Males (15–17 y) with HIV data
Burkina Faso (2010)	[a]	–	959
Cameroon (2011)	1,020	–	938
Congo (2009)	767	–	640
Cote d'Ivoire (2005)	591	432	528
Cote d'Ivoire (2011)	547	–	474
DRC (2007)	550	–	507
Ethiopia (2011)	2,191	–	1,582
Gabon (2012)	732	356	725
Lesotho (2004)	464	–	407
Lesotho (2009)	562	–	490
Liberia (2007)	734	330	606
Malawi (2004)	298	–	262
Malawi (2010)	1,115	616	1,037
Mozambique (2009)	525	–	541
Rwanda (2005)	830	826	–
Rwanda (2010)	988	509	919
Sierra Leone	311	–	–
Swaziland (2006)	739	–	778
Tanzania (2003)	750	–	687
Tanzania (2007)	1,335	–	1,174
Tanzania (2011)	1,369	–	1,174
Uganda (2011)	1,403	303	1,312
Zambia (2007)	780	397	679
Zimbabwe (2005–2006)	1,062	566	1,017
Zimbabwe (2010–2011)	1,005	516	923
Total	21,070	4,851	18,359

DHS = Demographics and Health Surveys.
[a] Burkino Faso was not included as there were no HIV-positive female adolescents.

Measures

Independent variable: We define orphans as children below 18 years who have lost one or both parents. We further classify orphans by whether they have lost their mother (maternal orphan), father (paternal orphan), or both parents (double orphan).

Dependent variables: The primary dependent variable in our analysis is HIV status. The DHS has been conducting anonymous, informed, and voluntary HIV testing since 2001. Blood spots are taken from individuals aged 15–49 years, and HIV status is assessed with an enzyme-linked immunosorbent assay test; positive results (and a subsample of negative results) are confirmed with a second test [18]. Secondary analyses used a binary variable capturing any self-reported sexually transmitted disease (STD) symptomology, abnormal genital discharge, or genital ulcers/sores in the past 12 months; these questions were asked only of sexually active respondents.