# Prevalence and Correlates of HIV Infection Among Street Youth in Kisumu, Kenya

By

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Abstract
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**Introduction:** Despite their marginalization and perceived vulnerability to HIV, East African street children and youth are neglected in HIV prevention research. We examined HIV seroprevalence and correlates of HIV infection in a sample of street youth in Kisumu, the capital of Nyanza Province in southwest Kenya,

**Methods:** A purposive sample of street youth age 13-21 years old was recruited by street outreach over a two-week period. Participants completed an interviewer-administered, computer-assisted survey, followed by voluntary HIV counseling and testing. Survey items included demographics, homelessness history, survival activities, sexual behavior and substance use. We used Fisher Exact Tests and logistic regression to examine the relationship between HIV status and predictor variables.

**Results:** The sample included 296 males for whom HIV test results were available. 72% had been on the street for at least one year. Survival activities included garbage picking (55%), helping market vendors (55%), begging (17%), and working as a porter (46%) or a houseboy (4%). 49% of participants reported at least weekly use of alcohol, 46% glue, 32% marijuana, and 8% fuel. 79% of participants reported ever having vaginal sex; 6% of participants reported ever having insertive anal sex and 8% reported ever having receptive anal sex. Twelve (4.05%, 95% CI 2.33-6.95%) participants tested positive for HIV; of those all had been on the street for at least one year and all had engaged in vaginal sex. Occupations placing youth at risk of coercion by adults, including helping vendors in the market (OR 9.4, p=0.033) and working as a houseboy (OR 5.4, p=0.044), were significantly associated with HIV infection. Insertive anal sex (OR=13.6, p<0.001) and receptive anal sex (OR=4.3, p=0.038) were associated with HIV infection. Drug use and activities associated with marginalization, including begging and garbage picking, were not associated with HIV infection.

**Conclusions**: HIV prevalence in the sample is comparable to that of similarly-aged male youth in Nyanza Province. Length of time on the street and survival activities, including helping market vendors and working as a houseboy, were associated with testing positive for HIV. Risk behaviors associated with HIV infection included receptive and insertive anal sex. These findings offer opportunities for interventions to prevent HIV infection among street children and youth in Kisumu and in East Africa.

This manuscript is dedicated to
Faith M’mbone Salano

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## Part 1: Determinants of HIV Infection in Homeless Adolescents in Sub-Saharan Africa

### Introduction

The number of homeless youth in sub-Saharan Africa (SSA) is unknown, however their numbers are thought to be increasing due to overall population growth, increased urbanization and the HIV pandemic (1). UNICEF estimates that there are approximately 150 million street children worldwide (2). Data on HIV infection in homeless adolescents in SSA are sparse, due in part to the transient and hidden nature of this population. This paper aims to examine what we know about HIV risk in street children and youth in Kenya, drawing on the existing literature regarding homeless youth, including the determinants of HIV prevalence in adolescents in SSA.

### HIV/AIDS in sub-Saharan Africa

Of the estimated 34 million people living with HIV/AIDS worldwide, SSA bears the greatest burden of HIV/AIDS infections and is home to an estimated 23 million people living with HIV/AIDS (3). In 2011, there were an estimated 1.8 million new HIV infections in SSA representing a 25% decrease from the 2.4 million new infections in 2001(4). Additionally, between 2005 -2011 there was a 32% decrease in AIDS-related deaths. There have been concomitant increases in the number of people receiving anti-retroviral treatment (4). Yet despite these encouraging trends, there are approximately 1.8 million adolescents between the ages of 10-19 years old who are HIV infected in SSA (5). Worldwide, 41% of new HIV infections occur in adolescents between the ages of 15 and 24 years old. Almost 80% of these new infections occur in sub-Saharan Africa (6,7).There is a steep increase in HIV prevalence as adolescents transition to young adulthood (7). Moreover, adolescent girls are disproportionately affected, comprising 72% of adolescent HIV infections in SSA (7). Unlike most other areas of the world where HIV infections are confined to certain high-risk groups, such as sex workers, men who have sex with men and injection drug users; the HIV epidemic in SSA is largely a generalized epidemic. This means that while certain groups may still be at higher risk for infection, the overall prevalence of HIV is greater than one percent in the general population(8). In some sub-Saharan African countries the prevalence of HIV exceeds twenty percent (4). In generalized epidemics, most HIV transmission occurs through heterosexual sex between married or unmarried partners.

### The Kenyan Context

There are approximately 1.6 million people living with HIV in Kenya or 6.3% of the population, according to the 2011 National AIDS and STI Control Program (NASCOP) (9). HIV prevalence varies widely across the country. The majority of new HIV infections in Kenya occur through heterosexual contact. However, over one-third of new infections occur in high-risk groups, 15.2 % are men who have sex with men or prison populations, 14.2% are sex workers and their clients and 3.8% are injection drug users (9).

Nyanza province, located on Lake Victoria in the south west of Kenya has twice the national HIV prevalence at 13.9% (9). Most of Nyanza province is ethnically Luo. Some traditional Luo practices such as polygamy, widow inheritance, and ritual sex around funerals

have been associated with increased risk for HIV transmission (10). Furthermore, Luo men have historically been uncircumcised (10). Nyanza province has the lowest prevalence of male circumcision in the country at 48.2% compared to all other provinces in Kenya which have a male circumcision prevalence of over 80% (9). Other factors associated with HIV infection in this region are suboptimal condom use, multiple concurrent partners, mother-to-child transmission, gender inequalities, alcohol use, mobile populations including truck drivers and fisherman, lack of access to healthcare and untreated sexually transmitted infections (STIs) (11). These determinants of HIV prevalence can be understood within the context of the ecological model, which provides a framework for the multilevel factors that influence health outcomes.

## The Ecological Model

The ecological model was developed in the late 1970s by a psychologist, Urie Bronfenbrenner, to describe the multiple levels of influence on human development (12). Since then, the ecological model has been adapted by social epidemiology to describe the multi-level influences on health outcomes (13). The ecological model is particularly useful for describing the structural, social and individual factors that affect HIV risk in homeless adolescents. A 2004 review by Poundstone et al, explored the usefulness of applying the ecological model as a framework for research on HIV incidence (13). The figure below from their paper summarizes the key components that they identified within the structural, social and individual realms that influence HIV transmission dynamics and HIV population incidence (see Figure 1).

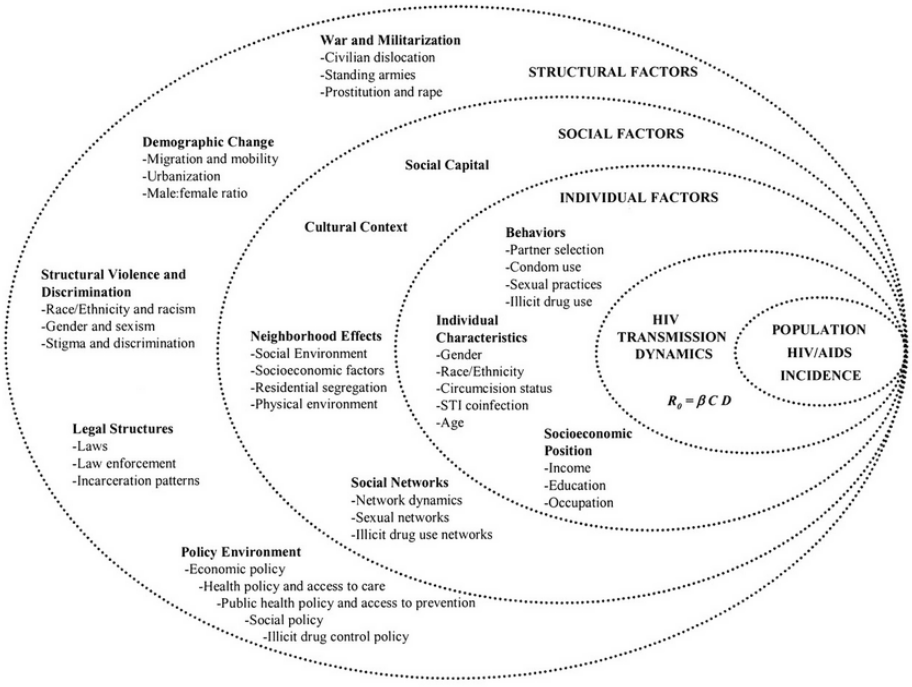


**Figure 1. Ecological Model of Population HIV/AIDS incidence from Poundstone 2004**

**Adolescent HIV in Southern/Eastern Africa and Kenya**

Adolescents experience many of the same risk factors for HIV as adults. For the purposes of this paper, adolescents are defined as those between the ages of 10-24. This wide range reflects the UNICEF designations of very young adolescents (ages10-14), older adolescents (ages 15-19), and young adults (ages 20-24) (7). Gender and age are important individual-level determinants of HIV in adolescents. There is a significant gender disparity in HIV prevalence, with young women more likely to be HIV infected than young men. This gender disparity is attributed to young women having sex with older, more sexually experienced men as well as biological differences that leave young women more vulnerable to HIV infection (10). According to 2011 national data, the HIV prevalence among Kenyan youth ages 15 to 17 was 0.5% in males and 2.8% in females; among youth ages18 to 19 it was 1% in males and 2.7% in females; among youth ages 20 to 22 it was 1% in males and 5.3% in females; and among youth ages 23 to 24 it was 2.4% in males and 8.3% in females (4,9,14).

These data, alongside data for men in Kisumu in Nyanza province, which found HIV seroprevalence was 4% in men aged 15 to 19 years old and 13% in men aged 20 to 24 years old, illustrate the increased risk associated with increased age (14). The gender disparity first seen in adolescence persists well into adulthood. A study in Asembo in Nyanza Province, found that women aged 13 to 34 years old had 12 times the HIV prevalence of men and that the gender disparity in HIV prevalence was present until the fourth decade of life (10).

Also at an individual level, multiple concurrent partnerships, older partners and low levels of condom use have all been linked to HIV transmission in youth (15). Early age of sexual debut has been linked to higher HIV prevalence (16). In a study in western Kenya, of those 13 to 19 years of age in the sample, 43.9% of females and 50.2% of males reported they had ever had sexual intercourse. The median age of sexual debut was 16.5 years for females and 15.5 years for males(10). However, despite this later sexual debut, young women still have higher rates of HIV infection. This may illustrate the importance of partner factors for HIV transmission in young women. Lack of access to treatment for sexually transmitted infections (STIs) has also been linked to increased HIV risk in adolescents compared to adults (17). Adolescents are also likely to have less familiarity with and more difficulty negotiating in health care systems (18).

Two protective factors against HIV infection are in-school status and educational attainment. Since the mid-1990s, HIV risk has become increasingly associated with low educational attainment (19). In particular, adolescents who remain in school are more likely to have delayed sexual debut and later marriage. These effects are particularly strong for girls, who are more likely to become infected at a younger age (16,17). One study of adolescents in rural South Africa examined the relationship of in-school status to HIV-risk behaviors and HIV seroprevalence (22). In the study, compared to out-of-school youth, both male and female students were more likely to have fewer numbers of lifetime partners, fewer older partners and less unprotected sex (22). Additionally, male students were less likely to be HIV infected than their out-of-school peers (22).

On a societal level, the HIV epidemic has led to widespread disruption of family structures and created unprecedented numbers of orphans. Traditionally, orphans in many parts of SSA were cared for by members of the extended family, including grandparents, aunts and uncles. The sheer number of orphans has overwhelmed these traditional structures and placed increased pressure on relatives who may themselves be elderly or ill. For example, in some areas of Western Kenya up to one-in-three children under the age of 18 had lost one parent and one-in-nine had lost both parents (23). Orphans are more likely to experience dramatically decreased social support, stigma and poverty, including reduced access to food, education and medical care (23–26).

Orphanhood is associated with increased risk for HIV infection. One meta-analysis of studies primarily conducted in SSA by Operario et al. found that HIV prevalence among orphans was 10.8% compared to 5.9% among non-orphaned youth (27). Studies have also shown that maternal orphans are at increased risk for HIV infection compared to paternal orphans (28). Interestingly, one recent study from Kenya found that it was not orphanhood per se that was associated with increased HIV-risk behavior, rather increased HIV-risk behavior was associated with spending the night away from the head of household (26). This indicates that addressing other types of family disruption may also help mitigate HIV risk.

Other societal level factors that are associated with HIV infection included overall HIV prevalence in the community and the prevalence of male circumcision and multiple concurrent partnerships. Male circumcision has been demonstrated to reduce a man's risk of acquiring HIV infection by as much as 60% (29,30). At a population level, higher prevalence of male circumcision is associated with lower HIV prevalence (31). There is a large literature on the association of multiple concurrent partnerships with increased population prevalence of HIV. Concurrency, as compared with serial monogamy, increases the likelihood of that HIV will be transmitted to other partners during the acute infection phase when viral loads are high (32). On a population level, this increases the size of sexual networks in which HIV infection can spread. Epidemiologic studies have documented that decreases in the number of concurrent partners has led to reduction in HIV prevalence (33). Despite numerous studies documenting the correlation of higher rates of sexual concurrency with higher HIV incidence, the degree to which multiple current partnerships are a driving factor behind the HIV epidemic in SSA remains controversial (34–37).

**Most-at-Risk-Populations and Orphans and Vulnerable Children**

In countries without generalized HIV epidemics, HIV infections are clustered in high-risk groups known as most-at-risk-populations (MARPs). However, it is important to still consider MARPs within the context of generalized epidemics (38). Traditionally, MARPs have included sex workers, men who have sex with men (MSM), injection drug users (IDU), prisoners and mobile populations such as migrant workers and truck drivers. The characteristics that distinguish MARPs as at increased risk for HIV infection are also often associated with stigmatizing or illegal behaviors (39). As a result, MARPs are not only more likely to acquire HIV infection, but they are also less likely to access HIV testing and treatment services for fear of discrimination and criminalization (38). A recent review of National Strategic Plans to address AIDS from 46 African countries examined the recognition of MSM as a high-risk group, as well

as strategies for addressing HIV in MSM. The report found that definitions of MARPs varied between countries and that most countries failed to acknowledge the roles that stigma and the criminalization of same sex practices play in driving the HIV epidemic among MSM. Furthermore, of those countries that did recognize the role of marginalization, only three recognized that it creates barriers to accessing care (41).

These findings have implications for how street youth are viewed with respect to HIV prevention and treatment programs. Several studies have found that street youth engage in many of the same high-risk behaviors as do other MARPs, including engaging in injection drug use, male same-sex practices and transactional sex which is defined as sex in exchange for money, food, shelter or protection (42,43). These behaviors augment the already significant discrimination that homeless adolescents face.

Orphans and vulnerable children (OVC) is a term that has arisen in the HIV literature to describe children who have been impacted by the HIV pandemic; however, the definition of this term remains somewhat unclear. Orphans are defined by UNICEF as children under 18 years of age who have lost one or both parents, with further breakdown into single (one parent) or double orphans (both parents) and maternal or paternal orphans (26) .Because the definition of "vulnerable children" is less specific, a 2006 study by Skinner et al. used focus groups in South Africa, Botswana and Zimbabwe to come up with a more systematic definition (44). The final definition of "vulnerable children" included children whose basic needs and rights were not being adequately met. It also identified individual factors (disability, HIV infection, family factors (poverty, inadequate caregivers) and community factors (unsafe environment, crime) associated with vulnerability (44). The definition also acknowledged that there were degrees of vulnerability and that vulnerability implied risk of long-term harm, including HIV infection.

Street youth clearly fall into the category of OVC and in the Skinner's study are ranked as one of the most vulnerable groups; however they are often not explicitly included in definitions of OVC used in other literature (44). For instance, in the background to Skinner's paper two out of four national definitions of OVC in SSA countries do not include street children and the USAID report on OVC in high HIV-prevalence SSA countries also did not include street children (44,45). Street children and youth are often caught between the two acronyms MARPs and OVC. They do not get specific attention when HIV prevention and care resources are allocated to address either of these priority groups. Explicitly including them in both of these categories has important policy implication for resource allocation and HIV prevention efforts.

**Characteristics of Homeless Children and Adolescents in Kenya and SSA**

Homeless youth are defined by UNICEF as either "of the street" or "on the street" (46). "On the street" youth still have ties to their families and may return home to sleep at night. "Of the street" youth have no ties to their families and live, sleep and work on the streets. "Of the street" youth compared to their housed or "on the street" peers are at increased risk for many negative outcomes including HIV (1,47,48). Most studies find that youth leave home around twelve years of age and that street youth in SSA are more likely to leave home at younger ages compared to street youth in other developed countries (49,50). Similar findings were seen in a medical camp for street children in Kisumu, Kenya

where average age was 15 years old (51). Studies of street youth in sub-Saharan African have documented that the majority of street youth are male (49,50,52,53). Again, of the 310 attendees at the medical camp, 306 were male and 4 were female (51).

Street children and youth are likely to be out of school and have low educational attainment (19,42,48,49,53). For instance, one study of "of the street youth" in Egypt found that while 60% of the sample had had some schooling, only 5% were still attending school (42). Similar numbers were seen in a study of street children from the Democratic Republic of Congo where up to 70% of participants had left school before completing their primary education (48).

Homeless adolescents in SSA are likely to have experienced economic deprivation, family disruption and orphanhood. Poverty is an important factor in the decision to leave home for the streets. One study among urban parents of street children in Nairobi found that lack of regular and adequate income compounded by lack of education or vocational skills, disability, alcoholism and lack of support from members of the extended family were factors that contributed to economic deprivation (54). Studies in South Africa, Nigeria and Ethiopia have also documented that the inability to provide for basic needs at home, such as food and clothing, is a common motive for street youth to leave home (19,49,53). Family disruption and conflict is another factor that is commonly reported by street children (55). One major source of family disruption is the death of a parent or caregiver. Orphanhood is a commonly shared characteristic of street children and youth. While the percentage of street children who are double orphans varies from around 7% in a study of Ethiopian street children to around 20% in a study of Kenyan street children, a much larger percentage of street children have lost at least one parent (49,54). The same Kenyan study found that 67% of children had lost at least one parent (54).

Rapid economic development and the loss of rural incomes have led to increased urbanization. This has created an environment where children are removed from the extended family who may have otherwise acted as social support or guardians (54). Political violence and social unrest have also contributed to family disruption. Additionally, street children report coming from homes headed by single parents, especially single mothers who do not have the resources to support them (19,53,54). A study of street children in Nigeria found that children may have also come from polygynous homes where either the death of their mothers or conflict over scarce resources has led to neglect or abuse (56). Furthermore, the death of a parent or guardian from HIV/AIDS and resulting stigma has also been associated with a move to the streets (54,57).

Violence, abuse or neglect at home constitute other major "push factors" in the trajectory of street youth (19,49,53–55,58). Push factors are experiences that lead children to the street, while pull factors attract children to street life (59). In her 1997 study, Suda describes the range of violence that street youth may have experienced at home including "verbal abuse, psychological or emotional abuse, sexual abuse, genital mutilation, rape, battery, prostitution, murder and economic deprivation" (54). Additionally, a more recent study in 2009 found that youth are more likely to run away from home if they experienced abuse or neglect (50). (McAlpine, et al., 2009). They also found that those who identified as "full time" street children were significantly more likely to have experienced abuse and lack of social support at home. Street children and

adolescents continue to experience stigma, abuse and violence after they transition to the streets. They are often viewed as criminal or nuisances. Ethnographic and epidemiological studies have documented high levels of police discrimination and violence (42,58,60). One study in Nigeria found that street youth engaged in high levels of what are deemed anti-social behaviors including, truancy, loitering, theft, drug use, transactional sex and fighting; however, at the same time these youth are also engaging in economically viable activities to provide for their basic needs (56). Many of the abovementioned distal and proximal factors that relate to risk of homelessness among children and adolescents in SSA can be integrated into the ecological model as seen below (Figure 2).

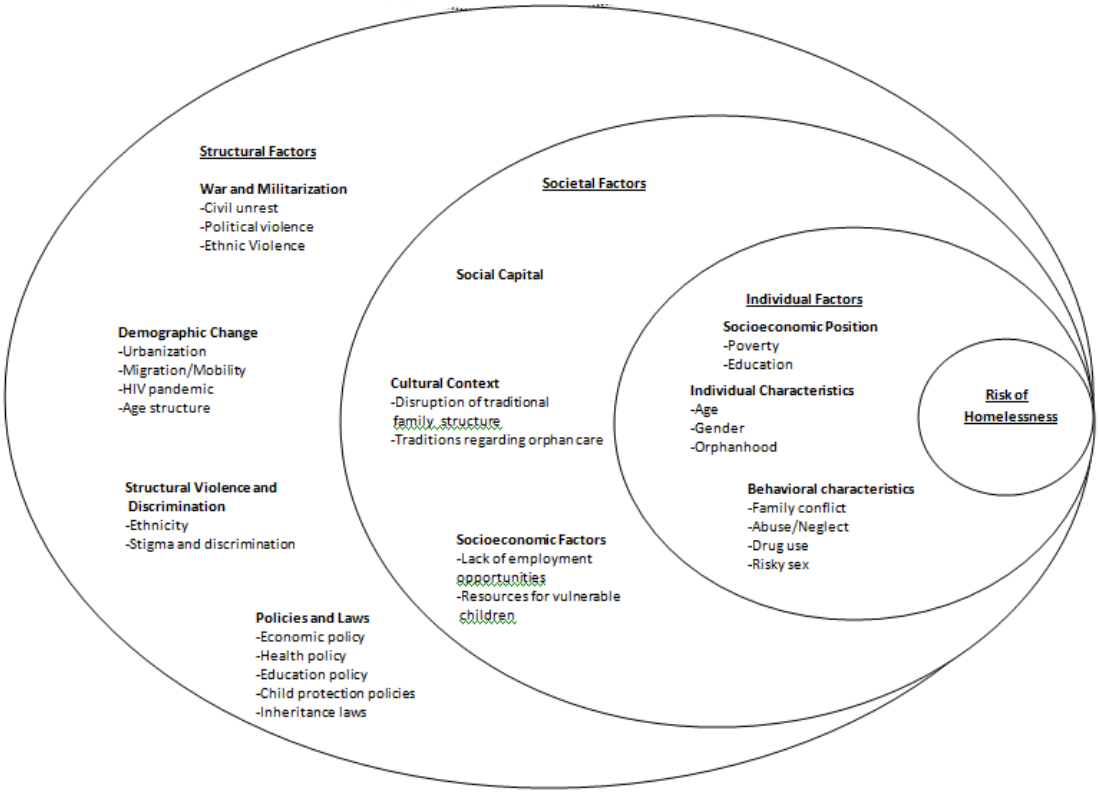


**Figure 2. Ecological model of the risk of homelessness among adolescents in SSA**

Once on the street, children and adolescents engage in various survival activities to sustain themselves. Survival activities include begging, garbage picking, selling waste paper or scrap metal, working as luggage porters, assisting bus drivers, guarding cars or market stalls, and engaging in theft and sex work (19,42,49,55,61). Many of these activities are stigmatizing and lead to harassment by the police or the public. In Kenya, a derogatory word for street children is "chokara" translated approximately from the Kiswahili as "pokers of dustbins and garbage heaps in search of food and other valuables"(55). After moving to the street, youth often join groups or gangs of other street youth. These groups provide economic and social support as well as a sense of belonging in an adoptive street family (61,62). Furthermore, the street gangs provide an introduction into street life and protection from police harassment (19,55).

Street youth are also burdened by many negative health morbidities. Street children and youth are often malnourished and may have stunted growth (1,63). Commonly reported illnesses include malaria, fevers, coughs and respiratory infections, scabies, other skin infections, dental carries, abdominal pain and diarrhea (1,47,54,57). Street youth also report STIs including gonorrhea, chancroid and herpes (1,56,64). Accidental injuries are also frequently reported (57,58,65). Street youth are prone to use self-care rather than seek medical care in Western or traditional health care systems and are only likely to seek medical care if their illness makes them unable to work (19,56,65).

**HIV in Homeless Youth in Africa**

Studies of HIV in street youth in sub-Saharan Africa have focused on their HIV knowledge, attitudes and beliefs, as well as HIV-related risk behaviors. Street youth in SSA have lower levels of knowledge and greater misconceptions about HIV transmission compared to their housed peers (52,66–68). Higher rates of knowledge about HIV are associated with older age and increased educational attainment (52). One study from Ghana found that only 54% of homeless adolescents perceived themselves to be at risk for contracting HIV, despite most of the sample having at least minimal knowledge of how HIV is transmitted (69). One reason they may not perceive themselves at risk for HIV infection is that day-to-day worries about food and shelter take precedence over concerns about HIV prevention (70).

Despite the hazards of orphanhood, sexual risk and drug use, there some protective factors that may mitigate HIV risk in homeless adolescents. Increased educational attainment and knowledge about HIV is protective. Studies in the general population of adolescents have shown that more education was associated with older age at sexual debut, increased condom use and later marriage (17,52). A study in the Democratic Republic of Congo, found that 70% of street children had left school before completing their primary education , while another study in Ghana found that 94% of street children were currently not attending school (52,69). An early study of street youth by Swart-Kruger and Richter found that increased knowledge of HIV was associated with both increased educational attainment and decreased HIV-risk behavior (70). Another study found that youth in shelters were less likely to engage in risk behavior, so shelters may offer an alternate protective environment for youth already on the street (47).

Homeless adolescents engage in high rates of sexual risk behavior; including many of the same risk factors for HIV that are seen in adults. These factors include multiple concurrent partnerships, low rates of condom use, the presence of other sexually transmitted infections and transactional sex. Early sexual debut is associated with increased risk for HIV infection. Most homeless adolescents have their sexual debut on the streets at younger ages than their housed peers (17,52,64). One study of street youth in Nigeria found that 14.2% of the sample had a history of STIs although these data were self report (56). Survival sex or transactional sex is common among street youth (48,64). Although boys are more likely to be street-based, girls are at greater risk than their male peers for sexual abuse and rape. They are also much more likely to engage in transactional sex (69). One study in Ghana found that 77% of girls had been sexually active while only 58% of boys were sexually active (69). Among a sample of Nigerian street youth aged 11 to 24 years old, 42.3% of males engaged in sex work and 11% had been raped,

while 100% of the girls in the sample engaged in sex work and 83.3% had been raped (56). A practice called "kunyenga" in which older more dominant youths will engage in forced anal sex with younger boys has also been documented in gangs of street youth (58,71). This practice is not viewed as sex, but rather as a means of initiation into a gang or as a way to establish dominance. As boys age, they transition from the "kunyenga" networks to heterosexual partnerships within larger sexual networks where the spread of HIV may be more likely (71). This transition period creates an opportunity for HIV transmission in homeless adolescents.

In addition to high sexual risk, street youth are also at increased risk for drug use, which may also increase their risk for HIV and other negative health outcomes. Homeless adolescents may engage in high-risk sexual behavior in order to get drugs (70). Studies have also found that street youth were more likely to engage in unprotected sex while under the influence of drugs (25,68,69). Compared to housed youth, both "on the street" and "of the street" youth have higher rates of drug use (47). Studies in Eldoret, Kenya, have shown that drug use was more prevalent in "of the street youth" compared to "on the street youth" with 83% and 56% reporting lifetime drug use respectively (25,47). Moreover, length of time on the street is correlated with increased drug use (47). Among homeless adolescents in the Americas and Eastern Europe injection drug use is a major mode of HIV transmission; however this is not true of homeless adolescents in sub-Saharan Africa (42,72,73). While use of injection drugs is currently almost nonexistent, street youth have been shown to have high rates of alcohol, tobacco and marijuana use (25,42). They also report use of solvents such as glue and local stimulants including khat and kola nut (42,47,68,73). Numerous studies document sniffing glue which is cheap and easily available as a way to abate hunger and loneliness (55,61,74).

Homeless adolescents are at increased risk for HIV compared to their housed peers however, there are no epidemiological studies that document HIV seroprevalence among homeless youth in SSA. Most studies that measured HIV seroprevalence in homeless adolescents are from Eastern Europe and the Americas, places where the demographics of the HIV epidemic are very different from the generalized heterosexual epidemics seen in SSA (40,72,75–77). One multicity seroprevalence study of HIV in homeless youth in Ukraine, found that 18% of those surveyed were HIV positive, more than ten times the prevalence among housed youth in Ukraine (78). HIV risk was similar across age groups, but was predicted by orphanhood, a longer length of time on the street, a history of anal sex, transactional sex, other STIs, and drug use especially injection drug use and needle sharing (78). A similar study in St. Petersburg, Russia used venue-based and convenience sampling to assess HIV prevalence in homeless adolescents and found it to be 37%, higher than other most-at-risk-populations in Russia (79). Again, independent predictors of HIV prevalence in the sample included injection drug use, inconsistent condom use, multiple partners and being a double orphan. This suggests that homeless youth in SSA may also suffer from disproportionate rates of HIV infection; however, research is lacking in this area.

**Challenges Studying Homeless Children and Youth**

Street youth are a hidden and hard-to-reach population and studies of street youth are hampered by the inability to gather a representative sample. Street youth are a transient population and no sampling frame exists as street youth are not captured in household or school-based population surveys (19,39,57). Current studies of street youth are often based on

convenience samples of youth who are more likely to be linked with service providers and may have different risk profiles compared to more marginalized youth (5,63).

Several strategies have been employed to try to overcome some of these difficulties. Snowball sampling also called chain referral identifies "seeds" in the population of interest to then recruit additional participants. This strategy has been used since the 1960s to sample hard-to-reach populations (39,80). Snowball sampling is limited because the initial seeds are not chosen randomly. The method still essentially yields a convenience sample (80). There have been several modifications made to snowball sampling, including targeted sampling and respondent-driven sampling. Targeted sampling involves ethnographic assessment of the population of interest and stratifying of seeds based on subgroups identified in that particular setting (39). Respondent-driven sampling uses a technique similar to snowball sampling, but uses Markovian modeling to adjust for the non-random selection of the seeds and their referrals(80,81).

Time-location sampling or venue-based sampling takes advantage of the fact that members of particular hidden populations may congregate at specific venues at particular times; for instance street youth at the central market or sex workers in red light districts (39,82). Preliminary ethnographic assessment to identify all the relevant venues is performed and then a random sample of venues and participants at those venues are selected (39). However, venue-based or time-location sampling is limited in that all members of a hidden population may not frequent that location. Despite the challenges of obtaining a representative sample of street youth, research is needed to inform effective interventions.

**HIV Interventions and Accessing MARPs and Homeless Youth**

There are scarce data on effective interventions that address HIV prevention in homeless youth in SSA. In a systematic review by Naranbhai et al, of the 255 studies globally that aimed to prevent HIV in homeless youth ages 12-24 with behavior change interventions, only three interventions were deemed rigorous enough to be included in the review. The included interventions were from the United States and were aimed at homeless youth who were also injection drug users (83). Given the risk and protective factors that are associated with HIV infection in homeless adolescents in SSA, new strategies must be explored.

There is some evidence that youth-led interventions offer the best way to reach adolescents who are developmentally more likely to be influenced by peers (84). Behavior change interventions generally aim to increase knowledge about how the virus is transmitted in an effort to decrease risk behavior including unprotected sex, transactional sex, multiple concurrent partnerships and drug use. Wutoh et al. found that those who did not perceive themselves at risk for HIV infection were more likely to engage in unprotected sex (69). However, an analysis by Richter and Swart-Kruger found that despite inadequate levels of knowledge about HIV, interventions that target only behavior change fail to address the extenuating circumstances that lead youth to engage in risk behavior (70).

School-based interventions designed to prevent HIV offer a model for preventing HIV transmission in homeless youth. In-school status is strongly protective of HIV infection; however

many street youth are out of school. One study randomized 12-14 year old Kenyan orphans into a program that paid school fees, provided school uniforms and had a case manager for each child. After one year, the program was successful at decreasing risk factors associated with HIV. Specifically those who were randomized into the intervention were still enrolled in school, less likely to be sexually active and were less likely to have attitudes that supported early sex. The intervention also increased feelings of social support and gender equity (21). Another similar study in Zimbabwe randomized orphaned sixth grade girls into a program to receive daily school feeding, uniforms, school fees as well as a "school based helper" to monitor attendance and troubleshoot problems. After 2 years, dropout rates had decreased by 82% and early marriage had decreased by 63% compared to controls (22). A study in Malawi provided conditional cash transfers to adolescent girls ages 13-22 and their families as long as the girls stayed in school. Although the study did not target sexual risk behavior directly, it did successfully reduce the odds of HIV transmission by 0.36 (95% CI 0.14–0.91) in the intervention arm (85). All of these studies targeted young adolescents in primary school before they began engaging in high risk behaviors. While school based programs are promising, they do not adequately address the fact that homeless adolescents are unlikely to be enrolled in school.

Community-level interventions offer a way to both prevent HIV and tackle some of the underlying factors that bring youth to the streets. One intervention in South Africa found that increasing cognitive social capital, defined as perceptions of trust and reciprocity among community members that enable them to address common concerns, was related to HIV prevention.(86) The study measured also measured structural social capital in villages by measuring social organizations such as religious affiliations, sports groups and economic groups. Individuals with higher levels of cognitive social capital were less likely to be HIV infected and more likely to actively participate in community mobilizations to address HIV prevention and stigma (86,87). Interventions such as these may be useful in improving support system in communities experiencing social disruption caused by HIV/AIDS.

Preventing HIV in homeless youth cannot be dealt with in isolation from addressing the factors that first lead adolescents to the streets. Economic vulnerability and food insecurity at home is a major factor behind moving to the street. Economic interventions can improve some of the underlying conditions that push adolescents toward the streets; however, they must be carefully designed. One study in Zimbabwe used an HIV educational intervention and microcredit for adolescent girls to start their own businesses. Although the educational component did increase knowledge about HIV; the study proved unsuccessful at improving economic outcomes and loan repayments at six months. Most importantly loans increased participant's vulnerability to physical harm, sexual abuse, coercion and HIV (88). Though not strictly aimed at homelessness, one study in Kenya called Shamba Maishia used microfinance initiatives to improve economic security in HIV positive farmers. The study was successful at increasing household incomes and improving food security (89). Additionally, USAID has identified that matched savings programs that target orphans and vulnerable youth have had success in improving attitudes around HIV and decreasing risk behavior (90).

Policies and laws also have an important role in ensuring the sustainability of interventions that address HIV risk in orphans and vulnerable children. The 2011 United Nations Human Rights Committee Resolution of the Rights of Street Children provides a legal ground for

interventions that ensure the rights of street children are protected (91). Integrated approaches toward interventions for street youth require the cooperation of both governmental and nongovernmental (NGO) organizations. An evaluation of programs for OVC found that those with strong collaborative ties between NGOs and governments were the most sustainable (92).

## Conclusion

Street children and youth constitute a vulnerable and at-risk population. They are likely to be marginalized and to have experienced stigma and abuse both before and after they transition to the streets. Street youth engage in behaviors that put them at an increased risk for HIV infection, including drug use and risky sex; however, their need to provide for their day-to-day survival trumps concerns about the long-term consequences of HIV infection. There is sparse research on street youth in SSA in part because of their status as a marginalized population and in part due to practical difficulties in sampling homeless youth. There is also a complete lack of HIV serostatus data from street youth in SSA, even though this population may be at increased risk for HIV infection. This lack of data and the lack of research surrounding modifiable factors that are associated with HIV infection urgently require further research in order to guide effective interventions.

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## Part 2: Prevalence and Correlates of HIV Infection Among Street Youth in Kisumu, Kenya

### Introduction

Street children and youth (SCY) are defined by UNICEF as either "of the street" or "on the street" (1). "On the street" youth retain ties to their families and may return home to sleep at night. "Of the street" youth have limited ties to their families and live, sleep and work on the streets. "Of the street" youth compared to their housed or "on the street" peers are at increased risk for many negative outcomes including HIV (2–4). The exact number of SCY worldwide is unknown and estimates vary widely (4). Their numbers are influenced by the rising pressures of rapid population growth in developing countries, poverty, urbanization, and the HIV/AIDS pandemic (5,6).

Prior to leaving home, SCY in sub-Saharan Africa (SSA) are likely to have experienced poverty, orphanhood, family disruption, neglect and abuse (6,7). Existing studies suggest that street youth leave home at approximately twelve years of age and that street youth in SSA are more likely to leave home at younger ages compared to street youth in developed countries (7,8). Studies of street youth in SSA have found that they are predominantly male (7–9). Children and adolescents who come to the street are likely to have experienced economic deprivation, including the inability of families to provide for basic needs such as food and clothing (6,10,11). SCY are also likely to have experienced emotional and physical abuse and neglect at home (6–8,10–12).These problems are often worsened by family disruption, commonly loss of a parent (6,8,12). Data from western Kenya suggest that up to one third of housed children had lost at least one parent (13). One study in Nairobi found that up to two-thirds of SCY in the sample had lost at least one parent (6). SCY are likely to come from homes with single parents or polygynous families where the death of the mother leads to conflict over limited resources (10,11,14). The death of a parent from HIV/AIDs and the resulting stigma is another reason that adolescents may come to the streets (6,15).

Once on the street, children and youth face continued deprivation, violence and vulnerability to negative health outcomes. Children and adolescents engage in various street survival activities in the informal or street economy to sustain themselves, including begging, garbage picking, selling recycling or scrap metal, working as luggage porters, assisting bus drivers, guarding cars or market stalls, as well as engaging in theft and sex work (7,12,16–19). Many of these activities are stigmatizing or illegal and lead to harassment by the police or the public. In Kenya, street children are known by the derogatory term "chokoraa" roughly translated from Kiswahili as "pokers of dustbins and garbage heaps in search of food and other valuables" (12). There is also considerable police violence and discrimination toward street youth (16,18,20). After moving to the street, youth often join groups or gangs of other street youth. These groups provide an introduction to street life, protection from harassment, economic and social support including a sense of belonging to an adoptive street family (12,17,21–23).

Accident and illness are common occurrences for children and youth on the streets. Street children and adolescents may be malnourished and may have stunted growth (4,24). Frequently reported illnesses include malaria, fevers, coughs and respiratory infections, scabies, other skin infections, dental carries, abdominal pain and diarrhea (2,4,6,15,24). Street youth in SSA also

report sexually transmitted infections (STIs) including gonorrhea, syphilis, chancroid and herpes. However, many of these studies employ self-report data; serologic or culture data are lacking (4,14,25). Overall, the hidden and transient nature of this population makes research challenging.

Current literature regarding HIV in SCY in SSA has focused on HIV-related attitudes, knowledge and risk behaviors. Studies have found that street youth in SSA have lower levels of knowledge and greater misconceptions about HIV transmission than their housed peers (9,26–28). Higher rates of knowledge about HIV were associated with older age and increased educational attainment and increased knowledge regarding HIV was associated with decreased HIV-risk behavior (9,27,28). However, studies have demonstrated street youth also have low levels of educational attainment. One study from the Democratic Republic of Congo reported that up to 70% of participants had not completed primary school, while another study in Ghana found that 94% of street children were currently not attending school (3,8,9,16,29). Additionally, many youth did not perceive themselves to be at risk for HIV infection (28–30). One reason for this was that day-to-day worries about food and shelter took precedence over concerns about HIV prevention (31). Street-based youth also have a high prevalence of orphanhood; being an orphan has been associated with increased risk of HIV infection, among both housed and homeless adolescents (6,32–34).

SCY engage in high rates of sexual risk behavior including early sexual debut, low rates of condom use, multiple partnerships and survival sex (defined as sex in exchange for money, food, shelter or protection). Homeless adolescents have their sexual debut on the streets and at younger ages overall than their housed peers (9,25,35). Street youth have low levels of condom use (3,9,30,36). Street youth are also likely to have multiple sexual partners (31,36). Survival sex is common among street youth (3,25). Although street-based children and youth are more likely to be boys, street-based girls are at greater risk than their male peers for sexual abuse and rape and are much more likely to engage in transactional sex (14,28–30). Among a sample of Nigerian street youth aged 11 to 24 years old, 42.3% of males engaged in sex work and 11% had been raped, while 100% of the girls in the sample engaged in sex work and 83.3% had been raped (14). Survival sex has also been documented among younger street boys who are raped by older youths in exchange for protection and admission into a group of street boys (18,23,37). In Kenya, this practice is called “kunyenga” in which older more dominant youths will engage in forced anal sex with younger boys (18,37). This practice is not viewed as sex, but rather as a means of initiation or as a way to establish dominance.

SCY have higher rates of substance use than do their housed peers, which may, in turn, increase their risk for HIV and other negative health outcomes. Homeless adolescents report both engaging in high-risk sexual behavior in order to obtain drugs and higher rates of risky sexual behaviors, including unsafe sex, when under the influence of drugs (28,29,38). Compared to housed youth, both “on the street” and “of the street” youth have higher rates of drug use and a longer length of time on the street is correlated with increased drug use (2,38). Among homeless adolescents in the Americas, Eastern Europe and Nepal, injection drug use is a major mode of HIV transmission (13,19,41). However, injection drug use is currently almost nonexistent among street youth in Western Kenya. Studies in the region have shown high rates of alcohol, tobacco and marijuana use among street youth (16,38). Youth also report use of inhalants such as

shoemaker's glue and fuel and of local stimulants including khat and kola nut (2,16,28,39). Sniffing glue is ubiquitous as it is inexpensive and an easily available way to abate hunger and loneliness (12,15,17,40,41).

Given the multiple barriers to studying SCY, HIV prevalence data about this population are sparse. Though sub-Saharan Africa has the greatest burden of HIV infection and of orphanhood globally, serologic data regarding the prevalence of HIV among SCY in this region are notably lacking. Studies of HIV prevalence in street youth in low-resource settings that employ serologic testing are primarily from Eastern Europe, Asia and the Americas (4,34,42–45). Data from Ukraine and Nepal document HIV prevalence in SCY that is ten to thirty times higher than the prevalence in the general population (42,43).

HIV infections are often clustered in high-risk groups known as most-at-risk-populations (MARPs). MARPs include sex workers, men who have sex with men, injection drug users, prisoners, and other mobile populations, such as migrant workers or truck drivers. The behaviors that place MARPs at increased risk for HIV infection are often highly stigmatized or illegal and consequently also decrease the likelihood that members of these populations will access HIV testing and care (46). SCY share many overlapping characteristics with recognized MARPs, including engaging in injection drug use, male same-sex practices and survival sex (16,47). These factors compound the already significant barriers street youth face in obtaining HIV testing and treatment. With this study we aimed to add to current knowledge about SCY in SSA by describing the prevalence and correlates of HIV infection in street youth in Kisumu, Kenya. Our previous work in this population suggests that infection risk among SCY will vary depending on whether they are engaging in more marginalized activities such a garbage picking or whether they may be involved in exploitative relationships with adults. We aim to elucidate how marginalization and coercion are associated with HIV infection and risk behavior.

## Methods

### Study Area and Population

We conducted our study in Kisumu, the capital of Nyanza Province, Kenya. Kisumu is the third largest city in Kenya. Nyanza province is located in southwest Kenya on the shores of Lake Victoria. With much of its economy based on subsistence farming, fishing and small-scale business, Nyanza is one of the poorest Kenyan provinces (33). The HIV prevalence in Nyanza province is 13.9%, approximately double the national average (48). In 2009, HIV seroprevalence among males aged 15 to 19 years old in Kisumu was 4% and among males aged 20 to 24 years old it was 13% (49) .

### Pilot study and Previous Work in the Community

The current study is informed by our previous ethnographic work in the community as well as by a pilot study conducted in 2009 (19,50). Our ethnographic work informed the choice of recruitment venues and variables of interest. The pilot study employed respondent-driven-sampling to recruit a sample of 66 SCY. Participants completed surveys and HIV and STI testing. The survey used in the current study was adapted from the pilot study survey, which was found to be acceptable and understandable to participants. The pilot study also demonstrated the feasibility and ethical acceptability of doing HIV testing in this population. Finally, our experience during the pilot study was that the compensation that SCY received for participation

was acceptable and not coercive. We also collaborated with local service providers to conduct a day-long camp in 2010 to provide medical and other services for 310 SCY (300 male) in Kisumu.

**Design and Sampling**

We recruited a cross-sectional sample of "of-the-street" youth from street venues to determine risk and protective factors for HIV infection. The study sample was stratified by age with quotas for the 13-15, 16-18 and 19-21 year old age groups to ensure adequate representation of harder-to-recruit older youth whom we hypothesized to be at greater risk for HIV infection. Participants completed a demographic and behavioral survey followed by voluntary counseling and testing (VCT) for HIV. Prior to the survey, participants were fingerprinted using Griaule Biometrics Fingerprint SDK software to prevent duplicate entry (51).

**Eligibility and Recruitment**

Participants were eligible for the study if they were between 13 and 21 years old and were considered "of the street" youth. For the study, we defined participants as "of the street" if they spent no more than three nights in the previous week with their parents or guardian. Participants were ineligible if they were too distressed to answer questions or if trained study staff determined that they were under the influence of drugs. Although gender was not an eligibility criterion, only one female was recruited during the study and was consequently excluded from the analysis.

We recruited participants in collaboration with outreach workers from local organizations serving street youth. Outreach workers identified recruitment sites frequented by street youth. Outreach workers recruited youth in the evenings during the two weeks the study was conducted. Youth were also recruited by informal peer referral. Participants were enrolled in the study after screening for age, "of the street" status, evidence of intoxication, and fingerprinting. Participants received a meal voucher for a local food vendor after completion of the interview.

**Data Collection**

Participants completed an interviewer-administered, computer-assisted 72-item survey. Youth could complete the survey in Kiswahili, Dholuo or English. The surveys were translated by a professional translator and tested with multilingual study staff. After survey completion, participants underwent voluntary counseling and testing for HIV (VCT). VCT was performed by Impact Research and Development Organization (Impact-RDO; http://www.impact-rdo.org). A finger-prick blood sample was obtained for the Determine (Abbott Laboratories, Illinois, USA) rapid HIV test. Participants who tested positive were referred to Tuungane Youth Clinic for confirmatory testing and initiation of care. Tuungane Youth Clinic is part of a collaboration between IRDO and the Kenya Medical Research Institute (KEMRI) to provide free youth–friendly HIV treatment and care services. After data collection, HIV test results were stored in the Impact-RDO database and matched to study participants by unique identification number.

**Measures**

The survey included measures of sociodemographics, family of origin, housing, street survival, sexual behaviors and drug use. HIV status was determined by the results of the initial rapid test.

Demographic variables included self-reported age, ethnicity, orphan status (both parents living/one parent living/both parents deceased), and educational attainment, recoded as less than or equal to grade five vs. greater than grade five (chosen as the cut-off because all should have completed grade 5 before the study and grade 5 was the median years of education in the sample).

Home life variables characterized youth's life before coming to the street, including items regarding parents' occupations, food security before coming to the street (three meals daily vs. less than three meals), the presence of electricity at home, and reasons for leaving home.

Street life variables included length of time on the street (recoded as less than one year vs. a year or more), shelter in the past seven days and street survival activities.

Survival activities over the past three months were selected from a list based on our prior ethnographic work. These included begging, garbage-picking, helping market vendors, working as a houseboy, working in beer halls, pickpocketing, acting as porters or "matatu touts" (assistants to informal bus drivers), and receiving money from family members or from strangers. To better characterize how the survival activities that participants engaged in may relate to their HIV risk, we created index variables for *marginalization* and *coercion*. The marginalization variable identified participants engaged in stigmatized survival behaviors associated with being street children, specifically garbage picking or begging. The coercion variable identified participants engaged in survival activities that rendered them particularly vulnerable to exploitation by adults, specifically working as houseboys or for market vendors.

Sexual behavior variables included whether youth had engaged in vaginal sex, insertive anal sex and receptive anal sex. For each behavior, youth were asked the following: whether they had ever engaged in the behavior, their age at debut, whether they had used a condom at last intercourse, whether the sex constituted survival sex, whether they had engaged in the behavior in the last three months, and, if so, with how many partners.

Drug use variables included frequency of alcohol and marijuana use in the last three months (less than weekly use/at least weekly use) and lifetime use of glue or fuel (ever used/never used). We solicited ever use of glue or fuel because they are highly stigmatized substances closely associated with being a street child or youth.

**Statistical Analysis**

HIV seroprevalence was calculated for the entire sample as well as for individual age categories. Confidence intervals were calculated using the Wilson Score Interval for small sample sizes. We anticipated small cell sizes because of the expected low prevalence of HIV in the sample based off estimates of HIV prevalence from the general population of males in this age range (52). A finite population correction was used to estimate confidence intervals for HIV seroprevalence over a range of estimates for the total population size of SCY in Kisumu (52). The finite population correction was used because we believe we sampled substantially more than five percent of the total population of SCY in Kisumu. Population estimates from service providers in Kisumu put the number of SCY in Kisumu between 500 and 1000 SCY on a given day. Because we had age quotas in the current study to oversample older youth, we also

calculated an age-weighted HIV seroprevalence with weights for age based on the 2010 medical outreach camp (53). The medical camp did not have any age quotas and provided a community-based sample for the distribution of ages of SCY in Kisumu.

Using logistic regression we assessed associations of predictor variables with HIV status and we used Fisher's exact tests to establish level of significance (54).

We used STATA SE/12.1 to perform our uni-variate and multivariate analyses. We considered results from Fisher's exact tests and bivariate logistic regression significant if they had a p-value $< 0.10$, given the lack of research in this population and anticipated small cell counts.

### Ethical Procedures

The study had ethical approval from the institutional review boards at the University of California at San Francisco (CHR #12-08728), the University of California, Berkeley and KEMRI. Study staff obtained written consent from participants using a consent form that was read in participants' preferred language (Kiswahili, Dholuo or English). Participants who were unable to sign their name made a mark in the presence of a witness. In addition, participants under 15 years old completed a short quiz to assess their understanding of the consent form. Participants who scored less than seventy percent on the quiz were told to return another day to retake the test, if they scored less than seventy percent on the repeat test they were excluded from the study. Kenya's National HIV testing guidelines allow for minors 15 years old or older to consent for VCT (55). Additionally, the national guidelines have a provision for mature minors, meaning that minors under the age of 15 may consent to VCT if engaged in behavior that puts them at risk for HIV infection.

## Results

### Demographic Characteristics

We recruited 300 youth. Demographic results are shown for the 296 male participants for whom HIV test results were available in Table 1. Results for four youth could not be accurately linked to the Impact-RDO database, including results for one positive youth. These four youth were dropped from the final study sample used for analysis.

The majority of the sample was Luo, consistent with the ethnic make-up of Nyanza Province. Sixty-six percent of the sample was orphaned, with 37% having lost one parent and 29% having lost both parents. The median years of school completed was five, corresponding to having less than a primary school education; only seven participants were currently in school. Most participants came to the streets from within Nyanza province, with 29% from Kisumu and 39% from neighboring communities, 31% were from outside of Nyanza province.

| Table 1: Sociodemographic characteristics N=296 | n(%) |
|---|---|
| **Ages** | |
| 13-15 | 81 (28) |
| 16-18 | 113 (38) |
| 19-21 | 101 (34) |
| **Orphan status** | |
| Both parents living | 75 (25) |
| Single orphan | 110 (37) |
| Double orphan | 85 (29) |
| Did not respond | 26 (9) |
| **Educational Attainment** | |
| ≤ grade 5 | 149 (50) |
| > grade 5 | 128 (43) |
| Did not respond | 19 (6) |

**Home Life and Reasons for Leaving**

Home life and reasons for leaving are summarized in Table 2. Thirty two percent of participants ate fewer than three meals a day before they left home. Only 16% of participants came from homes with electricity. Participants reported that their mothers were employed as urban laborers (such as domestic workers; 41%), small-scale market vendors (34%), and peasant farmers (11%), while few were professionals (such as teachers; 4%). Similarly, participants reported that their fathers were employed as urban laborers (such as security guards; 24%), peasant farmers (13%), and small-scale market vendors (10%), while some were skilled laborers (such as mechanics; 25%) and few were professionals (such as teachers; 8%).

Youth were invited to cite their top two reasons for leaving home. The most commonly reported reason for leaving home was family conflict (49%). Other commonly cited reasons for leaving home included death or illness of parent (36%), poverty at home (15%), not feeling safe (15%), and inability to attend school (12%).

| Table 2: Home Life N=296 | n(%) |
|---|---|
| **Electricity at home** | |
| Yes | 48 (16) |
| No | 243 (82) |
| Did not respond | 5 (2) |
| **Three meals/day at home** | |
| Yes | 195 (66) |
| No | 95 (32) |
| Did not respond | 6 (2) |
| **Mother's Occupation** | |
| Small scale business | 100 (34) |
| Urban laborer | 41 (14) |
| Peasant farmer/agricultural laborer | 31 (11) |
| Housewife | 15 (5) |
| Professional | 13 (4) |
| Unknown | 83 (28) |
| **Father's Occupation** | |
| Urban laborer | 70 (24) |
| Skilled Laborer | 40 (14) |
| Peasant farmer/agricultural laborer | 37 (13) |
| Small scale business | 29 (10) |
| Professional | 23 (8) |
| Unemployed | 8 (3) |
| Unknown | 75 (25) |
| **Reasons For Leaving home*** | |
| Family conflict | 144 (49) |
| Death/illness of a parent | 108 (36) |
| Poverty | 43 (15) |
| Did not feel safe | 46 (15) |
| Unable to attend school | 35 (12) |
| Just felt like it | 21 (7) |
| Too much responsibility | 15 (5) |
| Abandoned | 10 (3) |
| Peer pressure | 3 (1) |
| Stigma | 2 (1) |
| Witchcraft | 2 (1) |
| * Participants could choose two options. | |

**Street Life**

Characteristics of life on the street are illustrated in Table 3. The majority of the sample (72%) had been on the street for a year or more. Most participants reported having slept outside in the past week (80%). A smaller number of participants reported spending a night in the last week in a vehicle or an abandoned building (18%), in rented rooms (10%) or in other places,

including with a family member, with a stranger, in the youth detention center, or a shelter. Most participants were engaged in at least two survival activities. Garbage picking (55%), helping market vendors (55%) and working as porters or "matatu touts" (assistants to the informal bus drivers who load people on buses and collect fare) (46%) were the most commonly reported survival activities.

| **Table 3: Street Life N=296** | **n(%)** |
|---|---|
| **Time on the Street** | |
| < 1 year | 78 (26) |
| ≥ 1 year | 213 (72) |
| Did not respond | 5 (2) |
| **Sleeping Places in the last 7 days*** | |
| Outside | 238 (80) |
| Abandoned building/vehicle | 54 (18) |
| Rented house | 27 (10) |
| Shelter | 10 (3) |
| Stranger | 9 (3) |
| With family/adult guardian | 8 (3) |
| Remand center/prison | 3 (1) |
| **Street Survival Activities*** | |
| Garbage picking | 164 (55) |
| Helping market vendors | 162 (55) |
| Porters/Matatu touts | 136 (46) |
| Begging | 48 (16) |
| Money from strangers | 21 (7) |
| Houseboy | 12 (4) |
| Working in beer halls | 12 (4) |
| Pickpocketing | 8 (3) |
| Money from family | 8 (3) |
| *Participants could choose more than one option | |

**Risk Factors for HIV**

Behavioral risk variables are presented in Table 4. Most of the participants in the sample were circumcised (74%). Overall, 49% of participants reported at least weekly alcohol use and 32% of participants reported at least weekly marijuana use. Forty six percent of the sample reported ever using glue and 8% of the sample reported ever huffing fuel.

Seventy-nine percent of participants had ever had vaginal sex, with 49% of those having had vaginal sex in the preceding three months. Only 26% of participants reported condom use at last vaginal intercourse. The median age of sexual debut for vaginal sex was 14 years old with a range of 7 to 20 years old. The median number of partners in the last three months was two. Six percent of participants who had ever had vaginal sex reported having engaged in vaginal survival sex.

Nineteen participants (6%) reported ever engaging in insertive anal sex. Of those, 12 reported insertive anal intercourse in the past three months and 2 had used a condom at last insertive anal intercourse. The median age of sexual debut for insertive anal intercourse was 16.5 years old with a range of 13-20 years old. Four participants (21%) who had ever had insertive anal sex reported insertive anal survival sex.

Twenty-three participants (8%) reported ever engaging in receptive anal sex. Of those, 11 reported receptive anal intercourse in the past three months and 1 had used a condom at last receptive anal intercourse. The median age of sexual debut for receptive anal intercourse was 13.5 years old with a range of 7-18 years old. Five participants (22%) who had ever had receptive anal sex reported receptive anal survival sex.

| **Table 4. Selected Risk Factors for HIV** | **n (%)** |
|---|---|
| Circumcised | 219 (74) |
| **Substance Use** | |
| ≥ weekly alcohol use | 144 (49) |
| ≥weekly marijuana use | 95 (32) |
| Glue use ever | 137 (46) |
| Fuel use ever | 24 (8) |
| **Vaginal Sex** | |
| Vaginal sex ever | 233 (79) |
| Vaginal sex in the last 3 months* | 114 (49) |
| Condom at last vaginal intercourse* | 60 (26) |
| Median at first vaginal sex* | 14 (7-20) |
| Median number of vaginal sex partners* | 2 (1-15) |
| Vaginal exchange sex* | 15 (6) |
| **Insertive Anal Sex** | |
| Insertive anal sex ever | 19 (6) |
| Insertive anal sex in the last 3 months† | 12 (63) |
| Condom use at last insertive anal intercourse† | 2 (11) |
| Median at first insertive anal sex† | 16.5 (13-20) |
| Median number of insertive anal sex partners† | 1.5 (1-5) |
| Insertive anal exchange sex† | 4 (21) |
| **Receptive Anal Sex** | |
| Receptive anal sex ever | 23 (8) |
| Receptive anal sex in the last 3 months‡ | 11 (48) |
| Condom use at last receptive anal intercourse‡ | 1 (4) |
| Median at first receptive anal sex‡ | 13.5 (7-18) |
| Median number of receptive anal sex partners‡ | 2.5 (1-4) |
| Receptive anal exchange sex‡ | 5 (22) |
| * % of those reporting vaginal sex<br>† % of those reporting insertive anal sex<br>‡ % of those reporting receptive anal sex | |

**HIV Prevalence**

HIV prevalence is summarized in Table 5. There were 12 participants who tested positive for HIV, yielding a prevalence of 4.05% with a 95% confidence interval (CI) of 2.33-6.95%. Age-group specific HIV prevalence estimates did not vary significantly (p=0.206). When the HIV prevalence was calculated using the weighted age from the previous medical camp the overall prevalence was 2.82% (95% CI: 0.93-4.72%). Results from finite population calculations with estimated total population sizes of 500 and 1000 did not significantly change the confidence intervals for the HIV prevalence calculated from the sample overall.

| **Table 5. Prevalence of HIV** | **HIV Positive n (%)** | **95% CI (%)** |
|---|---|---|
| Entire sample (N=296) | 12 (4.05) | 2.33-6.95 |
| Ages 13-15 (n=82) | 1 (1.22) | 0.21-6.59 |
| Ages 16-18 (n=113) | 7 (6.19) | 3.03-12.24 |
| Ages 19-21 (n=101) | 4 (3.96) | 1.55-9.74 |
| Age-weighted by medical camp data | 12 (2.82) | 0.93-4.72 |
| **Finite Population Calculation** | | |
| Estimated N=500 | 12 (4.05) | 2.61-5.49 |
| Estimated N=1000 | 12 (4.05) | 2.17-5.94 |

**Correlates of HIV Infection**

The sociodemographic and home life correlates of HIV infection are summarized in Table 6. No sociodemographic or home life predictors were significantly associated with HIV infection.

**Table 6. Logistic regression analysis of Sociodemographic and Home Life Correlates of HIV Infection**

| Variable | HIV – (n) | HIV + (n) | P-value* | Unadjusted OR (P-value) |
|---|---|---|---|---|
| Age | | | 0.206 | |
| 13-15 | 81 | 1 | | ref |
| 16-18 | 106 | 7 | | 5.4 (0.120) |
| 19-21 | 97 | 4 | | 3.3 (0.285) |
| Orphan status | | | 0.917 | |
| Both parents living | 72 | 3 | | ref |
| Single orphan | 109 | 6 | | 1.3 (0.700) |
| Double orphan | 82 | 3 | | 0.9 (0.876) |
| Did not respond | 21 | 0 | | -† |
| Educational Attainment | | | 0.778 | |
| ≤ grade 5 | 142 | 7 | | ref |
| > grade 5 | 123 | 5 | | 0.8 (0.747) |
| Did not respond | 19 | 0 | | -† |
| Electricity at Home | | | 0.966 | |
| No | 233 | 10 | | ref |
| Yes | 46 | 2 | | 1.0 (0.987) |
| Did not respond | 5 | 0 | | -† |
| 3 meals/day | | | 0.639 | |
| Yes | 188 | 7 | | 0.7 (0.504) |
| No | 90 | 5 | | ref |
| Did not respond | 6 | 0 | | -† |

*Fisher's exact test
† not estimated due to zero cell

The associations between street life variables and HIV infection are presented in Table 7. Length of time on the street was significantly associated with HIV infection (p=0.077). All youth who tested positive had been on the street for at least one year. Type of shelter in the past week was not associated with HIV infection. Working as a houseboy was associated with increased odds of HIV infection (unadjusted OR 5.4, p=0.044), as was helping market vendors (unadjusted OR 9.4, p=0.033). None of the other listed survival activities were significantly correlated with being HIV-positive. No youth who reported begging, pickpocketing or receiving money from family as survival activities tested positive for HIV infection.

| Table 7. Logistic regression analysis of associations between Street Life and HIV Infection (N=292)* | | | | |
|---|---|---|---|---|
| **Variable** | **HIV – (n)** | **HIV + (n)** | **P-value†** | **Unadjusted OR (P-value)** |
| Time on the Street | | | 0.077 | -‡ |
| < 1 year | 78 | 0 | | |
| ≥ 1 year | 201 | 12 | | |
| Begging | | | 0.264 | --‡ |
| Yes | 48 | 0 | | |
| No | 232 | 12 | | |
| Garbage picking | | | 0.473 | |
| Yes | 159 | 5 | | 0.5 (0.308) |
| No | 121 | 7 | | ref |
| Helping market vendors | | | 0.030 | |
| Yes | 151 | 11 | | 9.4 (0.033) |
| No | 129 | 1 | | ref |
| Porter/ Matatu Tout | | | 0.485 | |
| Yes | 132 | 4 | | 0.6 (0.354) |
| No | 148 | 8 | | ref |
| Houseboy | | | 0.132 | |
| Yes | 10 | 2 | | 5.4 (0.044) |
| No | 270 | 10 | | ref |
| Money From Strangers | | | 0.391 | |
| Yes | 19 | 2 | | 2.8 (0.212) |
| No | 261 | 10 | | ref |
| Working in beer halls | | | 0.493 | |
| Yes | 11 | 1 | | 2.2 (0.463) |
| No | 269 | 11 | | ref |
| Money From Family | | | 0.768 | --‡ |
| Yes | 8 | 0 | | |
| No | 272 | 12 | | |
| Pickpocketing | | | 0.768 | --‡ |
| Yes | 8 | 0 | | |
| No | 272 | 12 | | |
| *4 participants were excluded due to non-response<br>†Fisher's exact test<br>‡ Not estimated due to zero cell | | | | |

Risk behavior correlates of HIV infection are displayed in Table 8. Drug use was not significantly associated with HIV infection. Although not statistically significant, all those who tested positive for HIV had engaged in vaginal sex. Having ever had insertive anal sex was associated with an odds ratio of 13.6 of being HIV-infected ($p<0.001$). Having ever had receptive anal sex was associated with 4.3 times increased odds of HIV infection ($p=0.038$). Condom non-use and survival sex were not associated with increased risk of HIV infection.

| Table 8. Logistic Regression Analysis of Risk Behavior Correlates of HIV Infection | | | | |
|---|---|---|---|---|
| **Variable** | **HIV – (n)** | **HIV + (n)** | **P-value*** | **Unadjusted OR (P-value)** |
| ≥ weekly alcohol use | | | 0.246 | |
| Yes | 136 | 8 | | 1.4 (0.479) |
| No | 138 | 4 | | ref |
| Did not respond | 10 | 0 | | -† |
| ≥weekly marijuana use | | | 0.259 | |
| Yes | 89 | 6 | | 2.4 (0.169) |
| No | 174 | 5 | | ref |
| Did not respond | 21 | 1 | | 1.7 (0.652) |
| Glue use ever | | | 0.884 | |
| Yes | 132 | 5 | | 0.7 (0.608) |
| No | 136 | 7 | | ref |
| Did not respond | 16 | 0 | | -† |
| Fuel use ever | 262 | 10 | 0.447 | |
| Yes | 22 | 2 | | 2.3 (0.305) |
| No | 228 | 9 | | ref |
| Did not respond | 34 | 1 | | 0.8 (0.783) |
| Vaginal sex ever | | | 0.236 | -† |
| Yes | 221 | 12 | | |
| No | 60 | 0 | | |
| Did not respond | 3 | 0 | | |
| Insertive anal sex ever | | | **0.001** | |
| Yes | 14 | 5 | | **13.6 (0.001)** |
| No | 267 | 7 | | ref |
| Did not respond | 3 | 0 | | -† |
| Receptive anal sex ever | | | **0.089** | |
| Yes | 20 | 3 | | **4.3 (0.038)** |
| No | 260 | 9 | | ref |
| Did not respond | 4 | 0 | | -† |
| *Fisher's Exact Test<br>†Could not be calculated due to zero cell | | | | |

**Correlates of Coercion and Marginalization**

Correlates of coercion and marginalization are presented in Table 9. Coercion was defined as working as a houseboy or for a market vendor. Ever using glue was significantly associated with increased odds of coercion (unadjusted OR=1.7, p=0.030). Having ever engaged in insertive anal sex was significantly associated with coercion (unadjusted OR=4.1, p=0.027). All youth who reported ever having engaged in receptive anal sex also engaged in survival activities associated with coercion (p=0.001). Testing positive for HIV was significantly associated with coercion (unadjusted OR=8.4, p=0.043). Having engaged in vaginal sex was not significantly associated with coercion.

Marginalization was defined as engaging in garbage picking or begging. Ever using glue was significantly associated with increased odds of marginalization (unadjusted OR=2.2, p=0.002). Marginalization was associated with reduced odds of ever having had vaginal sex (unadjusted OR=0.6, p=0.086). HIV infection was not associated with marginalization (p=0.230).

| Table 9. Logistic Regression Results for Associations of Coercion and Marginalization | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Coercion | | | | Marginalization | | | |
| **Variable** | **No (n)** | **Yes (n)** | **P-value*** | **Unadjusted OR (P-value)** | **No (n)** | **Yes (n)** | **P-value*** | **Unadjusted OR (P-value)** |
| Vaginal Sex ever | | | 0.186 | | | | 0.103 | |
| Yes | 92 | 140 | | 1.5 (0.149) | 98 | 134 | | **0.59 (0.086)** |
| No | 30 | 30 | | ref | 18 | 42 | | ref |
| Insertive anal sex ever | | | **0.017** | | | | 1.000 | |
| Yes | 3 | 16 | | **4.1 (0.027)** | 7 | 12 | | 1.1 (0.791) |
| No | 119 | 154 | | ref | 109 | 164 | | ref |
| Receptive anal sex ever | | | **0.001** | -† | | | 1.000 | |
| Yes | 0 | 23 | | | 9 | 14 | | 1.0 (0.940) |
| No | 122 | 146 | | | 107 | 161 | | ref |
| ≥ weekly alcohol use | | | 0.720 | | | | 0.276 | |
| Yes | 59 | 85 | | 1.1 (0.695) | 51 | 82 | | 0.8 (0.235) |
| No | 61 | 80 | | ref | 51 | 90 | | ref |
| ≥weekly marijuana use | | | 0.607 | | | | 0.795 | |
| Yes | 42 | 53 | | 0.9 (0.548) | 39 | 56 | | 0.9 (0.713) |
| No | 72 | 106 | | ref | 69 | 109 | | ref |
| Glue use ever | | | **0.039** | | | | **0.002** | |
| Yes | 48 | 89 | | **1.7 (0.030)** | 41 | 96 | | **2.2 (0.002)** |
| No | 68 | 74 | | ref | 68 | 74 | | ref |
| Fuel use ever | | | 0.670 | | | | 0.662 | |
| Yes | 9 | 15 | | 1.3 (0.617) | 9 | 16 | | 1.4 (0.510) |
| No | 101 | 135 | | ref | 95 | 141 | | ref |
| HIV positive | | | **0.017** | | | | 0.230 | |
| Yes | 1 | 11 | | **8.4 (0.043)** | 7 | 5 | | 0.5 (0.188) |
| No | 121 | 159 | | ref | 109 | 171 | | ref |

Do not add up to N=296 because participants could choose more than one answer, *Fisher's Exact Test
†Not estimated due to zero cell

## Discussion

The goals of this study were to describe the population of SCY in Kisumu, Kenya, and to determine the HIV seroprevalence and its correlates in this marginalized population. Our population of male SCY were primarily orphans, from poor backgrounds, who were literally homeless (sleeping outdoors), and living primarily by garbage picking, helping matatu (bus) drivers, or assisting market vendors. They exhibited high rates of alcohol, marijuana and glue use, the latter of which is rare among housed youth (4,56). Though their rate of HIV was not higher than the rates found among male adolescents in Kisumu, there were indications that some youth are at particularly high risk (57,58). These youth exhibited a constellation of risk factors which include having been on the street for a longer period of time, surviving through activities that are potentially coercive (houseboy and working for market vendors), receptive and insertive anal sex, and glue use (through its association with coercion and not directly through an increased risk of HIV infection).

A key strength of this study is that it is the first one that we know of that describes the HIV seroprevalence and its determinants in a population of street boys and youth in East Africa. However, this study has several limitations. The lack of a sampling frame, the use of age quotas and purposive sampling limit our ability to generalize our findings. The cross-sectional design of this study also limits our ability to elucidate temporal relationships. Survey questions are always susceptible to social desirability bias, especially sensitive questions about sexual behaviors and drug use. Furthermore, missing responses from participants and the inability to link four of the results from our community-based partner with our research database affected the completeness of our data. Given the context of the generalized epidemic in the population, it may be possible that vaginal sex presents a greater infection risk. However in this sample all participants who had tested positive for HIV had engaged in vaginal sex and thus vaginal sex could not be included in any regression models. Finally, the low prevalence of HIV in this sample limited our statistical power and our ability to conduct further sub-analyses.

Our participants came from backgrounds of relative deprivation and our findings echo others regarding why street children and adolescents may leave home (7,12,22). Consistent with other studies, SCY in our study experienced high levels of orphanhood and low levels of educational attainment. We found the prevalence of substance use in our sample to be consistent with that in other studies in SSA (38,39,59). It is notable that while alcohol, marijuana and glue use were common, no participants reported using injection drugs.

Most of the youth in our sample were sexually active and, consistent with other literature, we found that they engaged in multiple HIV-sexual-risk behaviors, including low rates of condom use, multiple partners and survival sex (3,9,29,36). Although fewer youth overall reported having engaged in any form of anal sex compared to vaginal sex, a greater percentage of youth engaging in anal sex reported having had anal sex in exchange for food, shelter, safety or other necessities, compared with the percentage reporting vaginal survival sex. We also found a relatively early age of sexual debut (14 for first vaginal intercourse) compared to the general population where the median age of first vaginal intercourse for males is 15.5 years old (9,25,57,58).

The HIV prevalence in our sample overlaps with the HIV prevalence estimate for in the general population of males in this age range of Nyanza province. This finding contrasts strongly with HIV serologic data on street youth from other regions of the world that have found dramatically increased risk of HIV in homeless youth relative to the general population of youth (34,42,43,45,60,61). These studies are from places where HIV infections are particularly clustered in MARPs. This is not the case in Kenya, which, like much of SSA, has a generalized HIV epidemic. The lack of injection drug use among street youth in Kisumu as well as their relative isolation from the general population may, in part, explain their lower than expected rates.

In contrast to other studies, which found a higher prevalence of HIV infection among orphans, orphanhood was not a risk factor for HIV in our study (32–34). It may be that we had such a high percentage of orphans in our sample that orphanhood did not differentiate risk. Another explanation may be that while orphanhood increases the risk that adolescents will end up on the streets, once they are there, youth's HIV risk is determined by other factors (2,8,22).

We found that length of time on the street was significantly associated with being HIV-positive. Robbins et al found a similar association between time on the street and the likelihood of being HIV-positive (42). All participants who tested positive for HIV had been on the street for at least one year. Although the study is cross-sectional, this seems to suggest that youth become HIV positive once on the street, rather than coming to the street because they are HIV positive due to vertical transmission or prior risk behavior, a common popular belief. This suggests that for the vast majority of youth, being on the street provides a window of opportunity to prevent infection, primarily by removing youth from the street. However, given that the majority of youth are literally homeless (sleeping outdoors) and given findings elsewhere suggesting that youth in shelters were less likely to engage in risk behavior, shelters may offer protective environment for youth already on the street (2).

We also found that survival activities, such as being a houseboy or helping market vendors, were related to increased likelihood of HIV infection. These survival activities may be associated with sexual exploitation including coercive anal sex. It is possible that consensual or coercive sexual relationships between female market vendors and street youth may be implicated in HIV transmission among networks of street youth. The relationship between these survival activities and HIV infection deserves further exploration. Intervening in these possibly exploitative relationships, by providing alternative ways for SCY to generate income, may help prevent HIV transmission.

Unlike other studies, substance use in this sample was not correlated with HIV infection, possibly reflecting the lack of injection drug use. However, we found that both insertive and receptive anal sex were highly correlated with HIV infection. Our previous unpublished ethnographic research in this setting suggests that anal sex among street boys is almost always coercive (19). It is not viewed as sexual activity, but rather is used as a means of initiation or asserting dominance in groups of street youth. These findings are consistent with Lockhart's descriptions of "kunyenga" in Mwanza, Tanzania (not far from Nyanza Province), as well as ethnographic findings from Malawi (23,37). Lockhart also found that older youth transition from the isolated "kunyenga" networks to heterosexual partnerships within larger sexual networks

where the spread of HIV is more likely. This transition period creates an opportunity for HIV transmission in networks of street boys (37). The increased risk of HIV infection associated with anal sex in this study suggests that these networks may not be isolated. However, we do not have enough information to determine whether most HIV transmission occurred through heterosexual transmission from the general population or within isolated networks of street boys.

The coercion and marginalization categories were created to examine how survival activities may be associated with different trajectories of risk. While HIV infection was associated with coercion, there was no relationship between HIV and marginalization. It may be that the street youth engaging in the stigmatized behaviors associated with marginalization may be so isolated from the general population that they are actually protected from HIV infection in the context of a generalized, primarily heterosexually-transmitted epidemic. This is suggested by the fact that marginalized youth had significantly reduced odds of ever having vaginal sex. Interestingly, glue use was associated with both marginalization and coercion. The use of inhalants such as glue has been widely documented in SCY (4,17,38,39,44). The association of glue with marginalization is consistent with the stigmatized image of "chokoraa" or a youth picking through garbage, a bottle of glue not far from his nose or mouth (12). The association of glue with coercion and coercion's relationship with anal sex is also strengthened by our previous ethnographic work. In qualitative interviews, street boys describe younger boys or boys new to the street being intoxicated by assailants or given glue in exchange for sex with older street-based youth "base" leaders or by adult men in the community. In this study the median age and range for receptive anal sex debut was younger than that of the median age and range for debut of insertive anal sex, again suggesting that older boys are coercing younger boys to engage in anal sex. This behavior may contribute to transmission of HIV infection among street youth. Interventions addressing glue use including policies restricting the sale of shoemaker's glue, may have important consequences for improving the health of street youth (38).

**Conclusion**

Results from this study show that the prevalence of HIV among street youth is comparable to HIV prevalence among the general population in Kisumu. However given the vulnerability of SCY to exploitation, their circumstances deserve attention. Several factors are associated with HIV status, among them length of time on the street, helping market vendors or working as houseboys and engaging in insertive and receptive anal sex. Interventions that address SCYs' susceptibility to exploitation, including providing them with alternative income-generating activities and possibly limiting access to inhalants, are necessary to reduce HIV transmission in this population. SCY are a vulnerable and neglected population to date in HIV prevention research in SSA. We hope that is study opens avenues for further research and intervention to promote their health, wellbeing, and re-integration into their community.

**Abbreviations**
HIV – human immunodeficiency virus
Impact-RDO – Impact Research and Development Organization
MARPs- most-at-risk populations
SCY- street children and youth
SSA – sub-Saharan Africa
STIs- sexually transmitted infections
VCT- voluntary counseling and testi

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