

**TRANSACTIONAL SEX AND HIV AMONG MEN IN RAKAI, UGANDA:
A MIXED METHODS STUDY**

by
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Abstract

Background: Addressing HIV risk associated with transactional sex (relationships motivated by implicit material exchange for sex) is important in curbing sub-Saharan Africa's generalized HIV epidemic. Research on the relationship between transactional sex and HIV among men is limited. This mixed methods study aimed to understand characteristics of men who engage in transactional sex, their risk for HIV acquisition and onward transmission of HIV, and how to best measure transactional sex.

Methods: We used data from the Rakai Community Cohort Study (RCCS), an open, population-based cohort study in Rakai District, Uganda to examine prevalence of HIV and viremia among 7,678 men by self-reported transactional sex and HIV incidence among 7,762 men who were HIV-negative at baseline by self-reported transactional sex over four person-intervals. In-depth interviews (IDI) were conducted with men (N=26) who did (n=21) and did not (n=5) report transactional sex in the RCCS. Cognitive interviewing IDIs were used to examine men's understanding of three transactional sex measures and explored changes in transactional sex relationships during the COVID-19 pandemic. Data were analyzed thematically.

Results: Prevalence of transactional sex among men was 9%. Overall, transactional sex was not associated with prevalence of HIV (adjusted prevalence risk ratios (adjPRR):1.04;95%CI:0.87,1.18) or viremia (adjPRR:1.05; 95%CI:0.81,1.37). However, prevalence of viremia was higher among boda boda drivers who engaged versus did not engage in transactional sex (adjPRR:2.46;95%CI:1.11,5.47). We observed a positive, but

non-statistically significant effect of transactional sex on HIV incidence (adjIRR:1.50;95% CI:0.86,2.61). Cognitive interviews revealed that the measure used in quantitative analyses may have misclassified some transactional relationships and underestimated transactional sex prevalence. An improved measure developed by Wamoyi and colleagues performed well in identifying transactional sex. Economic insecurity and restricted mobility during Uganda's COVID-19 lockdowns led to the dissolution of many transactional sex relationships, illustrating a strong link between material provision and the formation and continuation of transactional sex relationships.

Conclusion: This mixed methods study provides insight into multiple facets of the relationship between transactional sex and HIV outcomes. Our findings highlight the importance of using improved transactional sex measures and the need for a more nuanced conceptualization of men's participation in transactional sex.

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List of terms and abbreviations

AGYW	Adolescent girls and young women
AIDS	Acquired immune deficiency syndrome
ART	Antiretroviral therapy
CI	Confidence interval
COVID-19	Coronavirus disease 2019
FSW	Female sex worker
HIV	Human Immunodeficiency virus
IDI	In-depth interview
IMF	International Monetary Fund
IPV	Intimate partner violence
IRB	Institutional review board
IRR	Incidence rate ratio
PrEP	HIV pre-exposure prophylaxis
PRR	Prevalence risk ratio
RHSP	Rakai Health Sciences Program
RCCS	Rakai Community Cohort Study
STI	Sexually transmitted infection
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organization

Chapter 1. Introduction

1.1 Background

The HIV epidemic in sub-Saharan Africa – which accounts for 60% of new HIV infections globally – is driven primarily by heterosexual transmission (1). Among heterosexual partnerships, those motivated by the implicit exchange of sex for material benefit are common. Such relationships may help to explain the disproportionate burden of HIV among adolescent girls and young women (AGYW), thus generating substantial research interest and programmatic investments. However, considerably less attention has focused on men’s risk for HIV acquisition and onward transmission in transactional sex relationships. Men who engage in transactional sex are an important group to understand in their own right and particularly if they are the sexual partners of at-risk AGYW. Men’s practice and associated HIV risks need to be examined in order to address these risks in transactional sex relationships and effectively include men in prevention strategies.

Epidemiologic evidence for the association between transactional sex and HIV among men, however, remains limited. A 2016 systematic review identified eight studies measuring the association between transactional sex and HIV in men. The strength and direction of associations in the included studies were heterogenous and the relationship between transactional sex and HIV among men was deemed inconclusive. Authors attributed these inconclusive findings to inconsistent transactional sex measurement and the tendency to conflate transactional sex with commercial sex work (2). Our

understanding of the causal effect of transactional sex and HIV is even more limited. Even among AGYW, few studies have examined the causal effect of transactional sex on HIV acquisition (3-5) or potential causal pathways in this relationship (6, 7). Apart from one longitudinal study (5), which reported a positive but non-statistically significant association between relationships where food was exchanged for sex and incident HIV, prospective studies evaluating the effect of transactional sex on risk for HIV acquisition and potential causal mechanisms are nonexistent.

Understanding the context for transactional sex is critical for developing effective interventions to address HIV risk in these relationships. Policies implemented to prevent the spread of COVID-19, such as Uganda's 2020 and 2021 lockdowns, changed the social and economic landscape for transactional sex. Men and women alike experienced reduced mobility, job loss, and food insecurity during lockdowns which likely had an impact on sexual behaviors, including engagement in transactional sex. To our knowledge, there have been no studies assessing men's engagement in transactional sex during the COVID-19 pandemic.

The overall goal of this research was to understand men who engage in transactional sex and their risk for HIV acquisition and onward HIV transmission. We sought to achieve this overall research goal through four aims:

1.2 Specific aims

1. To examine risk factors for transactional sex among men, characteristics of transactional sex relationships, and association with prevalence of HIV and viremia.

2. To estimate the causal effect of transactional sex on HIV incidence among men.
3. To compare men's understanding of three transactional sex measures using a cognitive interviewing approach.
4. To qualitatively explore the impact of COVID-19 policies on men's transactional sex relationships.

1.3 Organization of the dissertation

This dissertation is organized in eight chapters. Chapter 1 introduces the research aims. Chapter 2 provides context for the dissertation; it includes a literature review and describes the theoretical grounding that guides the research. Chapter 3 describes the study setting and methods used in this dissertation. Chapters 4 through 7 present the main dissertation findings. Chapter 4 describes risk factors for transactional sex among men, characteristics of transactional sex relationships, and associations with prevalence of HIV and viremia (Aim 1). Chapter 5 describes findings from a longitudinal analysis to estimate the causal effect of transactional sex on HIV acquisition among men (Aim 2). Chapter 6 describes the cognitive properties of three commonly used transactional sex measures (Aim 3). Chapter 7 qualitatively explores men's accounts of transactional sex during Uganda's COVID-19 lockdowns (Aim 4). Chapter 8 summarizes the key findings and conclusions, study strengths and limitations, program implications, and areas for future research.

Chapter 2. Literature Review

2.1 Gendered disparities in HIV outcomes in sub-Saharan Africa

There are more than 25 million people living with HIV in sub-Saharan Africa, representing two-thirds of the global total (1). Biological, social, and structural factors drive gendered inequalities in HIV incidence and HIV-related morbidity and mortality for both men and women (8-12). These factors have been well-documented for women and girls (11, 13-16). For example, harmful gender norms can undermine women's economic independence and reduce sexual agency, thereby increasing women's exposure to HIV (16-19). A number of resource-intensive interventions, including PEPFAR's \$800 million DREAMS intervention, have sought to address the social and structural inequalities that place AGYW at increased risk for HIV and target AGYW most vulnerable to HIV, such as those engaging in transactional sex (20, 21).

There has been significantly less focus on men and boys in HIV research and interventions (with the exception of research around male circumcision). UNAIDS refers to the lack of focus on men and boys as a "blind spot" in the response to HIV (22). Though women are more likely to acquire HIV, men are less likely to be diagnosed, seek treatment and more likely to die from the disease (23). In 2021 in Eastern and Southern Africa, only 71% of men living with HIV were on treatment compared with 83% of women and only 65% of men were virally suppressed compared to 76% of women (1). While AIDS-related mortality has declined by 53% among women and girls, it has declined by only 41% for men and boys (24). In 2010, Higgins and colleagues (25) argued that while the focus on women's

risks for HIV have yielded significant benefits for reducing HIV transmission to women, HIV interventions have failed to acknowledge heterosexual men in generalized epidemic contexts and this pattern persists today (26, 27). Failure to address how masculinity intersects with structural forces like class to shape heterosexual men's risk for HIV and failure to effectively engage men as agents of change, impacts our ability to curb the HIV epidemic for both men and women.

2.2 Social and economic context for transactional sex in Uganda

Ethnographic accounts of the gendered aspects of the AIDS epidemic describe how gender, social norms, and economies have intersected to facilitate the formation of transactional sex relationships in sub-Saharan Africa in general and in Uganda more specifically. In his account of masculinity and AIDS in urban Uganda, Robert Wyrod (28) describes how modern ideas of manhood are rooted in precolonial notions of masculinity and gender relations. In precolonial Baganda, masculinity was performed and achieved through formal marriage, bearing children, and material provision to meet the household's basic needs. In the gender hierarchy, men presided over women which afforded them socially-accepted sexual privileges including the practice of polygamy and extramarital relationships. While women were afforded agency to divorce abusive or neglectful spouses, women were generally viewed as subordinate members of the household and their sexuality was highly regulated.

Gendered division of labor in precolonial Buganda reinforced gender hierarchies. Women's work was restricted to the domestic sphere and main responsibilities included

subsistence agriculture and maintaining the household (29). In contrast, men tended to work outside of the home and controlled household resources, setting a precedent for women's economic dependence on men which persists today (30).

Uganda was colonized by the British from 1894 to 1962 (31). Colonial economic structures led to changes in the gendered division of labor that existed in precolonial Buganda (29, 32). While women's work remained in the domestic sphere, colonialism introduced cash crop farming and wage labor opportunities for men. As men earned cash, their participation in the market economy expanded, driving demand for consumer goods. At the same time, notions of masculinity changed to reflect the growing importance of cash and men's economic self-sufficiency while reinforcing women's economic dependence on men (28).

Colonial economic structures also changed traditional marital rituals, a significant rite of passage for Ugandan men (28). Under the influence of colonialism and men's shift to wage labor, bridewealth payments were restructured to involve the exchange of cash rather than livestock or other goods (28). Payments required men to work outside of the home and, in areas with minimal job opportunities for men, cash bridewealth payments became unfeasible (28). Restructuring of bridewealth payments meant that the majority of men and women were no longer able to engage in official marriages, an important social institution which dictated social rules for courting, sex, and childbearing, and the ability to become head of a household (33). Between 2006 and 2016, the proportion of married 15-49 year old men decreased from 50 to 34 percent (34, 35). The inability to achieve this

significant rite of passage as for young men in Uganda is at odds with societal notions of masculinity (33, 36).

Economic and social changes during colonization facilitated the formation of transactional sex relationships across Africa. In her ethnography examining the historical context underlying women's risk for HIV in Kenya, Sanyu Mojola (37) describes how systems of labor and migration developed in colonial Kenya created gendered labor markets wherein men migrated to work while their wives remained in rural villages. Gendered labor markets and an increasingly cash-based economy exacerbated women's economic dependence on men. At the same time, migrant men formed transactional relationships with women to address their domestic and sexual needs while away from their wives.

Erin Moore and colleagues (38) describe how policy and economic changes in the post-colonial era created an enabling environment for transactional sex in Rakai. In the 1969, Uganda enacted the Coffee Marketing Act which allowed cooperative unions to control the purchase, processing, and sale of coffee. In contrast to the colonial era cash crop farming, the Ugandan government encouraged women's participation in growing coffee as a part of the country's plan for economic development (38). By the late-1980's, women represented three-quarters of the workforce in south central Uganda's coffee factories. Through structural adjustment programs, intended to relieve Uganda of foreign debt, The World Bank and International Monetary Fund took control of Uganda's coffee sector in the 1980s. Under Museveni, the country's president, the coffee industry was privatized in 1990, leading to its eventual collapse in 1998. The collapse of the coffee sector coincided with the rapid growth of Uganda's fishing industry and the growing HIV epidemic.

Without stable employment in coffee factories, many women migrated to the booming fishing communities in search of work. However, gendered labor markets afforded men work as fishermen and left women with few opportunities to earn money which, once again, reinforced women's economic dependence on men. Similar to Sanyu Mojola's (37) description of labor markets and migration in Kenya, Uganda's gendered fishing industry created a context in which migrant fishermen formed transactional relationships with women to address their domestic and sexual needs.

Julie Pulerwitz and colleagues conducted in-depth interviews with male partners of young women in Uganda and Eswatini to better understand motivations for transactional sex from the perspective of men (39). In both settings, men described provision of money or gifts as the primary way to establish and sustain sexual relationships, regardless of whether the relationships were short-term or long-term. Participants described that provision of material support was normative behavior and expected by women. Participants thought that older men with more resources had an advantage over younger men in securing sexual relationships because of their ability to provide. Some participants stated a preference they preferred younger partners over older, long-term partners because young women were more open-minded and compliant. Men perceived young women as having some agency in their ability to pursue transactional sex relationships to get material items they desired and did not view themselves as exploiting their transactional sex partners. However, some participants reported that other men sometimes exploited vulnerable poor, very young women, and migrants through transactional sex.

2.3 Characteristics of men engaged in transactional sex

Estimates of transactional sex prevalence among heterosexual men in sub-Saharan Africa range from 3.5% in a nationally representative sample of adolescent boys in South Africa (40) to 90.6% in a sample of men with multiple sexual partners in South Africa (41). To date, only three studies have examined demographic characteristics and sexual behaviors of heterosexual men who engage in transactional sex in sub-Saharan Africa.

First, a 2007 study conducted by Dunkle et al. (42) described factors associated with transactional sex in a sample of 1,288 young men aged 15-26 in rural South Africa. A relationship was considered transactional if a man thought that his partner's participation was motivated by material benefit. Lifetime prevalence of transactional sex with casual and main partners was 17.7% and 6.6%, respectively. Men's engagement in transactional sex was associated with higher socio-economic status, more adverse childhood experiences, more lifetime sexual partners, and alcohol use. Men who were more resistant to peer pressure were less likely to report transactional sex with casual partners and those with more gender equitable attitudes were less likely to report main partnerships motivated by material exchange. Perpetration of IPV or rape with women other than a main partner were the most consistent factors associated with transactional sex.

Second, Jewkes et al. (43) assessed, in 2012, characteristics of transactional sex relationships among 1,645 men ages 18-49 years residing in Eastern Cape and KwaZulu-Natal, South Africa. A relationship was considered transactional if the respondent thought his partner became involved with him because he provided or was expected to provide any of the following: food, clothes, cell phone, transportation, school or residence fees,

somewhere to stay, cosmetics, items for children or family, handyman work, cash or money to pay bills, or anything else that she could not afford by herself. Approximately 66% of men reported at least one type of transactional sex relationship, though it is unclear over what time period transactional sex was assessed (e.g., lifetime, recent, or current). Transactional relationships were reported among 58% of main partnership, 44% of once-off partnerships, and 42% of concurrent partnerships. For main and concurrent partnerships, men were most likely to provide food, clothes, cell phones, or transportation. For once-off partners, men were most likely to provide a place for the partner to stay or money for transport. Transactional sex was most common in men with lower education levels, lower income, and those aged 25–34. Approximately 15% of men who reported transactional sex relationships also reported sex with a sex worker.

Third, Magni et al. (44) examined patterns of transactional sex in a sample of 2,406 men ages 18-40 in an informal urban settlement in South Africa. Transactional sex was assessed with a measure developed by Wamoyi et al. "Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her?" with response options "yes" or "no" (2). Past-year transactional sex was reported by 47% of men. In contrast to Jewkes et al. (43), men in transactional sex relationships were most likely to provide money to support their partner's children or family. Similar to Dunkle et al. (42), this study used psychometric scales to assess childhood trauma, relationship control, and gender equitable attitudes. Controlling behavior, living in the community for seven years or less, having three or more sexual partners in the past 12 months, and hazardous drinking were associated with higher odds of transactional sex

(44). There was no association observed between transactional sex and childhood trauma or inequitable gender beliefs.

Together, these three studies provide important initial insights into the characteristics of men who engage in transactional sex and their relationships. However, insights are limited because all three studies were conducted with South African men. Because gender norms and economic context influence transactional sex, the practice may have different meanings and characteristics in other settings in sub-Saharan Africa. Therefore, further examination of men who engage in transactional sex and their relationships in other settings is important.

2.4 Transactional sex and HIV among men

Epidemiologic evidence on the relationship between transactional sex and HIV among men limited. Eight studies presenting sex-disaggregated estimates for the association between transactional sex and HIV among men were identified in a 2016 systematic review (45). There was inconsistency in the strength and direction of associations reported in the eight studies and only two reported a statistically significant positive associations between transactional sex and HIV in unadjusted or adjusted models (46, 47). All other studies reported non-statistically significant associations with heterogeneity in the strength and direction of estimates (5, 40, 41, 48-50). Poor and inconsistent transactional sex measurement may account for the heterogeneity across studies. A meta-analysis of four cross-sectional studies generated a pooled odds ratio for HIV of 1.47 (95% CI: 0.85-2.56) comparing men by engagement in transactional sex (45) which suggests a positive, if weak,

association between transactional sex and prevalent HIV. There have been far fewer studies examining the relationship transactional sex and incident HIV among men. To date, only one study has examined the causal effect of transactional sex on HIV acquisition among men (5). The prospective cohort study of men in rural Kenya found a weak association between transactional and risk of HIV acquisition among men who provided food for sex compared who men who did not provide food for sex (HR: 1.40; 95% CI: 0.69-2.88). Though limited, both cross-sectional and longitudinal evidence point to a potential positive association between transactional sex and HIV. These studies underscore the need for more evidence using improved transactional sex measures to quantify men's risk for HIV acquisition and onward transmission in transactional sex relationships and potential causal mechanisms underlying this risk.

2.5 Measuring transactional sex

Measurement of transactional sex varies widely across studies and may contribute to the considerable heterogeneity in prevalence estimates for transactional sex among men. Measures of transactional sex often conflate transactional sex with sex work and the direction of giving is often assumed based on gender norms rather than explicitly measured. Wamoyi et al. (2) developed improved transactional sex measures, which are gender-specific, to more accurately identify transactional sex relationships. The measure developed for women is, "In the past 12 months, did you enter into a sexual relationship with a man mainly in order to get things that you need, money, gifts, or other things that are important to you?" with response options "yes" or "no." The measure for men is, "In the

past 12 months, have you given a woman who is not your wife and is also not a sex worker any money, (gifts) or helped her to pay for things mainly in order to start or continue a sexual relationship with her?" with response options "yes" or "no." These measures have been tested with men and women in Uganda, Tanzania, and South Africa (2, 51). Based on cognitive interviews in these settings, the Wamoyi and colleagues describe five important elements for valid and reliable transactional sex measures. Transactional sex measures should: 1) clearly differentiate transactional sex from sex work to be certain that the measurement reflects noncommercial relationships; 2) include a clear statement of the motivation for the sexual relationship; 3) ensure the wording is nonjudgmental to minimize response bias, and resultant underreporting, while accurately capturing the prevalence of the practice; 4) exclude marital relationships (but may include married individuals' extramarital relationships); and 5) account for the gendered roles expected of women and men in transactional sexual relationships. For example, items for female respondents should focus on *receipt* of material goods whereas items for men should focus on *provision* of material goods.

2.6 Theory & Theoretical Perspectives

Masculinity theories have been adopted to explain the social and psychological mechanisms influencing men's HIV-related sexual behaviors and engagement in HIV prevention and treatment (52, 53). Connell's Theory of Gender and Power (54), Wilson's Theory of Respectability and Reputation (55), and Pleck's Gender Role Strain Theory (56) have informed the design and interpretation of findings in this dissertation. I draw on a

social-ecological framework for understanding interacting levels of influence underpinning transactional sex and HIV-related risks among men.

2.6.1 Theory of Gender and Power

R. W. Connell (54) describes a framework for understanding the social construction of gender in her 1987 work *Gender and Power*. Connell argues that gender is not an inherent immutable biological trait, but rather, notions of gender are constructed through repeated social interactions which socialize individuals into specific gender roles. Gender and gender relations are created and reinforced by three social structures, 1) gendered division of power, 2) gendered division of labor structures, and 3) structure of social norms and attachments.

First, the gendered division of power often privileges men over women and works in multiple dimensions, such as through physical force (e.g., gender-based violence) at the individual-level, through differential agency in sexual relationships at the dyadic-level, and through gender-biased policies and laws at the environmental-level. Gendered power is also strongly shaped and reinforced by cultural traditions such as patrilineal marriage, in which wives leave their families to join their husbands in their homes in parts of sub-Saharan Africa, including Uganda, and the continuing tradition of bridewealth payments. Differences in gender power affect each partner's ability to negotiate safe sex on equal terms.

Second, the gendered division of labor structures work opportunities along gendered lines and, over time, becomes ingrained as a "social rule" (54). Gendered division

of labor has historically placed women's work in the unpaid or underpaid domestic sphere, such as childcare, and men's work in wage labor opportunities outside of the home.

Differential access to income-earning opportunities allows men to control and accumulate wealth while creating imbalances in relationship power and decision-making (57). Power imbalances shift power in favor of men, facilitate women's economic dependence on men, and constrain women's sexual choices and behavior.

Third, the structure of social norms and attachments prescribes gender-specific norms for appropriate or ideal behavior for men and women (54). From childhood, men and women are taught appropriate and normative behavior based on gender roles. Gender-specific behaviors are reinforced throughout the life course through social interactions, traditions, and institutions. The structure of social norms dictates appropriate sexual behavior for men and women and may partly explain why multiple and concurrent sexual partnerships may be more acceptable in men than women.

Connell's Theory of Gender and Power provides a basis for understanding how masculinity and gender inequality can shape the context for transactional sex and vulnerability to HIV.

2.6.2 Respectability & Reputation

Wilson's (55) framework of *respectability and reputation* complements the paradigm of Connell's Theory of Gender and Power. In Wilson's ethnography of masculinities in the Caribbean, he posits that men are subject to two interconnected value systems called respectability and reputation. A man's reputation is judged by his male peers and depends on the performance of masculine behaviors such as athletic competition, virility, and ability

to father children. For example, qualitative research found that, for Ugandan men, status among male peers was increased by having numerous sexual partners (58, 59). As opposed to reputational norms, respectability is related a man's ability to conform to social norms set by institutions such as the church and government. These norms include employment in a good job and providing for one's family. Respectability and reputation value systems may occur within the same society and/or individual and may complement or contradict each other. Men who are able to demonstrate both respectability and reputation are socially rewarded for practicing these norms of masculinity, even when they may seem at odds.

2.6.3 Gender Role Strain

Gender role strain focuses on the psychological mechanisms of masculinity and the internalization of gender norms. Gender Role Strain theory, developed by clinical psychologist Joseph Pleck (56), describes three types of strain that impact men and boy's health: trauma strain, dysfunction strain, and discrepancy strain. This dissertation was mainly informed by the concept of discrepancy strain, which occurs when a man cannot live up to his internalized masculine ideal. Inability to adhere to masculine ideals may be influenced by a man's social class and socioeconomic status. Conceptualization of masculine ideals are influenced by traditional gender norms related to masculinity. Men may experience discrepancy strain related to perceived success and maintaining power over others, feeling subordinated to women at home, restricting their emotions, and sexual performance. Discrepancies may cause men to engage in behaviors harmful to themselves and others as a way of compensating for perceived failures or as a maladaptive method of

coping with stress (56). For example, a study of South African men in a high HIV prevalence setting found gender role conflict and stress was associated with a 49% greater odds of alcohol abuse, 42% greater odds of IPV perpetration, and 36% greater odds of sexual partner concurrency (60).

Gender norms influence men and boys through multiple dimensions that encourage risky sexual behavior while discouraging access to health services. Gender norms associated with masculinity create an environment in which having safer sex, taking an HIV test, accessing and adhering to treatment, or even talking about sexuality and emotions can be a significant challenge for men (22, 52, 58). While gender norms can significantly influence a man's behavior, it is important to note that these norms are dynamic and change depending on age, race, class, ethnicity, time, and place. There can be multiple masculinities within societies or even expressed within individuals. While numerous studies have examined the relationship between masculinity and men's HIV-related risk behaviors in sub-Saharan Africa (52, 59, 61-65), these theories are focused on constructs of masculine behavior developed in western countries. Few theories or frameworks acknowledge heterogeneity in African masculinities or how they may differ from western masculinities.

This study considers Ugandan masculinities as they relate to transactional sex, being open to both similarities and differences in masculine norms described in the western literature. For the purposes of this study, I focus mainly on the role of masculinity in influencing HIV risk, as this is an understudied area and a clear understanding is necessary to address the "blind spot" among men and boys in the HIV response.

2.6.4 Social Ecological Model

This research is grounded in a social ecological model approach. Acknowledging that most HIV risk-reduction approaches focused on the individual, in 1995, Sweat and Denison developed a social ecological framework specific to HIV incidence which draws on terms and concepts from sociology. The original framework included four levels: superstructural, structural, environmental, and individual (66) and an updated unpublished revision added a fifth dyadic level, which focused on family and couples. In the framework, superstructural factors include macrosocial and macropolitical forces, such as gender norms, which dictate power structures and resource allocation. Structural factors include laws, policies, and standard operating procedures such as structural adjustment programs. Environmental factors encompass living conditions, social pressure, and resources and opportunities. Sweat and Denison describe this level as “the realization of individual, structural, superstructural and other factors in the real world.” Environmental-level factors correspond to organizational- and community-level factors seen in other social ecological frameworks (66). The dyadic-level encompasses factors at the family and couple level and is analogous to the interpersonal- and household-levels seen in other social ecological frameworks (66). The individual level includes behavior and psychosocial factors that result from an individual’s interaction with their environment such as knowledge, skills, and self-efficacy.

While the social ecological framework does not illustrate the specific causal pathways that lead to health behaviors and outcomes, the framework highlights interacting levels of influence underpinning behaviors and outcomes, rather than solely focusing on

the individual-level. The benefit of considering nested levels of influence in behavioral research is that it allows researchers to examine important upstream determinants of health outcomes and how the levels interact which may lead to more effective interventions. For example, research and intervention focused solely on individual risk mechanisms associated with transactional sex may neglect the upstream gender norms that influence the formation of partnerships in the first place.

The Sweat and Denison social ecological framework was used in this dissertation to facilitate the conceptualization of multiple levels of interacting forces that may motivate an individual's engagement in transactional sex and risk for HIV. Informed by this framework and prior literature, a directed acyclic graph (DAG) was developed to guide quantitative analyses and described further in Chapter 3. A conceptual model was developed in Chapter 8 to synthesize findings from this dissertation, theory, and prior literature.

Chapter 3. Methods

3.1 Study location: Rakai District, Uganda

This study was conducted in and around Rakai District, a mostly rural district in south-central Uganda with a population of approximately 518,000 residents. The district is bordered to the south by Tanzania and to the east by Lake Victoria.

Figure 3.1 Map of Rakai District, Uganda



Source: https://www.researchgate.net/figure/Political-map-of-Uganda-with-research-sites-Rakai-and-Sese-Kalangala-Districts_fig1_41826935 (Accessed 29 April 2022)

3.2 Rakai Health Sciences Program

Data collection for this analysis was conducted by the Rakai Health Sciences Program (RHSP) research staff. RHSP was established as an HIV/AIDS research center in 1988 following the identification of the first case of HIV in East Africa in Rakai District. RHSP now serves 12 districts south-central Uganda with free voluntary male circumcision, HIV testing and counseling, provision of HIV antiretroviral therapy (ART), general and HIV-related medical care, prevention of mother-to-child transmission of HIV, and family planning services. In addition to providing HIV services to the community, RHSP also conducts numerous randomized control trials, clinical trials, and observational studies, including the Rakai Community Cohort Study. RHSP houses the Social and Behavioral Sciences Department, which is responsible for qualitative data collection, transcription, and translation. Study staff are trained in qualitative research methodology and bilingual in Luganda and English.

3.3 Rakai Community Cohort Study

The Rakai Community Cohort Study (RCCS), is an open, population-based cohort established by the RHSP in 1994. The RCCS surveys all individuals aged 15–49 years in approximately 40 agrarian, trading, and fishing communities. Figure 2 shows the RCCS catchment area and community types.

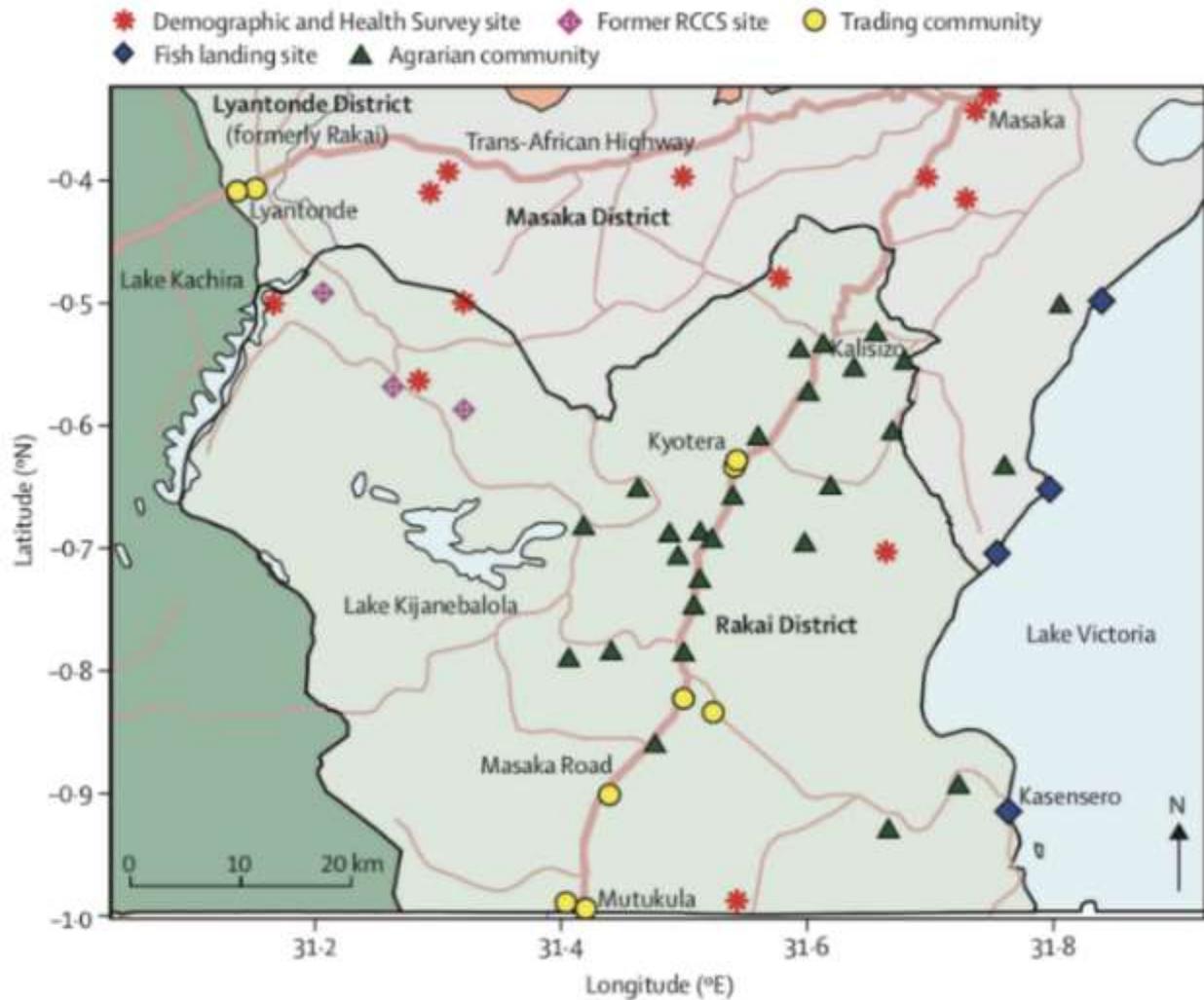
Census. A household census enumerates all residents of every household, whether they are present or absent, in approximately 40 Rakai communities censused annually (currently ~5,000 households and ~30,000 persons per year) for the RCCS. Data collected

for the RCCS census includes age, gender, marital status, key relationships within the household, and indicators of household economic status.

Survey. Following the census, RCCS staff survey all eligible residents who are present and provide written informed consent. To be eligible, participants must be between ages 15 and 49, speak Luganda or English, be willing and able to give written informed consent, and be resident for at least 6 months in the RCCS catchment area with an intention to stay longer. Two attempts are made to contact individuals who are censused and eligible but who did not initially participate in the surveys. The survey assesses individual-level demographic characteristics, HIV service uptake, and detailed information on past-year sexual partnerships for up to four partners. Participation rates over time have been high at 70%±9.0%. Non-participants are more likely to be younger, male, and residents of trading and agrarian communities (67).

Biological specimens. All RCCS participants are offered free voluntary counseling and HIV testing. HIV rapid tests results are returned to participants immediately through on-site post-test counselors. A field-validated parallel three test rapid HIV testing algorithm with demonstrated high sensitivity (>99.5%) and specificity (>99.5%). All rapid test positives are confirmed by two enzyme immunoassays (EIAs), with Western blot or PCR for discordant EIA results. HIV-1 viral load testing for HIV-positive individuals is performed using the Abbott RealTime assay (67).

Figure 3.2 Map of study setting showing Rakai Community Cohort Study communities



Source: Chang LW, Grabowski MK, Ssekubugu R, Nalugoda F, Kigozi G, Nantume B, Lessler J, Moore SM, Quinn TC, Reynolds SJ, Gray RH. Heterogeneity of the HIV epidemic in agrarian, trading, and fishing communities in Rakai, Uganda: an observational epidemiological study. *The Lancet HIV*. 2016 Aug 1;3(8):e388-96.

3.4 Key definitions and quantitative measures

Transactional sex. The main independent variable of interest was transactional sex. Men's self-report of transactional sex was assessed for each reported female sexual partner in the last 12 months (up to four). Men were asked "Were money, gifts, or favors ever exchanged for sex with this partner?" and provided the following four response options:

“Yes, received only;” “Yes, gave only;” “Yes, gave & received;” “No.” A response of “Yes, gave only”, was categorized as transactional sex. All other responses were categorized as no engagement in transactional sex. Regardless of the response to the transactional sex measure, relationships with marital partners or sex workers were not categorized as transactional sex.

History of transactional sex measures used in the RCCS. Several measures have been used to assess transactional sex in the RCCS from the first survey round in 1994 to the twentieth, which was administered between 2021 and 2022. The first measure was added to the RCCS in early rounds of the survey and intended to identify relationships in which material exchange occurred. A single item was used for both men and women and was phrased, “Were money, gifts, or favors ever exchanged for sex with this partner?” Initially response options were “yes” or “no” but were later changed to specify direction of giving and receiving (yes, gave and received; yes, gave only; yes, received only; no). This measure was used to assess transactional sex in Chapters 4 and 5 of this dissertation.

The second measure was added to the RCCS in 2015 (round 17) and was only answered on the condition of an affirmative response to the first transactional sex measure. The second measure was a single-item measure with different phrasing for men and women to reflect gender norms of giving and receiving. The men’s questionnaire measure was intended to be staged, “Is the primary reason you had a sexual relationship with this partner because *you provided material support to her* (such as money for personal needs, looking after *her* children, paying *her* rent, starting a business etc.)?” However, the women’s phrasing was used in the men’s questionnaire in error and men were asked, “Is

the primary reason you had a sexual relationship with this partner because you expected financial support from him (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)?” with response options “yes” or “no”. Therefore, responses to this question in RCCS rounds 17 to 19 cannot be used to assess transactional sex as intended.

To correct this error, transactional sex measures were revised in November 2021 (mid-round 20). Round 20 now includes three single-item transactional sex measures administered in each partner block. The first measure from 1994 with revised response options was retained to facilitate comparison across rounds. The second measure was developed by Wamoyi and colleagues and has been previously tested in Uganda, Tanzania, and South Africa (2, 51). In the men’s questionnaire, the measure is, “Have you given this partner any money, gifts, or helped her to pay for things mainly in order to start or continue a sexual relationship with her?” with response options “yes” or “no”. To assess transactional sex in which money or material items are provided by women to men in exchange for sex, Wamoyi et al.’s (2) transactional sex measure intended for women was added to round 20 and is phrased, “Did you enter into a sexual relationship with this partner mainly in order to get things you need, money, gifts, or other things that are important to you?” with response options “yes” and “no”.

HIV serostatus. A parallel three-test rapid HIV testing algorithm was used to identify individuals who were HIV-positive. An individual was considered HIV-positive if they had tested positive for HIV in a previous round.

HIV viremia. Viral-load suppression was defined as a viral load of less than 1,000 HIV RNA copies per milliliter, according to the recommendations of the World Health Organization (69). Unsuppressed viral load, or viremia, was defined as a viral load of 1,000 HIV RNA copies per milliliter or greater (69). In 2022, Uganda's definition of unsuppressed viral load will be changed from 1,000 HIV RNA copies per milliliter or greater to 200 HIV RNA copies per milliliter or greater (70) but this new cutoff was not assessed for the purposes of this dissertation.

HIV incidence. Cases of incident HIV infection were defined as cases in which persons tested HIV-seropositive for the first time after they had had an HIV-seronegative result at the previous RCCS visit; one missed visit was allowed. Incidence of HIV infection was measured in person-intervals of follow-up between surveys among persons who were initially HIV-negative and who participated in at least two surveys. Incident infections were assumed to occur at the midpoint of the interval between two surveys.

Demographic covariates included community type (inland, fishing), age (15-24, 25-34, 35-44, 44-49), marital status (currently, previously, never), educational level (defined as highest level of education completed using the following categories: no schooling, primary grades 1-7, and completion of secondary grade 1 or higher), and primary occupation (agriculture for home use/barter, agriculture for selling, housework in your own home, housekeeper, home brewing, government/clerical/teaching, fishing, student, military/police, shopkeeper, trading/vending, bar worker or owner, trucker, unemployed other, medical worker, casual laborer, waiter/restaurant owner, hair dresser/salon owner, construction, mechanic, boda boda, sports betting or gambling).

Behavioral and partnership covariates. Respondents were asked about sexual partner characteristics and sexual behaviors for up to four past-year sexual partners. These relationship-level covariates included partner label (e.g., girlfriend, friend), partner occupation, relationship duration, perceived likelihood of acquiring HIV from partner, consistency of condom use, alcohol use before sex, intimate partner violence (IPV). Measures for alcohol use before sex and IPV are described below.

Alcohol use before sex. In RCCS round 18, three mutually exclusive, single-item measures were used to assess alcohol use before sex by (1) the respondent, (2) his partner, or (3) both respondent and partner in each of four partner blocks. Alcohol use before sex by the respondent was defined as an affirmative response to the following question: “Do/did you drink alcohol before sex with this partner?” Alcohol use before sex by a partner was defined as an affirmative response to: “Does/did this partner drink alcohol before sex?” Alcohol use before sex by both the respondent and his partner was defined as affirmative responses to both questions.

Intimate partner violence. Three types of past year verbal, physical, and sexual intimate partner violence (IPV) were assessed using nine questions adapted from the Conflict Tactics Scales (71), a validated measure used in IPV research. In RCCS round 18, IPV was assessed in partner blocks for up to four past-year sexual partners. Verbal, physical, and sexual IPV were assessed and presented separately in quantitative analyses. An affirmative response to any item in each of three IPV scales was considered perpetration of IPV. The three forms of past year experiences of IPV were measured by asking, “In the past 12 months did you do any of the following to this partner?”

- Verbal IPV (1 item): “verbally abuse or shout at her?”
- Physical IPV (5 items): “push her, slap her or hold her down?”; “punch her with fist or with something that could hurt her?”; “kick her or drag her?”; tried “threatened her with a weapon (knife, gun, fire, rope)?” “and “attacked her with a weapon?”
- Sexual IPV (3 items): “used threats to force her to have sex when she did not want to?”; “physically forced her to have sex when she did not want to?”; or “forced her to perform sexual acts she did not want to do?”

Household wealth. As part of the RCCS census, one member of the household responds to questions regarding ownership of household assets (e.g., bicycle, motorcycle, car), livestock, agricultural land, type of toilet, housing status (e.g., rent, own, caretaker, other), household construction materials, and water sources. We used this data along with guidance from the Demographic and Health Survey (DHS) to develop a wealth index. Slight modifications were made to DHS guidelines so that it could be used with RCCS data (72). Specifically, we generated wealth scores for assets specific to inland and fishing communities and assets common to both which better reflected differences in household asset ownership in the RCCS catchment area. These separate wealth scores were then used to generate a composite wealth score and divided into wealth quintiles.

3.5 Study design and analytic methods

The study design and analytic methods for quantitative and qualitative strands of this dissertation are described in brief below. Detailed study design and analytic methods for

each specific aim can be found in Chapters 4, 5, 6, and 7. The overall mixed methods approach is described in detail below.

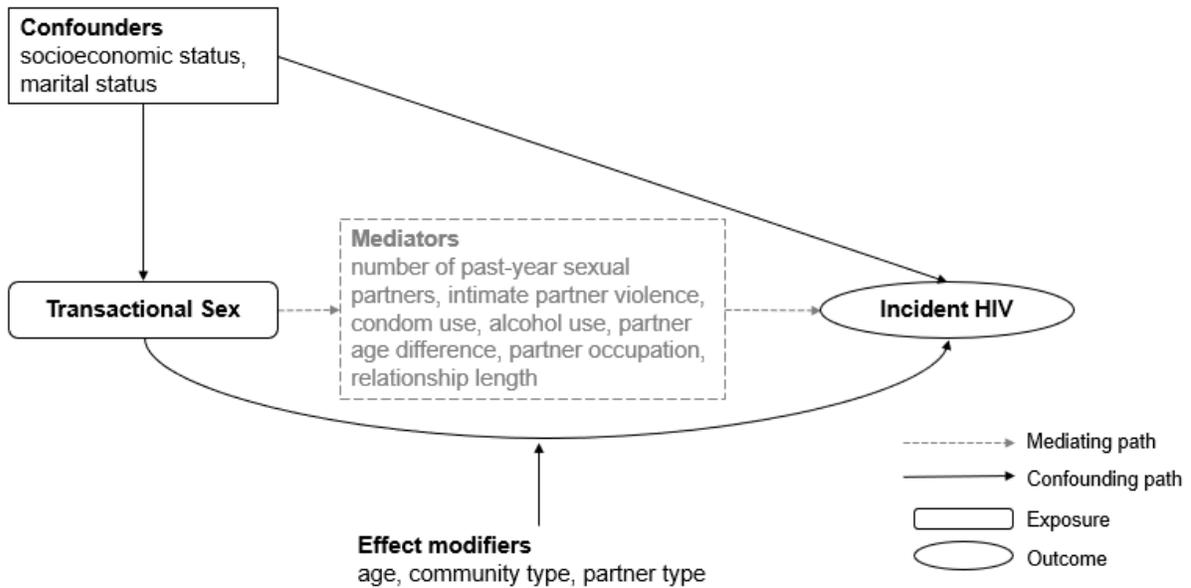
3.5.1 Quantitative design and methods

Chapters 4 and 5 involve secondary analyses of RCCS data. In Chapter 4, we conducted a cross-sectional analysis to examine risk factors for transactional sex among men, characteristics of transactional sex relationships, and association with prevalence of HIV and viremia. The analytic sample included 7,678 sexually-active men ages 15-49. The independent variable of interest was transactional sex. The primary outcomes of interest were HIV status and HIV viremia. Poisson regression with robust standard errors was used to estimate prevalence risk ratios (PRR) and 95% confidence intervals (CI) for each HIV status and viremia separately. Analyses were stratified by relationship length (once-off vs. longer-term) and community type (inland vs. fishing) because we suspected effect modification by these factors based on prior studies in the same setting (73) and our knowledge of the Rakai context.

In Chapter 5, we assessed the relationship between transactional sex and HIV incidence in a longitudinal analysis of 7,762 men sexually-active ages 15-49 who were HIV-negative at baseline. We modeled the timing of transactional sex (the independent variable) in three different ways. In the first analysis, individuals were considered to have engaged in transactional sex if reported in the person-interval, t_{n-1} , preceding the person-interval in which HIV serostatus was assessed. In the second analysis, individuals were considered to have engaged in transactional sex if reported in the same person-interval, t_n , in which HIV serostatus was assessed. In the third analysis, individuals were considered to

have engaged in transactional sex if reported in the preceding or the same person-interval, $t_{n-1|n}$, in which HIV serostatus was assessed. The primary outcome for this analysis was incident HIV infection. Poisson regression models with generalized estimating equations with exchangeable correlation structure were used to estimate incidence rate ratios (IRR) and 95% CIs of HIV acquisition for each of the three transactional sex variables. Because this was a causal analysis, we developed a directed acyclic graph (DAG) informed by prior transactional sex literature to guide our analysis (Figure 3) (2, 4, 6, 42, 74). Models were adjusted for socioeconomic status and marital status which were hypothesized to be confounders based on the DAG. Mediators were included in the DAG for completeness but were not assessed in this analysis. Analyses were stratified by factors that were suspected effect modifiers including age (<30 years vs. ≥ 30 years), and community type (inland vs. fishing), and relationship duration (once-off vs. longer-term).

Figure 3.3 Directed acyclic graph for the relationship between transactional sex and HIV



3.5.2 Qualitative design and methods

Chapter 6 and 7 involve primary data collection through semi-structured in-depth interviews (IDI) with adult men ages 18-49 residing in Rakai, District who had previously participated in the RCCS. The IDI guide consisted of five sections. Section 1 asked about how the respondent earned money, how earnings were spent, and whether there were times of the year when more or less money was earned. Sections 2 through 5 concerned the participant's last non-marital, non-commercial sexual relationship in the past 12 months. Section 2 assessed how participants understood and responded to three transactional sex measures. Section 3 probed on characteristics of the participant's relationship including characteristics of his partner, material support provided, and HIV risk behaviors that paralleled RCCS questions such as alcohol use before sex, condom use, and IPV. Section 4 assessed the perceptions of how men the participant's age are expected to

behave and how these expectations influenced the participant's own behavior, especially in regard to behavior in sexual relationships and related to HIV prevention. Results from Sections 3 and 4 are not presented in this dissertation. Section 5 assessed how men's sexual relationships changed during and after Uganda's COVID-19 lockdowns and were used for the analysis presented in Chapter 7.

Prior to recruitment, we conducted three pilot interviews to refine translation of the English interview guide to Luganda. We recruited a total of 28 men who were purposively sampled based on their response (assuming all 28 were recruited this way to one of the RCCS transactional sex measures. Two men declined to participate. Out of the remaining 25, we selected 20 men who responded "yes, gave only" to the transactional sex measure and five who provided any other response. Participants were also sampled for variation based on geographical location across the Rakai region (agrarian, fishing, and trading communities), age, and HIV status. Men residing in agrarian and trading communities were contacted via mobile phone to assess their interest in participating in a study to understand non-marital sexual partnerships. Men residing in fishing villages, who were more challenging to recruit because they are highly mobile and spend long periods of time fishing without access to phones, were mobilized by RCCS staff who provided a mobile phone and private location for recruitment conversations and interviews. IDIs were conducted between November 2021 and February 2022 over the phone to reduce the potential for COVID-19 transmission. Each IDI was audio-recorded and lasted approximately 60 minutes. All IDIs were simultaneously translated from Luganda to English and transcribed.

For Chapters 6 and 7, data analysis occurred throughout data collection process and interview debriefs and weekly meetings with qualitative data collectors to identify important and emerging themes or issues with the interview guide and data collection processes. Analytic memos were a crucial part of the data analysis process and included, for example, reflections on the data collection process, notes on translations, and concepts to be explored in future interviews. Thematic analysis was the primary analytic strategy (75). Following completion of data collection, an initial set of codes was developed for Chapter 6 and 7 analyses separately based on the IDI guide. In addition, transcripts were read closely several times and an open coding process informed by grounded theory was used to develop a list of emergent themes and codes (76). Codes were discussed with the study team and revised in an iterative process until a final codebook was agreed upon. In Dedoose (77), one coder applied codes based on the final codebook. Codes were grouped into themes and a detailed description of each theme along with illustrative quotes was written and then refined in an iterative process by members of the study team.

3.5.3 Mixed methods approach

The overall goal of this dissertation was to better understand the relationship better understand the practice of transactional sex among heterosexual men and its relationship to HIV outcomes. To achieve this goal, we employed an enhancement/complementary mixed methods approach which, according to Creamer (78), is appropriate when the principal purpose of the research is to “gain a more holistic picture by exploring different aspects of the same complex phenomenon.” Because evidence on the relationship between transactional and sex among men is extremely limited, this approach was used fill

important gaps in the literature. In terms of timing, data collection was sequential (quan→qual) and data analysis was iterative. Both quantitative and qualitative strands were given equal priority to improve the depth and richness of conclusions drawn from both strands.

Mixing occurred in the design, data collection, and inference stages of the dissertation. Mixing in the data analysis approach was planned but did not occur due to COVID-related changes in the timing of data collection and analysis. In the *design stage*, we developed research questions based on gaps in the literature that were best answered through a mixed methods approach. The research questions were,

Quantitative strand

1. What demographic and behavioral characteristics are risk factors for transactional sex among men?
2. What is the association between transactional sex and prevalence of HIV and viremia among men?
3. What is the causal effect of transactional sex on risk for HIV acquisition?

Qualitative strand

4. How do men understand and respond to commonly used transactional sex measures?
5. How did Uganda's COVID-19 mitigation measures impact men and their transactional sex relationships?

Mixed

6. How and to what extent is men's engagement in transactional sex associated with HIV outcomes?

In the qualitative *data collection stage*, we used a nested sample of men who had previously participated in the RCCS and a type of mixing called "linking" which involved using information from the quantitative strand to inform sampling in the qualitative strand. Specifically, we purposively sampled men for in-depth interviews based on RCCS variables (e.g., age, occupation, viral load suppression status, community of residence) that arose as important characteristics in the quantitative strand so that we could explore how these characteristics influenced transactional sex engagement and HIV outcomes in the qualitative strand.

In the *inference* stage, we used an iterative approach to draw conclusions from quantitative and qualitative strands separately and an overall meta-inference which combines inferences from both strands. Cognitive interviews with men in the qualitative strand were used to enhance understanding of the findings in the quantitative strand. For example, we note in the quantitative strand that the transactional sex measure we used may have led to misclassification of transactional sex relationships as non-transactional and this may be a reason for our relatively low prevalence estimates for transactional sex compared to other studies. Findings from both qualitative and quantitative strands were used to develop a conceptual model for the relationship between transactional sex and HIV among men which is presented in the Chapter 8.

3.6 Ethical considerations

3.6.1 Informed Consent

Quantitative analyses involve secondary analysis of RCCS data. All RCCS participants provided written informed consent prior to participation. As part of the informed consent process, RCCS participants indicate whether they agree to be contacted for future studies. Qualitative analyses involved primary data collection and all recruitment, consent, and interview procedures were conducted by mobile phone. Prior to initiating consent discussions, participants were asked to find a private place where they could talk on their mobile phone without being overheard. The informed consent process was administered in Luganda or English, based on the participant's preference. Individual information about the study was provided and verbal consent was obtained, after providing potential participants with the opportunity to have all questions asked and addressed. All consent was documented (per RHSP Department of Social and Behavioral Sciences standard procedures) by the data collector.

3.6.2 Protection Against Risks

Staff recruitment and training. RHSP recruits RCCS staff and provides an RHSP-specific ethics training for RCCS data collectors. For qualitative data collection, data collectors were selected from this existing group of interviewers in RHSP's Social and Behavioral Sciences Department, who were trained in the RHSP-specific ethics training. Training on ethical considerations specific to this study including the informed consent process, data confidentiality, and participant privacy were conducted by study investigators with support by senior Ugandan investigators. This supplemental training addressed sensitive

interviewing techniques, including handling situations in which participants appear uncomfortable. Staff were trained to remind participants that they can refuse to answer a question or cease the data collection session at any time.

Confidentiality. RCCS data was de-identified before being shared with study team. Datasets were stored on encrypted cloud-based software and use was restricted to members of the study team. For the qualitative study, participant data was immediately uploaded into a secure server following data entry. Records of informed consent forms were stored separately in locked cabinets separate from data with study ID numbers. All computers with participant data were password-protected and encrypted. Data collectors shared de-identified transcripts with the study team by uploading files into encrypted cloud-based software approved for use by Bloomberg School of Public Health (BSPH).

To prevent potential protocol violations related to breach of confidentiality, research staff were trained on the study protocol, procedures, and ethical issues, including the kinds of activities that constitute a protocol violation and the procedure for violations and adverse events. Staff were requested to report all protocol violations to senior Ugandan investigators who would then immediately notify the principal investigator. If a breach of confidentiality were to occur, the study team would work with senior Ugandan investigators to inform The Science and Ethics Committee of the Ugandan Virus Research Institute, the Uganda National Council on Science and Technology, and the BSPH Institutional Review Board.

Avoidance of social harm. Other than the risk of breach of confidentiality, there were no potential social risks from the research.

Protection from discomfort, distress, embarrassment, and fatigue. To mitigate study participant discomfort and fatigue, the following procedures were implemented: (1) training of research staff to emphasize caring, non-judgmental, and non-threatening approaches to questioning for both the RCCS and the qualitative data collection activities; (2) participants were informed that they have the right to withdraw from the study at any time; and (3) research staff were trained to stop data collection if the participant appeared to be in distress and to contact higher-trained staff if any distress was noted.

Chapter 4. Transactional sex and prevalence of HIV and viremia among men in Rakai, Uganda: A population-based study (Aim 1 Findings)

4.1 Abstract

Background: HIV outcomes among heterosexual men in sub-Saharan Africa who engage in transactional sex are poorly understood. We examined risk factors for transactional sex with non-marital, non-commercial sexual partners and assessed its association with prevalence of HIV viremia among men.

Methods: We conducted a cross-sectional analysis of 7,678 men ages 15-49 participating in a population-based open cohort study in Rakai District, Uganda between 2016 and 2018. To measure transactional sex, men were asked if they had ever given money, gifts, or favors to each of their four most recent past-year sexual partners. The main outcomes of interest were HIV serostatus and HIV viremia (≥ 1000 HIV RNA copies/mL). In exploratory analyses, we used modified Poisson regression with robust variance to estimate prevalence risk ratios (PRRs) and 95% confidence intervals (CI) for transactional sex by individual- (e.g., age, occupation) and relationship-level (e.g., relationship duration, partner occupation) risk factors. Modified Poisson regression with robust variance was used to estimate PRRs and 95% CIs separately for HIV and viremia by engagement in transactional sex. Analyses were stratified by relationship duration and community type.

Results: Transactional sex prevalence among men was 9%. Compared to currently married men, never married (adjPRR:2.51; 95% CI:2.03,3.10) and previously married (adjPRR: 2.14; 95% CI: 1.77,2.59) men were more likely to report transactional sex. Transactional sex

partners were perceived as higher-risk (PRR:1.48; 95% CI:1.27,1.73) compared to non-transactional partners and men engaged in transactional sex were less likely to be aware of their partner's HIV status (PRR:0.58; 95% CI: 0.51,0.66). We did not observe an association between transactional sex and prevalence of HIV or viremia overall. However, in sub-group analyses, boda boda (motorcycle taxi) drivers who engaged in transactional sex were 2.32 times more likely to be viremic (95% CI: 1.47,3.67) than their peers in non-transactional relationships.

Conclusion: We found that transactional sex involved high-risk sexual behaviors and partners. HIV prevalence and viremia are higher in subgroups of men engaged in transactional sex. Interventions targeting these men should focus on reducing risk of onward transmission to female transactional sex partners.

4.2 Introduction

UNAIDS refers to the lack of focus on men and boys as a “blind spot” in the response to HIV (23). In sub-Saharan Africa, material provision to sexual partners is normative behavior for men and is sometimes the primary motivation for sexual relationships (2, 74). Non-marital, non-commercial sexual relationships motivated primarily by material provision are called transactional sex relationships (74). Though material exchange does not pose an inherent risk for HIV, transactional sex relationships, in which gendered and economic power dynamics are skewed in favor of men, may impart greater risk of onward HIV transmission to female partners (74, 79). However, most transactional sex research to date has focused

on adolescent girls and young women and little is known about men who engage in transactional sex and their risk for HIV acquisition and transmission.

A clear understanding of the individual-level demographic and behavioral characteristics of men who engage in transactional sex and characteristics of transactional sex relationships is important for the development of effective HIV interventions addressing risks associated with the practice. Only three studies to date have examined the individual-level demographic and behavioral characteristics of men in transactional sex relationships, and all three were conducted among South African men (42, 43, 80). Transactional sex prevalence ranged from 6.6% in a sample of young men in rural South Africa reporting transactional sex with main partners to 66% in a representative sample of adult men in Eastern Cape and KwaZulu-Natal. Greater odds of transaction sex were found in men with higher socioeconomic status (42), lower education levels (43), men aged 25-34 compared to younger men (43), and cohabitating or divorced men versus men who were married (43). Men with the following behavioral characteristics were more frequently engaged in transactional sex: more sexual partners (42, 80), alcohol use (42, 80), perpetration of IPV (42). Evidence from South Africa may not be generalizable to other regions of sub-Saharan Africa with diverse HIV epidemics, economic contexts, and gender norms. Therefore, further study of the prevalence and risk factors for transactional sex among men in other regions of sub-Saharan Africa are needed to enhance our understanding of the practice among men and to effectively engage these men interventions to address HIV-related risks in transactional sex relationships.

Male transactional sex partners are assumed to be higher risk partners and responsible for onward transmission of HIV to their female transactional sex partners. Elevated risk for HIV among women and girls who engage in transactional sex supports this assumption (45). However, quantitative studies assessing prevalent HIV among men who engage in transactional sex, a necessary precursor for onward transmission, have been inconclusive. A 2016 systematic review and meta-analysis identified seven studies estimating the association between transactional sex and prevalent HIV among men. Substantial variation in transactional sex measurement, study design, and analytic approaches resulted in heterogeneity in the strength and direction of associations across studies, leading the authors to state that the relationship between transactional sex and HIV among men was inconclusive. Only four of the studies could be included in the meta-analysis which generated a pooled odds ratio for HIV of 1.47 (95% CI: 0.85, 2.56) among men (45). The meta-analysis suggests a positive, but non-statistically significant relationship between transactional sex and prevalent HIV among men but there is a clear need further investigation of this relationship.

Data on the HIV status of men engaged in transactional sex alone may be inadequate to understand men's risk of onward transmission. For example, even if an individual is living with HIV, they may not be able to transmit to others if they are engaged in appropriate care (e.g., consistent usage of ARTs) which keeps viral load undetectable and untransmissible (81). Therefore, understanding the prevalence of viremia among men who engage in transactional sex is important for understanding risk of onward transmission and to date, there have been no studies exploring this relationship. To address these gaps

in the literature, we conducted a cross-sectional analysis of sexually-active men in Rakai, Uganda to understand, 1) demographic and behavioral characteristics of men who engage in transactional sex and their partners; and 2) the relationship between transactional sex and prevalence of HIV and viremia among men.

4.3 Methods

Study design

Data from this study were obtained from the Rakai Community Cohort Study (RCCS), an open, population-based cohort in Rakai and surrounding districts in south central Uganda. The Rakai region is mostly rural with agricultural, semi-urban trading centers, and Lake Victoria fishing villages. HIV prevalence ranges from 9% in agrarian communities to 43% in fishing communities (68). The RCCS has been described in detail elsewhere (68). Briefly, the RCCS surveys all consenting individuals aged 15–49 years in study communities. All participants who provide written informed consent are interviewed to assess demographics, sexual risk behaviors, and uptake of HIV prevention, treatment and care services. Egocentric network data on the four most recent sexual partners in the past year are also collected. Free HIV testing is provided, with pre- and post-test counselling. Blood samples are obtained for viral load testing.

This study was a secondary, cross-sectional analysis of a single survey round in the RCCS conducted between August 2016 and May 2018 in 41 communities. Analyses were restricted to men who responded to survey questions related to transactional sex and other relevant sexual behavior variables (e.g., condom use). Ethical approval was granted

by the Uganda Virus Research Institute's Research and Ethics Committee, Uganda National Council of Science and Technology, and Western IRB's institutional review board (IRB).

Measurement of transactional sex

Men's self-report of transactional sex was assessed for each reported female sexual partner in the last 12 months (up to four). Men were asked "Were money, gifts, or favors ever exchanged for sex with this partner?" and provided the following four response options: "Yes, received only;" "Yes, gave only;" "Yes, gave & received;" "No." A response of "Yes, gave only", was categorized as transactional sex. All other responses were categorized as no engagement in transactional sex. Regardless of the response to the transactional sex measure, relationships with marital partners or sex workers were not categorized as transactional sex. HIV serostatus was our first dependent variable of interest.

Primary outcomes

Primary outcomes were HIV serostatus and HIV viremia. The RCCS assesses HIV serostatus through administration of a validated parallel three-test rapid HIV testing algorithm (82). Unsuppressed viral load, or viremia, was defined as a viral load measurement of 1000 HIV RNA copies per milliliter or greater (69).

Statistical analysis

This analysis was conducted in two stages and guided by a conceptual framework (Figure S1). In the first stage, we identified individual- and relationship-level risk factors for transactional sex and in the second stage, we assessed the relative risk of two primary outcomes (HIV and viremia) by engagement in transactional sex.

Individual- and relationship-level risk factors for transactional sex

Given the nascent stage of research on men who engage in transactional sex, we used risk factor analysis, a descriptive approach, to identify independent risk factors for transactional sex at the individual- and relationship-level. It is important to note that there are no causal assumptions made in risk factor analysis but results may provide insight into potential causal relationships which can be explored in future research (83, 84).

First, we examined individual-level demographic (e.g., age, educational attainment, marital status, occupation, community type, wealth) and behavioral (number of past-year sexual partners) characteristics of men who engaged in transactional sex with at least one past-year sexual partner with men who did not have any transactional sex partners. Unadjusted and adjusted modified Poisson regression models with robust standard errors were used to compare characteristics of men by engagement in transactional sex and reported as prevalence risk ratios (PRRs) with 95% confidence intervals (CIs). Multivariable analyses guided by the conceptual framework and the models were adjusted for age, marital status, occupation, and number of past-year sexual partners. We present analyses overall and stratified by community type (inland versus fishing) as these communities are economically, demographically, geographically distinct (68).

Next, we used RCCS egocentric partner block data to compare self-reported relationship-level characteristics (relationship label; partner's occupation; relationship length; condom use; knowledge of partner's HIV status; perceived likelihood of acquiring HIV from partner; alcohol use before sex; perpetration of verbal, physical, or sexual IPV; and a composite variable representing the co-occurrence of alcohol use before sex, sexual IPV, and multiple sexual partnership) of transactional sex versus other all other non-

marital, non-commercial sexual relationships. Unadjusted modified Poisson regression models with robust standard errors were used to compare relationship characteristics by relationship type (transactional sex versus other non-marital, non-commercial relationships) and reported as PRRs with 95% CIs. We present analyses overall and type (inland vs fishing) and relationship duration (once-off vs longer-term). We stratified by relationship duration because we expected once-off relationships to have different characteristics than longer-term relationships.

Relative risk of primary outcomes by engagement in transactional sex

In the second stage, we used modified Poisson regression with robust standard errors to estimate unadjusted and adjusted PRRs and 95% CIs for the primary outcomes (HIV and viremia) by engagement in transactional sex. Multivariable analyses were informed by the conceptual model and were adjusted for demographic characteristics only (age, marital status, and occupation). For the same reasons described in Stage 1, we present analyses overall and stratified by community type (inland vs fishing) and relationship duration (once-off vs longer-term).

4.4 Results

Description of study population

Of the 7,678 men included in the analysis, 699 (9.1%) reported one or more transactional sex relationships in the prior year. Table 1 presents the demographic characteristics of the sample and unadjusted (PRR) and adjusted (adjPRR) prevalence risk ratios for transactional sex. Approximately two-thirds of men in the sample were currently married. Almost 70%

resided in inland communities while the rest resided in fishing communities (30.9%). About half reported having one past-year sexual partner, 28.1% reported two partners, and 20.1% reported three or more partners. HIV prevalence was 17.3% and, among men living with HIV, 27% were viremic.

Individual-level demographic and behavioral correlates of transactional sex

In the unadjusted model, transactional sex was 1.56 times more common among young men aged 15-24 (95% CI: 1.32, 1.85) compared to men aged 25-34 years (Table 4.1).

Transactional sex was more frequent among fishermen (PRR: 1.73, 95% CI: 1.42,2.11) and students (PRR: 1.75, 95% CI: 1.23,2.49) compared to men employed in agriculture. Men

residing in fishing communities were 1.36 times more likely to engage in transactional sex (95% CI: 1.17,1.57) compared to men residing in inland communities. In the multivariable

model, engaging in transactional sex was associated with an unmarried marital status and greater number of past-year sexual partnerships. Never married (adjPRR:2.51; 95%

CI:2.03,3.10) and previously married men (adjPRR: 2.14; 95% CI: 1.77,2.59) were more than twice as likely to engage in transactional sex than currently married men. Men with

multiple sexual partners were more likely to engage in transactional sex (*2 partners* adjPRR: 3.14, 95% CI: 2.59,3.82; *≥3 partners* adjPRR: 5.34, 95% CI: 4.40,6.48) than men with only one sexual partner (Table 4.1).

Table 4.1 Characteristics of men by engagement in transactional sex in Rakai, Uganda, 2016-2018, N=7,678

Characteristic	Overall	TS	No TS	PRR (95% CI)	adjPRR (95% CI)
	n (%)	n (%)	n (%)		
Age Category					
15-24	1925 (25.1%)	259 (13.5%)	1,666 (86.5%)	1.56*** (1.32,1.84)	1.11 (0.91,1.36)
25-34	2776 (36.2%)	239 (8.6%)	2,537 (91.4%)	1 (1,1)	1 (1,1)
35-44	2260 (29.4%)	156 (6.9%)	2,104 (93.1%)	0.80* (0.66,0.97)	0.97 (0.80,1.17)
45-49	717 (9.3%)	45 (6.3%)	672 (93.7%)	0.73* (0.54,0.99)	1.05 (0.78,1.41)
Educational attainment					
No education	305 (4.0%)	29 (9.5%)	276 (90.5%)	1 (1,1)	
P1-P4	1782 (23.2%)	205 (11.5%)	1,577 (88.5%)	1.21 (0.84,1.75)	
P5-P7	3371 (43.9%)	321 (9.5%)	3,050 (90.5%)	1 (0.70,1.44)	
Secondary or higher	2220 (28.9%)	144 (6.5%)	2,076 (93.5%)	0.68* (0.47,1.00)	
Marital status					
Never married	1769 (23.0%)	259 (14.6%)	1,510 (85.4%)	2.64*** (2.25,3.11)	2.51*** (2.03,3.11)
Currently married	4798 (62.5%)	266 (5.5%)	4,532 (94.5%)	1 (1,1)	1 (1,1)
Previously married	1111 (14.5%)	174 (15.7%)	937 (84.3%)	2.82*** (2.36,3.38)	2.14*** (1.77,2.59)
Occupation					
Agriculture	2020 (26.3%)	156 (7.7%)	1,864 (92.3%)	1 (1,1)	1 (1,1)
Fishing	1570 (20.4%)	210 (13.4%)	1,360 (86.6%)	1.73*** (1.42,2.11)	1.17 (0.96,1.43)
Trading/vending	144 (1.9%)	6 (4.2%)	138 (95.8%)	0.54 (0.24,1.20)	0.44* (0.20,0.96)
Boda boda driver	454 (5.9%)	47 (10.4%)	407 (89.6%)	1.34 (0.98,1.83)	1 (0.74,1.35)
Student	244 (3.2%)	33 (13.5%)	211 (86.5%)	1.75** (1.23,2.49)	1.28 (0.88,1.85)
Other	3246 (42.3%)	247 (7.6%)	2,999 (92.4%)	0.99 (0.81,1.19)	0.79* (0.65,0.95)
Community type					
Inland	5303 (69.1%)	435 (8.2%)	4,868 (91.8%)	1 (1,1)	
Fishing	2375 (30.9%)	264 (11.1%)	2,111 (88.9%)	1.36*** (1.17,1.57)	
Wealth quintile					
1st	1182 (15.4%)	85 (7.2%)	1,097 (92.8%)	0.66** (0.52,0.85)	
2nd	1392 (18.1%)	143 (10.3%)	1,249 (89.7%)	0.95 (0.77,1.16)	
3rd	1610 (21.0%)	175 (10.9%)	1,435 (89.1%)	1 (1,1)	
4th	1715 (22.3%)	152 (8.9%)	1,563 (91.1%)	0.82 (0.66,1)	
5th	1779 (23.2%)	144 (8.1%)	1,635 (91.9%)	0.74** (0.60,0.92)	
Past-year sexual partners					
1	3978 (51.8%)	147 (3.7%)	3,831 (96.3%)	1 (1,1)	1 (1,1)
2	2159 (28.1%)	223 (10.3%)	1,936 (89.7%)	2.80*** (2.28,3.42)	3.14*** (2.59,3.82)
3 or more	1541 (20.1%)	329 (21.3%)	1,212 (78.7%)	5.78*** (4.80,6.95)	5.34*** (4.40,6.48)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Model adjusted for age, marital status, occupation, number of sexual partners.

Relationship-level correlates of transactional sex

A total of 6,899 past-year non-marital, non-commercial sexual relationships were reported by 4,390 men. Of these, 908 (13.1%) were transactional sex relationships. Table 4.2 shows characteristics of transactional sex and other non-marital, non-commercial relationships and unadjusted PRRs for transactional sex. Compared to relationships lasting 3 months to a year, once-off (PRR: 1.56; 95% CI: 1.34, 1.82) and <3 month-relationships (PRR: 1.25; 95% CI: 1.05, 1.49) were more likely to be transactional. Women employed in bars were 1.83 times more likely to be transactional sex partners (95% CI: 1.47, 2.27) than women employed in agriculture. Transactional sex partners of men were less likely to be students (PRR: 0.75; 95% CI: 0.59,0.94) and shopkeepers (PRR: 0.57; 95% CI: 0.42,0.78) compared to women employed in agriculture. In transactional sex relationships men were less likely to know their partner's HIV status (PRR: 0.58; 95% CI: 0.51,0.66) and more likely to rate their perceived likelihood of acquiring HIV from their transactional sex partner as "very likely" (PRR: 1.48; 95% CI: 1.27, 1.73) compared to non-transactional relationships. Relationships involving alcohol consumption before sex (*male partner only* PRR: 1.44; 95% CI: 1.17,1.77; *female partner only* PRR: 1.81; 95% CI: 1.45, 2.24; *both partners* PRR: 1.78; 95% CI: 1.55, 2.04), were more likely to be transactional than relationships with no alcohol consumption. Relationships involving the co-occurrence of alcohol use before sex, multiple past-year sexual partnerships, and/or sexual violence (*two behaviors*: PRR: 1.70; 95% CI: 1.39, 2.07; *three behaviors*: PRR: 2.48; 95% CI: 1.76, 3.50) were more likely to be transactional than relationships in which none of these behaviors were reported.

We stratified data by relationship duration (Table S4.2.1). In once-off relationships, transactional sex partners were more likely to be employed in bar work (PRR: 2.27; 95% CI: 1.55,3.34) or waitressing (PRR:1.55; 95% CI: 1.04,2.31) compared to women employed in agriculture. A similar association was found in longer-term relationships for women employed in bar work (PRR: 1.49; 95% CI: 1.13,1.98) but not waitressing. In longer-term relationships only, women employed in housework (PRR: 0.72; 95% CI: 0.52,0.99), students (PRR: 0.73; 95% CI: 0.55,0.98), and shopkeepers (PRR: 0.56; 95% CI: 0.39,0.81) were less likely to be transactional sex partners compared to women in other occupations. In both once-off and longer-term relationships men were less likely to know their transactional sex partner's HIV status (*once-off* PRR: 0.60; 95% CI:0.47,0.77; *longer-term* PRR: 0.63; 95% CI: 0.54,0.74) and more likely to rate the likelihood of acquiring HIV from their transactional sex partner as "very likely" (*once-off* PRR: 1.48; 95% CI: 1.17,1.87; *longer-term* PRR: 1.58; 95% CI:1.29,1.93) compared to non-transactional partners. In once-off and longer-term relationships, alcohol use before sex by both the respondent and his partner (*once-off* PRR: 2.45; 95% CI: 1.82,3.31; *longer-term* PRR: 1.80; 95% CI: 1.52,2.14) or the partner only (*once-off* PRR: 1.80; 95% CI: 1.45,2.24; *longer-term* PRR: 1.50; 95% CI: 1.11,2.03) was more likely to occur in transactional than non-transactional relationships. Co-occurrence of two risk behaviors (alcohol use, sexual IPV, or multiple partnerships) was almost twice as likely to occur in transactional relationships compared to non-transactional relationships in both once-off (PRR: 1.78; 95% CI: 1.34,2.36) and longer-term relationships (PRR: 1.85; 95% CI: 1.41,2.44).

Table 4.2 Characteristics of non-marital, non-commercial relationships in the previous 12 months reported by men in Rakai, Uganda, 2016-2018, N=6,899 relationships

Characteristic	Overall	TS	Non-TS	PRR (95% CI)
	n (%)	n (%)	n (%)	
Partner's occupation				
Agriculture	829 (12.0%)	119 (13.1%)	710 (11.9%)	1 (1,1)
Housework	820 (11.9%)	92 (10.1%)	728 (12.2%)	0.78 (0.61,1.01)
Student	1290 (18.7%)	138 (15.2%)	1152 (19.2%)	0.75* (0.59,0.94)
Shopkeeper	614 (8.9%)	50 (5.5%)	564 (9.4%)	0.57*** (0.41,0.78)
Trading/Vending	622 (9.0%)	72 (7.9%)	550 (9.2%)	0.81 (0.61,1.06)
Bar worker	523 (7.6%)	137 (15.1%)	386 (6.4%)	1.82*** (1.46,2.27)
Waitress/Restaurant owner	785 (11.4%)	118 (13.0%)	667 (11.1%)	1.05 (0.83,1.32)
Hairdresser/Salon owner	543 (7.9%)	71 (7.8%)	472 (7.9%)	0.91 (0.69,1.20)
Other	873 (12.7%)	111 (12.2%)	762 (12.7%)	0.89 (0.70,1.13)
Relationship length				
Once-off	1984 (28.8%)	345 (38.0%)	1639 (27.4%)	1.56*** (1.34,1.82)
< 3 months	1383 (20.0%)	192 (21.1%)	1191 (19.9%)	1.25* (1.05,1.49)
3 months to 1 year	2158 (31.3%)	240 (26.4%)	1918 (32.0%)	1 (1,1)
>1year	1374 (19.9%)	131 (14.4%)	1243 (20.7%)	0.86 (0.70,1.05)
Inconsistent condom use				
Respondent knows partner's HIV status	3366 (48.8%)	450 (49.6%)	2919 (48.7%)	1.03 (0.91,1.16)
Perceived likelihood of acquiring HIV from partner	3366 (48.8%)	323 (35.6%)	3043 (50.8%)	0.58*** (0.51,0.66)
Perceived likelihood of acquiring HIV from partner				
Unlikely or not at all	1963 (28.5%)	231 (25.4%)	1732 (28.9%)	1 (1,1)
Somewhat likely	2707 (39.2%)	292 (32.2%)	2415 (40.3%)	0.92 (0.78,1.08)
Very likely	2179 (31.6%)	380 (41.9%)	1799 (30.0%)	1.48*** (1.27,1.73)
DK/NR	50 (0.7%)	5 (0.6%)	45 (0.8%)	0.85 (0.37,1.97)
Alcohol use before sex				
Neither	3666 (53.1%)	362 (39.9%)	3304 (55.1%)	1 (1,1)
Respondent	683 (9.9%)	97 (10.7%)	586 (9.8%)	1.44*** (1.17,1.77)
Partner	477 (6.9%)	85 (9.4%)	392 (6.5%)	1.80*** (1.45,2.24)
Both	2073 (30.0%)	364 (40.1%)	1709 (28.5%)	1.78*** (1.55,2.04)
Verbal IPV				
Verbal IPV	752 (10.9%)	83 (9.1%)	669 (11.2%)	0.82 (0.66,1.02)
Physical IPV				
Physical IPV	315 (4.6%)	35 (3.9%)	280 (4.7%)	0.84 (0.61,1.15)
Sexual IPV				
Sexual IPV	51 (0.7%)	11 (1.2%)	40 (0.7%)	1.65 (0.97,2.79)
Co-occurrence of risk behaviors				
None	1067 (15.5%)	106 (11.7%)	961 (16.0%)	1 (1, 1)
Any 1 behavior	2854 (41.4%)	289 (31.8%)	2,565 (42.8%)	1.02 (0.83,1.26)
Any 2 behaviors	2361 (41.2%)	479 (52.8%)	2,361 (39.4%)	1.70*** (1.39,2.07)
All 3 behaviors	138 (2.0%)	34 (3.7%)	104 (1.7%)	2.48*** (1.76,3.50)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.00$; DK/NR: does not know/not reported

Association between transactional sex and HIV prevalence

Overall HIV prevalence was 17.2% (N=1,332) with 18.6% (n=130) among men who engaged in transactional sex and 17.1% (n=1,192) among men who did not. In unadjusted and adjusted models overall, transactional sex was not associated with HIV prevalence (adjPRR:1.04; 95% CI:0.87,1.18) (Table 4.3). Figure 4.1 (Panel A) shows HIV prevalence by engagement in transactional sex and age group. Point estimates for HIV prevalence were higher among men engaged in transactional sex for all age groups except 15–24-year-olds (TS: 1.5% vs No TS: 3.1%; PRR: 0.49; 95% CI: 0.18,1.36); however, HIV prevalence was only statistically significantly higher among 25-34-year-olds (26.4% vs. 18.1%; PRR: 1.46; 95% CI: 1.16,1.83). Men who in engaged in transactional sex who were currently married (PRR: 1.32; 95% CI 1.06,1.64) had higher HIV prevalence than married men in non-transactional relationships. Among men who had only one past-year sexual partner, those who engaged in transactional sex with that one partner had lower HIV prevalence (PRR: 0.42; 95% CI: 0.23,0.77) than men who did not engage in transactional sex (Table 4.3).

We stratified data by relationship duration (Table S4.3.1) and community type (Table S4.3.2). Among men who reported once-off relationships, HIV prevalence did not differ by engagement in transactional sex regardless of age, educational attainment, marital status, occupation, community type, wealth, circumcision status, or number of past-year sexual partners (Table S4.3.1). Among men in longer-term relationships, 35-44-year-olds (PRR: 1.44; 95% CI: 1.05,1.98) and currently married men (PRR: 1.41; 95% CI: 1.06,1.88) engaged in transactional sex had greater HIV prevalence compared to their peers in non-transactional relationships. Men in long-term relationships who reported only one past-

year transactional relationship had lower HIV prevalence (PRR: 0.43; 95% CI: 1.06,1.88) than men who reported one non-transactional relationship. All associations were attenuated in the multivariable model restricted to men in longer-term relationships.

Among men residing in inland communities, we did not observe an association between HIV prevalence by engagement in transactional sex regardless of age, educational attainment, marital status, occupation, community type, wealth, circumcision status, or number of past-year sexual partners among men (Table S4.3.2). In fishing communities, we observed higher prevalence of HIV among men engaged in transactional sex who were 25-34-years-old (PRR:1.32; 95% CI:1.05,1.65), currently married (PRR:1.38; 95% CI:1.12,1.71), and men who reported two past-year sexual partners (PRR:1.55; 95% CI:1.18,2.04) compared to men with the same characteristics in non-transactional relationships. In the multivariable model restricted to men in fishing communities, married men engaged in transactional sex (adjPRR: 1.28; 95% CI: 1.05,1.57) were more likely to have HIV compared to married men not engaged in transactional sex.

Figure 4.1 Prevalence of HIV and viremia by engagement in transactional sex and age group, 2016-2018, N=7,678

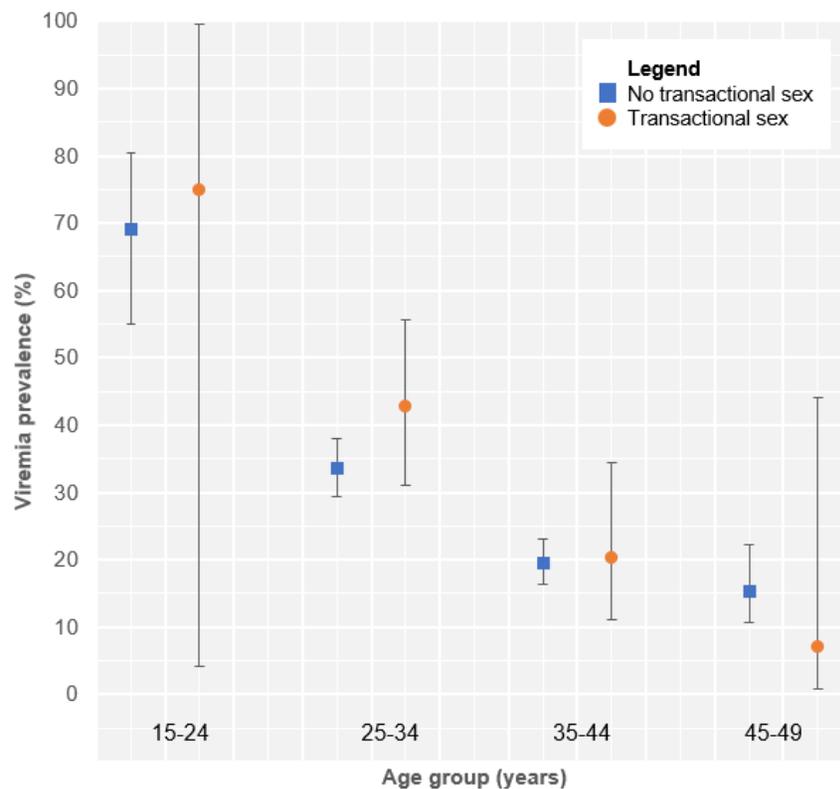
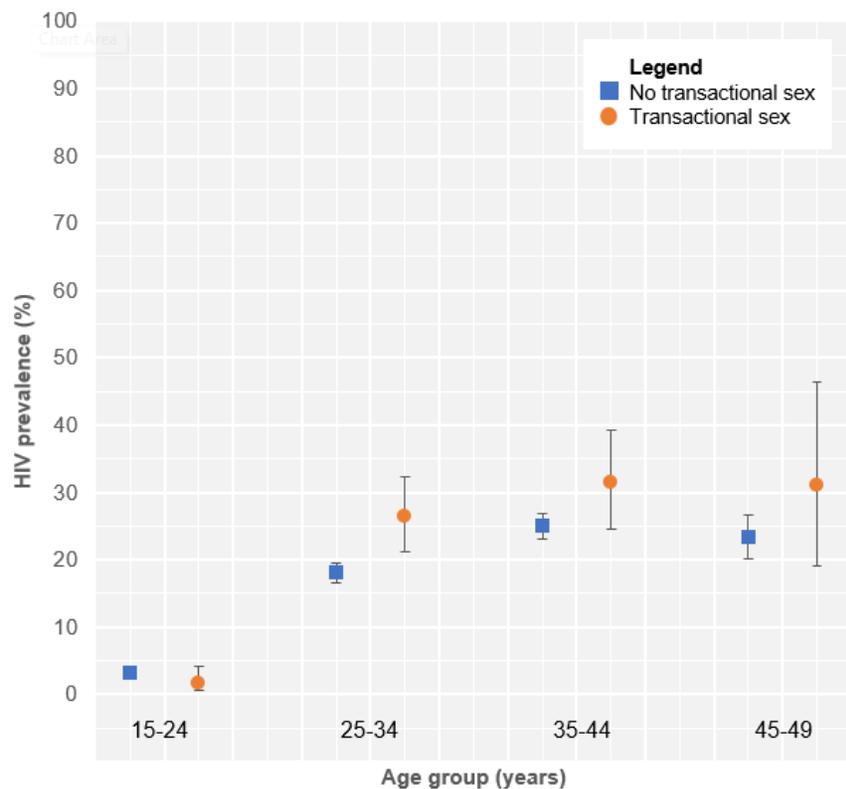


Table 4.3 Prevalence ratios for HIV among men in Rakai District, Uganda by report of transactional sex, 2016-2018, N=7,678

	TS (N= 699)		No TS (N=6,979)		PRR (95% CI)	adjPRR (95% CI)
	No. HIV+/ Total	Prev, %	No. HIV+/ Total	Prev, %		
Age Category						
15-24	4/259	1.5	52/1666	3.1	0.49 (0.18,1.36)	0.47 (0.17,1.30)
25-34	63/239	26.4	459/2537	18.1	1.46** (1.16,1.83)	1.12 (0.89,1.39)
35-44	49/156	31.4	525/2104	25.0	1.26 (0.99,1.61)	1.02 (0.82,1.28)
45-49	14/45	31.1	156/672	23.2	1.34 (0.85,2.12)	1.01 (0.64,1.58)
Educational attainment						
No education	11/29	37.9	98/276	35.5	1.07 (0.65,1.75)	
P1-P4	52/205	25.4	416/1577	26.4	0.96 (0.75,1.23)	
P5-P7	54/321	16.8	500/3050	16.4	1.03 (0.79,1.33)	
Secondary or above	13/144	9.0	178/2076	8.6	1.05 (0.62,1.80)	
Marital status						
Never married	7/259	2.7	63/1510	4.2	0.65 (0.30,1.40)	0.63 (0.30,1.35)
Currently married	65/266	24.4	841/4532	18.6	1.32* (1.06,1.64)	1.15 (0.94,1.40)
Previously married	58/174	33.3	288/937	30.7	1.08 (0.86,1.37)	0.99 (0.79,1.24)
Occupation						
Agriculture	13/156	8.2	236/1864	12.7	0.66 (0.39,1.12)	0.76 (0.45,1.28)
Fishing	83/210	39.5	537/1360	39.5	1.00 (0.84,1.20)	1.07 (0.90,1.27)
Boda boda driver	5/47	10.6	47/407	11.6	0.92 (0.39,2.20)	0.91 (0.39,2.12)
Community type						
Inland	33/435	7.6	510/4868	10.5	0.72 (0.52,1.02)	
Fishing	97/264	36.7	682/2111	32.3	1.14 (0.96,1.35)	
Wealth quintile						
1 st	7/85	8.2	119/1097	10.9	0.76 (0.37,1.58)	
2 nd	30/143	21.0	204/1249	16.3	1.28 (0.91,1.81)	
3 rd	46/175	26.3	306/1435	21.3	1.23 (0.94,1.61)	
4 th	26/152	17.1	320/1563	20.5	0.84 (0.58,1.20)	
5 th	21/144	14.6	243/1635	14.9	0.98 (0.65,1.48)	
Circumcision status						
Uncircumcised	62/626	25.1	564/2587	21.8	1.15 (0.92,1.45)	
Circumcised	68/452	15.0	627/4391	14.3	1.05 (0.84,1.33)	
Past-year sexual partners						
1	10/147	6.8	618/3831	16.1	0.42** (0.23,0.77)	
2	46/223	20.6	341/1936	17.6	1.17 (0.89,1.54)	
3+	74/329	22.5	233/1212	19.2	1.17 (0.93,1.47)	

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Adjusted for age, occupation, marital status.

Association between transactional sex and prevalence of HIV viremia among men living with HIV

We did not detect an association between transactional sex and viremia among men overall (adjPRR:1.05; 95% CI:0.81,1.37). Figure 4.1 (Panel B) shows the prevalence of HIV viremia among men living with HIV by engagement in transactional sex and age group. There were no clear patterns in prevalence of viremia by age and transactional sex. Confidence intervals for men who engaged in transactional sex were wide, particularly for young men aged 15-24 (n=10), indicating low precision. While there was no overall association between transactional sex and prevalence of viremia, specific subgroups of men engaged in transactional sex had higher prevalence of HIV compared to their counterparts not engaged in transactional sex. In bivariate analyses these subgroups included currently married men (PRR: 1.51; 95% CI: 1.03,2.23), boda boda drivers (PRR: 2.51; 95% CI: 1.36,4.62), and men in the second wealth quintile (PRR: 1.82; 95% CI: 1.19,2.78). In the multivariable model, prevalence of viremia remained statistically significantly higher among boda boda drivers who engaged in transactional sex (adjPRR: 2.32 95% CI: 1.47,3.67) (Table 4.4).

We stratified data by relationship duration (Table S4.4.1) and community type (Table S4.4.2). Among men living with HIV in once-off transactional sex relationships, we only observed higher prevalence of viremia among men with secondary or higher education (PRR: 1.78; 95% CI: 1.30,2.42) compared to men with the same education level in once-off non-transactional relationships (Table S4.4.1). Education was not associated with prevalence of viremia in longer-term transactional sex relationships. In longer-term transactional sex relationships, young men aged 15-24 (PRR: 1.75; 95% CI: 1.26,2.43) and boda boda drivers (PRR: 3.78;95% CI: 2.14,6.67) were more likely to be viremic than their peers in non-transactional relationships.

Men living with HIV residing in inland communities who engaged in transactional sex had greater prevalence of viremia if they were boda boda drivers (PRR: 2.72; 95% CI: 1.36,5.42) and in the second wealth quintile (PRR: 2.62; 95% CI: 1.39,4.92) compared to men with the same characteristics who did not engage in transactional relationships (Table S4.4.2). Men with higher levels of education in transactional sex relationships, were more likely to be viremic in both inland (*grades P5-P7* PRR: 1.67; 95% CI: 1.03,2.72) and fishing communities (*secondary or higher* PRR: 2.18; 95% CI 1.19,4.01) compared to men with the same level of education who were in non-transactional relationships. In fishing communities only, young men aged 15-24 living with HIV who engaged in transactional sex (PRR: 1.33; 95% CI: 1.05,1.69) were more likely to be viremic than young men in non-transactional relationships.

Table 4.4 Prevalence risk ratios for HIV viremia among HIV-positive men in Rakai District, Uganda by report of transactional sex, 2016-2018, N=1,322

	TS		No TS		PRR (95% CI)	adjPRR (95% CI)
	No. Viremic/ Total HIV+	Prev, %	No. Viremic/ Total HIV+	Prev, %		
Age Category						
15-24	3/4	75.0	36/52	69.2	1.08 (0.59,1.97)	1.11 (0.60,2.04)
25-34	27/63	42.9	154/469	33.6	1.28 (0.93,1.75)	1.2 (0.88,1.64)
35-44	10/49	20.4	102/525	19.4	1.05 (0.59,1.88)	0.91 (0.50,1.63)
45-49	1/14	7.1	24/156	15.4	0.46 (0.07,3.20)	0.34 (0.04,2.80)
Educational attainment						
No education	3/11	27.3	26/98	26.5	1.03 (0.37,2.86)	
P1-P4	16/52	30.8	110/416	26.4	1.16 (0.75,1.80)	
P5-P7	17/54	31.5	315/500	27.0	1.17 (0.77,1.77)	
Secondary or above	5/13	38.5	45/178	25.3	1.52 (0.73,3.17)	
Marital status						
Never married	3/7	42.9	39/63	61.9	0.69 (0.29,1.67)	0.64 (0.28,1.47)
Currently married	20/65	30.8	171/841	20.3	1.51* (1.03,2.23)	1.39 (0.97,2.01)
Previously married	18/58	31.0	106/288	36.8	0.84 (0.56,1.27)	0.88 (0.59,1.32)
Occupation						
Agriculture	5/13	38.5	53/236	22.5	1.71 (0.83,3.55)	1.3 (0.63,2.69)
Fishing	26/83	31.3	140/537	26.1	1.2 (0.85,1.70)	1.08 (0.76,1.53)
Boda boda driver	4/5	80.0	15/47	31.9	2.51** (1.36,4.62)	2.32*** (1.47,3.67)
Wealth quintile						
1 st	2/7	28.6	47/119	39.5	0.72 (0.22,2.39)	
2 nd	15/30	50.0	56/204	27.5	1.82** (1.19,2.78)	
3 rd	12/46	26.1	84/306	27.5	0.95 (0.56,1.60)	
4 th	8/26	30.8	77/320	24.1	1.28 (0.70,2.35)	
5 th	4/21	19.1	52/243	21.4	0.89 (0.36,2.22)	
Community type						
Inland	12/33	36.4	143/510	28.0	1.3 (0.81,2.08)	
Fishing	29/97	29.9	173/682	25.4	1.18 (0.85,1.64)	
Circumcision status						
Uncircumcised	21/62	33.9	153/564	27.1	1.25 (0.86,1.81)	
Circumcised	20/68	29.4	163/627	26.0	1.13 (0.76,1.67)	
Past-year sexual partners						
1	4/10	40.0	154/618	24.9	1.61 (0.74,3.47)	
2	13/46	28.3	83/341	24.3	1.16 (0.71,1.91)	
3+	24/74	32.4	79/233	33.9	0.96 (0.66,1.39)	

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Model adjusted for age, marital status, occupation.

4.1 Discussion

We examined the risk factors for transactional sex and assessed its association with prevalence of HIV and viremia in this population-based study of men in Rakai, Uganda. The prevalence of past-year transactional sex was 9% (8% in inland communities; 11% in fishing communities). We found that transactional sex was more common among unmarried men and men with multiple past-year sexual partners. Transactional sex relationships were more likely to be once-time sexual encounters compared to longer-term relationships. Compared to men in non-transactional relationships, men in transactional relationships were more likely to perceive their partners as high-risk. Men reported their transactional sex partners were more often employed in professions associated with high HIV risk like bar work compared to other professions. We did not observe an association with prevalence of HIV or viremia in the sample overall. However, transactional sex was associated with HIV among men in fishing villages in some age groups and among those currently married. Boda boda drivers who engaged in transactional sex were more than twice as likely to be viremic than their peers in non-transactional relationships.

Though prevalence estimates for transactional sex among men have been reported in other studies, inconsistency in transactional sex definitions and measurement make comparison of prevalence estimates challenging. Given this caveat, our prevalence estimate is relatively low compared to those reported in other settings in sub-Saharan Africa. A study in rural Tanzania reported 13% transactional sex prevalence at last sex among men (50) and a study of fishermen working along the Kenyan side of Lake Victoria

reported 65% prevalence of transactional sex with at least one of their last three sexual partners (49).

We found that men who were never or previously married and those reporting multiple past-year sexual partners were consistently more likely than others to engage in transactional sex. The association between transactional sex and men's marital status warrants further study as there is heterogeneity in findings reported. Some studies report that that transactional sex is more common in divorced or widowed men (43) and never married men (85), while others report no association (86). Greater prevalence of transactional sex among men with more sexual partners has been reported consistently across studies and settings (41, 42, 80, 86).

Our finding that students and youth were more likely to engage in transactional sex in unadjusted models was contrary to our initial hypotheses, though transactional sex in these groups has been documented in other studies (42, 85). Because men in transactional sex relationships are expected to provide for their partners, male transactional partners are often assumed to be older and working (16). Engagement in transactional sex among young men aged 15-24 and students may indicate a change in social norms around provision. Literature on transactional sex among young women, who are most likely to be the sexual partners of youth, suggests that the increasing influence of consumer culture in sub-Saharan Africa may drive the desire for material items representing modernity (e.g., clothes, jewelry, mobile airtime) (16, 37, 87, 88). It is possible that young men and students provide an affirmative response to our transactional measure even when providing these smaller gifts to their partners which differs from other paradigms of transactional sex in

which men provide greater financial support to their transactional sex partners (e.g., children's school fees, rent, etc.).

We found that men in transactional sex relationships were less likely to know their partner's HIV status and more likely to perceive their partners as high-risk for HIV. Men's choice of transactional sex partners, commonly women who work in bars, could be related to this perceived risk. Prior research on women in Rakai who work in bars reported high rates of untreated HIV compared to women employed in other fields, and stable HIV incidence despite significant declines in HIV incidence in the region overall and scale-up of HIV interventions (89). Our finding of frequent alcohol use before sex in transactional sex relationships could also be related to men's partner choice and environment in which relationships are formed. Prior research with female sex workers in sub-Saharan Africa, who often find clients in bars, reported that the purchase of alcohol by men signaled an implicit agreement of sexual exchange and facilitated high levels of alcohol use (90). Though men's partners in our study were not sex workers, there may be a similar mechanism of entering into a social contract of sexual exchange with bar workers which facilitates alcohol use. Alcohol consumption has been linked with transactional sex in other studies (91) and has implications for HIV risk as it lowers inhibitions, heightens sexual risk behaviors (92-94). In addition to alcohol use, transactional sex has been linked to multiple partnerships and perpetration of sexual violence with intimate partners (95, 96). To explore this relationship further, we examined the co-occurrence of these three HIV risk behaviors. More than half of transactional sex relationships involved at least two of these behaviors

and in relationships with all three behaviors, transactional sex was 2.5 times more common than in relationships with none of these risk behaviors.

The context for HIV transmission in transactional sex relationships in fishing communities is likely to be different than in inland communities because of the high density of bars in fishing communities facilitating transactional sex and demographics of the population in fishing villages, a large proportion of whom are young, highly mobile fishermen (97, 98). HIV prevalence reaches up to 43% in fishing communities in Rakai District (68). We observed an association between transactional sex and HIV prevalence among men residing in fishing communities who were ages 25-34 or currently married. Married fishermen may migrate away from their wives to fishing communities for economic opportunities where they may pursue new sexual relationships (99). Fishermen have access to cash due to the premium prices paid for fish and this access increases bargaining power in transactional relationships (99, 100). It appears that both occupation and environment are important factors influencing HIV risk among men who engage in transactional sex. A substantial proportion of men residing in fishing communities were not fisherman (40%) yet those who were married or ages 25-34 were still more likely to have HIV than their peers in inland communities.

We also observed a link between transactional sex and prevalence of viremia (≥ 1000 copies/mL) among boda boda drivers. However, These results are consistent with literature finding the largest burden of untreated HIV among transport workers, including boda boda drivers, and no declines in HIV incidence despite the increase in availability of HIV interventions in region (89). Prior research on boda boda drivers found that this highly

mobile profession allowed men to establish multiple and concurrent sexual relationships with women across a wide network and, similar to fishermen, gain regular access to cash which could be used to pursue transactional sex relationships (101). Further examination of boda boda drivers who engage in transactional sex could shed light on the risks for onward transmission to sexual networks.

This study is among the first to assess factors associated with transactional sex among men in Uganda. A major strength of this study is the use of a large, population-based sample drawn from the Rakai Community Cohort Study. This ongoing study collects detailed information on sexual behavior within partnerships which was used to characterize transactional sex relationships and compare to other relationship types. We also utilized biological specimens collected by the RCCS, rather than self-report, to assess men's HIV status and viral load measurements. However, this study also has limitations. The transactional sex item we used may have resulted in some misclassification of transactional sex relationship. Cognitive interviews conducted with men in this setting showed that the measure we used to identify transactional sex relationships may misclassify transactional relationships as non-transactional and therefore, we may have underestimated the prevalence of transactional sex. We addressed other potential issues of misclassification, which have been identified by Wamoyi et al. (2) as weakness in prior transactional sex studies, by classifying relationships in which the partner's occupation was listed as "sex worker" as non-transactional regardless of the response to the transactional sex item. Our finding that bar workers were more likely to be transactional sex partners may suggest that some commercial sex relationships were captured, though this is an area

where the line between commercial sex and transactional sex blurs. Finally, because this was a cross-sectional study, we did not attempt to make inferences on the causal relationship between transactional sex and HIV infection. Longitudinal analyses could shed light on the temporal relationship between transactional sex and incident HIV, providing evidence to support causality around HIV transmission.

4.2 Conclusion

In summary, we found that transactional sex relationships often involved co-occurring high-risk sexual behaviors and partners engaged in high-risk occupations. The large proportion of young men and students reported engaging in transactional sex may have heightened risk of HIV acquisition, and this warrants further study. We identified characteristics of men engaged in transactional sex, specifically boda boda drivers, who may be at greater risk of onward transmission of HIV. Interventions targeting boda boda drivers should focus on increasing uptake of and engagement in HIV services in this highly mobile population to decrease risk of onward transmission of HIV to transactional sex partners and AIDS-related morbidity and mortality.

Figure S4.1 Conceptual model for the relationship between transactional sex and HIV outcomes

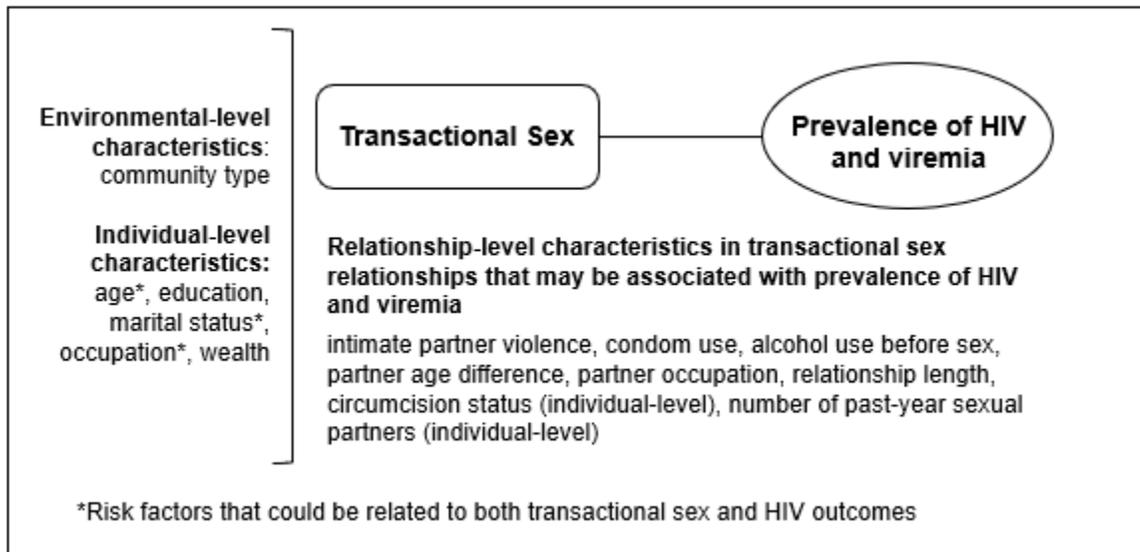


Table S4.1.1 Prevalence risk ratios for transactional sex stratified by relationship length in Rakai, Uganda stratified by report of transactional sex and relationship duration, 2016-2018

A. Once-off relationships

Characteristic	TS	No TS	PRR (95% CI)
	n (%)	n (%)	
Relationship type	100 (29.0%)	630 (38.4%)	1 (1,1)
Girlfriend	209 (60.6%)	923 (56.3%)	1.35** (1.08,1.68)
Friend	36 (10.4%)	87 (5.3%)	2.14*** (1.54,2.97)
Other			
Partner's occupation			
Agriculture	29 (8.4%)	142 (8.7%)	1 (1,1)
Housework	39 (11.3%)	243 (14.8%)	0.82 (0.52,1.27)
Student	61 (17.7%)	461 (28.1%)	0.69 (0.46,1.04)
Shopkeeper	14 (4.1%)	129 (7.9%)	0.58 (0.32,1.05)
Trading/Vending	19 (5.5%)	108 (6.6%)	0.88 (0.52,1.50)
Bar worker	64 (18.6%)	102 (6.2%)	2.27*** (1.55,3.34)
Waitress/Restaurant owner	56 (16.2%)	157 (9.6%)	1.55* (1.04,2.31)
Hairdresser/Salon owner	18 (5.2%)	101 (6.2%)	0.89 (0.52,1.53)
Other	45 (13.0%)	197 (12.0%)	1.1 (0.72,1.68)
Inconsistent condom use	226 (65.5%)	1121 (68.4%)	1.11 (0.91,1.36)
Knows partner's HIV status	67 (19.4%)	504 (30.7%)	0.60*** (0.47,0.77)
Perceived likelihood of HIV acquisition from partner	106 (30.7%)	602 (36.7%)	1 (1,1)
Unlikely or not at all	107 (31.0%)	565 (34.5%)	1.06 (0.83,1.36)
Somewhat likely	130 (37.7%)	456 (27.8%)	1.48*** (1.17,1.87)
Very likely	2 (0.6%)	17 (1.0%)	0.7 (0.19,2.64)
Doesn't know/Not reported			
Alcohol use before sex	145 (42.0%)	985 (60.1%)	1 (1,1)
Neither	33 (9.6%)	157 (9.6%)	1.35 (0.96,1.91)
Respondent	40 (11.6%)	87 (5.3%)	2.45*** (1.82,3.31)
Partner	127 (36.8%)	411 (25.1%)	1.84*** (1.48,2.28)
Both	6 (1.7%)	63 (3.8%)	0.49 (0.23,1.06)
Verbal IPV	2 (0.6%)	32 (2.0%)	0.33 (0.09,1.29)
Physical IPV	1 (0.3%)	3 (0.2%)	1.44 (0.26,7.88)
Sexual IPV			
Co-occurrence of risk behaviors	52 (15.1%)	345 (21.0%)	1 (1,1)
None	683 (41.7%)	105 (30.4%)	1.02 (0.75,1.39)
Any 1 behavior	612 (37.3%)	188 (54.5%)	1.78*** (1.34,2.36)
Any 2 behaviors	100 (29.0%)	630 (38.4%)	1 (1,1)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; Co-occurrence of risk behaviors: respondent reports a combination of alcohol use, sexual IPV, multiple partnerships; Longer-term partnerships refer to relationships with a duration longer than one sexual encounter; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A. Longer-term relationships

Characteristic	TS	No TS	PRR (95% CI)
	n (%)	n (%)	
Relationship type	544 (96.6%)	4221 (97.0%)	1 (1,1)
Girlfriend	17 (3.0%)	89 (2.0%)	1.4 (0.90,2.19)
Friend	2 (0.4%)	41 (0.9%)	0.41 (0.11,1.58)
Other			
Partner's occupation			
Agriculture	90 (16.0%)	568 (13.1%)	1 (1,1)
Housework	53 (9.4%)	485 (11.1%)	0.72* (0.52,0.99)
Student	77 (13.7%)	691 (15.9%)	0.73* (0.55,0.98)
Shopkeeper	36 (6.4%)	435 (10.0%)	0.56** (0.39,0.81)
Trading/Vending	53 (9.4%)	442 (10.2%)	0.78 (0.57,1.08)
Bar worker	73 (13.0%)	284 (6.5%)	1.49** (1.13,1.98)
Waitress/Restaurant owner	62 (11.0%)	510 (11.7%)	0.79 (0.59,1.07)
Hairdresser/Salon owner	53 (9.4%)	371 (8.5%)	0.91 (0.67,1.25)
Other	66 (11.7%)	565 (13.0%)	0.76 (0.57,1.03)
Inconsistent condom use	232 (41.2%)	1951 (44.8%)	1.14 (0.97,1.34)
Knows partner's HIV status	256 (45.5%)	2539 (58.4%)	0.63*** (0.54,0.74)
Perceived likelihood of acquiring HIV from partner	125 (22.2%)	1130 (26.0%)	1 (1,1)
Unlikely or not at all	185 (32.9%)	1850 (42.5%)	0.91 (0.74,1.13)
Somewhat likely	250 (44.4%)	1343 (30.9%)	1.58*** (1.29,1.93)
Very likely	125 (22.2%)	1130 (26.0%)	0.97 (0.33,2.89)
Doesn't know/Not reported			
Alcohol use before sex	217 (38.5%)	2319 (53.3%)	1 (1,1)
Neither	64 (11.4%)	429 (9.9%)	1.52** (1.17,1.97)
Respondent	45 (8.0%)	305 (7.0%)	1.50** (1.11,2.03)
Partner	237 (42.1%)	1298 (29.8%)	1.80*** (1.52,2.14)
Both	77 (13.7%)	606 (13.9%)	0.98 (0.78,1.23)
Verbal IPV	33 (5.9%)	248 (5.7%)	1.03 (0.74,1.43)
Physical IPV	10 (1.8%)	37 (0.9%)	1.87* (1.07,3.26)
Sexual IPV			
Co-occurrence of risk behaviors	54 (9.6%)	616 (14.2%)	1 (1,1)
None	1,882 (43.3%)	184 (32.7%)	1.11 (0.83,1.48)
Any 1 behavior	1,853 (42.6%)	325 (57.7%)	1.85*** (1.41,2.44)
Any 2 behaviors	544 (96.6%)	4221 (97.0%)	1 (1,1)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; Co-occurrence of risk behaviors: respondent reports a combination of alcohol use, sexual IPV, multiple partnerships; Longer-term partnerships refer to relationships with a duration longer than one sexual encounter; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table S4.1.2 Prevalence risk ratios for transactional sex among men in Rakai, Uganda stratified by community type, 2016-2018

A. Inland Communities (N=5,303)

Characteristic	TS	No TS	PRR (95% CI)	adjPRR (95% CI)
	n (%)	n (%)		
Age Category				
15-24	195 (13.4%)	1,256 (86.6%)	1.94*** (1.57,2.41)	1.2 (0.92,1.58)
25-34	123 (6.9%)	1,653 (93.1%)	1 (1,1)	1 (1,1)
35-44	95 (6.2%)	1,445 (93.8%)	0.89 (0.69,1.15)	1.06 (0.82,1.37)
45-49	22 (4.1%)	514 (95.9%)	0.59* (0.38,0.92)	0.79 (0.50,1.23)
Occupation				
Agriculture	147 (7.7%)	1,770 (92.3%)	1 (1,1)	1 (1,1)
Fishing	8 (7.8%)	94 (92.2%)	1.02 (0.52,2.03)	0.96 (0.51,1.83)
Trading/vending	5 (4.9%)	97 (95.1%)	0.64 (0.27,1.52)	0.57 (0.25,1.31)
Boda boda driver	45 (11.2%)	357 (88.8%)	1.46* (1.06,2.00)	1.11 (0.81,1.52)
Student	32 (14.2%)	194 (85.8%)	1.85*** (1.29,2.64)	1.26 (0.86,1.85)
Other	198 (7.8%)	2,356 (92.2%)	1.01 (0.82,1.24)	0.89 (0.73,1.10)
Marital status				
Never married	203 (14.4%)	1,205 (85.6%)	2.99*** (2.45,3.64)	2.60*** (1.95,3.46)
Currently married	161 (4.8%)	3,178 (95.2%)	1 (1,1)	1 (1,1)
Previously married	71 (12.8%)	485 (87.2%)	2.65*** (2.03,3.45)	2.41*** (1.84,3.15)
Wealth quintile				
1 st	85 (7.2%)	1,097 (92.8%)	0.76 (0.563,1.026)	0.65** (0.48,0.87)
2 nd	99 (8.8%)	1,025 (91.2%)	0.931 (0.697,1.243)	0.85 (0.64,1.13)
3 rd	72 (9.5%)	689 (90.5%)	1 (1,1)	1 (1,1)
4 th	79 (8.0%)	903 (92.0%)	0.85 (0.627,1.154)	0.84 (0.63,1.13)
5 th	100 (8.0%)	1,154 (92.0%)	0.843 (0.631,1.126)	0.8 (0.60,1.06)
Past-year sexual partners				
1 partner	118 (3.9%)	2,938 (96.1%)	1 (1,1)	1 (1,1)
2 partners	153 (10.5%)	1,305 (89.5%)	2.72*** (2.16,3.43)	3.17*** (2.54,3.96)
3+ partners	164 (20.8%)	625 (79.2%)	5.38*** (4.31,6.73)	5.22*** (4.15,6.56)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; adjPRR: adjusted prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; model adjusted for age category, occupation, marital status, wealth, and past-year sexual partners.

B. Fishing Communities (N=2,375)

Characteristic	TS	No TS	PRR (95% CI)	adjPRR (95% CI)
	n (%)	n (%)		
Age Category				
15-24	64 (13.5%)	410 (86.5%)	1.16 (0.88,1.55)	0.97 (0.71,1.33)
25-34	116 (11.6%)	884 (88.4%)	1 (1,1)	1 (1,1)
35-44	61 (8.5%)	659 (91.5%)	0.73* (0.54,0.98)	0.81 (0.61,1.08)
45-49	23 (12.7%)	158 (87.3%)	1.1 (0.72,1.66)	1.45 (0.98,2.14)
Occupation				
Agriculture	9 (8.7%)	94 (91.3%)	1 (1,1)	1 (1,1)
Fishing	202 (13.8%)	1,266 (86.2%)	1.57 (0.83,2.98)	1.22 (0.66,2.25)
Trading/vending	1 (2.4%)	41 (97.6%)	0.27 (0.04,2.09)	0.24 (0.03,1.80)
Boda boda driver	2 (3.8%)	50 (96.2%)	0.44 (0.10,1.96)	0.34 (0.08,1.39)
Student	1 (5.6%)	17 (94.4%)	0.64 (0.09,4.72)	0.83 (0.10,6.64)
Other	49 (7.1%)	643 (92.9%)	0.81 (0.41,1.60)	0.61 (0.32,1.16)
Marital status				
Never married	56 (15.5%)	305 (84.5%)	2.16*** (1.59,2.92)	2.20*** (1.56,3.09)
Currently married	105 (7.2%)	1,354 (92.8%)	1 (1,1)	1 (1,1)
Previously married	103 (18.6%)	452 (81.4%)	2.58*** (2.00,3.32)	1.85*** (1.41,2.43)
Wealth quintile				
1 st	0 (0%)	0 (0%)	--	--
2 nd	44 (16.4%)	224 (83.6%)	1.35 (0.98,1.87)	1.07 (0.78,1.48)
3 rd	103 (12.1%)	746 (87.9%)	1 (1,1)	1 (1,1)
4 th	73 (10.0%)	660 (90.0%)	0.82 (0.62,1.09)	1 (0.76,1.31)
5 th	44 (8.4%)	481 (91.6%)	0.69* (0.49,0.97)	1.02 (0.72,1.44)
Past-year sexual partners				
1 partner	29 (3.1%)	893 (96.9%)	1 (1,1)	1 (1,1)
2 partners	70 (10.0%)	631 (90.0%)	3.17*** (2.08,4.84)	3.32*** (2.20,5.02)
3+ partners	165 (21.9%)	587 (78.1%)	6.98*** (4.76,10.23)	6.36*** (4.28,9.44)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; -- no cases; model adjusted for age category, occupation, marital status, wealth, and past-year sexual partners.

Table S4.3.1 Prevalence risk ratios for HIV among men in Rakai District, Uganda by report of transactional sex and relationship duration, 2016-2018

A. Once-off (N=1,956)

	TS		No TS		PRR
	No. HIV+ /total	Prev, %	No. HIV+ /total	Prev, %	
Age Category					
15-24	3/152	2.0	24/687	3.5	0.47 (0.11,1.94)
25-34	39/ 141	27.7	104/ 510	20.4	1.17 (0.80,1.71)
35-44	22/76	29.0	104/309	33.7	0.87 (0.57,1.32)
45-49	7/21	33.3	17/60	28.3	0.92 (0.40,2.13)
Educational attainment					
No education	7/22	31.8	26/73	35.6	0.76 (0.34,1.71)
P1-P4	30/123	24.4	95/387	24.6	0.97 (0.64,1.46)
P5-P7	28/179	15.6	101/547	15.6	1.01 (0.66,1.54)
Secondary or above	6/66	9.1	27/459	5.9	0.28 (0.04,2.00)
Marital status					
Never married	5/152	3.3	31/692	4.5	0.53 (0.16,1.70)
Currently married	29/128	22.7	103/537	19.2	1.13 (0.75,1.70)
Previously married	37/110	33.6	225/337	34.1	0.93 (0.65,1.33)
Occupation					
Agriculture	6/69	8.7	23/277	8.3	1.38 (0.59,3.24)
Fishing	45/125	36.0	146/ 418	34.9	0.94 (0.67,1.31)
Boda boda driver	4/31	12.9	13/84	15.5	1.17 (0.42,3.27)
Community type					
Inland	15/220	6.8	68/899	7.6	1.12 (0.66,1.92)
Fishing	56/170	32.9	181/667	27.1	1.05 (0.77,1.43)
Wealth quintile					
1 st	4/51	7.8	20/249	8.0	1.13 (0.41,3.17)
2 nd	15/50	18.9	54/278	19.4	1.07 (0.61,1.86)
3 rd	26/100	26.0	79/371	21.3	1.05 (0.66,1.67)
4 th	60/342	17.5	14/89	15.7	0.83 (0.45,1.54)
5 th	12/70	17.1	36/326	11.0	0.99 (0.47,2.11)
Circumcision status					
Uncircumcised	34/141	24.1	126/542	23.3	0.95 (0.66,1.39)
Circumcised	37/249	14.9	123/1024	12.0	1.02 (0.68,1.53)
Past-year sexual partners					
1	4/66	6.1	38/428	8.9	0.68 (0.25,1.85)
2	17/93	18.3	64/420	15.2	1.19 (0.72,1.99)
3+	50/231	21.7	147/718	20.5	0.95 (0.67,1.34)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table S4.3.2 Prevalence risk ratios for HIV among men in Rakai District, Uganda by report of transactional sex and community type, 2016-2018

A. Inland Communities (N=5303)

	TS		No TS		PRR (95% CI)
	No. HIV+ /total	Prev, %	No. HIV+ /total	Prev, %	
Age Category					
15-24	3/195	1.5	28/1256	2.2	0.69 (0.21,2.25)
25-34	12/123	9.8	164/1653	9.9	0.98 (0.56,1.72)
35-44	15/95	15.8	229/1445	15.9	1.00 (0.62,1.61)
45-49	3/22	13.6	89/514	17.3	0.79 (0.27,2.29)
Educational attainment					
No education	2/10	20.0	19/114	16.7	1.20 (0.32,4.45)
P1-P4	8/91	8.8	128/830	15.4	0.57 (0.29,1.13)
P5-P7	17/218	7.8	240/2213	10.9	0.72 (0.45,1.15)
Secondary or above	6/116	5.2	123/1711	7.2	0.72 (0.32,1.60)
Marital status					
Never married	3/203	1.5	32/1205	2.7	0.56 (0.17,1.80)
Currently married	15/161	9.3	375/3178	11.8	0.79 (0.48,1.29)
Previously married	15/71	21.1	103/485	21.2	0.99 (0.61,1.61)
Occupation					
Agriculture	11/147	7.5	212/1770	12.0	0.62 (0.35,1.12)
Fishing	--	--	--	--	--
Boda boda driver	4/45	11.1	34/357	9.5	1.17 (0.48,2.83)
Wealth quintile					
1 st	7/85	8.2	119/1097	10.9	0.76 (0.37,1.58)
2 nd	8/99	8.1	113/1025	11.0	0.73 (0.37,1.46)
3 rd	3/72	4.2	54/689	7.8	0.53 (0.17,1.66)
4 th	6/79	7.6	102/903	11.3	0.67 (0.30,1.48)
5 th	9/100	9.0	122/1154	10.6	0.85 (0.45,1.62)
Circumcision status					
Uncircumcised	14/150	9.3	233/1836	12.7	0.74 (0.44,1.23)
Circumcised	19/285	6.7	277/3032	9.1	0.73 (0.47,1.14)
Past-year sexual partners					
1	6/118	5.1	300/2938	10.2	0.50 (0.23,1.09)
2	13/153	8.5	149/1305	11.4	0.74 (0.43,1.28)
3+	14/164	8.5	61/625	9.8	0.87 (0.50,1.52)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; -- insufficient cases.

B. Fishing communities (N=2,375)

Characteristic	TS		No TS		PRR (95% CI)	adjPRR (95% CI)
	No. HIV+ /total	Prev, %	No. HIV+ /total	Prev, %		
Age Category						
15-24	1/64	1.6	24/410	5.9	0.27 (0.04,1.94)	0.28 (0.04,2.02)
25-34	51/116	44.0	295/884	33.4	1.32* (1.05,1.65)	1.20 (0.95,1.51)
35-44	34/61	55.7	296/659	44.9	1.24 (0.98,1.58)	1.10 (0.87,1.41)
45-49	11/23	47.8	67/158	42.4	1.13 (0.71,1.80)	1.08 (0.66,1.77)
Educational attainment						
No education	9/19	47.4	79/162	48.8	0.97 (0.59,1.60)	
P1-P4	44/114	38.6	288/747	38.6	1.00 (0.78,1.28)	
P5-P7	37/103	35.9	260/837	31.1	1.16 (0.88,1.53)	
Secondary or above	7/28	25.0	55/365	15.1	1.66 (0.83,3.30)	
Marital status						
Never married	4/56	7.1	31/305	10.2	0.70 (0.26,1.92)	0.73 (0.27,1.99)
Currently married	50/105	47.6	466/1354	34.4	1.38** (1.12,1.71)	1.28* (1.05,1.57)
Previously married	43/103	41.8	185/452	40.9	1.02 (0.79,1.31)	0.99 (0.78,1.27)
Occupation						
Agriculture	2/9	22.2	24/94	25.5	0.87 (0.24,3.12)	0.90 (0.24,3.36)
Fishing	83/202	41.1	513/1266	40.5	1.01 (0.85,1.21)	1.07 (0.91,1.27)
Boda boda driver	--	--	--	--	--	--
Wealth quintile						
1 st	--	--	--	--	--	--
2 nd	22/44	50.0	91/224	40.6	1.23 (0.88,1.72)	
3 rd	43/103	41.8	252/746	33.8	1.24 (0.96,1.59)	
4 th	20/73	27.4	218/660	33	0.83 (0.56,1.22)	
5 th	12/44	27.3	121/481	25.2	1.08 (0.65,1.80)	
Circumcision status						
Uncircumcised	48/97	49.5	331/751	44.1	1.12 (0.90,1.39)	
Circumcised	49/167	29.3	350/1359	25.8	1.14 (0.89,1.47)	
Past-year sexual partners						
1	4/29	13.8	318/893	35.6	0.39* (0.16,0.97)	
2	33/70	47.1	192/631	30.4	1.55** (1.18,2.04)	
3+	60/165	36.4	172/587	29.3	1.24 (0.98,1.57)	

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; adjPRR: adjusted prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; model adjusted for age, marital status, occupation; -- insufficient cases.

Table S4.4.1 Prevalence risk ratios for HIV viremia among HIV-positive men in Rakai District, Uganda by report of transactional sex and relationship duration, 2016-2018

A. Once-off (N=1,956)

	TS		No TS		PRR (95% CI)
	No. viremic /total HIV+	Prev, %	No. viremic /total HIV+	Prev, %	
Age Category					
15-24	2/3	66.7	20/24	83.3	0.60 (0.14,2.47)
25-34	19/39	48.7	31/104	29.8	1.24 (0.72,2.12)
35-44	3/22	13.6	32/104	30.8	0.56 (0.19,1.65)
45-49	0/7	0	3/17	17.7	--
Educational attainment					
No education	2/7	28.6	7/26	26.9	0.7 (0.11,4.57)
P1-P4	10/30	33.3	35/95	36.8	0.91 (0.47,1.76)
P5-P7	7/28	25.0	30/101	29.7	0.76 (0.33,1.74)
Secondary or above	5/6	83.3	14/27	51.9	1.78*** (1.30,2.42)
Marital status					
Never married	2/5	40.0	19/31	61.3	0.55 (0.11,2.85)
Currently married	10/29	34.5	26/103	25.2	1.21 (0.61,2.40)
Previously married	12/37	32.4	41/115	35.7	0.68 (0.33,1.42)
Occupation					
Agriculture	2/6	33.3	5/23	21.7	1.53 (0.38,6.19)
Fishing	17/45	37.8	51/146	34.9	0.81 (0.44,1.50)
Boda boda driver	3/4	75.0	6/13	46.2	1.62 (0.70,3.77)
Wealth quintile					
1 st	1/4	25.0	8/20	40.0	0.62 (0.10,3.85)
2 nd	9/15	60.0	22/54	40.7	1.14 (0.60,2.17)
3 rd	5/26	19.2	29/79	36.7	0.17 (0.02,1.16)
4 th	5/14	35.7	16/60	26.7	1.07 (0.38,2.99)
5 th	4/12	33.3	11/36	30.6	1.46 (0.54,3.94)
Community					
Inland	5/15	33.3	28/68	41.2	0.81 (0.37,1.76)
Fishing	19/56	33.9	58/181	32.0	0.79 (0.44,1.43)
Circumcision status					
Uncircumcised	12/34	35.3	40/126	31.8	0.84 (0.43,1.65)
Circumcised	12/37	32.4	46/123	37.4	0.78 (0.40,1.51)
Past-year sexual partners					
1	2/4	50.0	13/38	34.2	1.46 (0.49,4.34)
2	4/17	23.5	17/64	26.6	0.73 (0.25,2.19)
3+	18/50	36.0	56/147	38.1	0.77 (0.43,1.38)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table S4.4.2 Prevalence risk ratios for HIV viremia among HIV-positive men in Rakai District, Uganda by report of transactional sex and community type, 2016-2018

A. Inland (N=543)

	TS		Non-TS		PRR (95% CI)
	No. viremic /total HIV+	Prev, %	No. viremic /total HIV+	Prev, %	
Age Category					
15-24	2/3	66.7	18/28	64.3	1.04 (0.44,2.45)
25-34	7/12	58.3	66/164	40.2	1.45 (0.87,2.43)
35-44	3/15	20	45/229	19.7	1.02 (0.36,2.90)
45-49	0/3	0	14/89	15.7	--
Educational attainment					
No education	0/2	0	2/19	10.5	--
P1-P4	3/8	37.5	38/128	29.7	1.26 (0.49,3.22)
P5-P7	9/17	52.9	76/240	31.7	1.67* (1.03,2.72)
Secondary or above	0/6	0	27/123	22.0	--
Marital status					
Never married	2/3	66.7	17/32	53.1	1.25 (0.52,3.01)
Currently married	6/15	40	84/375	22.4	1.79 (0.93,3.42)
Previously married	4/15	26.7	42/103	40.8	0.65 (0.27,1.57)
Occupation					
Agriculture	3/11	27.3	50/212	23.6	1.16 (0.43,3.13)
Fishing	--	--	--	--	--
Boda boda driver	4/5	80.0	10/34	29.4	2.72** (1.36,5.42)
Wealth quintile					
1 st	2/7	28.6	47/119	39.5	0.72 (0.22,2.39)
2 nd	5/8	62.5	27/113	23.9	2.62** (1.39,4.92)
3 rd	1/3	33.3	13/54	24.1	1.38 (0.26,7.46)
4 th	1/6	16.7	25/102	24.5	0.68 (0.11,4.24)
5 th	3/9	33.3	31/122	25.4	1.31 (0.49,3.48)
Circumcision status					
Uncircumcised	4/14	28.6	71/233	30.5	0.94 (0.40,2.20)
Circumcised	8/19	42.1	72/277	26.0	1.62 (0.92,2.85)
Past-year sexual partners					
1	3/6	50	77/300	25.7	1.95 (0.85,4.44)
2	3/13	23.1	42/149	28.2	0.82 (0.29,2.29)
3+	6/14	42.9	24/61	39.3	1.09 (0.55,2.16)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B. Fishing (N=779)

	TS		Non-TS		PRR (95% CI)
	No. viremic /total HIV+	Prev, %	No. viremic /total HIV+	Prev, %	
Age Category					
15-24	1/1	100.0	18/24	75.0	1.33* (1.05,1.69)
25-34	20/51	39.2	88/295	29.8	1.31 (0.90,1.93)
35-44	7/34	20.6	57/296	19.3	1.07 (0.53,2.16)
45-49	1/11	9.1	10/67	14.9	0.61 (0.09,4.35)
Educational attainment					
No education	3/9	33.3	24/79	30.4	1.1 (0.41,2.95)
P1-P4	13/44	29.5	72/288	25.0	1.18 (0.72,1.95)
P5-P7	8/37	21.6	59/260	22.7	0.95 (0.50,1.83)
Secondary or above	5/7	71.4	18/55	32.7	2.18* (1.19,4.01)
Marital status					
Never married	1/4	25.0	22/31	71.0	0.35 (0.06,2.00)
Currently married	14/50	28.0	87/466	18.7	1.5 (0.92,2.43)
Previously married	14/43	32.6	64/185	34.6	0.94 (0.59,1.51)
Occupation					
Agriculture	--	--	--	--	--
Fishing	26/83	31.3	137/513	26.7	1.17 (0.83,1.66)
Boda boda driver	--	--	--	--	--
Wealth quintile					
1 st	0/0	0	0/0	0	--
2 nd	10/22	45.5	29/91	31.9	1.43 (0.82,2.47)
3 rd	11/43	25.6	71/252	28.2	0.91 (0.53,1.57)
4 th	7/20	35.0	52/218	23.9	1.47 (0.77,2.79)
5 th	1/12	8.3	21/121	17.4	0.48 (0.07,3.29)
Circumcision status					
Uncircumcised	17/48	35.4	82/331	24.8	1.43 (0.93,2.19)
Circumcised	12/49	24.5	91/350	26.0	0.94 (0.56,1.59)
Past-year sexual partners					
1	1/4	25.0	77/318	24.2	1.03 (0.19,5.71)
2	10/33	30.3	41/192	21.4	1.42 (0.79,2.55)
3+	18/60	30.0	55/172	32.0	0.94 (0.60,1.46)

TS: Men engaged in transactional sex; No TS: Men not engaged in transactional sex; PRR: prevalence risk ratio; CI: confidence interval; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 5. Transactional sex and incident HIV infection in a cohort of men from Rakai, Uganda from 2013-2020

5.1 Abstract

Background: Transactional sex is associated with high-risk sexual behaviors among men; yet, the risk for HIV acquisition posed to men who engage in transactional sex is poorly understood. We assessed the causal effect of transactional sex and HIV incidence among sexually-active men residing in Rakai, Uganda.

Methods: We modeled the temporal relationship between transactional sex and HIV in three ways: 1) transactional sex occurring in the person-interval prior to measurement of HIV serostatus, t_{n-1} ; 2) transactional sex occurring in the same person-interval, t_n ; and 3) transactional sex occurring in the prior or same person-interval, $t_{n-1|n}$. Incidence of HIV infection, the primary outcome of interest, was measured in person-intervals of follow-up between surveys among men who were HIV-negative at baseline. Poisson regression models with generalized estimating equations and exchangeable correlation structure were used to estimate incidence rate ratios (IRR) and 95% confidence intervals (CIs) for HIV acquisition for each of the three transactional sex variables. Multivariable analyses were adjusted for age, marital status and occupation and informed by a directed acyclic graph. Analyses were stratified by age (<30 vs \geq 30) and community type (inland vs fishing). Lastly, we assessed the temporal relationship between transactional sex and incidence of 5 sexual behaviors and outcomes (sex with a sex worker, STI symptoms, alcohol use before sex, physical IPV, sexual IPV) by engagement in transactional sex using Poisson regression

models with generalized estimating equations and exchangeable correlation structure to estimate IRRs and 95% CIs.

Results: Overall, 7,762 individual men contributed a total of 17,464 person-visits. 17% of men reported transactional sex at any point during the study period. Most reports of transactional sex occurred in one person-interval with one sexual partner. We observed a weak but non-statistically significant positive effect of transactional sex in the interval prior (t_{n-1}) on HIV incidence (adjIRR: 1.50; 95% CI: 0.86, 2.61) and a weak negative effect of transactional sex during the same interval (t_n) on HIV incidence (adjIRR: 0.51; 95% CI: 0.21, 1.24). Similar results were found in analyses across age and community types.

Conclusions: Results of this analysis suggest that there is a delayed risk for HIV acquisition among men who engage in transactional sex, regardless of age or community of residence. Future longitudinal studies are needed to better understand this delayed effect and factors that may lie in the causal pathway between transactional sex and HIV acquisition.

5.2 Introduction

In sub-Saharan Africa, the HIV epidemic is generalized and transmission primarily occurs between heterosexual couples (1). Transactional sex relationships, in which there is an implicit assumption that men will provide material benefits to female partners in exchange for sex (74), are thought to be an important contributor to the disproportionate burden of new HIV infections observed among adolescent girls and young women (AGYW) (11, 102). Epidemiologic studies have reported elevated HIV prevalence and incidence among AGYW who engage in transactional sex (45). In two longitudinal studies, AGYW who engaged in

transactional sex were significantly more likely to acquire HIV than their peers in non-transactional relationships (3, 4). Despite the extensive research on transactional sex among women, little is known about the HIV risk posed to men who engage in transactional sex, and the nature of this relationship likely differs for men and women.

Dunkle et al. describe transactional sex as “part of a cluster of closely related violent and controlling practices” (42) and suggest that these practices may increase men’s risk for HIV. Prior research has found that, among men, transactional sex is associated with alcohol use (103), perpetration of intimate partner violence (IPV) (42, 95, 104), and sexual coercion (95, 96). We previously conducted a cross-sectional study of transactional sex among men in Rakai, Uganda and found that men who reported transactional sex relationships were more likely to report multiple partners, perceive their partners as high-risk, and less likely to know their partner’s HIV status compared to men in non-transactional relationships (Chapter 4). This same study found that transactional sex partners were frequently bar workers, an occupation associated with high risk of acquisition and onward transmission of HIV (93) and higher rates of untreated HIV compared to women employed in other occupations (89). High-risk sexual behaviors and selection of sexual partners in high HIV-risk professions are potential mechanisms through which transactional sex may increase men’s risk for HIV acquisition.

Prospective data linking transactional sex to risk of HIV acquisition among men is limited. The strength and direction of associations in studies of men who engage in transactional sex are heterogenous (45). A meta-analysis of four cross-sectional studies reported a positive association between transactional sex and HIV prevalence among men

though results were not statistically significant (pooled odds ratio: 1.54; 95% confidence interval (CI): 1.04–2.28) (45). To date, there has been only one longitudinal study examining transactional sex and incident HIV infection in men (5). The 2010 study reported a weak association between provision of food for sex, a narrow subset of transactional sex relationships, and incident HIV (adjusted hazard ratio: 1.40; 95% CI: 0.69–2.88) in a cohort of rural Kenyan men. While this preliminary data gives us some insight into the potential causal relationship between transactional sex and HIV in men, research using transactional sex measures which capture other types of transactional sex in HIV endemic regions are needed. We address this gap in the literature by examining the relationship between transactional sex in HIV incidence using population-based cohort data with men from a high HIV prevalence region of Uganda.

5.3 Methods

Study design

Data from this study were obtained from the Rakai Community Cohort Study (RCCS), an open, population-based cohort in Rakai and surrounding districts in south central Uganda. The Rakai region is mostly rural with agricultural, semi-urban trading centers, and fishing villages along Lake Victoria. HIV prevalence ranges from 9% in agrarian communities to 43% in fishing communities (68). The RCCS has been described in detail elsewhere (68). Briefly, the RCCS surveys all consenting individuals aged 15–49 years in study communities. All participants who provide written informed consent are interviewed to assess demographics, sexual risk behaviors; uptake of HIV prevention, treatment and care

services; and data on the four most recent sexual partners in the past year. Following the survey, all participants have access to free HIV testing with pre- and post-test counselling. The RCCS assesses HIV serostatus through administration of a validated parallel three-test rapid HIV testing algorithm (82).

This study conducted longitudinal analysis of data from four RCCS survey rounds conducted between June 2013 and December 2020 in 41 communities. Analyses were restricted to men who participated in at least two RCCS rounds, were sexually active, and were HIV-negative at baseline. Ethical approval was granted by the Uganda Virus Research Institute's Research and Ethics Committee, and the Uganda National Council of Science and Technology, Western IRB's institutional review board (IRB).

Incident HIV Infection

The primary outcome for this analysis was incident HIV infection. An individual was considered an incident HIV case when they received their first HIV-positive test result after a negative result at the previous visit, allowing for up to one missed visit. Participants were censored if they missed more than one visit. For example, an individual who tested positive for HIV at round 19 would need to have a negative result at round 18 or 17 to be considered an incident case. HIV seroconversion was assumed to occur at the midpoint of the visit-interval.

Assessment of transactional sex

Men's self-reported transactional sex was assessed for up to four female sexual partners in the last 12 months. Men were asked "Were money, gifts, or favors ever exchanged for sex with this partner?" and provided the following four response options: "Yes, received only;"

“Yes, gave only;” “Yes, gave & received;” “No.” A response of “Yes, gave only”, was categorized as transactional sex. All other responses were categorized as no engagement in transactional sex. Regardless of the response to the transactional sex measure, relationships with spouses or sex workers were not categorized as transactional sex.

Because the temporal relationship between transactional sex and HIV among men is not well understood, we modeled this relationship in three ways. In the first analysis, individuals were considered to have engaged in transactional sex if reported in the person-interval, t_{n-1} , preceding the person-interval in which HIV serostatus was assessed. In the second analysis, individuals were considered to have engaged in transactional sex if reported in the same person-interval, t_n , in which HIV serostatus was assessed. In the third analysis, individuals were considered to have engaged in transactional sex if reported in the preceding *or* the same person-interval, $t_{n-1|n}$, in which HIV serostatus was assessed.

Statistical analysis

We examined individual-level demographic characteristics and sexual behaviors at baseline (e.g., the first visit a participant was observed during the analysis period) for the study population overall and by engagement in transactional sex. Proportions were used to describe the distribution of demographic characteristics by engagement in transactional sex and significant differences were assessed using chi-square tests.

HIV incidence rates (IR) per 100 person-years (py) and 95% confidence intervals (CI) were calculated for men based on their engagement in transactional sex overall and by survey round. Poisson regression models with generalized estimating equations and exchangeable correlation structure were used to estimate incidence rate ratios (IRR) and

95% CIs of HIV acquisition for each of the three transactional sex measures. Mean HIV incidence rates among men who engaged in transactional sex were compared with the mean rates among men who did not engage in transactional sex. For each of the three transactional sex exposures, we conducted multivariable analyses adjusted for individual-level demographic characteristics (age, marital status) and community type which were hypothesized confounders. Informed by our DAG, analyses were stratified by age (<30 vs \geq 30) and community type (inland vs fishing) to account for potential effect modification.

Lastly, we assessed whether men who engage in transactional sex were more likely to report other high-risk sexual behaviors at a later round, specifically: physical IPV, sexual IPV, alcohol use before sex, self-report of sexually transmitted infection symptoms (STIs), sexual relationship(s) with a sex worker. IRs per 100 person-years and 95% CIs were generated for each behavioral outcome by transactional sex exposure. Poisson regression models with generalized estimating equations with exchangeable correlation structure were used to estimate IRRs and 95% CIs for each outcome and each of the three exposure variables. All analyses were conducted with STATA version 14 (105).

5.4 Results

Characteristics of study participants

Overall, 7,762 individual men contributed a total of 17,464 person-visits. Table 1 displays the baseline characteristics of the study population, including frequencies and percentages for categorical variables, overall and by engagement in transactional sex. Participants were most commonly between the ages of 25 and 34 (38%), had at least some primary-level

education (67%), and were married at baseline (61%). Most men reported their primary employment as agriculture (31%) or other occupation (41%). The prevalence of reporting transactional sex at any point over the study period was 17%.

Compared to men in non-transactional relationships, men engaged in transactional sex were more likely to be youth ages 15-24 (36% vs. 27.8%; $p < 0.001$). Men engaged in transactional sex were less likely to be married (39.2% vs. 65.9%; $p < 0.001$) or employed in agriculture (20.7% vs 32.6%; $p < 0.001$) compared to men in non-transactional relationships. Men engaged in transactional sex were more likely to reside in fishing communities (44.2% vs 26.2%; $p < 0.001$) and report three or more past-year sexual partners (41.4% vs 21.2%; $p < 0.001$) compared to men in non-transactional relationships. Circumcision did not differ by engagement in transactional sex.

Table 5.1 Baseline characteristics of the study population overall and by self-reported transactional sex, N=7,762

Characteristic	Any transactional sex reported over the study period			p-value
	Overall N=7762	No N= 6432	Yes N=1330	
Age Category				<0.001
15-24	2270 (29.2%)	1787 (27.8%)	483 (36.3%)	
25-34	2956 (38.1%)	2437 (37.9%)	519 (39.0%)	
35-44	2098 (27.0%)	1802 (28.0%)	296 (22.3%)	
45-49	438 (5.6%)	406 (6.3%)	32 (2.4%)	
Education				<0.001
No education	300 (3.9%)	237 (3.7%)	63 (4.7%)	
Primary	5172 (66.6%)	4140 (64.4%)	1032 (77.6%)	
Secondary or higher	2290 (29.5%)	2055 (31.9%)	235 (17.7%)	
Marital status				<0.001
Never married	924 (11.9%)	615 (9.6%)	309 (23.2%)	
Currently married	4762 (61.4%)	4241 (65.9%)	521 (39.2%)	
Previously married	2076 (26.7%)	1576 (24.5%)	500 (37.6%)	
Primary occupation				<0.001
Agriculture	2375 (30.6%)	2100 (32.6%)	275 (20.7%)	
Fishing	530 (6.8%)	395 (6.1%)	135 (10.2%)	
Trading/vending	827 (10.7%)	693 (10.8%)	134 (10.1%)	
Transportation	142 (1.8%)	117 (1.8%)	25 (1.9%)	
Student	718 (9.3%)	571 (8.9%)	147 (11.1%)	
Other	3107 (40.8%)	2556 (39.7%)	614 (46.2%)	
Community type				<0.001
Inland	5489 (70.7%)	4747 (73.8%)	742 (55.8%)	
Fishing	2273 (29.3%)	1685 (26.2%)	588 (44.2%)	
Circumcised				0.13
No	1116 (40.7%)	2100 (32.6%)	275 (20.7%)	
Yes	1627 (59.3%)	395 (6.1%)	135 (10.2%)	
No. sexual partners				<0.001
1 partner	3754 (48.4%)	3335 (51.9%)	419 (31.5%)	
2 partners	2097 (27.0%)	1736 (27.0%)	361 (27.1%)	
3+ partners	1911 (24.6%)	1361 (21.2%)	550 (41.4%)	

In the sample overall, most men (n=6,027; 82.9%) did not engage in any transactional sex relationships over the study period. Among the 1,246 men who reported any transactional sex, 83.1% reported transactional sex in one person-interval and 17.9% reported transactional sex in two or more person-intervals. The number of transactional sex

partners reported ranged from one to four and the median number of transactional sex partners reported per round was 1 (IQR:1,1).

Figure 5.1 illustrates individual trajectories of transactional sex engagement over the study period and number of transactional sex relationships reported (up to four) in each person-interval for a sub-sample of 2,203 men with observations at four consecutive person-intervals. Each row represents one individual's transactional sex trajectory over the four person-intervals. Trajectories of transactional sex engagement in this sub-sample of men were similar to the sample overall.

Figure 5.1 No. transactional sex partners reported by men with observations at 4 consecutive person-intervals, N=2203

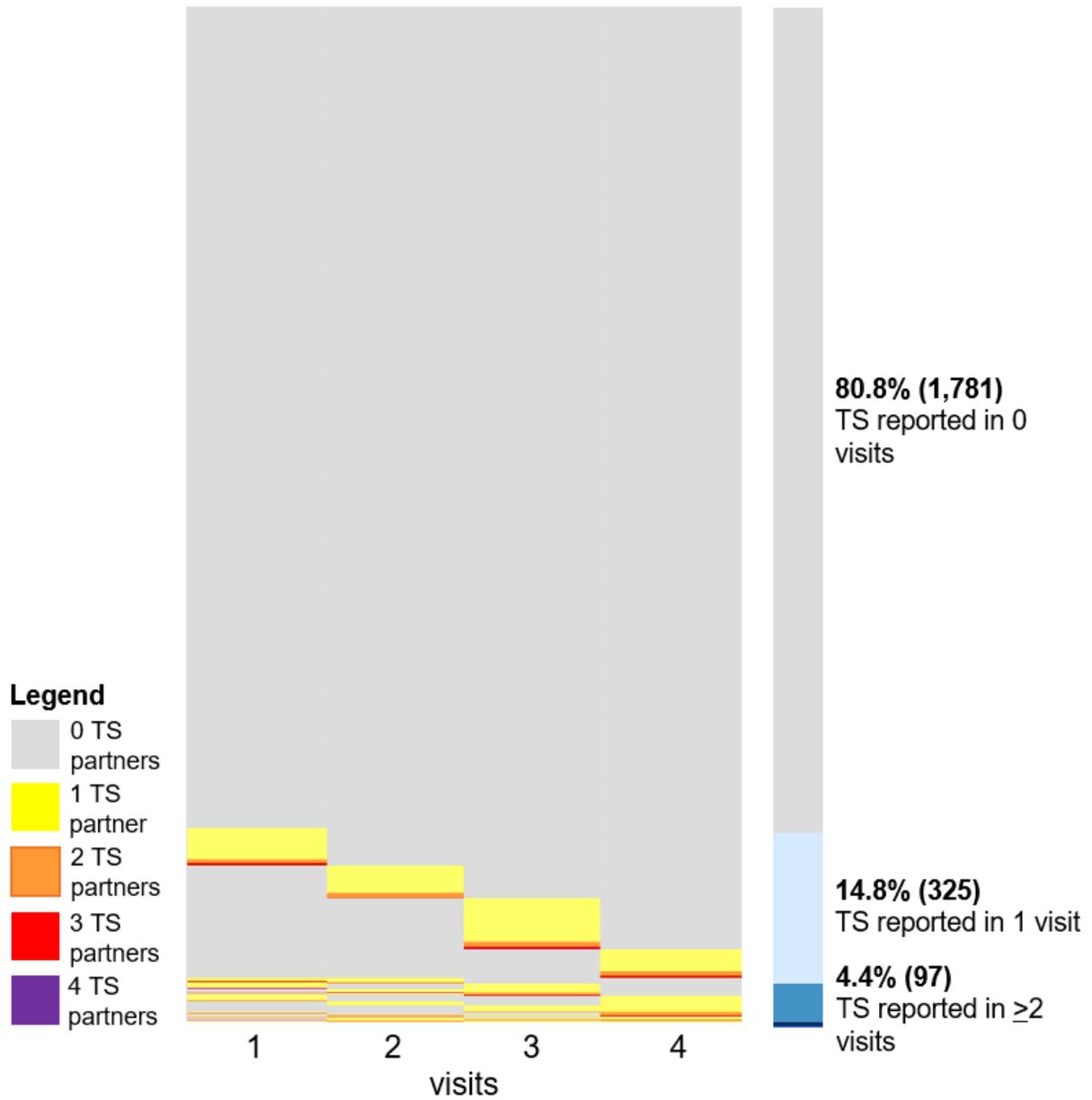


Table 5.2 shows IRs for HIV and 95% CIs by transactional sex engagement at t_{n-1} , t_n , and $t_{n-1|n}$. Overall, in adjusted models, we did not observe statistically significant differences in HIV incidence comparing men by engagement in transactional sex at t_{n-1} , t_n , or $t_{n-1|n}$. At the 90% confidence level, we observed a statistically significant positive effect of transactional sex at t_{n-1} on HIV in the unadjusted model (IRR: 1.62; 95% CI: 0.93, 2.83) but the association was attenuated after adjusting for demographic characteristics (adjIRR: 1.50; 95% CI: 0.86, 2.61). We observed a weak but non-statistically significant negative effect of transactional sex at t_n on HIV incidence (adjIRR: 0.51; 95% CI: 0.21, 1.24) and a weak positive effect of transactional sex at $t_{n-1|n}$ on HIV incidence (adjIRR: 1.24; 95% CI: 0.80, 1.93).

In Table 5.2 we present analyses stratified by age (<30 vs \geq 30) and community type (inland vs fishing). Similar to the overall analysis, we observed a non-statistically significant positive effect of transactional sex at t_{n-1} (IRR: 1.24; 95% CI: 0.56, 2.71) and a negative effect of transactional sex at t_n on HIV incidence (adjIRR: 0.38; 95% CI: 0.12, 1.22) among men under age 30. The relative risk of HIV acquisition for transactional sex at t_{n-1} was greater among men age 30 and above (adjIRR: 1.31; 95% CI: 0.88, 4.26) than for men under age 30 (adjIRR: 0.90; 95% CI: 0.45, 2.17), though neither reached statistical significance. Men age 30 and above who engaged in transactional sex at t_{n-1} had almost twice the risk of HIV acquisition (IRR: 1.94; 95% CI: 0.88, 4.26) compared to men who did not engage in transactional sex at t_{n-1} but only in the unadjusted model. In adjusted models, we again observed the pattern of a positive, but non-statistically significant effect of transactional sex at t_{n-1} on HIV incidence (adjIRR: 1.31; 95% CI: 0.88, 4.26) and a negative effect of transactional sex at t_n on HIV incidence (adjIRR: 0.39; 95% CI: 0.09, 1.62). Similar to patterns

observed in the overall sample and age strata, we found positive effects of transactional sex at t_{n-1} on HIV incidence and negative effects of transactional sex at t_n on HIV incidence among men in inland and fishing communities. Among men residing in inland and fishing communities, estimates for risk for HIV acquisition by transactional sex at t_{n-1} (*inland* adjIRR: 0.39; 95% CI: 0.09, 1.62; *fishing* adjIRR: 0.39; 95% CI: 0.09, 1.26) and transactional sex at t_n (*inland* adjIRR: 1.18; 95% CI: 0.47, 2.94; *fishing* adjIRR: 1.11; 95% CI: 0.55 – 2.24) were comparable.

Table 5.2 HIV incidence per 100 person-years by transactional sex engagement and transactional sex

	Transactional sex at t_{n-1}			Transactional sex at t_n			Transactional sex at $t_{n-1 t_n}$		
	IR (95% CI) n/py	IRR (95% CI)	adjIRR (95%CI)	IR (95% CI) n/py	IRR (95% CI)	adjIRR (95%CI)	IR (95% CI) n/py	IRR (95% CI)	adjIRR (95%CI)
Overall									
No TS	0.52 (0.44-0.63) 112/21,343	ref	ref	0.57 (0.48-0.67) 140/24,709	ref	ref	0.53 (0.44-0.64) 118/2,238	ref	ref
TS	0.85 (0.50-1.44) 14/1,646	1.62* (0.93, 2.83)	1.50 (0.86, 2.61)	0.38 (0.18-0.80) 7/1,847	0.57 (0.23, 1.38)	0.51 (0.21, 1.24)	0.70 (0.48-1.00) 29/4,168	1.35 (0.87, 2.09)	1.24 (0.80, 1.93)
Age									
Under age 30									
No TS	0.82 (0.63-1.05) 58/7,108	ref	ref	0.84 (0.62-1.56) 62/7,410	ref	ref	0.80 (0.61-1.05) 53/6632	ref	ref
TS	1.00 (0.05-2.12) 7/694	1.24 (0.56, 2.71)	0.99 (0.45, 2.17)	0.41 (0.64-1.27) 3/733	0.49 (0.15, 1.56)	0.38 (0.12, 1.22)	0.79 (0.45-1.40) 12/1511	0.99 (0.53, 1.86)	0.99 (0.53, 1.86)
Age 30 and above									
No TS	0.38 (0.31-0.51) 54/14,235	ref	ref	0.40 (0.29-0.50) 59/14,901	ref	ref	0.35 (0.27-0.47) 48/13,593	ref	ref
TS	0.74 (0.06-0.89) 7/951	1.94* (0.88, 4.26)	1.31 (0.58, 2.95)	0.22 (0.35-1.54) 2/898	0.56 (0.14, 2.30)	0.39 (0.09, 1.62)	0.59 (0.34-1.01) 13/2,205	1.67 (0.90, 3.08)	1.13 (0.59, 2.16)
Community type									
Inland									
No TS	0.38 (0.29-0.49) 60/15,900	ref	ref	0.38 (0.05-0.82) 63/16,390	ref	ref	0.49 (0.27-0.92) 55/15,343	ref	ref
TS	0.57 (0.24-1.38) 5/874	1.52 (0.61, 3.78)	1.18 (0.47, 2.94)	0.20 (0.30-0.49) 2/978	0.53 (0.13, 2.18)	0.39 (0.09, 1.60)	0.36 (0.28-0.47) 10/2,026	1.38 (0.70, 2.70)	1.03 (0.51, 2.05)
Fishing									
No TS	0.96 (0.73-1.26) 53/5,442	ref	ref	0.98 (0.76-1.27) 58/5,920	ref	ref	0.94 (0.73-1.26) 46/4,882	ref	ref
TS	1.17 (0.61-2.24) 9/771	1.22 (0.60, 2.47)	1.11 (0.55, 2.24)	0.46 (0.15-1.43) 3/653	0.47 (0.15, 1.50)	0.39 (0.12, 1.26)	0.89 (0.54-1.47) 15/1691	0.94 (0.53, 1.69)	0.84 (0.47, 1.52)

py: person years; IR: incidence rate per 100 person-years; IRR: incidence rate ratio; adjIRR: adjusted incidence rate ratio for age; *** p<0.01, ** p<0.05, * p<0.1; Models adjusted for age, marital status, and occupation.

Table 5.3 Incidence of sexual behaviors per 100-person years by engagement in transactional sex for each transactional sex measure

	Transactional sex at t_{n-1}		Transactional sex at t_n		Transactional sex at $t_{n-1 n}$	
	IR (95% CI)	IRR (95% CI)	IR (95% CI)	IRR (95% CI)	IR (95% CI)	IRR (95% CI)
Sex with a sex worker						
No TS	2.40 (2.18, 2.64)	ref	2.51 (2.28, 2.75)	ref	1.98 (1.78, 2.21)	ref
TS	6.29 (5.19, 7.61)	2.62***(2.13, 3.23)	4.70 (3.69, 5.98)	1.87***(1.45, 2.42)	6.31 (5.47, 7.28)	3.18***(2.66, 3.81)
STI symptoms						
No TS	2.98 (2.75, 3.23)	ref	2.94 (2.72,3.18)	ref	2.86 (2.63,3.11)	ref
TS	4.18 (3.32, 5.26)	1.40***(1.10, 1.78)	3.59 (2.79,4.62)	1.22(0.94, 1.59)	3.66 (3.07,4.37)	1.28**(1.05, 1.56)
Alcohol use before sex						
No TS	23.9 (23.3,24.5)	ref	23.1 (22.5, 23.7)	ref	22.6 (22.0,23.3)	ref
TS	26.7 (25.0,28.5)	1.12***(1.05, 1.19)	28.9 (27.4, 30.6)	1.25***(1.18, 1.32)	28.6 (27.2, 29.9)	1.26***(1.20, 1.33)
Physical IPV						
No TS	2.34 (2.15, 2.55)	Ref	2.34 (2.16, 2.54)	ref	2.24 (2.05,2.44)	ref
TS	3.08 (2.37,4.00)	1.31*(1.00, 1.73)	4.11 (3.28, 5.16)	1.76***(1.38, 2.24)	3.67 (3.14,4.29)	1.64***(1.37, 1.96)
Sexual IPV						
No TS	0.37 (0.30, 0.46)	Ref	0.35 (0.28, 0.44)	ref	0.34 (0.27,0.43)	ref
TS	0.49 (0.25, 0.97)	1.32(0.64, 2.71)	0.92 (0.56, 1.52)	2.64***(1.53, 4.56)	0.67 (0.46,0.99)	2.00***(1.27, 3.15)

TS: transactional sex; STI: sexually transmitted infection; IR: incidence rate per 100 person-years; IRR: incidence rate ratio; *** p<0.01, ** p<0.05, * p<0.1

We assessed incidence of high-risk sexual behaviors among men by engagement in transactional sex. Table 5.3 shows IRs and 95% CIs for sex with a sex worker, STI symptoms, alcohol consumption before sex, physical IPV, and sexual IPV by engagement in transactional sex by each transactional sex exposure. Transactional sex was associated with greater incidence of each outcome regardless of transactional sex exposure. Transactional sex was a strong predictor of sex with a partner employed in sex work across transactional sex exposures. However, risk of sex with a sex worker was greater for transactional sex at t_{n-1} (IRR: 2.62; 95% CI: 2.13, 3.23) compared transactional sex at t_n (IRR: 1.87; 95% CI: 1.45, 2.42). Similarly, STI risk was greater for transactional sex at t_{n-1} (IRR: 1.40; 95% CI: 1.10, 1.78) compared to transactional sex at t_n (IRR: 1.22; 95% CI: 0.94, 1.59). IRRs for alcohol consumption before sex, physical IPV, and sexual IPV were greater when they co-occurred in the same round as transactional sex (t_n) compared to when transactional sex preceded these outcomes (t_{n-1}).

5.5 Discussion

This study is the first population-based study to assess the causal relationship between transactional sex and incident HIV infection in men. We found that men did not report transactional sex consistently over time and most men only reported transactional relationships in one survey round, with one sexual partner. We report weak, but non-statistically significant, evidence of a positive effect of transactional sex at t_{n-1} on incident HIV, but not for transactional sex at t_n .

There are several possible explanations for these results. First, higher HIV incidence observed in men who report transactional sex at t_{n-1} and lower incidence observed in men who report transactional sex at t_n may suggest a delayed effect of transactional sex on risk for HIV acquisition. One hypothesis is that transactional sex relationships could facilitate entry into riskier sexual networks or sexual behaviors that heighten risk for HIV. This interpretation has been documented in previous literature on transactional sex in young women, but has not been well studied in men (43). Our finding that transactional sex at t_{n-1} strongly predicted future relationships with sex workers and STI symptoms supports this hypothesis. Similarly, a cross-sectional study of South African men who engaged in transactional sex reported that men in transactional relationships also frequently reported relationships with female sex workers (43). These factors may lie on the causal pathway between transactional sex and HIV acquisition, but further research is needed to explore these relationships.

Second, the weak associations with incident HIV may reflect lower vulnerability to HIV among men in transactional sex relationships compared to women. Epidemiologic and ethnographic literature have documented how social and structural factors such as unequal gender norms and economic inequalities influence women's vulnerability to HIV in transactional sex relationships (4, 106). In this context of inequality, women may have less agency in partner selection, negotiating protective measures used to prevent HIV, and sexual decision-making (7). In addition, men are less biologically vulnerable to HIV than women (107) and men in our sample had high rates of circumcision, another protective factor against HIV acquisition (108).

Third, challenges with transactional sex measurement may have limited our ability to detect differences between groups (67, 109, 110). In cognitive interviews with men in this setting, we found that the transactional sex measure used in this study may moderately underestimate the prevalence of transactional sex compared to other measures (Chapter 6). The measure used in this study, although commonly used in other studies on transactional sex, lacks some important characteristics identified by Wamoyi and colleagues (2). Our measure was not gender-specific and therefore did not account for gendered expectations of giving and receiving. The measure also did not directly assess motivations for sexual relationships. Furthermore, it is difficult to assess temporality of transactional sex and HIV acquisition when transactional sex was assessed in the same person-interval as HIV serostatus. Therefore, the results we present on the effect of transactional sex at t_n and HIV incidence should be interpreted with caution. Despite these limitations, we were able to ensure that transactional sex relationships were non-marital and non-commercial relationships based on the detailed partner data provided in the RCCS, a common issue in transactional sex research. Future longitudinal analyses using improved transactional sex measures, such as those developed by Wamoyi et al. (2), are needed.

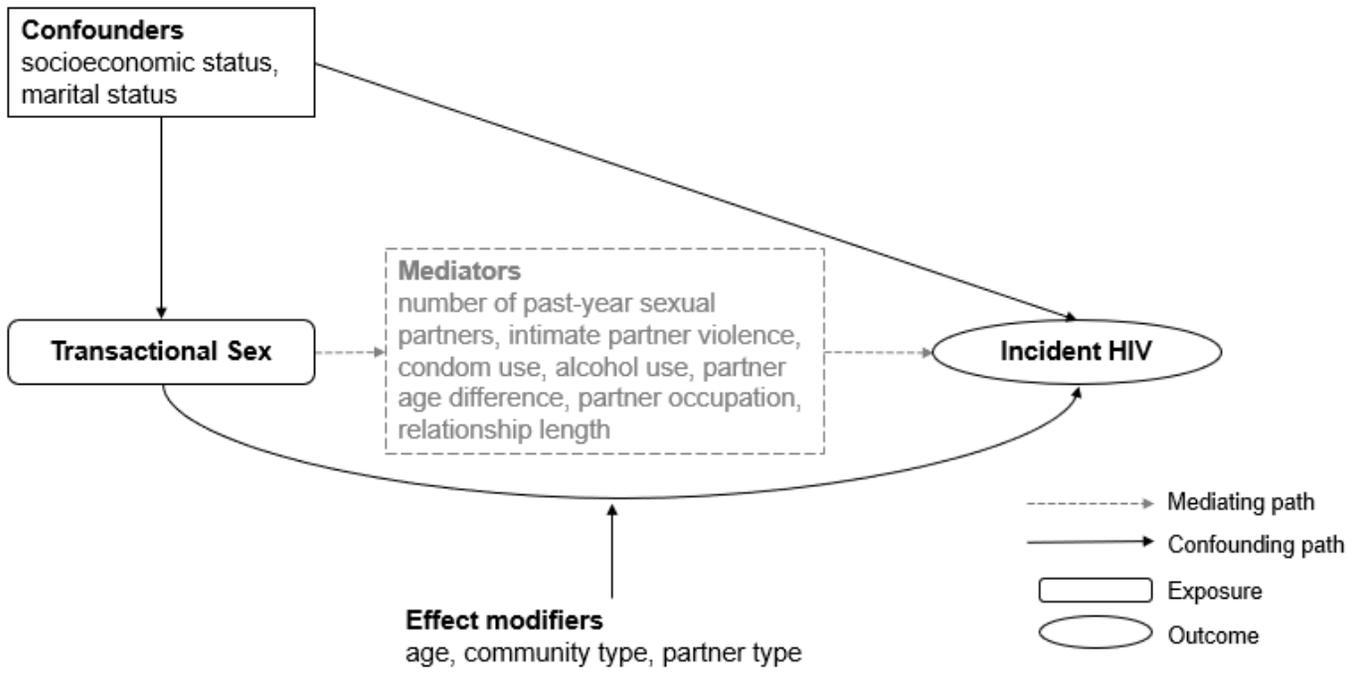
Apart from transactional sex measurement, this study had other strengths and weaknesses. A major strength of the study is the use of a large, population-based sample drawn from the Rakai Community Cohort Study. Other studies assessing the longitudinal relationship between transactional sex and HIV have been nested in randomized control trials (3, 4) or shorter prospective cohort studies (5). A strength of this study is use of data from a large population-based cohort with men followed over a period of up to seven

years. We also utilized biological specimens collected by the RCCS, rather than self-report, to assess men's HIV status. Though participation and retention rates in the RCCS are high, young men are more likely than others to be lost to follow-up (67). These hard-to-reach men may be an important population for further study.

5.6 Conclusion

In conclusion, we found evidence that transactional sex may be a distal cause of HIV acquisition among men. While there was not a strong relationship with incident HIV infection, this study has substantial strengths and we identified important areas for future research. Further examination of the causal relationship between transactional sex and HIV and potential causal mechanisms for men is needed.

Figure S5.3 Directed acyclic graph for the relationship between transactional sex and HIV in men



Chapter 6. Men's understanding of three different measures of transactional sex: A cognitive interviewing study among men in Rakai, Uganda

6.1 Abstract

Background: Research on transactional sex in sub-Saharan Africa has largely focused on adolescent girls and young women, with less focus on men's engagement in transactional sex. Furthermore, lack of valid and reliable measures and inconsistent measurement of transactional sex has resulted in poor understanding of the practice, particularly among men. To improve measurement and facilitate comparison across studies, we conducted cognitive interviews to examine three commonly used measures of transactional sex.

Methods: We conducted a qualitative study with sexually active adult men aged 18-49, residing in Rakai District, Uganda from November 2021-February 2022. We were primarily interested in how men who engage in transactional respond to transactional sex measures so we purposively sampled 20 men who reported engaging in transactional sex and 5 who did not for comparison. Using a cognitive interviewing approach, we assessed how men interpret and respond to three commonly used transactional sex measures. Interviews were conducted in Luganda by mobile phone and audio-recorded. Research assistants translated and transcribed interviews into English. We used a combination of deductive and inductive approaches to thematically analyze the data.

Results: Most men responded affirmatively to each of the three transactional sex measures, but there was variation in responses across measures. The two measures that

assessed both relationship motivation and gendered norms of the provision of material goods for sex showed better measure comprehension and consistency of responses across measures than the measure without these components. For the same two measures, a substantial proportion of men responded affirmatively but provided explanations related to gendered social expectations of material provision rather than describing provision in a specific relationship which was not the intention of the measures. The measure developed by Wamoyi and colleagues seemed to most accurately measure transactional sex in this sample of men.

Conclusions: Our findings strongly support transactional sex measures that include a clear statement of motivation and account for gendered norms of giving and receiving specifically in transactional sex. Given heterogeneity in transactional sex measurement, this study enhances our understanding of commonly used transactional sex measures.

6.2 Introduction

Transactional sex relationships are non-commercial, non-marital relationships motivated by the implicit exchange of goods, money, or favors for sex (74). Research and interventions addressing transactional sex have increased in recent years because transactional sex is thought to be associated with unprotected sex, and unequal relationship power dynamics which contribute to increased risk of HIV among adolescent girls and young women (AGYW) in sub-Saharan Africa (74). As research on transactional sex has proliferated, so have inconsistencies in measurement, limiting our understanding of the practice and its relationship to HIV (2). Wamoyi et al. identified several flaws with

transactional sex measurement which could compromise validity of findings (2). First, transactional sex measures often conflate transactional sex with commercial sex work and do not differentiate between marital and non-marital relationships. Second, transactional sex measures have failed to account for gendered norms of giving and receiving or relationship motivations which has resulted in misclassification of transactional sex relationships. Identification of transactional sex relationships through valid and reliable measurement is critical to understand the extent to which transactional sex impacts risk for HIV and to evaluate the impact of interventions addressing transactional sex.

Most research on transactional sex has focused on AGYW; there has been substantially less research on men and boys engaged in transactional sex. Estimates of transactional sex prevalence among men and boys vary widely across settings, and the relationship between HIV transmission and transactional sex among men is inconclusive (45). In addition, transactional sex measures often fail to assess whether men are providers of money or material items in the relationship, which may indicate unequal relationship power (45). Heterogeneity in transactional sex measurement may account for some of the variation in prevalence estimates and the lack of consistent measurement has made comparisons across studies challenging (45).

In 2019, Wamoyi and colleagues (2) developed improved transactional sex measures and validated them in a study in Tanzania and Uganda. Their goal was to more accurately identify transactional sex relationships and provide recommendations to guide future development of valid and reliable transactional sex measures. These recommendations were: 1) to clearly differentiate transactional sex from sex work; 2) exclude marital

relationships 3) include a clear statement of the motivation for the sexual relationship; 4) account for gendered expectations of giving and receiving in relationships; and 5) ensure wording is non-judgmental. We sought to further this work by using cognitive interviewing to compare three commonly used transactional sex measures¹, including one developed by Wamoyi et al. (2), among a sample of adult men residing in Rakai, Uganda.

6.3 Methods

Study setting

Rakai District is located in south-central Uganda. The district is bordered to the south by Tanzania, to the north by Masaka District, and to the east by Lake Victoria. The region is mostly rural and characterized by three main community types: agricultural, trading centers, and fishing villages. Adult HIV prevalence ranges from 9% in agrarian communities to 43% in fishing communities (68).

Sampling and recruitment

We conducted a qualitative study among sexually active adult men ages 18-49, residing in Rakai District, Uganda between November 2021 and February 2022. Men who participated in the Rakai Community Cohort Study (RCCS) and who had previously agreed to be contacted for future studies were eligible for recruitment. Prior to recruitment, we

¹ Measure 1 (RCCS): Were money, gifts, or favors ever exchanged for sex with this partner? Response options: Yes, received only; Yes, gave only; Yes, gave & received; No
Measure 2 (RCCS): Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)? Response options: Yes; No
Measure 3 (Wamoyi): Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her? Response options: Yes; No.

conducted three pilot interviews to refine translation of items to Luganda. We recruited a total of 27 men who were purposively sampled based on their responses. Two of these men declined to participate. We selected 20 men who responded “yes, gave only” to measure 1 and five men who provided any other response. Participants were sampled for variation based on geographical location across the Rakai region (fishing, trading, and agrarian communities), age, a. Men residing in agrarian and trading communities were contacted via mobile phone to assess their interest in participating in a study to understand non-marital sexual partnerships. Men residing in fishing villages, who were more challenging to recruit because they are highly mobile and spend long periods of time fishing without access to phones, were mobilized by RCCS staff who provided a mobile phone and private location for recruitment conversations and interviews.

Measure selection

Measures 1 and 2 were selected because they have been used in several rounds of the Rakai Community Cohort Study (RCCS) and measures with the exact or similar wording have been used in a wide range of prior transactional sex studies (5, 40, 47, 48, 50, 79, 111-116).

Table 6.1 Transactional sex measures in English and Luganda

Measure	English and Luganda translations
Measure 1 (RCCS)	Were money, gifts, or favors ever exchanged for sex with this partner? Yes, received only; Yes, gave only*; Yes, gave & received; No Omuntu ono wali omuwaddeyo oba yali akuwaddeyo ku sente oba ekirabo okwegatta naye? Yee, nz'eyafuna; Yee, Nz'eyagaba*; Yee, nagaba era nenfuna; Nedda
Measure 2 (RCCS)	Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)? Yes*; No Ensonga enkulu eyakuleetera okwetaba mu mukwano ogulimu okwegatta n'omwagalwawo kyali lwakuba nti wamuyambako mubyetaago bye? okugeza nga okumuwa sente asobole okumala ebyetaago, okulabirila abaana be, okusasula sente z'obupangisa oba okutandika wo ka business? Yee*; Nedda
Measure 3 (Wamoyi (2))	Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her? Yes*; No Wali owadde muganziwo atali mukyalawo era nga sineko sente, ebirabo, oba okumuyambako okusasula ebintu nga ekigendererwa ekikulu kutandikawo enkolagana ey'omukwano ogulimu okwegatta oba okugenda mu maaso n'omukwano guno. Yee*; Nedda

Relationships in which respondents provided responses with an (*) were classified as transactional sex relationships.

Measure 1 was added to the RCCS in early rounds of the survey and intended to identify relationships in which material exchange occurred. A single item is used for both men and women. Initially response options were “yes” or “no” but were later changed to specify direction of giving and receiving (yes, gave and received; yes, gave only; yes, received only; no). Measure 2 is also a single item measure but is phrased differently for men and women. Measure 2 was developed by RCCS researchers and to the questionnaire in 2015 (round 17) to assess transactional sex based on publications presenting refined definitions

of the term. In 2016, Stoebenau and colleagues published a conceptual paper arguing for the adoption of this, now widely used, transactional sex definition: “noncommercial, non-marital sexual relationships motivated by the implicit assumption that sex will be exchanged for material support or other benefit” (74). Administration of measure 2 in RCCS interviews was conditional on an affirmative response on measure 1. This measure was removed from the RCCS in 2021 (round 20). An improved single-item transactional sex measure was developed by Wamoyi and colleagues in 2019 which referenced gendered expectations for giving and receiving, explicitly excluded relationships with sex workers, and asked about relationship motivations (2). This measure is considered the current “gold standard” for transactional sex measurement and was added to the RCCS in November 2021.

Cognitive interviews

Cognitive interviewing is a qualitative method applied to the development and adaptation of questionnaires and other self-report measures (117). Cognitive interviews empirically study the ways in which individuals mentally process and respond to survey measures. The interviews rely on intensive verbal probing of participants by a trained interviewer. Because our aim was to understand the meaning of existing transactional sex measures common in the extant literature, we only conducted one round of interviews and deviated from other cognitive interviewing approaches which revise and retest measures (117).

Two Rakai Health Sciences Program (RHSP) staff with training in qualitative data collection and cognitive interviewing techniques conducted interviews via mobile phone. During the interviews, each participant was asked to recall their last non-marital, non-

commercial sexual relationship in the past 12 months and then respond to three different transactional sex measures (Table 1) based on this specific relationship. We removed measures 1 and 2 for the last four (IDI 26-29) participants to gain insight into whether answering transactional sex measures 1 and 2 influenced responses to measure 3 and looked for consistencies and inconsistencies across interviews. The interviewers were given scripted verbal probes and were trained to incorporate spontaneous verbal probes when appropriate. Scripted verbal probes included:

- Please repeat the question I just asked in your own words.
- Tell me about how you arrived at your response.
- How easy or difficult was this question to answer?

Data analysis

A deductive and inductive thematic analysis approach was used based on the interview guide and close review of the transcripts. We looked for patterns in respondents' understanding of transactional sex measures and response patterns by age and education. Participant quotes were categorized into themes and were used to understand participant comprehension of the measures, issues with the measures and response options, and fidelity with Wamoyi et al.'s recommendations for transactional sex measure development (2). These recommendations were: 1) to clearly differentiate transactional sex from sex work; 2) exclude marital relationships 3) include a clear statement of the motivation for the sexual relationship; 4) account for gendered expectations of giving and receiving in relationships; and 5) ensure wording is non-judgmental. We also attempted to identify patterns in participant explanations with discordant responses to the three measures.

Ethical considerations

This study was approved by the Uganda Virus Research Institute Research and Ethics Committee, the Uganda National Council for Science and Technology, and Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

6.4 Results

Table 2 shows the demographic characteristics of study participants and their responses to each of the three measures. Below, we present the patterns in response explanations by measure and response option. We also summarize issues participants encountered in responding to each measure. Most participants responded “Yes” to all 3 items. Three participants had discordant responses across the three items (IDI07, IDI15, IDI16); we present an analysis for these three individuals in Table 19.

Table 6.2 Participant demographic characteristics and measure responses, N=25

IDI#	Age	Education	Marital status	Occupation	HIV status	Viremia	Community	Response: Measure 1	Response: Measure 2	Response: Measure 3
IDI04	35-44	Primary	Married	Other	HIV-	N/A	Fishing	Yes, gave only	Yes	Yes
IDI05	25-34	Primary	Never married	Fishing	HIV+	Non-viremic	Fishing	Yes, gave only	Yes	Yes
IDI06	18-24	Primary	Never married	Fishing	HIV+	Non-viremic	Fishing	Yes, gave only	Yes	Yes
IDI07	35-44	Primary	Married	Military/police	HIV-	N/A	Trading	Yes, gave only	No	No
IDI09	35-44	Primary	Married	Fishing	HIV+	Non-viremic	Fishing	Yes, gave & received	Yes	Yes
IDI10	25-34	Secondary	Married	Fishing	HIV-	N/A	Fishing	Yes, gave only	Yes	Yes
IDI11	35-44	Primary	Never married	Fishing	HIV+	Non-viremic	Fishing	Yes, gave only	Yes	Yes
IDI12	25-34	Primary	Married	Fishing	HIV+	Viremic	Fishing	Yes, gave & received	Yes	Yes
IDI13	18-24	Primary	Never married	Student	HIV-	N/A	Trading	Yes, gave & received	Yes	Yes
IDI14	25-34	Secondary	Married	Boda boda	HIV-	N/A	Trading	Yes, gave only	Yes	Yes
IDI15	18-24	Secondary	Previously	Student	HIV-	N/A	Agrarian	Yes, gave & received	No	No
IDI16	25-34	Secondary	Married	Trading	HIV+	Viremic	Agrarian	Yes, gave only	No	No
IDI17	18-24	Primary	Never married	Student	HIV-	N/A	Trading	No	No	No
IDI18	≥45	Secondary	Married	Construction	HIV-	N/A	Agrarian	Yes, gave & received	Yes	Yes
IDI19	18-24	Primary	Previously	Agriculture	HIV-	N/A	Agrarian	N/R	Yes	NR
IDI20	18-24	Primary	Previously	Boda boda	HIV-	N/A	Agrarian	No	No	No
IDI21	35-44	Secondary	Married	Fishing	HIV-	N/A	Fishing	Yes, gave & received	Yes	Yes
IDI22	25-34	Secondary	Married	Boda boda	HIV+	Viremic	Fishing	Yes, gave & received	Yes	Yes
IDI23	18-24	Primary	Previously	Construction	HIV-	N/A	Agrarian	Yes, gave & received	Yes	Yes
IDI24	18-24	Secondary	Previously	Agriculture	HIV-	N/A	Trading	Yes, gave only	Yes	Yes
IDI25	≥45	Primary	Never married	Agriculture	HIV+	Non-viremic	Fishing	Yes, gave only	Yes	Yes
IDI26	35-44	Secondary	Married	Military	HIV-	N/A	Trading	--	--	Yes
IDI27	35-44	Primary	Never married	Agriculture	HIV+	Non-viremic	Agrarian	--	--	Yes
IDI28	25-34	Primary	Married	Trucker	HIV-	N/A	Trading	--	--	Yes
IDI29	25-34	Primary	Previously	Other	HIV-	N/A	Agrarian	--	--	Yes

Viremia defined as ≥1000 HIV RNA copies/mL; N/A: not applicable; N/R: no response; IDI26-29, respondents were only asked measure 3.

6.4.1 Measure 1 (RCCS): Were money, gifts, or favors ever exchanged for sex with this partner?

Out of the 21 respondents asked measure 1, half (n=10) responded “Yes, gave only.” These responses were categorized as transactional sex. Eight men responded “yes, gave and received,” two responded “no,” a response for one was not recorded and none responded “yes, received only.”

Measure 1 response explanations

Regardless of participants’ responses to measure 1, the measure was often not understood as intended. We describe below common themes in men’s understanding of measure 1 and explanation for their responses.

Measure 1 response: Yes, gave only. Among participants who responded “Yes, gave only,” half described a non-commercial, non-marital sexual relationship in which material exchange for sex was a primary motivation. In the example, below a man describes material provision as the reason for starting a relationship with his sexual partner. For these participants, the measure correctly classified relationships as transactional sex.

I decided to start enticing her by buying her things that I saw she needed. There’s one day I bought her shoes, and I took them to her. I continued to buy her many things like clothes, so she realized that she was no longer using her salary to buy the basic things that she wanted. And I was giving her everything. So, she started to get used to me and asked me why I cared about her so much and if I will continue to buy for her the things that she wants. I told her I will and that’s how we started to have a sexual relationship. IDI19

The other half of participants who responded “Yes, gave only” described provision in terms of gendered norms of giving and receiving in sexual relationships. For example, one respondent said, “Women say that we are the ones supposed to provide. Even if the woman has more, she expects the man to be the one to give to her.” According to these respondents, provision of money by the male partner was expected by women, the community, and men themselves. It is unclear whether men who responded to measure 1 in terms of gender norms were referencing their transactional sex relationship; therefore, there is a risk of misclassification of non-transactional sex relationships as transactional sex. For example,

Participant: Because I loved her, I gave her a gift and she also gave me what I wanted.

Interviewer: What do you mean when you say she gave you what you wanted?

Participant: I was able to have sex with her. I gave her my gift and she also gave me hers. IDI18

Measure 1 response: Yes, gave and received. Participants’ explanations for responding “Yes, gave and received” fell into two major categories. First, some participants misinterpreted the measure as asking about mutual exchange of material items. For example, this quote illustrates how the participant interpreted the question as whether there was mutual exchange of gifts between himself and his partner rather than exchange of these items for sex: “That exchange occurred during Valentine’s Day. I gave her a gift during Valentine’s Day and she gave me a gift on my birthday.” In this category, it is unclear whether the relationship described would be considered transactional sex. In the second

category, participants interpreted the measure as asking whether the man *gives* material items and, in turn, *receives* sex. Based on this explanation, “Yes, gave only” would have been the expected response for measure 1 rather than “Yes, gave and received”. In this category, there is potential misclassification of transactional sex relationships as non-transactional sex.

Measure 1 response: No. Two participants responded “No” to measure 1. One respondent said that there was no exchange in either direction in the relationship, suggesting the measure correctly identified this relationship as non-transactional sex. The other respondent who answered “No” explained that he provided material items to show he cares for his partner and was not a direct exchange for sex. This respondent could have interpreted measure 1 as asking about an exchange that occurred at the same time as sex or could have been describing a non-materially motivated relationship.

I have never done it as a way of paying her to have sex, but as you’re in a relationship as people who love each other you may give your partner some money if she tells you that she needs to buy something. But not paying her to have sex at that time. IDI20

Issues with measure 1 and response options. Despite frequent misinterpretation of measure 1 as intended, most participants said the measure was easy to answer. Explanations for the ease of answering the question were related to being able to recall a specific event in which an exchange occurred and trusting in the confidentiality of the interview.

It was not difficult at all because it was the truth, and I am sure of it. It happened and I am the one who did it, so I know it very well and I know what I am talking about. IDI18

Two respondents described difficulties responding to measure 1 related to recalling a past sexual relationship and too many response options to choose from. For example, one man said, "I don't have an official sexual partner right now, that is where I am finding some challenge."

6.4.2 Measure 2: Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)?

Compared to measure 1, measure 2 generated more responses that would be classified as transactional sex. Sixteen participants responded "Yes". These responses were categorized as transactional sex. Five men responded "No"

Measure 2 response explanations

Most participants understood measure 2 as intended regardless of whether they responded "Yes" or "No" to the question. Participants indicated that they were able to identify the "primary reason" for having a sexual relationship with their partner.

Participants who responded "Yes" were able to recall and describe characteristics of the relationship which indicated that the motivation for the relationship was provision of material support to their partner.

Measure 2 response: Yes. Some participants who reported “Yes” to measure 2 clearly described sexual relationships motivated by material exchange.

You see she told me that if I don’t help her with her problems, we shall not have a sexual relationship because she needed a phone, and she wanted to have a smart phone just like her friends. So, she told me if I wanted to have a sexual relationship with her, I must buy her a smart phone. IDI24

As with measure 1, some participants who responded “Yes” responded generally based on gendered norms of male provision. It was not clear if the response would have been “Yes” for the specific relationship they were asked to recall, and these responses may have misclassified non-transactional sex relationships as transactional sex.

You can’t pursue a woman with nothing. It’s not proper - if you are pursuing a woman you need to give her something that entices her. You see you can pursue a lady who is wealthier or has more money but because of love, you will still buy her something that entices her. ID05

A small number of participants described giving material support to their partner as a way to show they care but did not connect provision as a primary motivation for the sexual relationship in their explanation. It is not clear, based on participant explanations, whether these relationships would be considered transactional sex.

Measure 2 response: No. Descriptions of relationships from participants who responded “No” to measure 2 indicated that material exchange was not the primary motivation for the relationships and were consistent with descriptions of non-transactional sex relationships.

For example,

... our sexual relationship was not based on either gifts or money, we were just friends and we ended up being in a sexual relationship, but it's based on mutual understanding not on gifts or money. IDI15

One respondent initially responded "No" but upon further probing on relationship motivations, changed his response to "Yes," suggesting that there could be some misclassification of transactional sex relationships as non-transactional sex associated with measure 2.

Issues with measure 2 and response options. Most participants said measure 2 was easy to answer. Similar to measure 1, explanations for the ease of answering the question were related to being able to recall a specific event or relationship in which an exchange occurred. Three respondents described difficulties responding to measure 2 related to recalling a past sexual relationship, the measure being too long, or interpreting the item as three different questions.

6.4.3 Measure 3: Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her?

Twenty participants responded "Yes" and their relationships were categorized as transactional sex measure 3. Four participants responded "No".

Measure 3 response explanations

Most participants appeared to understand measure 3 as intended regardless of whether they responded "Yes" or "No." Participants' explanations indicated that they understood motivations for starting or continuing the relationship and could discern whether

motivations were related to material support. The four participants who were only asked measure 3 also appeared to interpret the question as intended, suggesting that responses to measure 3 were unlikely to be influenced by answering measures 1 and 2.

Measure 3 response: Yes. Most participants who reported “Yes” to measure 3 clearly described sexual relationships motivated by material exchange.

...I first gave her various gifts and I used to take her to hangout places. I used to give her those gifts with the aim of starting a sexual relationship with her. I first became her friend then started to pursue her with gifts, so she later accepted, and we became boyfriend and girlfriend. IDI26

Only one participant who responded “Yes” described motivations for provision that did not align with transactional sex. This could indicate potential misclassification of non-transactional relationships as transactional sex associated with this measure. Another category of relationships for which men responded “Yes” involved provision as a way of “enticing” partners. It is not clear whether this practice is indicative of transactional sex or normative courtship behavior for men.

I have done it; I have given her something. As you know, a person you have never known before, you need at least to give in something to her as a way of trying to find a way of getting closer to her mind. IDI10

Measure 3 response: No. All participants who responded “No” to measure 3 described sexual relationships that would not be defined as transactional sex.

You see you first ask the person to become your partner. If she accepts and stays with you for some time, you give her something not because you’re having sex with

her but because you're giving to her as a friend. If you have spent time with your partner, then you can give her money and gifts to keep her happy. The truth is you must give her some money but not because you want to start a sexual relationship, but as a way of appreciating her. IDI16

Issues with measure 3 and response options. Most participants said measure 3 was easy to answer. Explanations for the ease of answering the question were related to being able to recall a specific event or relationship in which an exchange occurred. Two respondents described difficulties responding to measure 3 related to discomfort discussing sexual relationships with a stranger and the problems with the length of measure 3.

6.4.4 Comparison of three transactional sex measures

Figure 6.1 summarizes the performance of the three transactional sex measures in terms of the five recommendations for transactional sex measurement set forth by Wamoyi and colleagues (2) and other performance considerations.

Figure 6.1 Evaluation of three transactional sex measures

	Measure 1	Measure 2	Measure 3
Recommendations by Wamoyi and colleagues			
1. Differentiation of transactional sex from sex work	Participants were asked to recall their last non-marital, non-commercial relationship in the past 12 months.		
2. Excludes marital relationships			
3. Motivation for relationship articulated	No	Yes	Yes
4. Non-judgmental wording	Pilot tested with 3 respondents for accurate translation, non-judgment, and cultural appropriateness.		
5. Accounts for male provision	Question and response options: No	Question and response options: Yes	Question and response options: Yes
Other performance considerations			
Consistent interpretation across participants and measures	Variation in interpretation across participants. Some disagreement with items 2 and 3.	Somewhat consistent interpretation across participants. Agreement with item 3.	Consistent interpretation of the question across participants. Agreement with item 2.
Gender norms rather than transactional sex	Often, men appeared to answer "Yes, gave only" indicating adherence to gendered norms of male provision rather than transactional sex specifically.	Rarely, men appeared to answer "Yes, gave only" indicating adherence to gendered norms of male provision rather than transactional sex specifically.	Men did not respond in terms of gender norms for this measure.
Courtship behaviors rather than transactional sex	Potential misclassification of relationships in which material items are used to "entice" potential partners.		
Question length	Too many response options.	Question too long	Question too long
Recall	Issues with recall if no current partner.		

Alignment with Wamoyi et al.'s 5 recommendations for transactional sex measurement

Wamoyi et al. (2) propose five recommendations for transactional sex measurement: 1) to clearly differentiate transactional sex from sex work; 2) exclude marital relationships 3) include a clear statement of the motivation for the sexual relationship; 4) account for gendered expectations of giving and receiving in relationships; and 5) ensure wording is non-judgmental. Below, we discuss alignment of the three transactional sex measures with these five recommendations.

Alignment with recommendations 1 & 2. Measures 1, 2, and 3 do not differentiate between sex work or marital relationships on their own. To identify non-commercial, non-marital relationships, we asked participants to recall a sexual relationship in the past 12 months with a partner that was not their wife and not a sex worker. This approach appeared to be effective as none of the participants described marital or commercial relationships.

Alignment with recommendation 3. Measure 1 did not include any reference to relationship motivation. Measures 2 and 3 included clauses that described the motivation for the relationship which appeared to improve measure comprehension.

Alignment with recommendation 4. Measures 2 and 3 also accounted for gendered norms of provision specific to men by explicitly asking if the man gave material/financial goods to the woman, while measure 1 referred to the direction of giving and receiving but was not gender-specific. Inclusion of a gender norms clause also contributed to improved construct measure comprehension.

Alignment with recommendation 5. We pilot tested measures with three participants to ensure measures were translated correctly and were culturally appropriate. Though not asked directly, participants did not describe feeling that the phrasing of the measures was judgmental. More than the wording of the question, however, rapport with the interviewer and trust that confidentiality would not be breached was important in obtaining responses from participants.

Other performance considerations

Consistent interpretation across participants and measures. There was substantial variability in the interpretation of the three measures. Participant responses were highly variable in the interpretation of measure 1 which was more susceptible to being misinterpreted than measures 2 and 3. Responses also indicated that measure 1 was interpreted differently than measures 2 and 3 which had more similar interpretations.

If all three measures reliably measured the same construct, transactional sex, we would expect answers to be consistent across the three items. For all respondents, responses were consistent across measures 2 and 3. In our analysis of discordant responses (see appendix), we found that all three respondents with discordant responses reported “Yes” to measure 1 and “No” to measures 2 and 3.

Interpretation of measures as intended. Cognitive interviews indicated that measure 1 was often not interpreted by respondents as intended. Measure 1 may identify some transactional sex relationships but may be a better indicator of men’s beliefs about gendered expectations of giving and receiving in romantic relationships. The measure appears to have poor sensitivity in identifying transactional sex relationships and may

underestimate transactional sex compared to measures 2 and 3. At face value, measures 2 and 3 appear to measure different constructs. Measure 2 asks men to report whether obtaining sex was the primary motivation of providing materials to their partners while measure 3's focused on participant's actual provision and motivations. Despite this difference, measures 2 and 3 showed similar performance in differentiating between transactional sex and non-transactional sex relationships. Though rare, measure 2 also appears to reflect men's beliefs about provision in relationships.

Measure length. Across all items, participants had trouble with recall if they were not currently in a relationship and there were complaints that all three measures were either too long and that measure 1 had too many response options.

Differentiation of courtship norms from transactional sex. None of the measures in this study distinguish between transactional sex and courtship norms. A notable proportion of participants who responded "Yes" to measures 2 and 3 described sexual relationships in which giving at the start of a relationship appeared to be normative courtship behavior and a demonstration of men's ability to be a good provider.

6.5 Discussion

We analyzed how a sample of men in Uganda understood and responded to three transactional sex measures. We identified significant issues with the interpretation of measure 1 but measures 2 and 3 were generally interpreted as intended by our participants. Measure 3, which was developed by Wamoyi and colleagues (2), performed best in terms of consistent interpretation across measures, measure comprehension, and

alignment with recommendations for transactional sex measure development. Our findings support recommendations for transactional sex measures to specify the primary motivation for the relationship and account for gendered norms of giving and receiving in sexual relationships.

We noted that none of the measures in this study distinguish between transactional sex and courtship norms. Development of transactional sex measures that can differentiate courtship from transactional sex is an area for further research. Similar to Wamoyi et al. (2), we found that participants' responded to some measures based on how men are generally expected to provide, rather than material provision in a specific relationship. To focus participants on provision as a means for having a sexual relationship, we recommend phrasing measures so that the relationship motivation clause precedes the provision clause. For example, the measure developed by Wamoyi and colleagues could be rephrased to, "In order to start or continue a sexual relationship with a partner (motivation clause), have you given her any money, gifts, or helped/supported her to pay for things (provision clause)?" Further refinement and testing of transactional sex measures, particularly across different languages, is needed to address this issue.

A strength of this research is the use of cognitive interviewing which has not been widely used in global health research. The method is particularly important for measurement of complex concepts, like transactional sex, which might not be well understood by many participants (118). Cognitive interviewing can also be useful in global health research to refine translation of items for use in different settings. Findings from cognitive interviews can be used to avoid measurement error by ensuring that questions

are comprehended by participants as intended and that respondents are able to answer accurately. We also find value in cognitive interviewing for interpreting and contextualizing findings from measures already in use that may not have undergone prior cognitive testing.

This study has limitations. The verbal probes employed in this study required participants to think and verbalize in a manner that was unfamiliar to many, and several participants had difficulty understanding the cognitive interviewing questions. Participants were told prior to hearing each item that they would be asked to repeat the item in their own words and therefore may have been listening more carefully than in an actual interview setting. In addition, participants' ability to repeat the question in their own words may not have been related to question comprehension. Social desirability bias likely influenced participants' answers about ease of answering questions, as most participants said the questions were easy to answer.

6.6 Conclusion

Our findings shed light on how men comprehend and respond to three common transactional sex measures. We found that the item developed by Wamoyi et al. performed best in terms of interpretation of the measure as intended and incorporation of recommendations for transactional sex measure development. Our findings strongly support recommendations to include a clear statement of motivation and account for gendered norms of giving and receiving in romantic and sexual relationships. Given the heterogeneity in transactional sex measurement, this study enhances our understanding of

previously used transactional sex measures which may facilitate comparison across transactional sex studies among men. Further study should examine how to refine transactional sex measures in order to differentiate transactional sex from normative courtship behaviors and how to improve item comprehension in research settings.

Table S6.2 Table of explanations from participants with discordant responses across measures 1, 2, and 3

	Measure 1	Measure 2	Measure 3	Reason for discordance
1	<p>Yes, gave only Women, you say that we men are the ones supposed to give you. (Participant laughs). Women say that we are the ones supposed to provide. Even if the woman has more, she expects the man to be the one to give her.</p>	<p>No I just loved her the way she is, and she also liked me the way I was. It was not because I helped her.</p>	<p>No I didn't give her. I never enticed her at all... You see I gave her a gift, but it was not like I was corrupting her to be in a relationship with me. I didn't ask her for sex when I gave her the gift. She just accepted to have sex with me just like a woman would have sex with a man.</p>	<p>Responds to Item 1 in terms of gender norms of provision. Responds to Items 2 and 3, referring the specific non-transactional sex relationship.</p>
2	<p>Non-TS relationship Yes, gave and received That exchange occurred during valentine's day. I gave her a gift during valentine's day and for her she gave me a gift on my birthday. That is what happened.</p>	<p>No Because when I pursued her in the beginning, she just loved me the way I was. I didn't first entice her. I won't say that there is something I helped her with to accept to be in a sexual relationship with me. I didn't give her anything while I was pursuing her.</p>	<p>Nos In my understanding you have asked me that apart from my wife, have I ever given money or a gift to a woman in order to start up a sexual relationship. And my answer is no...I have responded in that way because it never happened, the reason why it happened is that she was already my friend before the relationship turned to be a sexual relationship.</p>	<p>Respondent's responses and explanations are consistent with a non-transactional sex relationship which suggests that the response "Yes, gave and received" to Item 1 should be not used to identify transactional sex relationship.</p>
3	<p>Yes, gave only It's a known act. Women are supposed to be given money.</p>	<p>No Why I have answered you in that way is that the major object of the gifts or the help I was giving her was not connected to a sexual relationship. She was my friend before it turned to be asexual relationship.</p>	<p>No You see you first ask the person to become your partner. If she accepts and stays with you for some time. You give her something not because you're having sex with her but because you're giving her as a friend. Because if you have spent time with your partner, then you can give her money and gifts to keep her happy. The truth is you must give her some money but not because you want to start a sexual relationship but as a way of appreciating her.</p>	<p>Similar to ID107, this participant responds to Item 1 in terms of gender norms of provision. Responds to Items 2 and 3, referring the specific non-transactional sex relationship.</p>

Chapter 7. Dissolution of transactional sex relationships during COVID-19: A qualitative study of Ugandan men's experiences during COVID-19 lockdowns

7.1 Abstract

Background: The impact of the COVID-19 pandemic and subsequent mitigation measures led to negative economic shocks for a large proportion of Uganda's population. Prior research suggests that sexual behaviors, including engagement in transactional sex, may be sensitive to negative economic shocks. This purpose of this study was to understand how the unique social and economic consequences of COVID-19 impacted men's transactional sex relationships and potential impacts on HIV transmission related to transactional sex.

Methods: We conducted qualitative in-depth interviews with 26 men in a high HIV prevalence region of south-central Uganda. We purposively sampled 21 men engaged in transactional sex and 5 who did not for comparison to better understand how COVID-19 impacted the formation and continuation transactional sex relationships. Data were analyzed thematically.

Results: We found that COVID-19 had far-reaching social and economic impacts on the majority of men we interviewed, particularly for men employed in the informal economy. Participants described experiencing job loss, food insecurity, and severely restricted mobility which limited opportunities to provide for and meet with their transactional sex partners. Sudden decreases in material provision in transactional sex relationships clearly

illustrated the tenuous link between men's ability to provide and the formation and continuation of transactional sex relationships. Men who could no longer provide for their transactional sex partners often reported relationship dissolution and inability to provide meant that men could not form new transactional sex relationships. A small number of men who reported stable employment during the pandemic described no change in their transactional sex relationships. Similarly, men in relationships that were not materially motivated did not report relationship dissolution even though their incomes may have decreased.

Conclusions: Men described challenges forming and continuing transactional sex relationships due to the negative economic shocks and restricted mobility associated COVID-19 mitigation measures. Further research is needed to assess how and to what extent transactional sex relationships changed during the pandemic and the potential short- and long-term impacts on HIV transmission.

7.2 Introduction

The COVID-19 pandemic and subsequent mitigation measures have had far-reaching impacts on the health and economic well-being of populations globally (119). Following Uganda's first documented COVID-19 case in March 2020, the government implemented its initial "lockdown" policies to prevent the spread of COVID-19. These policies included country-wide curfews, stay-at-home-orders, restricted local travel, and closure of schools (120). Uganda's first lockdown ended in mid-May 2020 and a second lockdown was implemented in response to a surge of COVID-19 cases in June and July 2021. Lockdowns

led to a sharp contraction of economic activity. Following Uganda's second lockdown, unemployment rates and food insecurity increased dramatically with more than half of households nationally reporting moderate or severe food insecurity (121).

Transactional sex relationships, characterized by the implicit exchange of favors, money, and/or material goods for sex, are thought to facilitate HIV transmission in sub-Saharan Africa (37, 74). In this context, gender norms support men's role as material providers in romantic and sexual relationships. Negative economic shocks, such as those associated with Uganda's COVID-19 lockdowns, may have significantly impacted the formation and continuation of transactional sex relationships. Evidence from a 2021 systematic review suggests that risky sexual behaviors (e.g., transactional sex, multiple partnerships, condomless sex) are sensitive to persistent negative economic shocks such as illness, drought, and civil disorder (122). However, studies included in the review took place prior to COVID-19. There is reason to believe that the impact of COVID-19 economic shocks may be different from other economic shocks, as COVID-19 was accompanied by significant social impacts due to policies which limited movement (strict travel restrictions, stay-at-home orders, curfews) and opportunities for social interaction (closure of schools, social distancing policies, and size limits for gatherings). These limitations on movement may have decreased sexual risk behaviors and HIV transmission if they reduced people's ability to form and sustain sexual relationships.

There has been limited research on the impact of COVID-19 on changes in sexual risk behaviors in sub-Saharan Africa. A recent study of the economic and social impact of COVID-19 in Kenya found that women at high risk of HIV reported declines in economic

security and a 50% decrease in transactional sex partners during the pandemic (123). To date, no studies have been conducted from other countries in sub-Saharan Africa, or among men. Using data from semi-structured in-depth interviews (IDIs), we sought to understand how COVID-19 and associated mitigation measures impacted the formation and continuation transactional sex relationships among men in rural Uganda.

7.3 Methods

Study setting

Rakai District is located in south-central Uganda. The district is bordered to the south by Tanzania, to the north by Masaka District, and to the east by Lake Victoria. The region is mostly rural and characterized by three main community types: agricultural communities, trading centers, and fishing villages. HIV prevalence ranges from 9% in agrarian communities to 43% in fishing communities, also known as “HIV hotspots” (68).

Sampling and recruitment

We conducted a qualitative study among sexually active adult men ages 18-49, residing in Rakai District, Uganda from November 2021-February 2022. Men who participated in the Rakai Community Cohort Study (RCCS) (68) and who had previously consented to be recontacted for future studies were eligible for recruitment. We purposively sampled 28 men, two of whom declined to participate. To gain insight into the experiences of men with and without a self-reported history of transactional sex, we sampled 21 who reported engaging transactional sex in the RCCS and five men who did not. Participants were

sampled for variation in geographical location across Rakai District (fishing, trading, and agrarian communities), age, and occupation (all measures included in the RCCS).

Men residing in agrarian and trading communities were contacted via mobile phone to assess their interest in participating in a study to understand non-marital sexual partnerships. Men residing in fishing villages, who were more challenging to recruit, were mobilized by RCCS staff who provided a phone and private location for recruitment conversations and interviews. Two Rakai Health Sciences Program (RHSP) staff with experience in qualitative interviewing conducted recruitment and consent procedures and in-depth interviews. Verbal consent was provided by all participants via telephone and documented. Interview questions regarding the impact of COVID-19 on transactional sex relationships included:

1. Since the COVID-19 lockdowns in March 2020, how have your sexual relationships changed among your non-marital partners?
2. Have social distancing considerations changed how you engage in sexual partnerships?
3. Has the way that you provide for your non-marital sexual partner changed?

Interviews were conducted over the phone in Luganda, were audio-recorded, and then simultaneously transcribed and translated to English.

Analysis

The main analytic approach was thematic analysis (75). We used a deductive approach to develop codes based on the interview guide as well close reading of transcripts to identify

emergent themes through a process of open coding, informed by grounded theory (76). Coding was conducted by one member of the study team and then codes were grouped into themes. Themes were discussed and refined in an iterative process with members of the study team.

Ethical considerations

This study was approved by the Uganda Virus Research Institute Research and Ethics Committee, Uganda National Council for Science and Technology, and Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

7.4 Results

In the section below, we describe men's accounts of the social and economic impact of Uganda's COVID-19 mitigation measures, including policies that restricted mobility and reduced income-generating opportunities. We then discuss how financial strain and reduced mobility impacted transactional sex relationships for most men during the height of the COVID-19 pandemic in 2020 and 2021. Table 1 shows the demographic characteristics of study participants.

Table 7.1 Characteristics of study participants, N=26

Characteristic	N
TS reported in RCCS	21
Community	
Agrarian	9
Fishing	9
Trading	8
Age category	
18-24	8
25-34	9
≥35+	9
Occupation	
Boda boda driver	4
Fishing	9
Student	4
Other	9

Economic impact of COVID-19

Most men described the significant negative economic impact of COVID-19 on their livelihoods. A majority experienced job loss, decreased income, and food insecurity during the pandemic particularly if their primary source of income was from the informal economy.

...people had no money. Money became scarce during that time and many people were just struggling to eat. IDI06, fishing community, age 25-34

Some men had not fully recovered from the economic impact of the pandemic during our interviews which took place over a year and a half into the pandemic.

...we are no longer working in the same way we used to to get money so things are just normalizing but still we have not started to work as we used to. My income is still down. IDI13, trading community, age 18-24

Influence of financial strain on transactional sex relationships

Fewer economic opportunities changed the way most men reported providing for their transactional sex partners. Men described being unable to maintain provision with the frequency and amount of financial support they gave their partners prior to the pandemic.

Interviewer: Has the way that you provide for your non-marital sexual partner changed?

Participant: Yes, we have been greatly affected financially, I can't provide for her the way I used to...Things are not going well on the lake...and the people who were our customers don't have money. IDI12, fishing community, age 25-34

For many, dissolution of the relationship was directly related to changes in financial provision.

Those who had like 3 or 4 partners, had to end (their sexual relationships) because they could not afford to take care of them since their income levels had reduced. They could no longer take care of them. Most of my friends abandoned their non-marital sexual partners in the houses they had rented for them because they could no longer pay rent for their non-marital sexual partners and provide for them. Some of them had lost their jobs. IDI26, trading community, age 35+

To adapt to job loss and lower incomes, some men strategically ended selected transactional relationships while keeping others that they could support financially.

...before I used to have more than one partner but because of the lockdown, I was affected financially, and I couldn't manage them, and I remained with one who I am able to support financially...Before (the pandemic), I managed to come from work

with a gift for my partner but now you can go to work, and you fail to get money.

IDI22, agrarian community, age 25-34

During the lockdown, I dropped some fake relationships and concentrated on one who understands me...all other activities had come to a standstill and I remained only with farming. I was affected and even the way I used to provide for my partners changed, I was no longer able to provide for them in time as I used to. Due to the financial hardships, I had to stick to one partner. IDI25, trading community, age 35+

One respondent attributed the change in provision to his partner pursuing other relationships.

A lot changed during the lockdown because my earnings were reduced a lot and I was not able to provide the way I used to. I was not even able to meet her during that time, but would communicate with her by phone. COVID changed my life a lot, especially my finances. I think that also contributed to her promiscuous ways. IDI29, agrarian community, age 18-24

Another participant attributed decreased provision with the eventual dissolution of his transactional sex relationship.

Since we were not working the way we used to, the little money I would get would be for buying food for myself. Even the times I used to meet my partner reduced because I didn't have enough money to give her...I could not continue giving her the gifts I used to give her. I think that's why she started not to respond to me whenever I called her. IDI14, trading community, age 25-34

Two respondents from trading and agrarian communities described noticing an increase in available sexual partners during the lockdown because women were also experiencing increased economic instability.

During the COVID lockdown, any woman you would approach and talk to about being in a sexual relationship, would not refuse. They would just accept. IDI02, trading community, age 35+

They (sexual relationships) changed, in that there are many girls around us, though we don't engage much with them in sexual acts. IDI20, agrarian community, age 18-24

Influence of restricted movement on transactional sex relationships

At the beginning of the lockdown, several men described being worried about COVID-19 transmission, but this worry subsided over time.

It (fear of COVID-19) affected us a lot at the start of the lockdown, but now we are no longer being affected by it. (Before), even when you went out and you returned in the evening, your partner would not even need to come close to you because she didn't know where you had been and the people you had been associating with, but now everything has returned to normal. IDI10, fishing community, age 25-34

Stay-at-home policies, curfews, and social distancing requirements restricted men's ability to meet with their transactional sex partners in person. Strict travel restrictions prevented men from visiting partners who lived far away.

The only thing that changed (during the pandemic) were the times I met my non-marital sexual partner due to the lockdown. She was a bit far and therefore I struggled to reach her since all transport means had been stopped but I would find a way to visit her like once a month. (Before the pandemic), I used to meet her twice or once a week. IDI26, trading community, age 35+

One young man described adapting to travel restrictions by increasing phone communication with his non-transactional sex partner, but this adaptation was not described by men in transactional sex relationships.

Before the lockdown, we had a lot of time to meet each other which was not the case when they introduced the movement restrictions...Since we were not able to meet the way we used to, communication through phone calls increased, and another thing was that people were home so whenever you call, you were able to talk to the person you needed to talk to. IDI15, agrarian community, age 18-24

In addition, curfew restricted men's ability to establish new relationships or spend time with their current partners at night.

It changed in that the time you would have spent with our partner in the evening hanging out, was curfew time – you have to be at your place of residence. IDI13, trading community, age 18-24

A small number of respondents were able to maintain their pre-lockdown transactional sex relationships but the frequency and amount of material support decreased, creating challenges in relationships and sometimes relationship dissolution. One man described that he was unable to meet his transactional sex partner in person for sex due to

restrictions on mobility during the lockdown so he decreased the amount of financial support to his partner.

It changed a bit because she used to tell me to send her money through mobile money and yet I wanted to give it to her physically... I would send her money occasionally but I would send her less than she wanted. For example, if she asked me like for 50,000 Ugandan shillings, I would send her 10,000. During the lockdown, the love she had towards me reduced a bit...I would send less because I was not meeting her in person (for sex). IDI01, trading community, age 35-44

Several men in transactional sex relationships with partners who lived far from their homes, established new transactional sex relationships in close proximity, whom they could visit without violating travel restrictions.

Before, the lockdown I had one (non-marital sexual partner) but when the lockdown began, we could no longer meet, then I got this current non-marital partner...I got another (partner) that did not need me to travel long distances. IDI08, fishing community, age 25-34

One respondent reported refocusing on his relationship with his wife while required to stay at home during the lockdown. In contrast, fishermen, who were often migrants to fishing communities, reported staying with their transactional sex partners and being unable to visit their wives who resided in other villages due to travel restrictions.

During COVID nothing changed because my non-marital partner stayed with me at the fishing site. It only changed with my wife in the village because I could not go to

the village since there were no means of transport. IDI09, fishing community, age 35+

A fisherman speculated that HIV infections in fishing villages may have decreased as a result of the lockdown because women's migration to fishing villages decreased. Therefore, there were fewer opportunities for sexual partnerships.

What I have seen during this time is that there have been few people coming to the fishing site, which was not the case (before). Before we used to get many women coming from different parts, some from different fishing sites, others from Kampala. So, the infections were coming from different angles. Remember here we are on the border, so people come from different angles. So, the rate of HIV infections was going down and remember most of the HIV infections happen at night and we have night curfew so now people don't move at night. IDI12, fishing community, age 25-34

Some relationships did not change

A small proportion of men in our study reported no change in their transactional sex relationships. Men with stable employment during the lockdown and whose partners lived in the same village were able to continue pre-pandemic provision for their partners which allowed them to maintain these relationships.

I was able to meet her (my non-marital sexual partner) because she stays in the same area that I stay in with my wife. There's no big distance so I was able to meet up with her during the lockdown...when the lockdown was announced, I was

working, and I had a number of sites that I was managing so I was able to continue providing for her. IDI18, agrarian community, age 35+

Nothing changed (during the lockdown) because we were using the money she saved from the farm. The lockdown found me at her home, and I had to lie to my wife that it found me at work and therefore I had no means of reaching home and she accepted...Before lockdown, I had made some money that I saved up and it also helped because it's the one I sent to my wife. IDI21, fishing community, age 35+

Non-transactional sex relationships may have been less impacted by the lockdown. One respondent described decreasing the amount of money he provided his non-marital partner but decreased provision did not influence the relationship.

Of course, (the way I provide for my partner) reduced a bit because I wasn't able to give her the amount of money, I used to give her, but she understood the situation.

IDI07, trading community, age 35+

One respondent in a non-transactional relationship, in which provision was infrequent prior to COVID lockdowns, reported no change in his relationship.

To me and my partner (having more or less money) doesn't (influence our relationship). I don't change when I get more or less. I behave the same way...The lockdown did not affect me just as I told you before because I was not giving her money daily. Each time she needed money, I had it. IDI20, agrarian community, age

18-24

7.5 Discussion

This study adds to the body of literature on transactional sex by illustrating the clear link between men's ability to provide material support and the formation and continuation of transactional sex relationships. During the COVID-19 pandemic, men in Rakai, Uganda faced significant economic challenges including job loss and food insecurity. In this context, men's ability to provide material goods for partners decreased and many transactional sex relationships dissolved. During the pandemic, a large proportion of men and women who lost their jobs in urban and peri-urban centers returned to villages for agricultural work (124). Two respondents perceived an increase in women seeking transactional sex relationships in inland communities could be related to this migration to agrarian communities. However, formation of new relationships was limited because of men's economic insecurity and diminished capacity to act as providers. In our study, men who were financially stable during the pandemic did not report any changes in their transactional sex relationships. Additionally, men who were not engaged in transactional sex relationships did not report changes in their sexual relationships. Some described that provision before the pandemic was infrequent and others explained that their relationships were unaffected by decreased provision.

Though the present study was restricted to men, our findings are consistent with literature on the economic and social impact of COVID-19 on transactional sex relationships generally. A study from Kenya comparing sexual relationships before and during the pandemic similarly found a stark decrease in the number of transactional sex relationships reported by women at high-risk of HIV infection, which authors defined as

HIV-negative women having two or more sexual partners in the past four weeks (123). Descriptions of men's experiences suggest that women residing in inland communities sought out transactional sex relationships potentially to cope with economic insecurity. This description is consistent with findings that transactional sex and multiple partnerships increase as a coping mechanism for financial strain when women in low-resource settings experience negative economic shocks (122).

Men's reports of changes in transactional sex relationships during the pandemic provide insight into possible changes in HIV transmission in these partnerships. A decrease in men's demand for transactional relationships may have led to a temporary decrease in the number of men engaging in transactional sex. Alternatively, during the pandemic, economically vulnerable women may have sought out transactional sex relationships among a relatively small number of financially stable men. The pandemic may have exacerbated the formation of relationships with this potentially high-risk population of men – those who were able continue providing financial support to their partners – in a context where multiple sexual partnerships is normative (125). In order to appropriately address HIV risk in transactional sex relationships, further quantitative analyses should examine the prevalence and characteristics of transactional sex relationships during the pandemic and whether these changes persisted after the lockdowns.

Limitations

We purposefully recruited men who previously reported transactional sex relationships, given our interest in this group. Therefore, this study does not capture experiences of men with other kinds of relationships and we may not have reached saturation on how covid

has impacted non transactional sex relationships. We also did not interview any women for this study as our interest focused on transactional sex among men.

7.6 Conclusion

This study provides insight into how Uganda's COVID-19 mitigation measures impacted men's transactional sex relationships through changes in their economic standing and restricted mobility. Further research is needed to determine the extent to which transactional sex relationships decreased during the pandemic, the impact on HIV transmission, and whether these changes have persisted post-lockdown.

Chapter 8. Conclusions

8.1 Summary of results

Using a mixed methods approach and data from a population-based sample drawn from the Rakai Community Cohort Study, the overall objective of this thesis was to better understand the relationship between transactional sex and HIV among men. In the quantitative strand, we examined risk factors for transactional sex among men and its association with three HIV outcomes - prevalence of HIV, prevalence of viremia, and HIV incidence. In the qualitative strand, we explored cognitive properties of three commonly used transactional sex measures and men's experiences regarding the impact of Uganda's COVID-19 mitigation measures on transactional sex relationships.

8.1.1 Prevalence and patterns of transactional sex

In Chapter 4, we discuss findings of a cross-sectional analysis using data from 7,678 men aged 15-49 residing in Rakai, Uganda. The prevalence of past-year transactional sex was 9.1%. Though prevalence estimates for transactional sex among men have been reported in other studies, inconsistency in transactional sex definitions and measurement make comparison of prevalence estimates challenging. Given this caveat, our prevalence estimates of 9% (8% in inland communities; 11% in fishing communities) is low compared to those reported in other settings in sub-Saharan Africa. A study in rural Tanzania reported 13% transactional sex prevalence at last sex among men (50) and a study of fishermen working along the Kenyan side of Lake Victoria reported 65% prevalence of transactional sex with at least one of their last three sexual partners (49).

Characteristics of men who engage in transactional sex

Being unmarried and having more than one past-year sexual partner were consistent risk factors for transactional sex. Never married (adjPRR: 2.62; 95% CI: 2.12,3.2) and previously married men (adjPRR: 2.03; 95% CI: 1.67,2.47) were more than twice as likely to engage in transactional sex compared to married men. Compared to men with only one past-year sexual partner, men with two partners were 2.87 times more likely to engage in transactional sex (95% CI: 2.35,3.50) and men with three or more partners were 4.35 times more likely to engage in transactional sex (95% CI: 3.54,5.34). Younger age (15-24 years), being unmarried, and an occupation as a student or fisherman were associated with transactional sex in unadjusted models only. Prevalence of transactional sex was 1.56 times greater among youth aged 15-24 (95% CI: 1.32, 1.85) compared to men aged 25-34. Transactional sex was more frequent among fishermen (PRR: 1.73, 95% CI: 1.42,2.11) and students (PRR: 1.75, 95% CI: 1.23,2.49) compared to men employed in agriculture.

Characteristics of transactional sex partners

In Chapter 4, we present results of an analysis comparing transactional sex relationships to other non-marital, non-commercial relationships. We observed that in transactional sex relationships, men were less likely to know their partner's HIV status (PRR:0.58; 95% CI: 0.51,0.66) and more likely to perceive their partners as high-risk (PRR:1.48; 95% CI:1.27,1.73) compared to non-transactional relationships. Relationships in which there was a co-occurrence of multiple past-year sexual partnerships, alcohol consumption before sex, and sexual IPV were 2.5 times more likely to be transactional (95% CI: 1.76, 3.50) than relationships in which none of these behaviors were reported. Women employed in bars

were 1.83 times more likely to be transactional sex partners (95% CI: 1.47, 2.27) than women employed in agriculture, which may explain high rates of alcohol consumption before sex and the perception that transactional sex partners were high-risk. Prior research on women in Rakai who work in bars has reported high rates of untreated HIV compared to women employed in other fields, and stable HIV incidence over time despite significant declines in HIV incidence in the region overall and scale-up of HIV interventions (89).

Patterns of transactional sex over time

In Chapter 5, we analyzed the transactional sex trajectories of 2,203 men over four consecutive RCCS rounds conducted between 2013 and 2020. We found that most men (81%) did not engage in transactional sex over the study period. The total number of transactional sex partners reported per person-interval ranged from one to four, and the median number of transactional sex partners reported per personal-interval was 1 (IQR:1,1). In this sample of 2,203 men, 422 (19%) engaged in transactional sex at least once during over the study period. Of those 422 men, 77% reported transactional sex in one round and 23% reported transactional sex in two or more rounds. This data suggests that transactional sex is not a consistent practice over time and does not often occur with concurrent sexual partners.

8.1.2 Relationship between transactional sex and HIV

In Chapter 4, we compared prevalence rates for HIV and viremia (≥ 1000 copies/mL) by engagement in transactional sex using data from 7,678 men. In Chapter 5, we compared

incidence rates for HIV by engagement in transactional sex over four RCCS rounds using data from 7,762 men.

Transactional sex and prevalence of HIV and viremia

Understanding the prevalence of HIV and viremia among men who engage in transactional sex is important for understanding potential for onward transmission of HIV. While we did not observe higher prevalence of HIV or viremia among men who engage in transactional sex overall, we found elevated prevalence of HIV and viremia in specific sub-groups of men engaged in transactional sex (Chapter 4). Men residing in fishing communities who were ages 25-34 (adjPRR: 1.29; 95% CI: 1.01,1.64) and married men (adjPRR: 1.42; 95% CI: 1.13,1.76) in transactional sex relationships were more likely to be living with HIV compared to their peers in non-transactional relationships. Boda boda (motorcycle taxi) drivers who engaged in transactional sex were 2.46 times more likely to be viremic (95% CI: 1.11,5.47) than their HIV-positive peers in non-transactional relationships.

Transactional sex and HIV incidence

Understanding the timing of transactional sex as it relates to HIV acquisition is important for determining causal relationships. The timing of transactional sex was an important factor in estimating men's risk for HIV acquisition.² In Chapter 5, we observed a positive, but non-statistically significant, association between transactional sex and HIV incidence (adjIRR: 1.50; 95% CI: 0.86 - 2.61) when transactional sex was assessed in the person-interval preceding HIV acquisition, t_{n-1} . We observed a negative, but non-statistically

² See the Chapter 6 methods section for a detailed description of how transactional sex was modeled.

significant, association between transactional sex and HIV incidence (adjIRR: 0.51; 95% CI: 0.21 - 1.24) when transactional sex was assessed in the same round as HIV acquisition, t_n . These estimates suggest that there may be a delayed effect of transactional sex on HIV acquisition.

8.1.3 Potential causal pathways

To gain insight into potential causal pathways between transactional sex and risk for HIV acquisition, we assessed the incidence of five sexual behaviors (sex with a sex worker, STI symptoms, alcohol consumption before sex, physical IPV, and sexual IPV) by men's engagement in transactional sex (Chapter 5). We found that transactional sex was a strong predictor of sex with a woman employed in sex work regardless of when transactional sex was reported (t_{n-1} versus t_n) but was greater when transactional sex was assessed at t_{n-1} (IRR: 2.62; 95% CI: 2.13-3.23) compared to transactional sex at t_n (IRR: 1.87; 95% CI: 1.45-2.42). Similarly, incidence of STI acquisition was greater when transactional sex was assessed at t_{n-1} (IRR: 1.40; 95% CI: 1.10-1.78) compared to transactional sex at t_n (IRR: 1.22; 95% CI: 0.94-1.59). These findings suggest that transactional sex may predict other sexual behaviors or outcomes, such as sex with a sex worker and STI acquisition, which may increase risk for HIV. Alcohol consumption before sex, physical IPV, and sexual IPV were greater when transactional sex was assessed at t_n compared to t_{n-1} , which indicates that these behaviors likely occurred within transactional sex relationship and is consistent with our findings from Chapter 4.

8.1.4 Transactional sex measurement

In Chapter 3, we examined men's understanding of three commonly used transactional sex measures using a qualitative method called cognitive interviewing. The three transactional sex measures were:

Measure 1: Were money, gifts, or favors ever exchanged for sex with this partner?

Response options: Yes, received only; Yes, gave only; Yes, gave & received; No

Measure 2: Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)? Response options: Yes; No

Measure 3: Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her? Response options: Yes; No.

About half of men responded affirmatively to measure 1 and most men responded affirmatively to measures 2 and 3, but there was variation in responses across measures. Measures 2 and 3, which assessed both relationship motivation and gendered norms of the provision (Figure 8.1), showed better measure comprehension and consistency of responses across measures than measure 1 which didn't have these components.

Figure 8.1 Relationship motivation and gendered norms of provision in transactional sex measures 2 and 3

Measure 2: Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after your children, paying your rent, starting a business etc.)? Response options: Yes; No

Measure 3: Have you given a partner any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her? Response options: Yes; No.

—— Refers to relationship motivations

- - - Refers to male gender norms related to provision

For measures 1 and 2, a substantial proportion of men responded affirmatively, but explanations for their responses revealed that they were referring to gendered expectations of material provision rather than describing behavior in a specific relationship. Measure 3, which was developed by Wamoyi and colleagues (2), most accurately measured transactional sex as intended by capturing actual behaviors related to men's material provision and relationship motivations in which material provision was the main reason for initiation or continuation of the sexual relationship. While there are areas for further refinement of all transactional sex measures assessed in Chapter 6, findings from the analysis strongly support the use of the improved transactional sex measures developed by Wamoyi et al. (2) and recommendations for transactional sex measures to account for gendered norms of giving and receiving and a clear statement of relationship motivation.

Findings from Chapter 5 may provide further insight into transactional sex measurement and facilitate interpretation of cross-sectional studies, though this was not

the intent of the analysis. If there is a delayed effect of transactional sex on HIV acquisition, cross-sectional studies measuring lifetime prevalence of transactional sex may be more likely to observe an association with HIV if most of the sample engaged in transactional sex a substantial amount of time prior to the study. Cross-sectional studies measuring recent transactional sex (e.g., past-year partners, last partner) may be less likely to observe an association with HIV because not enough time has elapsed to capture the lagged effect of transactional sex on HIV. This could help to explain some of the heterogeneity in findings across cross-sectional studies measuring the relationship between transactional sex and HIV.

8.1.5 Impact of COVID-19 on men's transactional sex relationships

The impact of the COVID-19 pandemic and subsequent mitigation measures on men's sexual behaviors has not been well-studied, particularly in HIV endemic settings. In Chapter 7, we present findings from in-depth interviews with 26 men to understand how COVID-19 impacted the formation and continuation of transactional sex relationships.

We found that COVID-19 had far-reaching economic impacts on men employed in the informal economy in occupations such as fishing and agriculture. These men described experiencing job loss, food insecurity, and severely restricted movement which limited opportunities to provide for and physically meet with their transactional sex partners. We found that decreased frequency of provision was closely tied to relationship dissolution. Despite perceived increase in women interested in pursuing transactional sex relationships – likely due to their own economic instability – men described being unable to pursue these relationships, and overall reported fewer transactional sex relationships. Men with more

stable employment did not report changes in their transactional sex relationships and men in non-transactional relationships similarly did not report changes.

If Uganda's COVID-19 policies have affected men's ability to form and sustain transactional relationships, we would expect a subsequent decrease in HIV infections associated with transactional sex. However, it is not clear whether men who were financially stable during the pandemic were able to secure more transactional partners which would also have an impact on HIV transmission. Though a decrease in transactional sex relationships may have a desirable effect on HIV outcomes and this should be explored further, it COVID-19 policies appear to have had an overall detrimental effect on men's livelihoods. The devastating effect of COVID-19 mitigation measures on Uganda's economy, food security, and job opportunities has been documented by other sources (121, 124).

8.2 Overall conclusions

Figure 9 shows a refined conceptual model for the relationship between transactional sex and HIV drawing on theory and extant literature described in Chapter 2 and findings presented in this dissertation. This conceptual model draws on Sweat and Denison's Social Ecological Model and includes factors at five interacting levels of causation which influence behaviors and outcomes: superstructural, structural, environmental, dyadic, individual (66). Superstructural factors include macrosocial and macropolitical forces which dictate power structures and resource allocation. At this level, the Connell's three social structures (gendered division of power, gendered division of labor, structure of social norms and attachments) shift power, wealth, and resources in favor of men and influence all other

levels (54). These social structures also dictate acceptable sexual behaviors for men and women. Stoebenau and colleagues (74), who developed a framework to describe factors motivating transactional sex among adolescent girls and young women, describe how economic processes of globalization exert influence at the superstructural level. Current economic processes are largely driven by the global influence of neoliberal political philosophy and associated economic policies that promote free-market capitalism, privatization of industries, and reduction in government spending (126). The increasing social value of consumer goods has occurred alongside the implementation of neoliberal policies. Studies have documented youths' experience of peer pressure to improve or maintain their social standing with wealthier peers through the consumption of consumer goods, through transactional sex and other sexual behaviors (87, 127-129).

Factors at the structural-level include political and economic arrangements, stage of the HIV epidemic, and national policy. Evidence of the impact of structural forces such as structural adjustment programs and the stage of the HIV epidemic are illustrated in the aftermath Uganda's coffee sector collapse. According to Erin Moore's analysis, the collapse of the coffee sector resulted in loss of reliable paid work for thousands of Ugandan women and increased economic dependence on men (38). At the same time, the emerging HIV epidemic and the rapid expansion of the fishing industry created a perfect storm for the formation of commercial sex work to serve fishermen, transactional sex relationships, and HIV transmission. Other structural factors, such as Uganda's COVID-19 mitigation measures have led to the dissolution of at least some of men's transactional sex relationships, as described in Chapter 7. According to men's accounts, Uganda's COVID-19 lockdowns

severely limited men's mobility and incomes which meant that men were no longer able to meet new partners, travel to their existing transactional sex partners in other communities or provide with the frequency they had prior to pandemic.

Factors at the environmental level encompass living conditions, resources, and opportunities (66). Availability of HIV services that specifically target men and regional HIV prevalence exert influence at the environmental-level and also influence men's individual risk for HIV acquisition and onward transmission. Gendered work opportunities and regional infrastructure have influence on transactional sex and HIV at the environmental-level. The structuring of boda boda driving and fishing as men's work provides men with exclusive access to opportunities to earn relatively large sums of quick cash (97, 101) whereas women are excluded from these opportunities. In Chapter 4, we report that fishermen were more likely than men in other professions to engage in transactional sex and boda boda drivers who engaged in transactional sex were more likely to be to be viremic compared those who didn't engage in transactional sex. Regional infrastructure, such as the high concentration of bars and lodges in Uganda's fishing communities, facilitates alcohol use, IPV, sexual exchange including sex work and transactional sex (90). Our finding in Chapter 4 that transactional sex relationships commonly involve the co-occurrence of alcohol use and sexual IPV and that transactional sex partners were more likely to be employed in bar work than any other occupation illustrate the influence of environmental factors on the opportunities for engagement in transactional sex and individual risk for HIV.

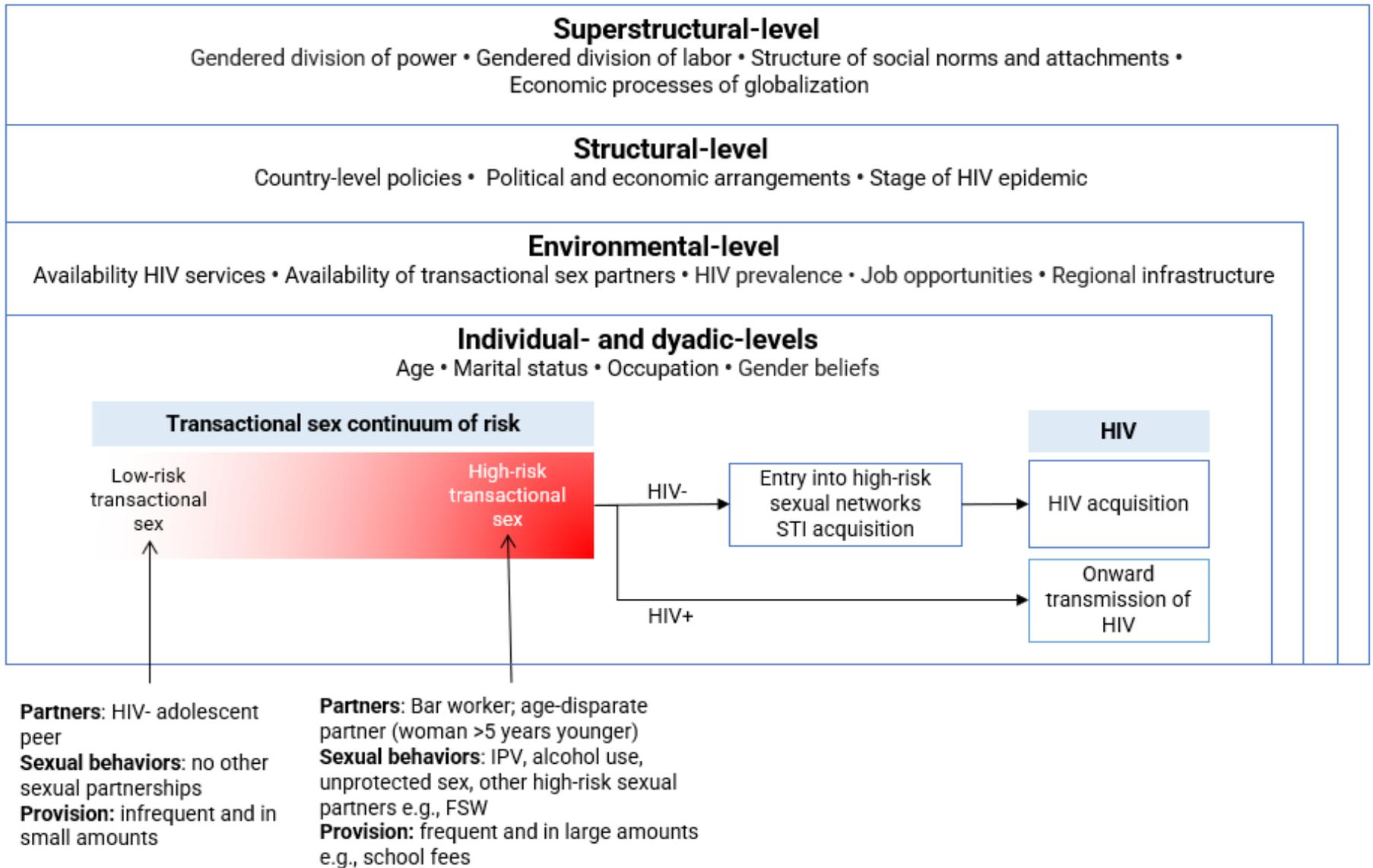
The dyadic-level encompasses factors at the couple-level and the individual-level includes behavioral and psychosocial factors that result from an individual's interaction with their environment (66). An individual's position on the transactional sex continuum of risk is associated with an individual's age, occupation, and marital status (Chapter 4) and adherence to gender norms (42) which, in turn, are influenced by superstructural-, structural-, and environmental-level factors. Importantly, this conceptual model illustrates that some transactional sex relationships may be low-risk. We observed a high prevalence of transactional in youth and students compared to other groups, but did not observe an association with prevalence of HIV or viremia or HIV incidence. Low-risk, however, should be interpreted caution because, as we note in Chapters 4 and 5, transactional sex may predict future high-risk sexual behaviors or entry into high-risk sexual networks.

A man's beliefs about gender roles and relations and adherence to those beliefs may influence his engagement in transactional sex and his behavior in those relationships (42). For example, prior literature from sub-Saharan Africa has found that men with more gender equitable attitudes were less likely to engage in transactional sex with main partners (42), while men with more rigid gender beliefs were more likely to perpetrate gender-based violence and engage in transactional sex (130).

Our understanding of transactional sex, which encompasses a complex set of latent values, beliefs and behaviors, is informed by its measurement (not shown in conceptual model). Issues with measure validity and reliability can result in differential misclassification of transactional sex relationships and skew estimates measuring its

relationship with HIV outcomes. Therefore, measurement approach should be taken into account when interpreting transactional sex literature.

Figure 8.2 Conceptual model for the relationship between transactional sex and HIV



8.3 Strengths and limitations

A major strength of this dissertation is that it is among the first to comprehensively examine the relationship between transactional sex and HIV among heterosexual men in a sub-Saharan African country. This dissertation research is also the among the first to examine the association between transactional sex and prevalence of HIV viremia as well as the effect on HIV incidence and potential causal pathways in this relationship.

Use of data from the RCCS represents a strength of the quantitative analysis presented in this dissertation. The RCCS collects biological specimens from individuals at reach round to ascertain HIV status and viral load suppression (67), rather than relying on self-report, which may be subject to recall or social desirability bias. The wealth of data provided by the RCCS allowed us to sample men for the qualitative strand based on HIV status, demographic characteristics (e.g., occupation), engagement in transactional sex, and other sexual behaviors (e.g., alcohol use and IPV). A limitation that should be noted is that due to changes in the phrasing of transactional sex measures in the RCCS, we were limited to use of only four of 19 RCCS rounds for the longitudinal analysis presented in Chapter 5. Furthermore, the RCCS does not include measures to assess gender equitable norms, relationship control, or nature of the material support provided in transactional sex relationships which may have enhanced the Chapter 4 analysis and our understanding of how gender norms and characteristics of provision impact transactional sex in men. The amount of material support and nature of the exchange has been shown in previous studies to be associated with power dynamics in the relationship which has implications for HIV risk (3).

For the qualitative strand, a major strength of the analysis described in Chapter 6 is that this study is among the first to provide insight into how men interpret and respond to common transactional sex measures as well as the measure comprehension and consistency of responses across measures. The Chapter 6 analysis helps to contextualize findings the quantitative strand and highlights an important limitation of this dissertation. The transactional sex measure we used in the quantitative strand (measure 1) did not perform as well as the two other measures assessed (measures 2 and 3), especially in terms of its ability to identify relationships primarily motivated by material exchange for sex. We attribute poor performance of measure 1 to two missing components, a clause referencing relationship motivations and a clause specifying gendered norms of giving and receiving. Measure 1 may have misclassified some transactional sex relationships. However, we were able to avoid misclassification of marital relationships and relationships with sex workers, a common pitfall of other transactional sex studies (2).

A further limitation of this dissertation is my limited knowledge of Baganda culture and Luganda, the dominant language spoken in Rakai District. All interviews had to be transcribed and translated from Luganda to English and may have resulted in some losses of meaning and nuances in the data. We minimized risk of issues with translation through thorough interview debriefs and weekly meetings with qualitative data collectors. To account for my limited knowledge of the Baganda culture, I spent a total four months in Rakai District prior to developing my dissertation and during data collection and analysis for the qualitative strands. Being in present in Uganda during these stages and working closely with the qualitative team allowed me to frequently consult with community

members and RHSP staff who were able to help me appropriately contextualize the findings in Rakai's specific history, culture, and context.

Lastly, a strength of this research is the mixed methods design which utilized the strengths of quantitative and qualitative methodologies to provide insight into the relationship between transactional sex and HIV. Mixed methods research also facilitates the development of meta-inferences through the integrations both qualitative and quantitative strands of data (131). A product of the mixed methods design is the preliminary conceptual model described above which can be used to guide future research and programming addressing men's engagement in transactional sex and HIV-related risks.

8.4 Implications for practice

The conceptual model shows areas for potential intervention at each social-ecological level. Though public health interventions can most easily address environmental-, dyadic-, and individual-level factors, it is important to recognize the superstructural and structural forces that influence all other levels and may therefore influence the success of programs and interventions addressing HIV outcomes among men who engage in transactional sex.

Programming that addresses the most proximal risks for HIV in transactional sex relationships can target individual sexual behaviors involved in "high-risk transactional sex" such as hazardous alcohol consumption, IPV, and partner concurrency. A considerable proportion of men who engage in high-risk transactional sex are considered key and priority populations in Uganda, including fishermen, boda boda drivers, and clients of female sex workers, and are eligible for pre-exposure prophylaxis (PrEP), according to

Ministry of Health guidelines (132). Despite studies finding a preference for oral PrEP over other HIV prevention methods and high acceptability of PrEP among men (133), rates of PrEP uptake and continuation have fallen behind national targets (134). Programming addressing HIV risk among men who engage in transactional sex could focus on men in high-risk sexual networks and provide free HIV testing and linkage to care for men seeking STI treatment.

The implementation of universal test and treat protocols in 2017 significantly increased the proportion of men linked to HIV care; however, ART retention and viral load suppression rates for men are still below UNAIDS 90-90-90 targets across most of Southern and Eastern Africa (1). Men living with HIV who engage in transactional sex (men in fishing communities and boda boda drivers) may be harder to retain in care than other men because of high rates of mobility and migration which make it difficult to engage in consistent HIV care. Programming should consider the unique needs of highly mobile populations of men to prevent progression to AIDS and risk of onward transmission of HIV to sexual partners.

To the extent that engagement in transactional sex in youth aged 15-24 influences future sexual networks and sexual behaviors, youth should be considered for gender transformative programming that critiques harmful norms. An example intervention that has been successful in this approach is Stepping Stones, a 50-hour program that uses participatory learning approaches to enhance risk awareness, communication skills and to stimulate critical reflection on gender norms and relations (42). The program has been shown to enhance gender equitable beliefs among young men and reduce perpetration of

IPV, engagement in transactional sex relationships, and problem drinking among young men (106). Stepping Stones is a critical component of the DREAMS core package of interventions (20) yet only AGYW have access to Stepping Stones programming. Not involving men and boys in this component of DREAMS is a potential missed opportunity to meaningfully them in HIV prevention efforts and intervene of those aspects of transactional sex that may increase risk for HIV.

This dissertation supports calls for increased focus on the specific needs of boys and men in HIV programs (22, 23, 25, 58, 65, 135-137). Although men are in a privileged position compared to women, like women, they are subject to a range of social and structural forces that influence their engagement in transactional sex relationships and HIV outcomes. Though not often considered as part of public health interventions, more attention is needed to understand the potential superstructural and structural factors such as the spillover effects of policies (e.g., COVID-19 lockdowns) and economic arrangements (e.g., privatization of industries) that create an enabling environment for high-risk transactional sex relationships to occur. Though these policies and economic arrangements may not be preventable, public health interventions can take a proactive approach in mitigating their effects which play out differently among men and women.

8.5 Recommendations for future research

This dissertation helps to fill important gaps in the literature related to engagement in transactional sex and its relationship with HIV outcomes among men. Based on our findings, several topics merit further research.

Further research using improved measures for transactional sex are needed in Rakai and other regions of sub-Saharan Africa. As of 2021, the RCCS changed its approach to measuring transactional sex and now uses the items developed by Wamoyi et al (2) which was found to be the most valid and reliable measure among the three measures we assessed. However, additional cognitive interviewing studies are needed to further refine transactional sex measures. For example, in Chapter 6 we found that the item developed by Wamoyi and colleagues (2), could be refined to improve item comprehension and to differentiate transactional sex from normative courtship behaviors. To facilitate comparison across studies, researchers should explicitly state how they define transactional sex, transactional sex measure(s) used, and over what time period transactional sex was assessed (e.g., last sex, lifetime).

With these refined measures, future quantitative studies are needed to clarify the relationship between transactional sex and HIV. In particular, future cross-sectional studies examining prevalence of HIV viremia are critical to understanding the potential for onward transmission of HIV in transactional sex relationships. Future longitudinal studies can provide insight into whether there is a causal relationship between transactional sex and HIV incidence among men. These studies should focus on examining the timing of transactional sex as it relates to HIV acquisition, specifically the extent to which there is a lagged relationship, and what factors may mediate this relationship. Factors thought to be mediators in the causal pathway between transactional sex and HIV should not be included in models as confounders, an issue identified in prior research, which could lead to underestimation of the effect of transactional sex on HIV outcomes (45).

Further research on specific sub-populations of men engaged in transactional sex who are at risk for HIV acquisition, morbidity, and mortality and are needed. Our research indicates that transactional sex is common among youth but further study on the nature of these relationships and the HIV risks involved are needed. Development of programming to actively engage adolescent boys and young men using gender transformative approaches could be a critical next step in addressing the upstream predictors of transactional sex, such as harmful gender norms, and more proximal risks for HIV, such as reducing IPV and harmful alcohol use. Few gender-transformative programs have been developed for men and boys, of those, few have been rigorously evaluated (137). Further research is needed develop new gender transformative programming for men and boys to address HIV risks associated with transactional sex and refine existing programs such as *Stepping Stones* and *Promundo's Program H*.

Qualitative and ethnographic studies that provide further insight into the gender norms which may motivate men's engagement in transactional sex and nature of exchange can help contextualize quantitative findings. Qualitative work may elucidate whether there are paradigms of transactional sex, such as those that exist for AGYW (74), which connote greater risk for HIV acquisition or onward transmission and can facilitate targeting of interventions. Furthermore, qualitative and ethnographic studies are critical to ensuring that programming developed to address men's specific HIV risks in transactional sex relationships is appropriate for the context and take into account external pressures that gender roles may exert on individual men.

Finally, these suggested future studies should be used to refine the conceptual model explaining the relationship between transactional sex and HIV among men which can help direct future research and interventions.

Appendices

A. Data collection instruments

In-depth interview guide used for Aims 3 and 4

PARTICIPANT DEMOGRAPHIC INFORMATION	
PARTICIPANT ID	<input type="text"/>
RCCS STUDY ID	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
PARTICIPANT IDENTITY VERIFIED	<input type="checkbox"/> Yes <input type="checkbox"/> No (<i>Stop interview</i>)
INTERVIEW INFORMATION	
INTERVIEW DATE	<input type="text"/> <input type="text"/> DD <input type="text"/> <input type="text"/> MM <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> YYYY
INTERVIEWER INITIALS	<input type="text"/> <input type="text"/> <input type="text"/>
CONSENT TO BE INTERVIEWED	<input type="checkbox"/> Yes (<i>Ensure consent is verbally obtained and audio recorded</i>) <input type="checkbox"/> No
CONSENT TO RECORD	<input type="checkbox"/> Yes (<i>Ensure the consent is verbally obtained and audio recorded</i>) <input type="checkbox"/> No
LANGUAGE OF INTERVIEW	<input type="checkbox"/> Luganda <input type="checkbox"/> English
START TIME	<input type="text"/> <input type="text"/> HH <input type="text"/> <input type="text"/> MM
END TIME	<input type="text"/> <input type="text"/> HH <input type="text"/> <input type="text"/> MM

Introduction

Thank you again for agreeing to participate in this study. Today, I will be asking you questions related to three main topics:

Weebale okukkiriza okwetaba mu kunoonyereza kuno. Leero ngenda ku kubuuzayo ebibuuzo nga bikwatagana n'emitwe emikulu gino wammanga

1. *how you make money and how you spend money,*
Engeri gy'okolamu sente n'engeri gy'ozisaasaanyamu,
2. *your experience with sexual relationships in which money, favors, or gifts are exchanged,*
byoyiiseemu mu mikwaano egirimu okwegatta oba egilimu okuwanyisiganya sente, ebirabo oba ebisikiriza ebirala byonna.
3. *expectations of men your age.*
ebisuubirwa mu basajja ab'emyakagyo.

I welcome you to speak freely; if you think of something you want to share that I have not asked about, please let me know. All the information you share today will be kept confidential. You do not have to answer any question you do not want to and you may stop at any time. Do you have any questions before we begin?

Nkusaba owulire eddembe ng'oyogera era bwe wabaawo ekintu kyonna kye wandiyagadde twogereko nga sikikubuuziza nkusaba ombuulire. Byononziramu byonna bijja ku kumiibwa nga byakyaama. Tolina kuddamu kibuuzo kyonna kyotandyagadde kuddamu era osobola okuva mu kunoonyereza kuno obudde bwonna. Olinayo ekibuuzo kyonna nga tetunatandika?

SECTION 1: CONTEXTUAL INFORMATION

These first questions are to understand how you make and spend money.

Ebibuuzo byaffe ebisooka, bigenda kutuyamba okutegeera engeri gy'okolamu sente ne'engeri gy'ozisaasaanyamu

Purpose: To understand how men earn money and their spending habits.

- 1.1 Tell me about how you make money
Mbulira kungeri gyokolamu sente.

Probe:

Are there times of the year when you make more money? Less money?

Waliwo ebiseera mu mwaaka byolaba nti okola sente nyingi? Nyonyola.

Waliwo ebiseera mu mwaaka byolaba nti okola sente ntono? Nyonyola.

- 1.2 When you have extra money, what do you spend it on?
Bwofuna sente eziyiseemu ku z'obadde osuubira, ozikozesaaki?

SECTION 2: COGNITIVE INTERVIEWING

Purpose: To understand how men understand and respond to RCCS transactional sex measurement items?

*These next questions pertain to your **most recent non-marital sexual partner in the last 12 months.***

Ebibuuzo bino ebiddako bikwata ku muganziwo gw'osembyeeyo okwegata naye mu myeezi ekumi n'ebiri egiyise.

*We want to understand how you interpret and respond to the following question. Am going to read the question and give you some response options to choose from (**Read question and response options aloud to participant**): Remember we are referring to your most recent non marital partner in the last 12 months.*

Twagala okumanya engeri gyotegeeramu nokudamu ekibuuzo kino. Ngenda kusomera ebibuuzo nkuwe ne byokudamu kwonolonda ekitufu kyomanyi.
Jjukira twogera ku muganziwo gwo ngambyeko waggulu (Read question and response options aloud to participant):

Kati kino kyekibuuzo:

Were money, gifts, or favors ever exchanged for sex with this partner?

Omuntu ono wali omuwaddeyo oba yali akuwaddeyo ku sente oba ekirabo okwegatta naye?

Response options: Yes, received only; Yes, gave only; Yes, gave & received; No

Response options: **Yee, nz'eyafuna; Yee, Nz'eyagaba; Yee, nagaba era nenfuna; Nedda.**

- 2.1 Please repeat the question I asked you in your own words.
Nkusaba okuddamu mu bigambo byo ekibuuzo kyenkubuziza.
- 2.2 How easy or difficult is this question to answer?
Ekibuuzo kino kikwanguyide kitya oba kikuzibuwalide kitya okuddamu
- 2.3 Tell me how you have arrived at this response.
Mbuulirako lwaki ozzeemu bwotyo.
- 2.4a **If yes:** Tell me more about the exchange that you are referring to.
If yes: Nsaba oyongere okunyonyola ku (insert option mentioned above) kwoyogeddeko waggulu.
- 2.4b **If no:** Is there a partner apart from your most recent partner in which you would have answered 'yes'.
If no: Nga ojjeeko muganziwo ey'akaseembyo, waliwo muganziwo yenna omulala nga wandigambye nti yee, waaliwo okuweebwa oba okufuna ebirabo, sente, oba ekintu kyona ekisikiriza?

Next, we want to understand how you interpret and respond to the following question. I am going to read the question and give you some response options to choose from. (Read question and response options aloud to participant):

Era, twagala okumanya engeli gyotegeera awamu n'okudamu ekibuuzo kino. Ngenda kusomera ebibuuzo nkuwe ne by'okuddamu kwonolonda ekituufu ky'omanyi. (Read question and response options aloud to participant):

Is the primary reason you had a sexual relationship with this partner because you provided material support to her (such as money for personal needs, looking after her children, paying her rent, starting a business, etc.)?

Ensonga enkulu eyakuleetera okwetaba mu mukwano ogulimu okwegatta n'omwagalwawo kyali lwakuba nti wamuyambako mubyetaago bye? okugeza nga okumuwa sente asobole okumala ebyetaago, okulabirila abaana be, okusasula sente z'obupangisa oba okutandika wo ka business? Response options: Yes, No

2.5 Please repeat the question I asked you in your own words.

Nkusaba okuddamu mu bigambo byo ekibuuzo kyenkubuziza.

2.6 Tell me how you have arrived at this response.

Mbuulirako lwaki ozzeemu bwotyo.

2.7 How easy or difficult is this question to answer?

Ekibuuzo kino kikwanguyira kitya oba kikuzibuwalira kitya okuddamu?

2.8 How did you determine the "primary reason" for the relationship?

Wasalawo otya nti eno ye nsonga enkulu eyakuletela okwetaba mu mukwano ogulimu okwegatta n'omuntu oyo?

2.9a **If yes:** Tell me more about the exchange that you are referring to.

If yes: Nsaba oyongere okunyonyola ku (insert option mentioned above) kwoyogeddeko wagulu.

2.9b **If no:** Is there a partner apart from your most recent partner in which you would have answered 'yes'.

If no: Nga ojjeeko muganziwo eyakasembyo, waliwo muganziwo yenna omulala nga wandigambye nti yee, ensonga enkulu eyakuleetera okwetaba mumukwano ogulimu okwegata n'omwagalwa wo kyali lwakuba nti wamuyambako mu byetaago bye, okugeza nga okumuwa sente asobole okumala ebyetaago, okulabirila abaana be, okusasula sente z'obupangisa oba okutandika wo ka business?

We'd like to learn about how you respond to this question regarding your most recent non-marital sexual partner in the last 12 months (read question and response options aloud to participant). I am going to read the question and give you some response options to choose from.

Nandyagadde okuyiga okuva gyooli engeri gyewaddamu ekibuuzo ekikwata ku muganziwo gwe wakasembayo okwegatta naye mu myeezi 12 egiyise. Ngenda kusomera ebibuuzo nkuwe ne by'okuddamu kwonolonda ekituufu ky'omanyi.

Preamble: Sometimes women enter relationships because they need help paying for things they need, even if that is not directly exchanged for sex.

Ebiseera ebimu abakyala beetaba mu mukwano olw'ensonga nti beetaga obuyambi okusobola okugula ebintu byebaba beetaga, ne bwekiba nti tewabadde kusooka kwegatta mu mukwano.

Have you given a partner who is not your wife and not a sex worker any money, gifts, or helped/supported her to pay for things mainly to start or continue a sexual relationship with her?
Wali owadde muganziwo atali mukyalawo era nga sineko sente, ebirabo, oba okumuyambako okusasula ebintu nga ekigendererwa ekikulu kutandikawo enkolagana ey'omukwano ogulimu okwegatta oba okugenda mu maaso n'omukwano guno. Response options: Yes, no

2.10 Tell me how you have arrived at this response.

Mbuulirako lwaki ozzeemu bwotyo.

Please repeat the question I asked you in your own words.

2.11 **Nkusaba okuddamu mu bigambo byo ekibuuzo kyenkubuziza.**

SECTION 3: TRANSACTIONAL SEX CONTEXT & MECHANISMS

If respondent answers 'yes' to any of the questions above, say the following:

These questions pertain to the partner you just described. I realize these are extremely private matters (renew promise of confidentiality), but I want to ask you some questions about this relationship.

If respondent answers 'yes' to any of the questions above, say the following: *Ebibuuzo ebiddako bikwata ku muganziwo gwe wakambuulirako. Nkitegeera nti ebibuuzo bino byakyaama (renew promise of confidentiality), naye njagala ku kubuuzayo ebibuuzo ebikwata ku mukwano guno.*

If respondent answers 'no' to *all* the questions above, say the following: *These questions pertain to the last partner who was not your wife and also not a sex worker that you had a sexual relationship with. I realize these are extremely private matters (renew promise of confidentiality), but I want to ask you some questions about this past relationship.*

If respondent answers 'no' to *all* the questions above, say the following: *Ebibuuzo ebiddako bikwata ku muganziwo atali mukyalawo era nga sineko gwe wakasembayo okwegatta naye mu mukwaano. Nkitegeera nti ebibuuzo bino byakyaama (renew promise of confidentiality), naye njagala ku kubuuzayo ebibuuzo ebikwata ku mukwano ogwo ogwa ggwa.*

3.1 Tell me about this partner.

Mbuulirako kubikwata ku muganzi wo ono.

Purpose: To obtain information about actual experiences of transactional sex and their context/meaning

Probes:

Do you currently have a sexual relationship with this partner?

Mukyalina enkolagana n'omuntu ono nga erimu okwegatta?

What label would give to this partner (e.g. girlfriend, casual partner, etc.)?

Omukwano gwo nomuntu ono ogutwaalira mutuluba ki? (e.g. girlfriend, casual partner, etc.)?

Age difference (e.g. >5 years or >10 years),

Omusinga oba akusinga emyaaka emeka?

Occupation

Akola mulimu ki?

Marital status,

Mufumbo?

Children

Alina abaana?

partners' other romantic/sexual relationships,

Waliyo baganzibe abalala bonna bomanyi?

partner's HIV status

Ebyaava mukukebera akawuka akaleeta siliimu mu musaayi gwe byali bitya?

3.2 Now I'd like to learn more about your relationship with this partner.

Njagala kwongera kumanya ebikwata ku nkolaganayo n'emuganziwo ono.

Purpose: To obtain information about the relationship dynamics and expectations between these partners.

Probes:

How did you meet?

Mwasisinkana mutya?

Why did you decide to have a relationship with this partner?

Lwaki wasalawo okukolagana ne muganziwo ono/omwagalwa wo ono?

How long were/have you been in a relationship with this partner?

Mwamala bangaki/mwakamala bangaki nga muli mu mukwaano n'omwagalwawo ono?

If it ended: How did it end?

If it ended: **Omukwano gwamwe bweguba nga gwagwaawo, gwagwaawo gutya?**

If relationship has ended, change to past tense.

What types of activities do you do together?

Bintuki byemukolela awamu?

What feelings do you have for this person?

Bwagazi ki bwolina eri omuntu oyo?

How do you show your feelings to this person? (Gifts, kisses, sex)

Omuntu ono omulaga otya obwagazi? (okumuwa ebirabo, okumukiisinga, okwegatta naye mu mukwano)

How does this person feel towards you?

Omuntu ono alina bwagazi ki gyoli?

How does she show her feelings? (Gifts, kisses, sex)

Omuntu ono akulaga atya obwagazi? (okuwa ebirabo, okukiisinga, okwegata naawe mu mukwano)

What expectations do you have from this partner (emotional, physical, material)?

Biki byosubila ekuva eri omwagalwawo? (Okuyingira mubusomyo, Okukola ebilabika, okuwa ebintu ebikalu)

What expectations do you think this partner has of you (emotional, physical material)?

Biki muganziwo ono byakusubilamu? (Okumuyingira mubusomyo, Okumukolera ebilabika, okumuwa ebintu ebikalu)

- 3.3** Please describe the material support you provide/have provided to this partner.
Nsaba ombuulire ku bintu ebikalu by'omuwa/by'omuyambamu oba byewamuwade oba by'omuyambyemu.

Purpose: To obtain information about items exchanged and the context of the exchange with a transactional sex partner

Probes:

What material support do you provide?

Bintuki ebikalu byomuwa??

At what point during the relationship did the first exchange occur?

Kiseeraki oba ddi mu mukwano gwammwe lwe wasookera ddala okuwaayo ekirabo oba sente oba ekintu kyonna ekisikiriza?

How often do you provide this material support to this partner?

Ebintu ebikalu otera kubimuwa buli luvanyuma lwa bangaki?

When was the last time you provided material support for this partner?

Ddi lwe wasembayo okumuwa ebintu ebikalu?

Why did you provide material support to this partner?

Lwaki omwagalwawo ono wasalawo okumuwa ebintu ebikalu?

- 3.4** Please describe the *last* time you had sex with this partner.
Nsaba onyinyonyole ku mulundi gwe wasembayo okwegatta n'omuntu ono.

Purpose: To understand behaviors that might influence HIV risk or if there was an exchange of material support on the same day as the sex.

Probes: Describe any steps you took to prevent HIV and/or pregnancy if any?

Bwekiba ng kyaliwo, nsaba onyinyonyole amakubo gewakozesa okusobola okwetangira akawuka akaleeta siliimu oba okumufunyisa olubuto.

- 3.5** Have you ever had a health problem you thought could be related to having sex with this partner (e.g., STIs, HIV)?
Wali ofunyeyo ekizibu kyonna ekikwatagana ne by'obulamu, kyewalowoza nti kyava ku kwegatta mu mukwano n'emuganziwo oyo? (okugeza nga endwadde z'obukaba oba akawuka akaleeta silimu)

Purpose: To obtain information on perception of HIV/STI risk associated with this partner.

- 3.6** Do you or this partner ever consume alcohol before sex? Tell me about when you consume alcohol.
Gwe oba omwagalwawo ono, mutera okunywa kumwenge nga temunaba kwegatta mu mukwano. Mbuulirako gwe n'omwagalwawo lwemunya omwenge.

Purpose: To understand experiences with alcohol use in transactional sex partnerships.

Probes:

How much alcohol do you normally consume before having sex?

Mutela kunywa omwenge gwenkana ki nga temunegatta mu mukwano?

How often do you consume alcohol with this partner before having sex?

Mutera okunywa omwenge emirundi emeka nga temunegatta m umukwano?

- 3.7** Has there ever been violence/abuse in your relationship? If so, please tell me about that.
Mwali mufunyeeko obutabanguko oba okutyobolebwa mu mukwano gwamwe? If so, Nsaba ombulireko.

Purpose: To understand experiences of IPV in transactional sex partnerships.

Probes:

Describe the type of abuse in your relationship (shouting, threatening with an object, physical abuse, sexual abuse).

Nyinyonyola ko kubutabanguko obwali bubaddewo mu mukwano

gwamwe.(okuwoganira omuntu , okutisatisa n'ekissi, okukuba , oba okukaka akaboozi akekikulu)

- 3.8** You mentioned earlier that you make more money during certain times of the year. Do you think having more or less money influences your sexual partnerships?
Emabegako awo wangambyeko nti waliwo ebiseera mwokolera sente enyingiko. Olowooza okubeera ne sente enyingi oba entono kiyina engeri gye kiyusamu ebyokwegata.

Purpose: To understand how amount of disposable income affects sexual partnerships.

- 3.9** Have you heard of the term *de-toothing*? Tell me about experiences with this in your own relationships.
Wali owulideko ku njogera egamba "okukuula ebinnyo"? Mbuliraako ku byoyisemu ku nsonga y'okukuula ebinnyo mu mukwano gwamwe.
Have you heard of the term *jaboya*? Tell me about experiences with this in your own relationships.
Wali owulideko ku njogera egamba "jaboya"? (term used in fishing community where women exchange sex for fish) Mbulilako kubyoyisemu kunsonga ya "jaboya" mu mukwano gwamwe.

Purpose: To understand types of transactional sex relationships.

SECTION 4: MASCULINITY

The purpose of these next few questions is to discuss how men your age are expected to behave with family, peers, in the community, and in romantic/sexual relationships.

Ekigendererwa kye bibuuzo bino ebiddako kwe ku kubaganya ebirowoozo, ngeri ki abasajja abemyaka gyo gyebasubirwa okweyisamu nga bali ne family zaabwe, emikwano/ebekinywi, mu kitundu, awamu ne mikwano ekigirimu okwegatta.

Purpose: Men are influenced by the expectations of their family, peers, community, and romantic partners. The purpose of this section is to understand how these expectations affect men's behavior, especially in regard to behavior in sexual relationships and HIV prevention.

- 4.1** Describe how men of your age are expected to behave. Nyinyonyola abasajja abemyaka gyamwe engeri gyebasubirwa okweyisamu.

Probes:

How are these expectations different with friends? Other men your age?

Community members?

Ebi basubilwamu byawukana bitya mu mikwano ? Ate mu basajja abalala abemyaka gyamwe?Ate mu bantu bekitundu?

- 4.2** Describe how are men your age expected to behave in *romantic/sexual relationships*. **Ninyonyola abasajja abemyaka gyamwe enggeri gyebasubirwa okweyisamu nga bari mu mukwano egirimu okwegadanga oba okwegatta.**

Probes:

How do men your age show love for their romantic/sexual partners? (gifts, kisses, sex).

Abasajja abemyaka gyamwe balaga batya baganzi baabwe omukwano ogulimu okwegatta?

How does this behavior change with a woman he wants to marry?

Enneyisa eno ekyuka etya ku mukazi gwayagala okuwasa?

- 4.3** How concerned are men your age regarding protecting themselves against HIV? **Abasajja abemyaka gyo bafaayo batya okulaba nga bekuuma obutakwatibwa akawuka akaleeta obulwade bwa silimu?**

- 4.4** How concerned are men your age regarding protecting their sexual partners against HIV? **Abasajja abemyaka gyo bafayo batya okulaba nga bantagila abagalwa babwe obutafuna kawuka kaleeta bulwade bwa silimu.**

- 4.5** How do you think your behavior compares to the expectations you've just described? **Olowooza gwe enneyisaayo egerageranyizibwa etya ne byo ebisuubilwa mu basajja bo nyonyodde waggulu?**

SECTION 5: COVID-19

5.1 Since the COVID-19 lockdowns in March 2020, how have your sexual relationships changed among your non-marital sexual partners.

Okuva lwebateekawo omuggalo gwa covid19 mu March 2020, emikwano gyo egirimu eby'okwegatta gikyuse gitya?

Purpose: To understand how the COVID-19 pandemic has influenced material exchange for sex in relationships.

Probes: Have social distancing considerations changed how you engage in sexual partnerships? Has the way that you provide for your non-marital sexual partner changed?
Eky'okuteekesa munkola ekya tonseemberera kikyusiza kitya engeri gyewetaba munkolagana ezomukwano ezirimu okwegata. Engeri gy'olabiriramu muganziwo ekyuseemu?

Please let me tell you a few important things about the new coronavirus/COVID-19.

Nsaba nkubulireko ku bintu bitonotono eby'omugaso ebikwata ku kirwadde kya COVID-19

Coronavirus or COVID-19 is a highly infectious disease that can spread from person-to person through sneezing and coughing, and through close contact. Symptoms of COVID-19 can include flu-like symptoms such as fever, cough, sore throat, difficulty breathing, and body pains and weakness. Everyone is at risk.

Coronavirus oba COVID-19 kirwadde ekikwata amangu era kisobola okusaasaana mangu okuva ku muntu omu okuda kumulala nga kiyita mu kolola oba okweyasimula, nokulilanigana. Obubonero bwa COVID-19 mwe muli obubonero obulinga obwa senyiga okugeza nga, omusujja, okukolola, obulumu mu mimiro, okukalubirizibwa mukusa, obulumu no bunafu mumubiri. Buli muntu ali mukatyabaga kokukwatibwa.

Most persons with COVID-19 get well in about two weeks. However, some people can get very sick and can even die. To protect yourself and others, some suggestions from the MOH include maintaining a reasonable distance between yourself and someone else of at least 2 meters, avoiding contact with persons who show flu-like symptoms, covering your mouth and nose when sneezing or coughing, and regularly washing your hands with soap and running water.

Abantu abasinga abalina COVID -19, batera okubeera obulungi oba okuwona mu banga lya weeki biri. Naye abantu abamu balwalra ddala era ne baffa. Okwekuuma no kukuuma abalala, Okuwabulwa okuva mu kitongole kye byobulamu kulimu ebimu kubino wamanga; okwewa akabanga ka mita nga biri okuva kumuntu omulala, okwewala okusemberera abantu abalina obubonero obwefananyirizako obwa senyiga,okubikka kumumwa oba ennyindo nga weyasimula oba okukolola eera n'okunaaba engalo nga mukozesa amazzi nesabuuni buli kiseera.

For more information, call the Ministry of Health toll free lines on: 919, 0800-100-066, 0800-203-033 and 0800-303-033 or send a free SMS to Ureport on 8500 or WhatsApp on 0770-818-139.

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- alcohol use, gender-based violence and HIV risk among female sex workers in Tanzania. *Cult Health Sex*. 2018;20(12):1409-23.
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Curriculum Vitae

EDUCATION

PhD Candidate

Johns Hopkins Bloomberg School of Public Health, Department of International Health
Dissertation topic: Transactional sex and HIV among men in rural Uganda: A mixed methods study Baltimore, MD
August 2022

Master of Public Health

UC Berkeley School of Public Health, Department of Maternal and Child Health Berkeley, CA
May 2018

Bachelor of Arts

UC Berkeley College of Letters & Sciences, Department of Integrative Biology Berkeley, CA

RESEARCH EXPERIENCE

Graduate Student Researcher, Baltimore Mayor's Guaranteed Income Initiative Jun 2021-Present
SOURCE, Johns Hopkins University

Conduct a qualitative analysis and scoping review on the impact of guaranteed income programs on health-related outcomes (PI: Lorraine Dean, PhD)

Develop a conceptual framework illustrating the relationship between guaranteed income and health

Graduate Student Researcher, Women's Role in HIV Transmission Networks in Uganda Mar 2020 – Present
Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health

Collaborate with a team of Johns Hopkins and Ugandan researchers to design and implement a qualitative study of HIV-infected women who have central roles in transmission networks to gain insight into their HIV-related risks and to understand the barriers to reporting these risks (PI: Kate Grabowski, PhD)

Analyze in-depth interview and relationship timeline data using a framework analysis approach

Graduate Student Researcher, Evidence Project Aug 2018 – Dec 2020
Department of International Health, Johns Hopkins Bloomberg School of Public Health

Assisted in protocol development, data extraction, and analysis for systematic reviews and meta-analyses on sexual and reproductive health-related topics including voluntary male circumcision interventions, risk compensation with ART treatment, values and preferences for HPV self-sampling (PI: Caitlin Kennedy, PhD)

Global Health Established Field Placement Fellow, Rakai Health Sciences Program Jun – Aug 2019
Center for Global Health, Johns Hopkins Bloomberg School of Public Health

Designed and implemented a qualitative study to examine factors associated with dropout from PEPFAR's DREAMS program, a package of evidence-based interventions addressing social and structural drivers of young women's risk for HIV. (PI: Fred Nalugoda, PhD)

Led a qualitative study evaluating a motivational interviewing intervention to improve uptake of HIV testing and ART adherence in Rakai, Uganda. Used NVivo to analysis qualitative in-depth interview and focus group data (PI: Larry Chang)

Graduate Student Researcher, Behavioral Surveillance Research (BESURE) Study Feb – Jun 2019
Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health

Conducted formative research using qualitative methods to examine the context for heterosexual transmission of HIV in Baltimore for the BESURE study, a community health project that measures prevalence of HIV, health and social issues, health-related behaviors and access to services among key groups in Baltimore. Analyzed interviews with key informants and focus groups with community members and developed a report for submission to the funding agency (Centers for Disease Control) (PI: Danielle Germane, PhD)

Research Associate Jun – Sep 2018

Survey Research Group, Public Health Institute

Conducted case studies using both qualitative and quantitative data to examine local health departments' transition from clinical services model to population-based services model for the National Association of County and City Health Officials (NACCHO) resulting in a publication in the *Journal of Public Health Management and Practice*

Research Analyst

Nov 2013 – Apr 2018

Office of Medical Education, UCSF School of Medicine

Notable accomplishments

Led a team of faculty and trainees in developing competencies for teaching learners and treating patients from diverse backgrounds in health professions education. Results presented at national and regional medical education conferences. Competencies were taught to over 200 School of Medicine faculty in summer 2017.

Developed a survey to examine how faculty address microaggressions in the classroom and clinical learning environment

Conducted a quasi-experimental study to assess knowledge and skill acquisition among students volunteering with UCSF student run clinics resulting in an oral presentation at the 2016 Association of American Medical Colleges Annual Meeting

General responsibilities

Design and administer focus group, interview, and surveys for School of Medicine research and program evaluations

Analyze and interpret qualitative data using Dedoose and NVivo software

Assist in survey development using validated questionnaires

NIMHD Minority Health and Health Disparities International Research Training Fellow Jun – Aug 2017

UC Berkeley School of Public Health & Public Health Research Institute of India

Trained qualitative research team on conducting in-depth interviews with women living to HIV for study exploring the impact of maternal HIV stigma and social support on their child's health

Worked collaboratively with an international team to implement a study to comparing the acceptability and accuracy of self-collected versus clinician-collected samples for HPV testing in rural Mysore, India

TEACHING EXPERIENCE

Graduate Student Instructor

AY 20-21

Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health

Baltimore, MD

Course: Program Planning and Health Behavior Change, Qualitative Reasoning

Graduate Student Instructor

AY 20-21

Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health

Baltimore, MD

Course: Foundations of Social Epidemiology

Graduate Student Instructor

AY 18-19

Department of International Health, Johns Hopkins Bloomberg School of Public Health

AY 20-21

Courses: Qualitative Research Theory and Methods, Qualitative Data Analysis

Baltimore, MD

Qualitative Research Workshop Facilitator

June 2020

School of Medicine, Johns Hopkins University

Baltimore, MD

Led a two-day workshop on conducting remote in-depth interviews and data management for a team of qualitative researchers from the Johns Hopkins School of Medicine

GRANTS & AWARDS

Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship

2021-2023

PhD Fellowship Award for COVID Relief, Johns Hopkins University

2021

Center for Qualitative Studies in Health and Medicine's Dissertation Enhancement Award; Johns Hopkins Bloomberg School of Public Health

2021

Fulbright-Fogarty Public Health Fellowship Award, Uganda	2020
Tuition Scholarship, Johns Hopkins Bloomberg School of Public Health	2018-present
Global Health Research Award, Johns Hopkins Bloomberg School of Public Health	2019
Honorable Mention, Consortium of Universities for Global Health Annual Meeting Video Competition	2019
Staff Assembly Scholarship Award, University of California San Francisco	2017, 2018
Minority Health Research Training Award, UC Berkeley & National Institute on Minority Health and Health Disparities	2017

PEER-REVIEWED PUBLICATIONS

Nishimura H, Yeh PT, Oguntade H, Kennedy CE, Narasimhan M. HPV self-sampling for cervical cancer screening: a systematic review of values and preferences. *BMJ Glob Health*. 2021 May;6(5):e003743. doi: 10.1136/bmjgh-2020-003743. PMID: 34011537.

Adewumi, K., **Nishimura, H.**, Oketch, S. Y., Adsul, P., & Huchko, M. (2021). Barriers and Facilitators to Cervical Cancer Screening in Western Kenya: A Qualitative Study. *Journal of Cancer Education*, 1-7.

Ryan-Ibarra, S., **Nishimura, H.**, Gallington, K., Grinnell, S., Bekemeier, B. (2020). Time to modernize: Local public health transitions to population-level interventions. *Journal of Public Health Management and Practice*. PMID: 31834010.

Placek, C. D., **Nishimura, H.**, Hudanick, N., Stephens, D., & Madhivanan, P. (2019). Reframing HIV Stigma and Fear. *Human Nature*, 1-22.

Jauregui, J., O'Sullivan, P., Kalishman, S., **Nishimura, H.**, & Robins, L. (2019). Remooring: A Qualitative Focus Group Exploration of How Educators Maintain Identity in a Sea of Competing Demands. *Academic Medicine*, 94(1), 122-128.

Brondfield, S., Boscardin, C., Strewler, G., Hyland, K., Oakes, S. A., **Nishimura, H.**, Hauer, K. E. (2019). A medical student inquiry behavior assessment tool: Development and validity evidence. *Academic Medicine*, 94(4), 586-594. PMID: 30431452.

Nishimura, H., Krupp, K., Gowda, S., Srinivas, V., Arun, A., & Madhivanan, P. (2018). Determinants of exclusive breastfeeding in rural South India. *International Breastfeeding Journal*, 13(1), 40.

Hauer, K. E., **Nishimura, H.**, Dubon, D., Teherani, A., & Boscardin, C. (2018). Competency assessment form to improve feedback. *The Clinical Teacher*, 15(6), 472-477.

Veeranki, S. P., **Nishimura, H.**, Krupp, K., Gowda, S., Arun, A., & Madhivanan, P. (2017). Suboptimal Breastfeeding Practices among Women in Rural and Low-Resource Settings: A Study of Women in Rural Mysore, India. *Annals of Global Health*, 83(3-4), 577-583.

Teherani, A., **Nishimura, H.**, Apatira, L., Newman, T., & Ryan, S. (2017). Identification of core objectives for teaching sustainable healthcare education. *Medical Education Online*, 22(1), 1386042.

SUBMITTED MANUSCRIPTS

Nishimura, H., Pollard, R., Chang, L.W., Hutton, H. Motivational Interviewing for HIV Testing and ART Adherence in Rakai, Uganda: A Qualitative Study. *AIDS Care*.

CONFERENCE PRESENTATIONS

Nishimura, H., Grabowski, M.K., et al. Near-universal coverage of recent HIV testing in rural Uganda: A population-based study: A population-based study (poster presentation). Conference on Retroviruses and Opportunistic Infections. February 2022.

Nishimura, H., Grabowski, M.K., et al. Characteristics of transactional sex relationships and association with HIV viremia among men in rural Uganda: A population-based study (e-poster presentation). 11th IAS Conference on HIV Science. Virtual. July 2021.

Grabowski, M.K., **Nishimura, H.**, et al. Barriers and facilitators of risk disclosure among women at high risk for HIV acquisition and onward transmission in Uganda: A qualitative study (e-poster presentation). 11th IAS Conference on HIV Science. Virtual. July 2021.

Nishimura, H., Reynolds, S., Fernald L. Effect of *Bolsa Familia* conditional cash transfer program on adolescent sexual behavior and contraceptive knowledge (poster presentation). Adolescent Health Symposium. University of California Berkeley, Berkeley, CA. April 2018.

Nishimura, H., Jackson, A., Rincon, A., O'Sullivan, P., Davis, D., Teherani, A. Diversity and inclusion competencies for faculty educators in medicine (poster presentation). Association of American Medical Colleges (AAMC) Annual Meeting. Boston, MA. November 2017.

Ruddick, V., **Nishimura, H.**, van Schaik, S., O'Sullivan, P.S. Teach for UCSF Certificate Program: Encouraging educational skills development in faculty and trainees (oral presentation). Society for Academic Continuing Medical Education. San Diego, CA. May 2017.

Nishimura, H., Jackson, A., Rincon A., O'Sullivan, P.S., Davis, D., Teherani, A. Assessing medical educators' personal and professional beliefs towards diversity (oral presentation). UC Berkeley Graduate School of Education: Education Research Day. Berkeley, CA. April 2017.

Nishimura, H., Jackson A., Rincon, A., O'Sullivan, P.S., Davis, D., Teherani, A. Diversity and inclusion competencies for faculty educators in medicine (oral presentation). Western Group on Educational Affairs (WGEA). Salt Lake City, UT. February 2017.

Nishimura, H., and Rincon, A. Developing faculty competencies for diversity and inclusion medical education (workshop). Western Group on Educational Affairs (WGEA). Salt Lake City, UT. February 2017.

Nishimura, H., Jain, S., Teherani, A. Effect of participation in student run clinic electives on knowledge and skill acquisition (oral presentation). Association of American Medical Colleges (AAMC) Medical Education Meeting. Seattle, WA. November 2016.

Nishimura H., Yatich N., Huchko M. Facilitators and Barriers to Cervical Cancer Screening in rural Kenya (oral presentation). American Public Health Association (APHA) Annual Meeting. Denver, CO. October 2016.

Jauregui J., Kalishman S., O'Sullivan P.S., **Nishimura H.**, Robins L. Identity as trajectory: How faculty members modulate their newly formed educator identity after graduating from a longitudinal faculty development program (oral presentation). Association for Medical Education in Europe (AMEE) Annual Meeting. Dublin, Ireland. August 2016.

Fulton T., Lindsley J., **Nishimura H.** What is the impact of providing visual reference materials on assessments? (poster presentation). International Association of Medical Science Educators (IAMSE) Annual Meeting. Leiden, Netherlands. June 2016.

Nishimura, H., Yatich, N., Huchko, M. Facilitators and barriers to cervical cancer screening among women in Western in Kenya (poster presentation). Global Cancer Symposium. San Francisco, CA. April 2016.

O'Sullivan P.S., **Nishimura H.**, Ruddick V. Teach for UCSF: Tools for encouraging educational skills development in faculty and trainees (oral presentation). World Congress on Continuing Professional Development. San Diego, CA. April 2016.

Boscardin, C.K., Ackerman, S., **Nishimura, H.**, Karliner, L., Gonzales R. Action Research Program: Integrating education with clinic needs (oral presentation). American Educational Research Association (AERA) Annual Meeting. Chicago, IL. April 2016.

O'Sullivan, P.S., **Nishimura, H.**, Irby, D.M. The most valuable features of faculty development workshops as identified by participants. Oral Presentation, Association of American Medical Colleges (AAMC) Medical Education Meeting. Honolulu, HI. November 2014.