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ORIGINAL PAPER

Transactional Sex, Alcohol Use and Intimate Partner Violence Against Women in the Rakai Region of Uganda

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Abstract

Transactional sex (TS) is prevalent in sub-Saharan Africa. Women's engagement in TS is linked with HIV infection; little is known about the relationship between TS, intimate partner violence (IPV) and alcohol use—established HIV risk behaviors. Using modified Poisson regression, we assessed associations between TS and physical, verbal and sexual IPV among 8248 women (15–49 years) who participated in the Rakai Community Cohort Study across forty communities in Uganda. An interaction term assessed moderation between alcohol use and TS and no significant interaction effects were found. In adjusted analysis, alcohol use and TS were significantly associated with all forms of IPV. In stratified analysis, TS was only associated with IPV in agrarian communities; alcohol use was not associated with physical IPV in trade communities or sexual IPV in trade and fishing communities. Identifying differences in IPV risk factors by community type is critical for the development of tailored interventions.

Keywords Transactional sex · Alcohol use · Intimate partner violence · Uganda · Sub-Saharan Africa · HIV

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Resumen

El sexo transaccional (ST) es frecuente en África subsahariana. La participación de las mujeres en el ST está relacionada con la infección por VIH; Se sabe poco sobre la relación entre el ST, la violencia de pareja íntima (VPI) y el consumo de alcohol: conductas de riesgo establecidas para el VIH. Utilizando la regresión de Poisson modificada, evaluamos las asociaciones entre el ST y la VPI física, verbal y sexual entre 8,248 mujeres (15-49 años) que participaron en el Estudio de cohorte de la comunidad Rakai en cuarenta comunidades de Uganda. Un término de interacción evaluó la moderación entre el consumo de alcohol y el ST y no se encontraron efectos de interacción significativos. En el análisis ajustado, el consumo de alcohol y el ST se asociaron significativamente con todas las formas de VPI. En el análisis estratificado, el ST solo se asoció con la VPI en las comunidades agrarias; El consumo de alcohol no se asoció con la VPI física en las comunidades comerciales ni con la VPI sexual en las comunidades comerciales y pesqueras. Identificar las diferencias en los factores de riesgo de la violencia de género por tipo de comunidad es fundamental para el desarrollo de intervenciones personalizadas.

Introduction

Transactional Sex (TS) is typically defined as a sexual relationship where sex is exchanged for material goods or money [1]. The practice of TS is often mistakenly equated with sex work and many researchers initially treated the practice of TS as synonymous with commercial sex work and/or prostitution [2]. However, TS is a distinct practice from sex work and warrants focused attention for numerous reasons [3], namely it is prevalent in sub-Saharan Africa (SSA) and associated with HIV [4] and other HIV risk factors in the region (e.g. sexual coercion, intimate partner violence (IPV), gender-based violence) [5–9]. While commercial sex work exists in Africa, many women and girls who exchange sex for goods or money do not identify as sex workers and the nature of this exchange in their relationships is distinct and *non-commercial* [2]. Women and girls who engage in TS typically consider themselves as partners or lovers of the people with whom they informally exchange sex for materials and financial resources. Further, unlike sex workers who explicitly link their provision of sex to a "client" in exchange for money or goods, those who engage in TS tend to perceive this exchange (i.e., sex for money/goods) as *implicit* to an ongoing relationship with a boyfriend, girlfriend, partner or lover [4]. Many transactional relationships are characterized by emotional intimacy between the involved parties. While women who engage in sex work can also develop ongoing relationships with their clients, these relationships usually lack emotional intimacy. Instead of considering themselves as partners or lovers of the people they "provide" sex to (clients) individuals engaged in sex work typically self-identify as sex workers [4].

TS has gained recognition as an important public health issue, in light of research suggesting its high prevalence, both globally [3] and in SSA (up to 80% among women aged 12–19 years in some countries) [10] and the significant associations between TS and increased HIV infection in adolescent girls and young women observed in SSA [4, 11]. A recent systematic review of TS in SSA estimated that engagement in TS doubled a woman's risk for HIV infection [4]. A longitudinal analysis of a cohort of women in South Africa found a higher incidence of HIV (hazard ratio 1.59, 95% confidence interval 1.02–2.19) among young women who engaged in TS relative to those who did not report TS [12]. In addition to increased biological susceptibility, the disproportionate burden of HIV experienced by women and girls in SSA is driven by a constellation of interrelated economic and social factors and individual behaviors shaped by gender and social norms (reinforced by both men and women) that women experience living in a gender inequitable society [13]. From a gender equity perspective, TS is a strong indicator of a system where women and girls have lower social status, less power and agency in relationships, and higher economic vulnerability than men and boys. Against this backdrop, women and girls are often influenced to adopt behaviors and tolerate social norms that are directly and indirectly linked with HIV risk and infection including, sexual risk behaviors (e.g., condomless sex and multiple partners), and use of alcohol and other drugs [3]. Understanding and intervening on TS could be key to reducing the burden of new HIV infections in young women. First, however, the relationship between TS and other frequently co-occurring HIV risk factors must be understood—independently and in relation to HIV infection – and accounted for in risk reduction interventions.

The links between IPV and TS are complicated; some studies suggest this relationship is shaped by prevailing cultural norms surrounding notions of masculinity and femininity, whereby men are expected to "provide for" and "control" (i.e., discipline through violence) their female partners [6, 14]. In such circumstances, women often become financially dependent on their male partners, making it difficult for them to leave, even in the context of an abusive relationship [2]. In past research with adolescent females in Rakai, we found TS constrained girls' ability to negotiate safe sex because it is culturally accepted that money, gifts and favors provided by boys and men entitle them to dictate the context and dynamic of the sexual encounter [15]. A study from Eswatini (formerly Swaziland) found constrained relationship agency to be the primary driver of the association between IPV and

TS, implying that gender-unequal systems should be targeted for reducing the harmful aspects of TS, such as HIV infection [16].

TS has also been associated with alcohol use in multiple ways. In settings characterized by gender inequalities, some of the most lucrative (or only) jobs available to young women are in establishments serving alcohol (e.g., bars and restaurants). These jobs require the promotion and sale of drinks, which involves interaction with customers, often leading to unwanted and/or exchanged sex [17, 18]. Working around alcohol also exposes women to its availability, increasing likelihood of consumption and many studies in Africa have linked drinking with lowered inhibitions and heightened sexual risk behavior and HIV and other sexually transmitted infections [19, 20]. Studies from South Africa have also documented how alcohol is sometimes taken as "currency" for sexual exchange, particularly within drinking venues [21, 22].

The body of research linking alcohol use to experiences of IPV among women in SSA is robust. The literature suggests that the relationship between these frequently co-occurring issues is bidirectional, with alcohol use serving as a risk factor for IPV and IPV serving as a risk factor for increased alcohol use [23–25]. Qualitative research among women living with HIV in Rakai, Uganda suggests that alcohol use by one or both partners often precedes instances of IPV, both through escalation of arguments into physical altercations and leading to fights and misunderstandings that would not have occurred in the absence of alcohol [26]. The trauma experienced through IPV can also lead to increased alcohol use as a coping mechanism [27]. Furthermore, there is a body of evidence suggesting that these two HIV risk factors have a synergistic relationship with HIV, with all three interrelated public health epidemics interacting, mutually enhancing and exacerbating one another. This phenomenon is known as a syndemic [28]. The substance abuse, violence and HIV/AIDS syndemic (known as the SAVA syndemic) has been well studied among women and other high risk groups in the US [29]. More recently, some studies have adopted the SAVA syndemic framework to study these interrelated health issues in SSA [30, 31]. Although TS is also associated with alcohol use, IPV and HIV, there is a gap in the literature that looks specifically at how TS fits into the SAVA syndemic framework, not only as a co-occurring risk factor of HIV infection but as an exacerbating component of all overlapping elements of the syndemic.

Addressing associations between TS, HIV infection and other related HIV risk behaviors is critical in SSA given multiple studies suggesting women who engaged in TS in SSA were 1.5 to 2 times more likely to be living with HIV [4], at risk for IPV [5, 6, 32] and current alcohol users [32, 33]. To be most effective, however, in SSA and all other settings, targeted programming is needed to reach and address the specific requirements of individuals involved in TS relationships. Given the distinctions between TS and sex work, interventions developed for sex workers are unlikely to reach those engaged in TS and even less likely to resonate with the context in which the interrelated motivations of TS occur.

The current study aims to increase understanding of associations between TS, alcohol use and IPV, three frequently co-occurring HIV risk factors, in Rakai, Uganda, where HIV prevalence exceeds the national average (it ranges from 9 to 42% across Rakai communities whereas the national average is 6.2%) [34] and varies substantially by community type (14% in agrarian, 17% in trading, and 41% in fishing communities) [35]. In previous research from Rakai, 13% of sexually active women self-reported TS and its relationship with HIV varied by partner and community type [36]. Prior research in Rakai has also found that women residing in fishing communities are more likely to experience IPV and use alcohol relative to those residing in agrarian and trade communities [37, 38]. Research from Rakai and elsewhere in East Africa has also found elevated rates of TS in fishing communities, along with high rates of engagement in other high risk sexual practices [35, 39]. Rakai's fishing communities are considered HIV hotspots, with nearly half of women (49%) living with HIV [35]. The high burden of HIV in these communities makes disentangling the relationship between the HIV risk factors of interest explored in this paper of particular importance to the development of HIV prevention programming. Furthermore, understanding how the relationship between TS, alcohol use and IPV differs by community type will allow for identification of highest priority populations for intervention as well as the development of unique context specific interventions that focus on specific clusters of HIV risk factors for a given community.

In this setting, alcohol use has been linked to IPV against women [40] and HIV acquisition in both women and men [41]. However, despite IPV and alcohol use being identified as independent drivers of HIV risk among women who engage in TS in other sub-Saharan African settings [3] this relationship has not been explored in Rakai. While the overlap of these social and health issues in Rakai is established, and the relationship between alcohol use and IPV in this setting is well documented, there is a lack of literature examining the relationship between TS and IPV and for whom (i.e., which groups of women in Rakai specifically, those that use alcohol, those that live in certain community types) this relationship may be strongest.

The main objective of the current paper is to address these gaps in the literature by examining associations between past year TS and two other frequently co-occurring HIV risk factors (past year experiences of IPV and past year alcohol use) among sexually active women who participated in the Rakai Community Cohort Study, a thirty year, population-based HIV surveillance cohort in Rakai, Uganda. This paper is

the first to look at the relationship between TS and IPV and alcohol use and IPV, in this setting and we hypothesized that among women who were sexually active in the past year, those who engaged in TS would have higher risk of past year IPV relative to women who did not engage in TS and that women who consumed alcohol in the past year would have higher risk of past year IPV compared to those who did not consume alcohol. Expanding upon the literature demonstrating the robust relationship between women's alcohol use and experiences of IPV globally [23], we examine whether alcohol use moderates the relationship between TS and IPV victimization, a relationship that has not previously been explored in SSA. We hypothesized that past year alcohol use would strengthen (exacerbate) the positive association between TS and physical, sexual, and verbal IPV victimization among women during the same time period. In other words, compared to women who did not drink alcohol, we hypothesized the association between TS and IPV victimization would be stronger among women who did engage in alcohol use. This hypothesis is based on evidence that alcohol use is a well-established risk factor for IPV, globally [42], as well as in this setting and that qualitative evidence from Rakai indicates that the use of alcohol by one or both partners typically precedes instances of IPV [26].

Finally, given the heterogeneity of alcohol use and IPV throughout the district we also conducted a stratified analysis to examine differences in these relationships by community type (rural, agrarian and fishing). We hypothesized that the highest risk of all three forms of IPV would occur in the fishing communities, where TS, alcohol use and IPV are more prevalent.

Methods

Participants and Procedures

The Rakai Community Cohort Study (RCCS) is an open, population-based cohort of persons 15 to 49 years across 40 communities in and around the Rakai District. The survey cycle is continuous as it works its way through the communities, with each round of data collection in a given community typically happening 12–18 months apart. Prior to each round of the survey, a household census is conducted to identify eligible participants. Irrespective of presence or absence in the home at the time of census, all persons are enumerated according to sex, age, and duration of residence and information on births, deaths, dwelling characteristics and mobility are collected. After the census, the RCCS surveys all residents between the ages of 15 and 49 years who are present and provide written informed consent. The RCCS survey interviews participants regarding sociodemographic characteristics, sexual behaviors, antiretroviral therapy (ART) use, male circumcision status (of self or partner) and health care utilization. RCCS participants who report past year sexual activity are asked to provide detailed partner-related information on up to four sexual partners in the past year. Venous blood is collected for HIV testing and results and post-test HIV counseling is provided. Additional details on the study design and implementation have been detailed elsewhere [43].

This study involved a secondary analysis of cross-sectional data collected from women who participated in RCCS between August 2016 and May 2018. Written informed consent was obtained from all women who contributed to the dataset, and each woman received 10,000 Ugandan shillings (roughly $3 USD at the time of interview) in compensation for her time. Data were only included in the analysis from participants who provided complete responses (i.e., a response other than "not applicable" or "no response") to the main questions of interest on alcohol use, TS and IPV victimization ($n = 8248$). Analysis was further limited to women who reported past year sexual activity, as the questions on TS and IPV were only asked among these individuals. Ethical approval was granted by the Johns Hopkins School of Public Health's institutional review board (IRB), Columbia University's IRB, Western IRB, the Uganda Virus Research Institute's Research and Ethics Committee and the Uganda National Council of Science and Technology.

Measures

The main independent variable (exposure) of interest for this study was TS. We defined TS in this paper to be a non-commercial sexual relationship motivated by the *implicit* assumption that sex will be exchanged for material support or other benefits. TS was measured by responses to the question: "Were money, gifts or favors exchanged for sex with this partner?" Response options were categorical: (1) yes, gifts given only; (2) yes, gift received only; (3) yes, gifts given and received and (4) no. Participants were asked to respond to this question for up to four of their most recent past year intimate/sexual partners. To differentiate responses to this question from the profession of sex work, in an earlier part of the survey, participants were asked about engagement in sex work as an occupation. A negligible proportion of women ($n = 15$; 0.18%) identified their occupation as sex work. Our primary measure of TS was converted to a dichotomous variable defined as any self-report of TS (giving and/or receiving) with any of the (up to four) past year intimate/sexual partners. The variable was operationalized in this manner in order to match the reference period of our other main exposure of interest, past year alcohol use and our dependent (outcome) variable of interest, past year IPV. Alcohol use was a dichotomous variable defined as an affirmative response to the question, "Have you drunk any

alcohol in the past year, for instance, beer, wine, waragi or other spirits, or home-made beer?".

Our dependent variable of interest was past year IPV experience (i.e., victimization). Covariates included community type (agricultural, fishing, trade), marital status (currently, previously, never), educational level (defined as highest level of education completed using the following categories: no schooling, Primary grades 1–4, Primary grades 5–7, secondary grades 1–4 and completion of secondary grade 5 or higher), employment status (defined as primary occupation), religion, past year drug use (defined as any past 12 month use of marijuana, amphetamines, aero fuels ("glue"), mayirungi, and/or heroin), age and HIV serostatus (obtained through administration of a rapid HIV test).

Three types of past year IPV (verbal, physical, sexual) were measured using 10 adapted questions from the Conflict Tactics Scales (CTS) [44], a validated measure that is used globally for IPV research. The three forms of past year experiences of intimate partner violence were measured by asking, "In the past 12 months has your partner…": *Verbal IPV* (1 item) "verbally abused or shouted at you." *Physical IPV* (6 items) "pushed, pulled, slapped, held you down;" "punched you with fist or something that could hurt you;" "kicked or dragged you; tried "to strangle or burn you;" "threatened you with a knife, gun, other weapon;" and "attacked you with knife, gun, other weapon." *Sexual IPV* (3 items) "used verbal threats to force you to have sex;" "physically forced you to have sex;" or "coerced you to perform other sexual acts when you did not want to."

Responses to the six physical IPV items were combined and dichotomized into a single variable of any physical IPV/no physical IPV. Similarly, responses to the three sexual IPV questions were combined and dichotomized into a single variable of any sexual IPV/no sexual IPV. As with the TS variable, we then further collapsed these variables into three new variables that captured if participants reported these forms of IPV with *any* of their past year partners, by collapsing responses across partners and dichotomizing the final variables (any verbal IPV/no verbal IPV; any physical IPV/no physical IPV; any sexual IPV/no sexual IPV).

Data Analysis

All analyses were conducted in SAS studio [45]. Data on demographic variables and the independent variables of interest were first analyzed, using descriptive statistics, to characterize the sample overall and explore differences between participants who did/did not report any past year TS and do/do not report any past year alcohol use. Descriptive analysis included frequencies for dichotomous and categorical variables and stratified bivariate analysis of covariates by exposure category using χ^2 analysis. We performed a sensitivity analysis across sexual partner blocks and saw the proportion of women who engaged in TS and prevalence of HIV dramatically increased by the number of past year partners reported. To address this, we created a new variable to account for the number of reported sexual partners which we included as a covariate in the analysis. We also performed a sensitivity analysis to see if marital status moderated the relationship between TS and any of the three types of IPV by creating an interaction term (marital status*IPV) during multivariate analysis. The relationship between TS and each of the three forms of IPV did not differ by category of marital status (see Supplemental File 1). Therefore, we included marital status as a covariate in analysis but did not conduct a stratified analysis. Modified Poisson regression with robust variance estimation was used to obtain prevalence risk ratios (PRR) to test our hypotheses. First, we ran bivariate analysis for each exposure variable and each of the three IPV outcomes to get unadjusted prevalence risk ratios (PRR). For each outcome, only variables that were statistically significant at the $p \leq 0.05$ level in bivariate analysis were included in multivariate analysis. To test our moderation hypothesis, we created an interaction term (TS*alcohol) and ran multivariate modified Poisson regression models for each of the three IPV outcomes. To ease interpretation of the results, all independent variables included in the multivariate modified Poisson regression models were centered. Adjusted models were then fitted for each outcome. The interaction term and covariates were only retained in the final fitted models if significant ($p \leq 0.05$). Finally, to test our third hypothesis, we built fitted models for each of the three IPV outcomes for the three community types. We did not assume that variables that were significant in bivariate and multivariate analyses in the full sample would be significant in the stratified community samples. Instead, we reran bivariate analysis for each covariate, and built our final fitted models in the same way described above, including testing for interaction.

Results

Description of Study Population

A total of 8248 women were included in the analysis. Table 1 depicts the sociodemographic characteristics of the study participants. The mean age was 30.7 years (SD 8.2), just over two thirds of the women were currently married (71.5%), and 18.6% had been previously married. Most participants (88.6%) reported only one sexual partner in the past year. Fifty four percent (53.8%) resided in agrarian communities; 24.3% and 21.9% resided in fishing communities and trade communities, respectively. The most common form of IPV experienced in the past year was verbal (25.5%), followed by physical (20.2%) and sexual (11%). Roughly two fifths (39.5%) of women reported any past year alcohol use

Table 1 Descriptive frequencies of sociodemographic and behavioral characteristics, overall, and by transactional sex and alcohol use exposure category

Variable	TS (n = 1242)				No TS (n = 7006)				Full sample
	Alcohol use [n = 566] N (%)	No alcohol use [n = 677] N (%)	χ^2 test statistic	P-value	Alcohol use [n = 2696] N (%)	No alcohol use [n = 4310] N (%)	χ^2 test statistic	P-value	[n = 8248] N (%)
HIV status			20.48	< 0.0001			27.67	< 0.0001	
Positive	193 (34.2%)	153 (22.6%)			659 (24.5%)	826 (19.2%)			1831 (22.2%)
Negative	372 (65.8%)	524 (77.4%)			2037 (75.6%)	3484 (80.8%)			6417 (77.8%)
Marital status			36.05	< 0.0001			77.64	< 0.0001	
Yes, married	319 (56.5%)	405 (59.8%)			1926 (71.5%)	3246 (75.3%)			5897 (71.5%)
No (previously married)	194 (34.3%)	148 (21.9%)			579 (21.5%)	610 (14.2%)			1531 (18.6%)
Never married	52 (9.2%)	124 (18.3%)			190 (7.1%)	454 (10.5%)			820 (9.9%)
Community type			18.78	< 0.0001			34.12	< 0.0001	
Agrarian	278 (49.2%)	407 (60.1%)			1356 (50.3%)	2394 (55.6%)			4435 (53.8%)
Fishing	181 (32.0%)	148 (21.9%)			744 (27.6%)	930 (21.6%)			2003 (24.3%)
Trade	106 (18.8%)	122 (18.0%)			596 (22.1%)	986 (22.9%)			1810 (21.9%)
Age			35.58	< 0.0001			66.40	< 0.0001	
Mean (SD)	30.3 (7.8)	27.8 (8.4)			32.0 (8.0)	30.3 (8.2)			30.7 (8.2)
15–24 years	153 (27.1%)	293 (43.3%)			562 (20.9%)	1258 (29.2%)			2266 (27.5%)
25–34 years	249 (44.1%)	223 (32.9%)			1099 (40.8%)	1679 (39.0%)			3250 (39.4%)
35–49 years	163 (28.9%)	161 (23.8%)			1035 (38.4%)	1373 (31.9%)			2732 (33.1%)
Level of education completed			9.33	0.0533			14.13	0.0069	
No schooling	45 (8.0%)	35 (5.2%)			138 (5.1%)	200 (4.6%)			418 (5.1%)
P1-P4	139 (24.6%)	136 (20.1%)			503 (18.7%)	719 (16.7%)			1497 (18.2%)
P5-P7	245 (43.4%)	315 (46.5%)			1133 (42.0%)	1751 (40.6%)			3444 (41.8%)
S1-S4	112 (19.8%)	155 (22.9%)			685 (25.4%)	1261 (29.3%)			2213 (26.8%)
S5 +	24 (4.3%)	36 (5.3%)			237 (8.8%)	379 (8.8%)			676 (8.2%)
Occupation			58.72	< 0.0001			92.14	< 0.0001	
Agriculture/housework	287 (50.8%)	381 (56.3%)			1308 (48.5%)	2263 (52.5%)			4239 (51.4%)
Student	3 (0.5%)	35 (5.2%)			25 (0.9%)	105 (2.4%)			168 (2.0%)
Trade/shopkeeper	97 (17.2%)	110 (16.3%)			569 (21.1%)	834 (19.4%)			1610 (19.5%)
Bar/restaurant work	78 (13.8%)	27 (4.0%)			276 (10.2%)	219 (5.1%)			600 (7.3%)
Other	100 (17.7%)	124 (18.3%)			518 (19.2%)	889 (20.6%)			1631 (19.8%)
Religion			78.98	< 0.0001			432.61	< 0.0001	
Catholic	412 (72.9%)	379 (56.0%)			2026 (75.2%)	2343 (54.4%)			5160 (62.6%)
Protestant	98 (17.4%)	105 (15.5%)			438 (16.3%)	740 (17.2%)			1381 (16.7%)
Saved/Pentecostal	11 (2.0%)	45 (6.7%)			74 (2.7%)	317 (7.4%)			447 (5.4%)
Muslim	34 (6.0%)	141 (20.8%)			146 (5.4%)	856 (19.9%)			1177 (14.3%)
No religion	4 (0.7%)	2 (0.3%)			6 (0.2%)	22 (0.5%)			34 (0.4%)
Other religion	6 (1.1%)	5 (0.7%)			6 (0.2%)	32 (0.7%)			49 (0.6%)
Past year drug use			6.67	0.0098			4.21	0.0402	
Yes	13 (2.3%)	4 (0.6%)			17 (0.6%)	13 (0.3%)			47 (0.6%)
No	552 (97.7%)	673 (99.4%)			2679 (99.4%)	4297 (99.7%)			8201 (99.4%)
Past year intimate partners			80.65	< 0.0001			163.00	< 0.0001	
> 1 partner	246 (43.5%)	135 (19.9%)			358 (13.3%)	205 (4.8%)			944 (11.5%)
1 partner	319 (56.5%)	542 (80.1%)			2338 (86.7%)	4105 (95.2%)			7304 (88.6%)

and 15% reported engaging in TS with an intimate partner in the past year. HIV prevalence was 22% overall, with the highest prevalence (34.2%) among women who reported both past year TS and past year alcohol use and lowest prevalence (19.2%) among women who reported neither. Similarly, women who reported both past year TS and past year alcohol use were more likely to report more than one sexual partner in the past year (43.5%) and the exposure group with the smallest proportion having more than one sexual partner (4.8%) reported neither alcohol use nor TS. Less than 1% of all participants reported past year drug use. All sociodemographic and behavioral characteristics were statistically significantly different by alcohol use status (any versus no past year drinking) except education level among persons who had engaged in TS ($p = 0.0533$).

Associations Between our Independent Variables and IPV

Table 2 presents the unadjusted prevalence risk ratios (PRR) for our main exposures of interest (alcohol use and TS), covariates and each of the three IPV outcomes. The religion variable was not significant in any of the models and was excluded from multivariate analysis. Past year alcohol use was positively associated with experiencing all three forms of IPV. Women who reported any past year alcohol use had 17% greater risk of experiencing verbal abuse (PRR 1.17 95% CI 1.07, 1.27; $p < 0.0001$); 53% greater risk of experiencing physical abuse (PRR 1.53 95% CI 1.39, 1.69; $p < 0.0001$); and 42% greater risk (PRR 1.42 95% CI 1.25, 1.62; $p < 0.0001$) of experiencing sexual abuse compared to women who reported no past year alcohol use. TS was significantly associated with increased risk of experiencing physical and sexual IPV, but not verbal IPV. Women who reported TS were at 44% greater risk of experiencing physical abuse (PRR 1.44 95% CI 1.28, 1.62; $p < 0.0001$); and 55% greater risk of experiencing sexual abuse from a past year intimate partner (PRR 1.55 95% CI 1.32, 1.81; $p < 0.0001$) relative to women who reported no TS. TS was one of our two main exposures of interest so the variable was retained in multivariate analyses for all three outcomes, regardless of significance in bivariate or multivariate models. HIV positive status and past year drug use were both significantly associated with increased risk of experiencing physical and sexual IPV but not verbal IPV, so both variables were excluded from the verbal IPV multivariate analysis. Only 47 women (0.06%) reported past year drug use but they had nearly 2.5 times greater risk of experiencing physical IPV (PRR 2.45 95% CI 1.62, 3.69, $p < 0.0001$) and more than three times greater risk of experiencing sexual IPV (PRR 3.11 95% CI 1.90, 5.11 $p < 0.0001$) than women who did not report past year drug use.

Associations Between TS, Alcohol Use, and IPV

Table 3 presents the adjusted PRRs for each of the three IPV outcomes. The interaction term alcohol use*transactional sex was not significant in any of the models and was excluded from the final fitted multivariate models. In adjusted analysis, alcohol use was still significantly positively associated with all three types of IPV. After adjusting for the other variables in the model, women who reported any alcohol use were at 33% greater risk of experiencing verbal IPV (PRR 1.33 95% CI 1.22–1.45; $p < 0.0001$); 37% greater risk of experiencing physical IPV (PRR 1.37 95% CI 1.24–1.41; $p < 0.0001$); and 22% greater risk of experiencing sexual IPV (PRR 1.22 95% CI 1.07–1.40; $p < 0.0001$), compared to women who reported no alcohol use. Further, women who reported TS were at 20% greater risk of experiencing verbal IPV (PRR, 1.20 95% CI 1.05–1.36; $p = 0.0055$); 14% greater risk of experiencing physical IPV (PRR, 1.14 95% CI 1.00–1.30; $p = 0.0437$); and 25% greater risk of experiencing sexual IPV (PRR 1.25 95% CI 1.06, 1.48; $p = 0.0086$) relative to women who reported no TS. The risk of past year sexual IPV was more than twice as high for women with more than one intimate partner during the same time period (PRR 2.21 CI 1.86, 2.63; $p < 0.0001$) relative to those with one partner. Women with more than one intimate partner were at 83% higher risk of physical IPV as well (PRR 1.83 CI 1.61, 2.09; $p < 0.0001$). Having more than one partner was associated with a reduced risk of verbal IPV (PRR 0.11 CI 0.08, 0.16; $p < 0.0001$). Women reporting any past year drug use had a 92% higher risk of sexual IPV (PRR, 1.92 95% CI 1.16, 3.18; $p < 0.0109$) compared to women who reported no past year drug use but drug use was not significantly associated with verbal or physical IPV in adjusted analyses.

Stratified by Community Type

Tables 4, 5 and 6 present the adjusted PRRs from stratified analysis for our main exposure variables, alcohol use and TS; significant (and therefore retained) covariates for final models are listed in the tables as a footnotes. In adjusted analyses, past year alcohol use was significantly associated with increased risk of experiencing verbal IPV in all three community types. The positive association between TS and verbal IPV was only significant in agrarian communities. Alcohol use was positively associated with physical IPV in all three community types but this association was not significant in the trade communities. In fishing communities, women who reported past year alcohol were at 42% higher risk (PRR 1.42, 95% CI 1.19, 1.68; $p < 0.0001$) of experiencing physical IPV than women who did not report alcohol use. Women in agrarian communities who reported past year alcohol use had higher risk of physical IPV (PRR

Table 2 Unadjusted prevalence risk ratios (PRR) for associations between independent variables and verbal, physical and sexual IPV

	Verbal IPV		Physical IPV		Sexual IPV	
Variables	PRR (95% CI)	P-value	PRR (95% CI)	P-value	PRR (95% CI)	P-value
Past year alcohol use						
Yes	1.17 (1.07, 1.27)	< 0.0001	1.53 (1.39, 1.69)	< 0.0001	1.42 (1.25, 1.62)	< 0.0001
No	ref	–	ref	–	ref	–
Past year TS						
Yes	0.91 (0.81, 1.03)	0.1420	1.44 (1.28, 1.62)	< 0.0001	1.55 (1.32, 1.81)	< 0.0001
No	ref	–	ref	–	ref	–
HIV status						
Yes	0.99 (0.90, 1.10)	0.9179	1.38 (1.24, 1.54)	< 0.0001	1.27 (1.09, 1.47)	0.0016
No	ref	–	ref	–	ref	–
Marital status						
Yes, married	ref	–	ref	–	ref	–
No (previously married)	0.54 (0.47, 0.62)	< 0.0001	0.86 (0.75, 0.97)	0.0182	0.93 (0.78, 1.10)	0.3691
Never married	0.34 (0.27, 0.43)	< 0.0001	0.42 (0.33, 0.53)	< 0.0001	0.51 (0.38, 0.67)	< 0.0001
Community type						
Agrarian	ref	–	ref	–	ref	–
Trading	0.75 (0.66, 0.84)	< 0.0001	0.81 (0.70, 0.93)	0.0025	0.78 (0.65, 0.94)	0.0086
Fishing	1.06 (0.96, 1.17)	0.2476	1.57 (1.41, 1.75)	< 0.0001	1.24 (1.07, 1.44)	0.0039
Age						
15–24 years	ref	–	ref	–	ref	–
25–34 years	0.94 (0.85, 1.04)	0.2219	0.89 (0.79, 1.00)	0.0429	1.05 (0.89, 1.23)	0.5754
35–49 years	0.85 (0.76, 0.94)	0.0029	0.69 (0.60, 0.78)	< 0.0001	1.01 (0.85, 1.19)	0.9186
Education level						
No schooling	1.01 (0.83, 1.23)	0.9238	1.18 (0.96, 1.44)	0.1231	0.99 (0.73, 1.34)	0.9331
P1-P4	1.13 (1.01, 1.27)	0.0338	1.16 (1.03, 1.32)	0.0171	1.29 (1.10, 1.53)	0.0024
P5-P7	ref	–	ref	–	ref	–
S1-S4	0.94 (0.84, 1.04)	0.2303	0.82 (0.73, 0.93)	0.0018	0.89 (0.76, 1.05)	0.1748
Higher than S4	0.96 (0.81, 1.13)	0.6062	0.53 (0.42, 0.67)	< 0.0001	0.60 (0.44, 0.81)	0.0011
Occupation						
Housekeeping	ref	–	ref	–	ref	–
Student	0.24 (0.13, 0.43)	< 0.0001	0.28 (0.15, 0.52)	< 0.0001	0.45 (0.23, 0.87)	0.0178
Trade/shopkeeper	0.94 (0.84, 1.06)	0.3100	0.93 (0.82, 1.05)	0.2549	0.91 (0.77, 1.08)	0.2778
Bar owner/waitress	0.71 (0.58, 0.86)	0.0004	1.06 (0.89, 1.27)	0.5008	0.91 (0.70, 1.18)	0.4802
Other	0.90 (0.80, 1.00)	0.0573	0.81 (0.71, 0.93)	0.0024	0.82 (0.69, 0.98)	0.0291
Religion						
Catholic	ref	–	ref	–	ref	–
Protestant	0.93 (0.83, 1.05)	0.2479	0.97 (0.85 1.11)	0.6787	1.04 (0.87, 1.25)	0.6486
Saved/Pentecostal	1.07 (0.89, 1.28)	0.4937	1.14 (0.93, 1.40)	0.2106	1.25 (0.96, 1.64)	0.0950
Muslim	1.01 (0.89, 1.14)	0.9211	1.01 (0.88, 1.17)	0.8079	1.10 (0.91, 1.32)	0.3354
No religion	1.03 (0.54, 1.99)	0.9186	0.73 (0.30, 1.77)	0.4901	0.82 (0.27, 2.57)	0.7394
Other religion	1.28 (0.78, 2.09)	0.3318	1.32 (0.77, 2.29)	0.3146	0.76 (0.29, 2.04)	0.5900
Past year drug use						
Yes	0.67 (0.33, 1.34)	0.2540	2.45 (1.62, 3.69)	< 0.0001	3.11 (1.90, 5.11)	< 0.0001
No	ref	–	ref	–	ref	–
# of past year intimate partners						
1 partner	ref	–	ref	–	ref	–
> 1 partner	0.12 (0.08, 0.17)	< 0.001	2.19 (1.95, 2.46)	< 0.001	2.39 (2.05, 2.79)	< 0.0001

Table 3 Adjusted prevalence risk ratios (PRR) for final multivariate models

Variables	Verbal IPV		Physical IPV		Sexual IPV	
	PRR (95% CI)	P-value	PRR (95% CI)	P-value	PRR (95% CI)	P-value
Past year alcohol use						
Yes	1.33 (1.22, 1.45)	< 0.0001	1.37 (1.24, 1.41)	< 0.0001	1.22 (1.07, 1.40)	0.0034
No	Ref	–	Ref	–	Ref	–
Past year TS						
Yes	1.20 (1.05, 1.36)	0.0055	1.14 (1.00, 1.30)	0.0437	1.25 (1.06, 1.48)	0.0086
No	Ref	–	Ref	–	Ref	–
Interaction term						
Alcohol and TS	Not included in final model; not significant in multivariate analysis		Not included in final model; not significant in multivariate analysis		Not included in final model; not significant in multivariate analysis	
HIV status						
Yes	Not included in final model; not significant in bivariate analysis		1.17 (1.04, 1.32)	0.0073	Not included in final model; not significant in multivariate analysis	
No			Ref	-		
Marital status						
Yes, married	Ref	–	Ref	–	Ref	–
No (previously married)	0.64 (0.56, 0.73)	< 0.0001	0.71 (0.62, 0.81)	< 0.0001	0.74 (0.63, 0.89)	0.0009
Never married	0.38 (0.30, 0.48)	< 0.0001	0.39 (0.30, 0.49)	< 0.0001	0.48 (0.36, 0.64)	< 0.0001
Community type						
Agrarian	Ref	–	Ref	–	Ref	–
Trading	0.80 (0.71, 0.90)	0.0003	0.81 (0.71, 0.93)	0.0032	0.77 (0.64, 0.92)	0.0044
Fishing	1.14 (1.02, 1.27)	0.0169	1.24 (1.10, 1.39)	0.0003	1.05 (0.90, 1.23)	0.5018
Age						
15–24 years	Ref	–	Ref	–	Not included in final model; not significant in bivariate analysis	
25–34 years	0.80 (0.72, 0.89)	< 0.0001	0.77 (0.69, 0.87)	< 0.0001		
35–49 years	0.70 (0.62, 0.78)	< 0.0001	0.61 (0.73, 0.85)	< 0.0001		
Education level						
No schooling	1.08 (0.88, 1.32)	0.4858	1.13 (0.92, 1.39)	0.2449	Not included in final model; not significant in multivariate analysis	
P1-P4	1.13 (1.01, 1.28)	0.0339	1.09 (0.92, 1.39)	0.1958		
P5-P7	Ref	–	Ref	–		
S1-S4	0.95 (0.86, 1.07)	0.4099	0.89 (0.78, 1.00)	0.0581		
Higher than S4	0.99 (0.82, 1.18)	0.8802	0.66 (0.52, 0.84)	0.0006		
Occupation						
Housekeeping	Ref	–	Not included in final model; not significant in multivariate analysis		Not included in final model; not significant in multivariate analysis	
Student	0.53 (0.28, 1.00)	0.0490				
Trade/shopkeeper	1.03 (0.91, 1.16)	0.6452				
Bar owner/waitress	0.85 (0.69, 1.03)	0.0973				
Other	1.02 (0.90, 1.16)	0.7349				
Past year drug use						
Yes	Not included in final model; not significant in bivariate analysis		Not included in final model; not significant in multivariate analysis		1.92 (1.16, 3.18)	0.0109
No					Ref	–
# of past year intimate partners						
1 partner	Ref	–	Ref	–	Ref	–
> 1 partner	0.11 (0.08, 0.16)	< 0.0001	1.83 (1.61, 2.09)	< 0.0001	2.21 (1.86, 2.63)	< 0.0001

1.42, 95% CI 1.23–1.63; p < 0.0001) and sexual IPV (PRR 1.36, 95% CI 1.18–1.57; p < 0.0001) relative to women who did not drink alcohol. In agrarian communities, women who engaged in past year TS had higher risk of verbal IPV (PRR 1.21, 95% CI 1.03–1.42; p = 0.0176); physical IPV (PRR 1.26, 95% CI 1.05–1.50; p = 0.0110); and sexual IPV (PRR 1.34, 95% CI 1.12–1.59; p = 0.0013). Statistically

significant associations were not found between TS and risk of experiencing IPV in fishing and trade communities.

Discussion

Our findings indicate that past year alcohol use and TS are positively associated with experiences of all three types of IPV victimization among women in Rakai. The alcohol use and TS interaction term was not significant in any of the models, suggesting that while these two exposures are both independently associated with increased risk of experiencing sexual, physical and verbal IPV, alcohol use does not modify (i.e., change the strength of) the relationship between TS and any form of IPV. The positive associations observed between both alcohol use and IPV and TS and IPV are consistent with previous findings from SSA [5, 6, 32, 41, 46, 47]. The lack of a significant interaction between alcohol use and TS, overall and in the stratified analysis, was contrary to our moderation hypothesis. The literature suggests that TS is

Table 4 Adjusted prevalence risk ratios (PRR) from final multivariate models of the main effects (alcohol use and TS) on experiences of physical IPV by community type

Variables	Agrarian (n = 4435)[a]		Fishing (n = 2003)[b]		Trading (n = 1810)[c]	
	PRR (95% CI)	P-value	PRR (95% CI)	P-value	PRR (95% CI)	P-value
Past year alcohol use						
Yes	1.42 (1.23, 1.63)	< 0.0001	1.42 (1.19, 1.68)	< 0.0001	1.08 (0.84, 1.39)	0.5554
No	Ref	–	Ref	–	Ref	–
Past year TS						
Yes	1.26 (1.05, 1.50)	0.0110	1.10 (0.89, 1.37)	0.3810	0.97 (0.68, 1.38)	0.8525
No	Ref	–	Ref	–	Ref	–

[a]Covariates included age, education, marriage, number of partners, occupation

[b]Covariates included drug use, education, HIV, marriage, number of partners

[c]Covariates included age, HIV, marriage, number of partners, occupation

Table 5 Adjusted prevalence risk ratios (PRR) from final multivariate models of the main effects (alcohol use and TS) on experiences of sexual IPV by community type

Variables	Agrarian (n = 4435)[a]		Fishing (n = 2003)[b]		Trading (n = 1810)[c]	
	PRR (95% CI)	P-value	PRR (95% CI)	P-value	PRR (95% CI)	P-value
Past year alcohol use						
Yes	1.36 (1.18, 1.57)	< 0.0001	1.26 (0.98, 1.62)	0.0662	1.14 (0.82, 1.59)	0.4367
No	Ref	–	Ref	–	Ref	–
Past year TS						
Yes	1.34 (1.12, 1.59)	0.0013	1.03 (0.75, 1.40)	0.8577	1.10 (0.70, 1.73)	0.6805
No	Ref	–	Ref	–	Ref	–

[a]Covariates included age, marriage, number of partners, occupation

[b]Covariates included drug use, HIV, number of partners

[c]Covariates included age, education, HIV, marriage, number of partners, occupation

Table 6 Adjusted prevalence risk ratios (PRR) from final multivariate models of the main effects (alcohol use and TS) on experiences of verbal IPV by community type

Variables	Agrarian (n = 4435)[a]		Fishing (n = 2003)[b]		Trading (n = 1810)[b]	
	PRR (95% CI)	P-value	PRR (95% CI)	P-value	PRR (95% CI)	P-value
Past year alcohol use						
Yes	1.35 (1.20, 1.52)	< 0.0001	1.30 (1.10, 1.54)	0.0018	1.24 (1.00, 1.53)	0.0477
No	Ref	–	Ref	–	Ref	–
Past year TS						
Yes	1.21 (1.03, 1.42)	0.0176	1.19 (0.92, 1.54)	0.1818	1.22 (0.87, 1.71)	0.2493
No	Ref	–	Ref	–	Ref	–

[a]Covariates included age, education, marriage, number of partners, occupation

[b]Covariates included marriage, number of partners, occupation

associated with IPV [6], and there is robust evidence that alcohol use is associated with IPV [42], but moderation of TS and IPV by alcohol use has not been explored in previous studies. Quantitative data from Rakai [41] and qualitative data from fishing communities in Rakai suggest that IPV frequently occurs in the context of alcohol use [26]. A causal relationship between alcohol use and violence is also supported by the global literature [42]. While our hypothesis that both TS and alcohol use would independently be associated with IPV was confirmed, our results did not support the moderation hypothesis, suggesting that regardless of alcohol use, TS is associated with higher risk of experiencing verbal, physical, and sexual IPV in this setting.

It is worth noting that the alcohol use measure in the present study differs from prior research looking at the relationships between alcohol use, IPV, coerced sex and HIV using RCCS data that have found positive significant associations. Past research has utilized the variable "alcohol use before sex" [37, 40, 41]; in this study we opted for a global alcohol use measure ("any past year alcohol use") because we were interested in understanding if alcohol use (regardless of context) moderated the relationship between TS and IPV. We did find higher rates of alcohol use among women who engage in TS relative to those who do not (45.4% vs 38.5%) and it is possible that other alcohol measures may be more predictive of experiences of IPV than the measure used in the present analysis. Future studies should continue to explore this relationship using other alcohol use measures that are context specific (such as alcohol before sex) or speak to drinking patterns and drinking severity (e.g. Alcohol Use Disorders Identification Test, i.e. AUDIT) to further probe this relationship.

When looking at associations between TS, alcohol use and IPV by community type, we found heterogeneity in the statistical significance and magnitude of the association between our main effects and IPV. In adjusted stratified analysis, alcohol use was associated with increased risk of verbal and physical IPV in all three community types, but only associated with increased risk of sexual IPV in agrarian communities. The risk of experiencing physical IPV for alcohol users was highest in fishing and agrarian communities, which partially confirms our secondary hypothesis. The risk of experiencing verbal IPV among alcohol users was higher than non-alcohol users in all three community types, and highest in agrarian communities. TS was only significantly associated with any form of IPV in agrarian communities.

Prior research in Rakai has found higher rates of alcohol use among women in fishing communities (50.4%) compared to the more comparable rates of alcohol use observed in agricultural (35.9%) and trade communities (37.9%) [38]. East Africa's fishing communities experience a high burden of HIV infection, which has led to increased focus and international public health attention on exploring the relationship between HIV risk factors, such as IPV, alcohol use and TS (and more specifically "fish for sex" a specific type of TS) and HIV in this setting [48–52]. These studies have found positive associations between women's engagement in fish for sex and engagement in other HIV risk behaviors [48] and highlight the implications of gendered power differentials, and the ecology and sexual economy of life in fishing communities on engagement in HIV risk behaviors among women who engage in fish for sex [52]. They have also found a high burden of sexual IPV among women who engage in TS in fishing communities and associations between IPV and HIV seropositivity [53]. A study undertaken in fishing communities in the neighboring district of Wakiso by Sileo et al. (2017) found that engagement in TS was associated with increased risky sexual acts and experiences of IPV, but their definition of TS included women from four specific professions, including commercial sex workers [53]. Finally, a 2012 study in Uganda's fishing communities found associations between male fisherman's heavy alcohol use and increased odds of engaging in TS [49]. There is a paucity of parallel research from agrarian and trade communities, but alcohol use is widely recognized as a driver of IPV globally [42], so we expected to see a significant association between alcohol use and all forms of IPV across all community types.

The lack of a significant association between TS and IPV in fishing and trading communities in our study was another unexpected finding that warrants additional research. TS in SSA is not monolithic and multiple paradigms have been identified as primary drivers for women and girls to engage in TS in this context, including "sex for basic needs", "sex for improved social status" and "sex and material expressions of love" [2]. These paradigms suggest different gender power dynamics and different levels of vulnerability for the female partner. For example, a woman who relies on TS to meet her basic needs (e.g., food or money for housing) is likely to have limited agency and an economic reliance on her male partner, resulting in unequal power.

A lack of agency and unequal power dynamics can make it difficult for a woman to safely negotiate safer sex practices (such as condom use), increasing her risk of both HIV and IPV [2]. A recent structural equation modelling analysis looking at predictors of IPV among women in eSwatini found that the strongest predictor of experiences of IPV among women was constrained relationship agency. After adjusting for constrained relationship agency, receipt of material goods was no longer associated with physical or sexual IPV and was actually protective against emotional IPV [16]. This suggests that underlying socioeconomic factors (such as food insecurity, poverty or familial pressure to marry) and not TS itself may impact a woman's risk of IPV in that partnership more than anything else. Women living in the fishing and trade communities may have more

opportunities for employment and income generation than women residing in agrarian communities which could lead to more relationship agency (i.e. less constrained relationship agency) for women in these communities relative to the agrarian communities. The inclusion of a measure for constrained agency, a potentially important mediator in the relationship between TS and IPV, in future rounds of RCCS data collection may elucidate why TS was significantly associated with violence in some community types but not others.

Applying a gender lens may also provide more context around the nuanced nature of the relationship between TS, alcohol use and IPV in individual partnerships. Intimate partnerships where women are receiving goods in exchange for sex both reflect and reinforce traditional gender roles. Providing for one's partner is considered a hallmark of masculinity along with heavy alcohol and drug use and exerting one's dominance over others (including intimate partners) [54, 55]. Furthermore, men who hold gender inequitable attitudes are more likely to perpetrate IPV [8, 56]. Looking at TS, alcohol use and IPV without considering the role of gender attitudes and norms held by both the male and female partners may provide an incomplete picture of a complex relationship. Similarly, given that our analysis is focused on women's alcohol use, TS and IPV victimization, we are restricted in understanding how these two behaviors (TS and alcohol use) among men influence IPV perpetration.

A South African study among men applying the syndemic framework found that men's engagement in risky sexual practices, including TS, was independently predicted by IPV perpetration, alcohol misuse and holding gender inequitable views [57]. Furthermore, men who reported IPV perpetration, alcohol use and gender inequitable views had more than 12 times greater odds of engaging in risky sexual practices such as TS than men that reported none of these characteristics [57]. Findings from this study suggest that targeting the intersection of these topics, as opposed to programming focused on a single HIV risk behavior may be more effective in reducing both HIV risk and IPV. They also highlight the need to include both men and woman in any intervention programming aimed at shifting gender attitudes and norms and related behaviors. The inclusion of validated measures around gender attitudes and constructs as well as looking at experiences of IPV among dyads (i.e., intimate couples) in future research could offer a more comprehensive picture of additional factors that influence the relationship between IPV, TS and alcohol use.

Although our findings provide insight to the relationship between alcohol use, TS and IPV in Rakai, both overall and by community type, important study limitations merit attention. The data presented here are cross-sectional which precludes our ability to attribute causality or establish the temporal direction of relationships. Instead, we are limited to estimating associations between the variables of interest. Future research should examine all possible pathways between alcohol use, TS and IPV using longitudinal data in order to parse out the nature of these relationships. Our measurement of TS did not assess the motivation for the sexual relationship (e.g. for basic needs), nor did we differentiate between patterns and correlates of TS by partner type (i.e., spouse, long-term partner, extramarital relationship, etc.). New recommendations for measuring TS in large-scale surveys in SSA advise against including marital relationships in the definition [58]. The format of the past year alcohol use question (any/none) did not allow us to explore a dose response relationship between quantity or frequency of alcohol use and experiences of IPV victimization and this may reduce the question's sensitivity. However, given that the majority of alcohol drinkers in Rakai consume "hazardous" levels of alcohol when drinking [49], the question is more sensitive in this context than in others. Despite these limitations, this paper fills an important gap in the literature by describing the relationship between TS, alcohol use and IPV in rural Uganda and exploring differences in this relationship across community types.

Given the bidirectional association between HIV and IPV [9, 47, 59–62], identifying factors that put women at increased risk of IPV (including residential community) is critical to the development of both HIV and IPV prevention programming. Differences in these associations by community type is an important finding for intervention development. IPV is a risk factor for HIV but it is also a public health issue in its own right. The emphasis on HIV research in Uganda has led to concentrated public health efforts in communities experiencing the greatest burden of HIV: fishing communities. This focus of attention and resources on fishing communities has not been matched in trade and agrarian communities still experiencing a generalized HIV epidemic (albeit a lower prevalence) as well as other related public health issues. Our findings suggest that interventions to reduce IPV in Rakai must take community type into consideration when developing programmatic content to ensure community type specific co-occurring HIV risk factors are addressed. In agrarian communities, IPV interventions should address TS and alcohol use as risk factors for IPV and in fishing and trade communities IPV interventions should address women's alcohol use. If future research identifies additional risk factors that either co-occur or synergistically interact with these risk factors to increase risk of IPV they should also be incorporated into intervention programming.

A recent commentary by Mannell et al. (2019) identified three reasons why existing IPV interventions in SSA have failed young women and girls: (1) failure to engage both sexes (2) failure to address multiple intersecting risk factors for IPV and (3) failure to account for shifting gender and social norms occurring throughout sub-Saharan Africa [63].

Our findings and recommendations speak directly to these shortcomings. We propose future HIV and IPV interventions avoid an individual risk behavior approach, opting for context specific combination interventions that consider multiple HIV and IPV risk factors. We suggest additional data collection around gender attitudes and constrained agency to explore additional IPV risk factors that may impact the relationship between TS and IPV. We also suggest that the relationship between men's perpetration of IPV and TS and alcohol use be explored in conjunction with women's victimization and that interventions consider how to address and transform harmful gender norms among men and women. Finally, we suggest that data among couples be explored to better understand how each partner's attitudes and behaviors influence the occurrence of IPV among dyads and the heterogeneity of these associations by partner/relationship type. This work could be supported through a mixed methods study where a qualitative component explores in-depth how TS is conceptualized in different types of relationships and a quantitative analysis focuses on how the relationship between TS and IPV differs by type of partner. Adoption of these suggestions can inform the development of more robust and context tailored IPV interventions in rural settings in SSA.

Conclusion

Alcohol use did not moderate the relationship between TS and IPV in our study sample but both alcohol use and TS were identified as risk factors for IPV victimization among women in Rakai district. There was heterogeneity in the strength and statistical significance of associations between TS and IPV and alcohol use and IPV in fishing, trade and agricultural communities, suggesting that drivers of IPV may vary by community type. Additional research that includes other covariates that may explain the relationship between TS and IPV such as gender constructs and constrained agency is needed, especially in agrarian communities. Identifying other HIV risk behaviors associated with IPV in specific community types in SSA can inform the development of more comprehensive and targeted IPV and HIV prevention programming.

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Compliance with Ethical Standards

Conflict of interest The authors declare that there are no conflicts of interest.

Informed Consent Written informed consent was obtained from all women who contributed to the dataset, and each woman received 10,000 Ugandan shillings (roughly $3 USD) in compensation for her time.

References

1. Chatterji M, Murray N, London D, Anglewicz P. The factors influencing transactional sex among young men and women in 12 sub-Saharan African countries. Biodemography Soc Biol. 2005;52(1–2):56–72.
2. Stoebenau K, Heise L, Wamoyi J, Bobrova N. Revisiting the understanding of "transactional sex" in sub-Saharan Africa: a review and synthesis of the literature. Soc Sci Med. 2016;168:186–97.
3. Transactional sex and HIV risk: from analysis to action. Geneva, Switzerland: Joint United Nations Programme on HIV/AIDS and STRIVE, 2018
4. Wamoyi J, Stobeanau K, Bobrova N, Abramsky T, Watts C. Transactional sex and risk for HIV infection in sub-Saharan Africa: a systematic review and meta-analysis. J Int AIDS Soc. 2016;19(1):20992.
5. Adudans MK, Montandon M, Kwena Z, Bukusi EA, Cohen CR. Prevalence of forced sex and associated factors among women and men in Kisumu Kenya. Afr J Reprod Health. 2011;15:87.
6. Zembe YZ, Townsend L, Thorson A, Silberschmidt M, Ekstrom AM. Intimate partner violence, relationship power inequity and the role of sexual and social risk factors in the production of violence among young women who have multiple sexual partners in a peri-urban setting in South Africa. PLoS ONE. 2015;10(11):e0139430.
7. Dunkle KL, Jewkes R, Nduna M, Jama N, Levin J, Sikweyiya Y, et al. Transactional sex with casual and main partners among young South African men in the rural Eastern Cape: prevalence, predictors, and associations with gender-based violence. Soc Sci Med. 2007;65(6):1235–48.
8. Jewkes R, Sikweyiya Y, Morrell R, Dunkle K. Gender inequitable masculinity and sexual entitlement in rape perpetration South Africa: findings of a cross-sectional study. PLoS ONE. 2011;6(12):e29590.
9. Dunkle KL, Jewkes RK, Brown HC, Gray GE, McIntryre JA, Harlow SD. Gender-based violence, relationship power, and risk of HIV infection in women attending antenatal clinics in South Africa. The Lancet. 2004a;363(9419):1415–21.
10. Moore AM, Biddlecom AE, Zulu EM. Prevalence and meanings of exchange of money or gifts for sex in unmarried adolescent sexual relationships in sub-Saharan Africa. Afr J Reprod Health. 2007;11(3):44–61.
11. Austrian K, Soler-Hampejsek E, Duby Z, Hewett PC. "When he asks for sex, you will never refuse": transactional sex and adolescent pregnancy in Zambia. Stud Fam Plann. 2019;50(3):243–56.
12. Kilburn K, Ranganathan M, Stoner MCD, Hughes JP, MacPhail C, Agyei Y, et al. Transactional sex and incident HIV infection

in a cohort of young women from rural South Africa. AIDS. 2018;32(12):1669–77.
13. Sia D, Onadja Y, Hajizadeh M, Heymann SJ, Brewer TF, Nandi A. What explains gender inequalities in HIV/AIDS prevalence in sub-Saharan Africa? Evidence from the demographic and health surveys. BMC Public Health. 2016;16(1):1136.
14. Jewkes R, Dunkle K, Nduna M, Levin J, Jama N, Khuzwayo N, et al. Factors associated with HIV sero-status in young rural South African women: connections between intimate partner violence and HIV. Int J Epidemiol. 2006;35(6):1461–8.
15. Wagman J, Baumgartner JN, Waszak Geary C, Nakyanjo N, Ddaaki WG, Serwadda D, et al. Experiences of sexual coercion among adolescent women: qualitative findings from Rakai district Uganda. J Interpers Violence. 2009;24(12):2073–95.
16. Fielding-Miller R, Dunkle K. Constrained relationship agency as the risk factor for intimate partner violence in different models of transactional sex. Afr J AIDS Res. 2017;16(4):283–93.
17. Rosenberg M, Pettifor A, Van Rie A, Thirumurthy H, Emch M, Miller WC, et al. The relationship between alcohol outlets, HIV risk behavior, and HSV-2 infection among South African young women: a cross-sectional study. PLoS ONE. 2015;10(5):e0125510.
18. Akoku DA, Tihnje MA, Vukugah TA, Tarkang EE, Mbu RE. Socio-economic vulnerabilities and HIV: drivers of transactional sex among female bar workers in Yaounde, Cameroon. PLoS ONE. 2018;13(6):e0198853.
19. Kalichman SC, Simbayi LC, Vermaak R, Cain D, Smith G, Mthebu J, et al. Randomized trial of a community-based alcohol-related HIV risk-reduction intervention for men and women in Cape Town South Africa. Ann Behav Med. 2008;36(3):270–9.
20. Fisher JC, Bang H, Kapiga SH. The association between HIV infection and alcohol use: a systematic review and meta-analysis of African studies. Sex Transm Dis. 2007;34(11):856–63.
21. Watt MH, Aunon FM, Skinner D, Sikkema KJ, Kalichman SC, Pieterse D. "Because he has bought for her, he wants to sleep with her": alcohol as a currency for sexual exchange in South African drinking venues. Soc Sci Med. 2012;74(7):1005–12.
22. Townsend L, Ragnarsson A, Mathews C, Johnston LG, Ekstrom AM, Thorson A, et al. "Taking care of business": alcohol as currency in transactional sexual relationships among players in Cape Town. South Afr Qual Health Res. 2011;21(1):41–50.
23. Devries KM, Child JC, Bacchus LJ, Mak J, Falder G, Graham K, et al. Intimate partner violence victimization and alcohol consumption in women: a systematic review and meta-analysis. Addiction. 2014;109(3):379–91.
24. Kaysen D, Dillworth TM, Simpson T, Waldrop A, Larimer ME, Resick PA. Domestic violence and alcohol use: trauma-related symptoms and motives for drinking. Addict Behav. 2007;32(6):1272–83.
25. Cunradi CB, Caetano R, Schafer J. Alcohol-related problems, drug use, and male intimate partner violence severity among US couples. Alcohol Clin Exp Res. 2002;26(4):493–500.
26. Miller AP, Zinner L, Kigozi G, Bonnevie E, Nakyanjo N, Ddaaki W, et al. HIV+ Women's perspectives on integrating a screening and brief intervention for intimate partner violence and alcohol harm reduction into HIV post-test counseling: qualitative findings from three Ugandan fishing villages. Institue on Violence Abuse and Trauma (IVAT) Annual Summit; September 6–10, 2018; La Jolla, California 2018.
27. Khantzian EJ. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. Harv Rev Psychiatry. 1997;4(5):231–44.
28. Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. The Lancet. 2017;389(10072):941–50.
29. Meyer JP, Springer SA, Altice FL. Substance abuse, violence, and HIV in women: a literature review of the syndemic. J Womens Health (Larchmt). 2011;20(7):991–1006.
30. Russell BS, Eaton LA, Petersen-Williams P. Intersecting epidemics among pregnant women: alcohol use, interpersonal violence, and HIV infection in South Africa. Curr HIV/AIDS Rep. 2013;10(1):103–10.
31. Pitpitan EV, Kalichman SC, Eaton LA, Cain D, Sikkema KJ, Watt MH, et al. Co-occurring psychosocial problems and HIV risk among women attending drinking venues in a South African township: a syndemic approach. Ann Behav Med. 2013;45(2):153–62.
32. Choudhry V, Agardh A, Stafstrom M, Ostergren PO. Patterns of alcohol consumption and risky sexual behavior: a cross-sectional study among Ugandan university students. BMC Public Health. 2014;14:128.
33. Singh K, Buckner B, Tate J, Ndubani P, Kamwanga J. Age, poverty and alcohol use as HIV risk factors for women in Mongu, Zambia. Afr Health Sci. 2011;11(2):204–10.
34. Ugandan Ministry of Health. Uganda population-based HIV impact assessment: UPHIA 2016–2017: Extended summary sheet: Preliminary findings. 2018.
35. Chang LW, Grabowski MK, Ssekubugu R, Nalugoda F, Kigozi G, Nantume B, et al. Heterogeneity of the HIV epidemic in agrarian, trading, and fishing communities in Rakai, Uganda: an observational epidemiological study. The Lancet HIV. 2016;3(8):e388–96.
36. Grabowski MK, Burke V, Nakiigozi G, Nalugoda F, Ssekubugu R, Chang L, et al. Tramsactional sex measurement and association with HIV incidence among women. Conference on Retroviruses and Opportunistic Infections (CROI); March 4–7, 2018; Boston, Massachusettes, 2018.
37. Sabri B, Wirtz AL, Ssekasanvu J, Nonyane BAS, Nalugoda F, Kagaayi J, et al. Intimate partner violence, HIV and sexually transmitted infections in fishing, trading and agrarian communities in Rakai, Uganda. BMC Public Health. 2019;19(1):594.
38. Wagman JA, Nabukalu D, Miller AP, Wawer MJ, Ssekubugu R, Nakowooya H, et al. Prevalence and correlates of men's and women's alcohol use in agrarian, trading and fishing communities in Rakai, Uganda. Manuscript under review. 2020
39. Kwena ZA, Bukusi E, Omondi E, Ng'ayo M, Holmes KK. Transactional sex in the fishing communities along Lake Victoria, Kenya: a catalyst for the spread of HIV. Afr J AIDS Res. 2012;11(1):9–15.
40. Zablotska IB, Gray RH, Serwadda D, Nalugoda F, Kigozi G, Sewankambo N, et al. Alcohol use before sex and HIV acquisition: a longitudinal study in Rakai, Uganda. AIDS. 2006;20(8):1191–6.
41. Zablotska IB, Gray RH, Koenig MA, Serwadda D, Nalugoda F, Kigozi G, et al. Alcohol use, intimate partner violence, sexual coercion and HIV among women aged 15–24 in Rakai, Uganda. AIDS Behav. 2009;13(2):225–33.
42. Leonard KE, Quigley BM. Thirty years of research show alcohol to be a cause of intimate partner violence: future research needs to identify who to treat and how to treat them. Drug Alcohol Rev. 2017;36(1):7–9.
43. Wawer MJ, Gray RH, Sewankambo NK, Serwadda D, Paxton L, Berkley S, et al. A randomized, community trial of intensive sexually transmitted disease control for AIDS prevention, Rakai, Uganda. AIDS. 1998;12(10):1211–25.
44. Straus MA. Measuring intrafamily conflict and violence. The conflict tactics (CT) scales. J Marriage Fam. 1979;41:75–88.
45. SAS Institute Inc. SAS University Edition. Cary, NC.: SAS Institute Inc. .
46. Dunkle KL, Jewkes RK, Brown HC, Gray GE, McIntryre JA, Harlow SD. Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection. Soc Sci Med. 2004b;59(8):1581–92.

47. Jewkes R, Nduna M, Levin J, Jama N, Dunkle K, Khuzwayo N, et al. A cluster randomized-controlled trial to determine the effectiveness of stepping stones in preventing HIV infections and promoting safer sexual behaviour amongst youth in the rural Eastern Cape, South Africa: trial design, methods and baseline findings. Trop Med Int Health. 2006;11(1):3–16.
48. Kwena ZA, Shisanya CA, Bukusi EA, Turan JM, Dworkin SL, Rota GA, et al. Jaboya ("Sex for Fish"): a qualitative analysis of contextual risk factors for extramarital partnerships in the fishing communities in Western Kenya. Arch Sex Behav. 2017;46(7):1877–90.
49. Tumwesigye NM, Atuyambe L, Wanyenze RK, Kibira SP, Li Q, Wabwire-Mangen F, et al. Alcohol consumption and risky sexual behaviour in the fishing communities: evidence from two fish landing sites on Lake Victoria in Uganda. BMC Public Health. 2012;12:1069.
50. MacPherson EE, Sadalaki J, Njoloma M, Nyongopa V, Nkhwazi L, Mwapasa V, et al. Transactional sex and HIV: understanding the gendered structural drivers of HIV in fishing communities in Southern Malawi. J Int AIDS Soc. 2012;15(Suppl 1):1–9.
51. Mojola SA. Fishing in dangerous waters: Ecology, gender and economy in HIV risk. Soc Sci Med. 2011;72(2):149–56.
52. Bene C, Merten S. Women and fish-for-sex: transactional sex, HIV/AIDS and gender in African fisheries. World Dev. 2008;36:875.
53. Sileo KM, Kintu M, Kiene SM. The intersection of intimate partner violence and HIV risk among women engaging in transactional sex in Ugandan fishing villages. AIDS Care. 2018;30(4):444–52.
54. Heise LL. Violence against women: an integrated, ecological framework. Violence Against Women. 1998;4(3):262–90.
55. Seedat M, Van Niekerk A, Jewkes R, Suffla S, Ratele K. Violence and injuries in South Africa: prioritising an agenda for prevention. The Lancet. 2009;374(9694):1011–22.
56. McCarthy KJ, Mehta R, Haberland NA. Gender, power, and violence: a systematic review of measures and their association with male perpetration of IPV. PLoS ONE. 2018;13(11):e0207091.
57. Hatcher AM, Gibbs A, McBride RS, Rebombo D, Khumalo M, Christofides NJ. Gendered syndemic of intimate partner violence, alcohol misuse, and HIV risk among peri-urban, heterosexual men in South Africa. Soc Sci Med. 2019. https://doi.org/10.1016/j.socscimed.2019.112637.
58. Wamoyi J, Ranganathan M, Kyegombe N, Stoebenau K. Improving the measurement of transactional sex in Sub-Saharan Africa: a critical review. J Acquir Immune Defic Syndr. 2019;80(4):367–74.
59. Campbell JC, Baty ML, Ghandour RM, Stockman JK, Francisco L, Wagman J. The intersection of intimate partner violence against women and HIV/AIDS: a review. Int J Inj Control Saf Promot. 2008;15(4):221–31.
60. Fonck K, Leye E, Kidula N, Ndinya-Achola J, Temmerman M. Increased risk of HIV in women experiencing physical partner violence in Nairobi Kenya. AIDS Behav. 2005;9(3):335–9.
61. Maman S, Mbwambo JK, Hogan NM, Kilonzo GP, Campbell JC, Weiss E, et al. HIV-positive women report more lifetime partner violence: findings from a voluntary counseling and testing clinic in Dar es Salaam Tanzania. Am J Public Health. 2002;92(8):1331–7.
62. Li Y, Marshall CM, Rees HC, Nunez A, Ezeanolue EE, Ehiri JE. Intimate partner violence and HIV infection among women: a systematic review and meta-analysis. J Int AIDS Soc. 2014;17:18845.
63. Mannell J, Willan S, Shahmanesh M, Seeley J, Sherr L, Gibbs A. Why interventions to prevent intimate partner violence and HIV have failed young women in southern Africa. J Int AIDS Soc. 2019;22(8):e25380.