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Client-perpetrated gender-based violence among female sex workers in post-conflict Gulu district, Northern Uganda: a cross-sectional study

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3 **Client-perpetrated gender-based violence among female sex workers in post-conflict**
4 **Gulu district, Northern Uganda: a cross-sectional study**
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Abstract

Background: Gender-based violence (GBV) among female sex workers (FSWs) negatively affects their mental wellbeing and sexual and reproductive health and rights. This study aimed to determine the prevalence and associated factors of client-perpetrated GBV among FSWs in post-conflict Gulu district, Northern Uganda.

Methods: A cross-sectional study was conducted among 300 FSWs aged 18+ years who were operating in Gulu district. Participants were selected using simple random sampling and interviewed between March and June 2020. Pre-tested semi-structured questionnaires were utilized to collect information on socio-demographic and sex-work-related characteristics, alcohol and illicit drug use, HIV status, and exposure to client-perpetrated GBV. Data were entered into EPI INFO 7 and analyzed using logistic regression with the aid of STATA 14.0.

Results: Sixty one percent (61.0%) of the participants reported client-perpetrated GBV. The most common forms of GBV in this population were economic (58.7%) and emotional (52.0%) violence. Meanwhile, sexual violence (21.0%) was the least common form of GBV among the study participants. At multivariate level; street-based sex work (aOR=9.66, 95%CI: 2.78-33.5), mobile sex work (aOR=3.21, 95%CI: 1.83-5.64), HIV-positive status (aOR=1.90, 95%CI: 1.09-3.31), and low monthly income below 50th percentile {<200,000 UGX} (aOR= 2.26, 95% CI: 1.18-4.30) remained independently associated with client-perpetrated GBV.

Conclusion: Our findings revealed a high prevalence of client-perpetrated GBV driven by street-based sex work, sex work-related mobility, HIV-positive status, and low income. Therefore, interventions to address client-perpetrated GBV should target FSWs who are street-based, HIV-positive, mobile, and with low income.

Strengths and limitations of this study

- In post-conflict Gulu district, there is a high prevalence of client-perpetrated GBV which is associated with street sex work, sex work-related mobility, being HIV-positive, and low income.
- This study provide evidence needed by health care systems to develop or strengthened GBV policies and interventions among FSWs; such interventions should target the economically disadvantage FSWs who are street-based, HIV-positive, and practice mobile sex work.
- In addition, unlike most previous studies among the FSWs that used non-probability sampling methods, we utilized a simple random sampling technique to select our participants. Thus, our study participants were representative of the FSWs and finding can be more generalizable.
- However, the information collected may have been influenced by recall bias since we asked FSWs about their personal experience of client-perpetrated GBV.
- In addition, we implored some sensitive information relating to sex work that might have been difficult to answer which might have resulted into information bias.

Introduction

The United Nations defined violence against women as “any act of GBV that results in or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or private life”(1). Survivors of GBV often fail to achieve legal, social, political, and economic equality in society (1). A previous study indicated that the majority of FSWs were affected by both intimate and nonintimate partner violence (2). Moreover, the management of GBV in this vulnerable population remains suboptimal since FSWs have poor access to health care services for fear of victimization by the health care providers (3,4). Besides, the impacts of political conflict might have worsened the GBV among FSWs operating in settings like Gulu district yet client-perpetrated GBV in post-conflict settings remain understudied. Additionally, sex work is illegal and not recognized as a form of employment in Uganda (5). This illegality of sex work may have led to an increase in workplace violence among FSWs in the country since the law does not protect them.

Currently, there is a growing body of literature on risk factors of GBV among FSWs. One such evidence suggests that HIV infection increases the risk of GBV (6). However, the relationship between GBV and HIV is bidirectional since survivors of GBV also tend to have a greater risk of acquiring HIV infection (7,8). Secondly, compared to FSWs who provide sexual services from one locality, mobile sex workers are more likely to get exposed to client-perpetrated GBV (9,10). Additionally, a systematic review revealed that both alcohol and illicit drug use increase intimate and nonintimate partner GBV among FSWs (11). Moreover, if left untreated, GBV could lead to poverty, alcohol abuse, reduction in condom use consistency (12,13), decrease in condom self-efficacy with clients (14), reduction in the uptake of sexual and reproductive health services (15), and mental disorders like depression (16–19). Thus, addressing client-perpetrated GBV among the FSWs is of public health importance and is very critical for the improvement of mental wellbeing and promotion of sexual reproductive health and rights in this vulnerable and marginalized population.

In order to prevent and manage GBV among FSWs in the country, understanding the epidemiology of GBV in this population is very crucial since findings provide the evidence needed for the development of evidence-based and context-specific interventions. Yet the prevalence and risk factors of client-perpetrated GBV among FSWs living and working in post-conflict settings like Gulu district have not been well explored. The specific objectives of this study were 1) to determine the prevalence of client-perpetrated GBV among FSWs in post-conflict Gulu district, Uganda and 2) to determine factors associated with client-perpetrated GBV among FSWs in the post-conflict Gulu district, Uganda.

Methods

Study setting, design, and population

We conducted a study among FSWs in the post-conflict Gulu district, Northern Uganda. FSWs are considered a key population and are targeted for HIV prevention because of the high burden of HIV among them (20). People in Gulu districts are still recovering from the more than 20 years of Lord Resistant Army (LRA) rebellion that devastated their social and economic livelihoods. More than 80% of the inhabitants of the district practice subsistence farming (21) and an estimated 1425 FSWs operate in Gulu district (22), the majority of whom operate in Gulu municipality. Unpublished program data show that more than 1300 fully mapped-out FSWs receive HIV treatment and/or preventive services from TASO Gulu. We conducted a cross-sectional study among FSWs aged 18+ years who were operating in the district.

Sample size and sampling

We collected data among 300 FSWs between March and June 2020. The sample size was determined using the Cochran [1963,1975](23) formula: $n_0 = Z^2pq/e^2$. This work was part of a project that examined the epidemiology of depression among FSWs in Gulu district on which the sample size determination was based and the calculated sample size was 303. The sample size was adjusted 380 for work-related mobility (10%) and non-response (10%). We utilized a simple random sampling technique because we had an up-to-date database of FSWs at TASO Gulu. However, with the help of the peers of FSWs, we had to rapidly update the existing database to include any missing FSW in the database.

Data collection

Data were collected through face-to-face interviews using a pre-tested semi-structured questionnaire developed in English and translated into Acholi language (*Luo*), the most widely spoken local language in the district. The first author and a trained female research assistant collected data in either Acholi or English language depending on the participant's literacy level and preference. Independent variables included socio-demographic characteristics like age, education, religion, and marital status, sex work-related characteristics like duration of sex work, average monthly income, place of sex work, and sex work-related mobility, alcohol use, illicit drug use, and HIV status. To determine intra-regional sex work-related mobility, we asked the participants whether they provided sexual services in an urban or a rural setting only, or both urban and rural settings. We considered FSWs who provided sexual services in both rural and urban settings to be mobile. Our dependent variable was client-perpetrated GBV. We asked each participant whether her client(s) ever: refused to pay for sexual services (economic), verbally abused (insulted) her (emotional), physically abused/beat her (physical), or forced her to have sex/raped her (sexual violence). Reporting either economic, emotional, physical, or sexual violence by male clients was considered client-perpetrated GBV.

Data management and statistical analysis

Data were entered and cleaned in EPI INFO 7 and then exported to STATA 14.0 for analyses. None of the participant had significant missing variables and all were considered for analyses. We described univariate analyses using frequencies with their corresponding proportions for categorical variables and means with corresponding standard deviations for continuous variables. We conducted both bivariate and multivariate logistic regression analyses to examine the associations of the independent factors with client-perpetrated GBV. We presented the

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3 results of bivariate analyses using unadjusted odds ratios (UOR) with corresponding
4 confidence intervals (CI) and p-value. Then, using all the significant ($p < 0.20$) independent
5 variables at bivariate analysis, we constructed a multivariate logistic regression model to
6 identify factors associated with client-initiated GBV. Thus, controlling for age, marital status,
7 average monthly income, and illicit drug use, we entered all eligible independent variables into
8 the multivariate logistic regression model at the beginning stage of model building. We utilized
9 the backward elimination method and sequentially removed each factor with the least
10 significant p-value while testing the model fit using the goodness-of-fit test until we obtained
11 the best fit model. Results from multivariable analyses were presented using adjusted odds
12 ratios (AOR) with corresponding 95% CIs and p-value.

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14 After fitting the adjusted regression model, we conducted sensitivity analysis and regression
15 diagnostics tests on the best fitted model. Specifically, we investigated the predictive power of
16 the model using the sensitivity and specificity analyses, and performed the linktest to check for
17 specification error.
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20 21 **Patient and Public Involvement**

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23 We involved the patients and the public in the dissemination plans of our research; findings
24 were shared with the relevant authorities in the district local government and the non-
25 governmental organizations providing health care services to the key population in the region.
26 It is worth noting that the complex nature of FSWs made it very difficult to actively involve
27 the patients or the public in the design, or conduct, or reporting plans of our research. However,
28 the first author's personal experience and interactions with the FSWs and their peers, during
29 his more than three years of providing HIV and sexual-reproductive health services to the key
30 population that include the FSWs, informed the design and conducts of the study. Additionally,
31 the peers of FSWs were involved in the identification and location of the selected participants.
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Results

Socio-demographic and sex work-related characteristics of study participants

Out of the 380 participants sampled, 302 were successfully traced, accounting for 79.5% of the adjusted sample size (380). Among the 302 successfully traced, 300 participants were enrolled into the study while two (02) refused to consent for the study. The mean age of the study participants was 26.4 years (SD \pm 6, Range = 18-50 years) majority (40%) of whom were below 25 years old. Additionally, 62.0% of the participants had no or primary education, 51.3% had migrated to Gulu district, only 14.3% were married/cohabiting, and 60.7% were Catholics. The majority (39.7%) of the participants had been sex workers for 3-5 years, 63.9% had sex work as their main source of income and, 43.5% earned below the 50th percentile of the average monthly income of the FSWs (200,000 UGX (60\$)) (Table 1).

Table 1: Socio-demographic and sex work-related characteristics of study participants

Characteristic	Number (N)	Percent (%)
Age (completed years)		
<25	120	40.0
25-29	85	28.3
30+	95	31.7
Education		
\leq Primary level	186	62.0
\geq Secondary level	114	38.0
District of Origin		
Gulu	146	48.7
Others	154	51.3
Married/Cohabiting		
No	257	85.7
Yes	43	14.3
Religion		
None/others	36	12.0
Catholic	182	60.7
Protestant	48	16.0
Born Again	34	11.3
Years of sex work		
\leq 2	108	36.0
3-5	119	39.7
>5	73	24.3
Sex work is the main source of income		
No	108	36.1
Yes	191	63.9
Monthly income (UGX)		
\geq 300,000	114	38.1
200,000-<300,000	55	18.4
<200,000	130	43.5
Practice mobile sex work		
No	161	53.7

Yes	139	46.3
Use illicit drug		
No	216	72.0
Yes	84	28.0
Consume alcohol within the Week of the interview		
No	107	36.3
Yes	188	63.7
Frequency of alcohol consumption		
Never	79	26.5
Occasional	52	17.5
Daily	167	56.0
Reported to be HIV positive		
No	173	57.9
Yes	126	42.1

Prevalence of client-perpetrated GBV among FSWs in Gulu district

During sex work, 61.0% of the participants experienced at least one incidence of client-perpetrated GBV. The most common forms of GBV reported were economic (58.7%) and emotional (52.0%) violence and sexual violence (21.0%) was the least common form of GBV. One-fifth (19.0%) of FSWs reported experiencing all the forms of GBV (Table 2).

Table 2: Prevalence and forms of client-perpetrated GBV among study participants

Characteristics	Numbers (n =300)	Percent (%)
Experienced client-perpetrated GBV		
No	117	39.0
Yes	183	61.0
Client-perpetrated GBV experienced		
Economic violence	176	58.7
Emotional violence	156	52.0
Physically violence	145	48.3
Sexual violence	63	21.0
All forms of violence	57	19.0

Predictors of client-perpetrated GBV among female sex workers

At bivariate level, participants who reported client-perpetrated GBV were more likely to be based on the street (uOR=12.0, 95% CI: 3.64-39.8, $p<0.001$), club (uOR= 3.16, 95% CI: 1.66-6.00, $p<0.001$), brothel (uOR=2.91, 95% CI: 1.80-4.70, $p<0.001$), mobile (uOR=3.99, 95% CI: 2.41-6.62, $p<0.001$), or the bar (uOR: 2.16, 95% CI: 1.29-3.60, $p=0.003$). The other associated factors with client-perpetrated GBV were illicit drug use (uOR= 2.21, 95% CI: 1.27-3.86, $p=0.005$), age 25-29 years (uOR=2.05, 95% CI: 1.14-3.68, $p=0.016$), and being HIV positive (uOR: 1.72, 95% CI: 1.07-2.79, $p=0.026$).

Results of multivariate logistic regression analysis showed that factors that remained independently associated with client-perpetrated GBV were street-based sex work (aOR=9.66,

95%CI: 2.78-33.5), sex work-related mobility (aOR=3.21, 95%CI: 1.83-5.64), being HIV-positive (aOR=1.90, 95%CI: 1.09-3.31), and low monthly income compared with highest monthly income category (aOR= 2.26, 95% CI: 1.18-4.30). Regression diagnostic tests showed that the adjusted model had; good predictive power (0.77), non-significant goodness-of-fit test outcome ($p=0.97$), and no specification error (linktest hatsq, $p=0.38$) (Table 3).

Table 3: Factors associated with client-perpetrated GBV among FSWs

Factor	Experienced GBV		Unadjusted OR (95%CI)	Adjusted OR (95%CI)
	Yes N (%)	No N (%)		
Age (completed years)				
<25	63(52.5)	57(47.5)	1.00	1.00
25-29	59(69.4)	26(30.5)	2.05(1.14-3.68)/*	1.88(0.93-3.79)
≥30	61(64.2)	34(35.8)	1.62(0.93-2.82)	1.80(0.91-3.55)
Married/Cohabiting				
No	162(63.0)	95(37.0)	1.00	1.00
Yes	21(48.8)	22(51.2)	0.56(0.29-1.07)	0.56(0.27-1.18)
Monthly income (UGX)				
≥300,000	67(58.8)	47(41.2)	1.00	1.00
200,000-<300,000	35(63.6)	20(36.4)	1.23(0.63-2.38)	1.84(0.85-3.97)
<200,000	81(62.3)	49(38.8)	1.16(0.69-1.94)	2.26(1.18-4.30) *
Mobile sex worker				
No	75(46.6)	86(53.4)	1.00	1.00
Yes	108(77.7)	31(22.3)	3.99(2.41-6.62)/*	3.21(1.83-5.63) ***
Sex work in a brothel				
No	62(47.0)	70(53.0)	1.00	---
Yes	121(72.0)	47(28.0)	2.91(1.80-4.70) /*/	---
Sex work in bars				
No	107(54.9)	88(45.1)	1.00	---
Yes	76(72.4)	29(27.6)	2.16(1.29-3.60)/*	---
Sex work on streets				
No	139(54.9)	114(45.1)	1.00	1.00
Yes	44(93.6)	03(6.4)	12.0(3.64-39.8)/*	9.66(2.78-33.5) ***
Sexwork in clubs				
No	128(55.4)	103(44.6)	1.00	---
Yes	55(79.7)	14(20.3)	3.16(1.66-6.00)/*	---
Use any illicit drug				
No	121(56.0)	95(44.0)	1.00	---
Yes	62(73.8)	22(26.2)	2.21(1.27-3.86)/*	---
Consume alcohol				
Never	43(54.4)	36(45.6)	1.00	---
Occasional	37(71.1)	15(28.9)	2.07(0.98-4.35)/*	---
Daily	102(61.1)	65(38.9)	1.31(0.76-2.26)	---
HIV-positive				
No	96(55.5)	77(44.5)	1.00	1.00
Yes	86(68.2)	40(31.8)	1.72(1.07-2.79)/*	1.90(1.09-3.31) *

/*/ Significant at $P<0.20$ and entered into the multivariate model.

* $p<0.05$, *** $p<0.001$

Discussion

Our findings revealed a high prevalence of client-perpetrated GBV among FSWs with the majority reporting emotional and economic violence. Further analysis indicated that the odds of client-perpetrated gender-based violence increased among FSWs who were street-based, mobile, illicit drug users, HIV-positive, and had lower monthly income.

There is a high prevalence of client-perpetrated GBV among FSWs in Gulu district (61%) with the most common forms of violence reported being emotional and economic. This is an increase beyond the previous magnitude of client-perpetrated GBV (50%) among FSWs in Gulu district (24). Cautions should be taken while interpreting these two results since the two studies had some slight measurement variation. In the current study, we measured client-perpetrated GBV for the entire period of sex work as opposed to the previous report that examined client-perpetrated GBV only during the last six months. However, the prevailing magnitude of client-perpetrated GBV is lower than the 82% prevalence of GBV reported among FSWs in Kampala city, Uganda's Capital (25). We posit that FSWs in Gulu district recorded less client-perpetrated GBV than their Kampala counterparts. Almost all participants in the Kampala study (95%) depended on sex work as their main source of income compared to 63.9% of the current participants who depended on sex work as their main source of income. Results from our study revealed a high magnitude of client-perpetrated GBV among FSWs in the post-conflict Gulu district and calls for urgent public health interventions, especially in the light of the close relationship between GBV and HIV infection (26).

Our findings indicated that street-based FSWs were more likely to experience client-perpetrated GBV. The available literature is in agreement with the current finding showing that FSWs who work in riskier settings like street have increased odds of experiencing client-perpetrated violence (27–29).

Secondly, FSWs who practiced mobile sex work were found to have increased odds of experiencing client-perpetrated GBV. The literature on the relationship between sex work-related mobility and exposure to client-perpetrated GBV are scarce. Moreover, to the best of our knowledge, this is the first study on the relationship between client-perpetrated GBV and sex work-related mobility in post-conflict settings. However, our finding is consistent with previous studies reporting that mobile FSWs were at increased odds of client-perpetrated GBV (9,10,30). This is because mobile FSWs tend to have less control over their work environment and many of the male clients of FSWs tend to refuse to use condoms with the new coming mobile FSWs (30). Therefore, to reduce client-perpetrated GBV, health programmers need to organize GBV interventions that reach all the regional hot-spots where the mobile FSWs operate.

Thirdly, our findings showed that FSWs living with HIV were at increased odds of reporting client-perpetrated GBV. This is in agreement with previous studies showing that living with HIV in the general population (6) as well as among the FSWs (2,31) increases a woman's odds of experiencing GBV. The relationship between HIV and client-perpetrated GBV could have been mediated through accidental exposure of HIV status to clients, HIV stigma, and depression which are common in this population. However, it's worth noting that the relationship between GBV and HIV is bidirectional because studies have indicated that people who experienced GBV were more likely to get HIV infection (7,32,33).

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Lastly, client-perpetrated GBV did not show any significant relationship with income at the bivariate level. However, at the multivariate level, client-perpetrated GBV showed a strong positive association with low monthly income. Specifically, FSWs earning less than 50th percentile of the average monthly income of FSWs were almost three times more likely to report client-perpetrated GBV compared to the relatively higher-income earners. Only a few studies examined the relationship between client-perpetrated GBV and FSWs' monthly income. In Tanzania, the income level did not significantly affect the occurrence of client-perpetrated GBV (10). However, in Northern Ethiopia low earning FSWs were more likely to suffer from client-perpetrated GBV(34).

This high magnitude of client-perpetrated GBV among FSWs calls for more attention and resources to address this public health threat to the mental and sexual reproductive health of FSWs. The government should enact favorable laws that protect the FSWs against GBV. Secondly, because client-perpetrated GBV among FSWs is multi-dimensional, interventions to prevent and treat GBV in this population should target the low earning FSWs who are mobile, street-based, illicit drug users, and HIV-positive.

Strengths and limitations of the study

Our study had several strengths: unlike most previous studies among the FSWs that used the non-probability methods of participants' selection, we utilized a simple random sampling technique to select our sample. Thus, our study participants were representative of the FSWs and therefore the findings are more generalizable. However, this study had some limitations; the information collected may have been negatively influenced by recall bias since we asked FSWs about their personal experience of client-perpetrated GBV since joining sex work. In addition, we implored some sensitive information relating to sex work that might have been difficult to answer and thus underreported. However, we interviewed the FSWs in such a way that we reduce any chance of information bias.

Conclusion

Our findings revealed a high magnitude of client-perpetrated GBV among FSWs in Gulu district, Northern Uganda. Further results indicated that FSWs who were street-based, mobile, HIV-positive, and low-income earners had increase odds of client-perpetrated GBV. Therefore, to maximize interventional benefits, future public health interventions to address client-perpetrated GBV in this population should be integrated within the existing HIV programs and should target the mobile, street-based, and low income earning FSWs.

List of abbreviation

AIDS: Acquired Immunodeficiency Syndrome, ART: Antiretroviral Therapy, aOR: Adjusted Odd Ratio, CI: Confidence Interval, FSWs: Female Sex Workers, GBV: Gender-Based Violence, HIV: Human Immunodeficiency Virus, TASO: The AIDS Support Organization, UGX: Ugandan Shillings, uOR: Unadjusted Odd Ratio.

Ethics approval and consent to participate

We obtained ethical clearance for this study from the Makerere University School of Public Health Higher Degrees, Research, and Ethics Committee. Each participant provided written informed consent. We maintained participants' privacy and confidentiality throughout the different processes of participant's enrollment into the study and data collection and analysis.

Consent for publication

Not applicable

Data sharing statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request to oumasimple@gmail.com.

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Competing interests

The authors declare that they have no competing interests.

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Contributorship

SO, conceived and designed the study, collected and entered data, conducted data analysis, interpreted the findings, and wrote the first draft of the manuscript. RN, AC, and NMT conceived the study, supported data analysis, interpretation of results, and critically reviewed the draft manuscript. All authors approved the final manuscript for publication.

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4-5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	4-5
		(b) Describe any methods used to examine subgroups and interactions	4-5
		(c) Explain how missing data were addressed	4
		(d) If applicable, describe analytical methods taking account of sampling strategy	4-5
		(e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	6-8
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8

		(b) Report category boundaries when continuous variables were categorized	6-8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Client-perpetrated gender-based violence among female sex workers in post-conflict Gulu district, Northern Uganda: a cross-sectional study

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3 **Client-perpetrated gender-based violence among female sex workers in post-conflict Gulu**
4 **district, Northern Uganda: a cross-sectional study**
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Abstract

Objective: The study aimed to determine the prevalence and the factors associated with client-perpetrated gender-based violence among female sex workers in the post-conflict Gulu district in Uganda.

Design and settings: We conducted a cross-sectional study among female sex workers operating in post-conflict Gulu district, Northern Uganda.

Participants: We conducted this study among 300 adult female sex workers aged 18 years or more who were selected using a simple random sampling from a database maintained by a Non-governmental Organization.

Outcome measure: The outcome measure was client-perpetrated gender-based violence.

Methods: Using a pre-tested semi-structured questionnaire, we collected information on socio-demography, sex-work-related characteristics, alcohol and illicit drug use, HIV status, and exposure to client-perpetrated gender-based violence. Data were entered into EPI INFO 7 and analyzed using logistic regression with the aid of STATA 14.0.

Results: Sixty-one percent of the participants reported client-perpetrated gender-based violence. The most common forms of gender-based violence were the economic (58.7%) and emotional (52.0%) violence while the least common form of gender-based violence was sexual violence (21.0%). At multivariate level; street-based sex work (adjusted OR=9.66, 95%CI: 2.78-33.5), mobile sex work (adjusted OR=3.21, 95%CI: 1.83-5.64), HIV-positive status (adjusted OR=1.90, 95%CI: 1.09-3.31), and low monthly income {<200,000 UGX} (adjusted OR= 2.26, 95% CI: 1.18-4.30) remained independently associated with client-perpetrated gender-based violence.

Conclusions: Our findings revealed a high prevalence of client-perpetrated gender-based violence driven by the street-based, mobile, HIV-positive, and low-income earning female sex workers who should be targeted with effective gender-based violence prevention, response, and risk mitigation measures.

Strengths and limitations of this study

- This is among the first studies on the relationship between client-perpetrated GBV and sex work-related mobility in post-conflict settings.
- Our study used a simple random sampling technique to select the participants increasing representativeness and generalizability.
- We asked female sex workers about their previous exposures to client-perpetrated gender-based violence which could have resulted in recall and information biases.

Introduction

Gender-based violence (GBV) is any harmful act directed at an individual based on their gender including sexual, physical, mental, and economic harm inflicted in public or private and the threats of violence, coercion, and manipulation (1). Although hostility from the more than 20 years of the Lord's Resistant Army (LRA) rebellion in Northern Uganda has ceased, Gulu district has not yet achieved complete reconciliation, societal integration, and economic recovery (2). The LRA conflict led to increased vulnerability to HIV infection (3), a high rate of intimate partner violence (4), and depression (5) in the population.

GBV is rooted in gender inequality, the abuse of power, and harmful norms that leave the survivors of GBV unable to achieve legal, social, political, and economic equality in society (6). A previous study indicated that being a female sex worker (FSW) is a risk factor for intimate and nonintimate partner violence among women (7). In Gulu, the LRA conflict might have worsened the GBV situation among FSWs. Besides, many FSWs in the district are mobile and thus move from place to place to provide sexual services in multiple localities thus putting themselves at greater risk of client-perpetrated GBV as seen elsewhere (8,9). Besides, sex work is illegal and not recognized as a form of employment in Uganda (10). The illegality of sex work affects FSWs' ability to form social support networks, access social services, and report client-perpetrated GBV to legal authorities. Moreover, the management of GBV among FSWs remains suboptimal since FSWs can't easily access health care services for fear of victimization by health care providers (11,12). However, client-perpetrated GBV among FSWs in post-conflict settings like Gulu remains understudied.

Currently, there is a growing body of literature on risk factors of GBV among FSWs. A systematic review revealed that alcohol and illicit drug use increase intimate and nonintimate partner GBV among FSWs (13). If left untreated, GBV could lead to poverty, alcohol abuse, reduction in condom use consistency (14,15), decrease in condom self-efficacy with clients (16), reduction in the uptake of sexual and reproductive health services (17), and mental disorders like depression (18–21). If the government is to improve the mental wellbeing and the sexual reproductive health and rights of FSWs, there is an urgent need to address the challenge of GBV in this population.

To prevent and manage GBV among FSWs in the country, understanding the epidemiology of GBV in this population is crucial for the development of evidence-based and context-specific interventions. This study aimed to determine 1) the prevalence of client-perpetrated GBV among FSWs in post-conflict Gulu district, Uganda, and 2) the factors associated with client-perpetrated GBV among FSWs in the post-conflict Gulu district in Uganda.

Methods

Study setting, design, and population

We conducted a cross-sectional study among FSWs in the post-conflict Gulu district, Northern Uganda. In Uganda, the Ministry of Health targets FSWs for HIV prevention because of the high burden of HIV in this key population group (22). People in Gulu are still economically recovering from the more than 20 years of the LRA rebellion that devastated their social and

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3 economic livelihoods. More than 80% of people in the district practice subsistence farming
4 (23). An estimated 1425 FSWs operate in the district (24), of whom the majority live and work
5 in Gulu municipality and are supported by The AIDS Support Organization (TASO), a national
6 Non-Governmental Organization (NGO) that provides HIV treatment, care, and preventive
7 services across Uganda through its 11 TASO Clinics (25). TASO provides HIV care and
8 prevention services and reproductive health services to all the key populations. TASO
9 conducted mapping for all the key population groups that include the FSWs. Currently, the
10 Clinic has mapped more than 1300 FSWs in the district. TASO database contained sex work
11 venues, hang-out places, and residences for the FSWs. We conducted a cross-sectional study
12 among FSWs operating within the district and aged 18 years or more.
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16 **Sample size and sampling**

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19 A sample size of 380 study participants was determined using the Cochran [1963,1975] (26)
20 formula as part of a project that studied depression among FSWs in Gulu and presented
21 elsewhere (27). From the FSWs' database at TASO Gulu, we identified 789 adult FSWs and
22 used a simple random sampling technique to select 380 FSWs with help of an online random
23 number generator. To minimize non-response bias, we reached out to the selected FSWs by
24 telephone or their peers to schedule appointments, physically tracing them using the existing
25 mapping information at TASO, or meeting them during their clinic days. Out of the 380
26 selected FSWs, we successfully tracked and contacted 302 to participate of whom 300
27 consented and were interviewed within conducive places that they chose.
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31 **Data collection**

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33 Data was collected from 300 adult FSWs between March and June 2020. Using a pre-tested
34 semi-structured questionnaire developed in English and translated into Acholi language (*Luo*),
35 we conducted face-to-face interviews to collect information from each study participant.
36 Before data collection, we pre-tested the questionnaire among 20 FSWs from the
37 neighbouring Amuru district to check for consistency in question interpretation and language
38 appropriateness. The first author and a trained female research assistant collected data in
39 either Acholi or English language depending on the participant's literacy level and preference.
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43 Independent variables included socio-demographic characteristics like age, education,
44 religion, and marital status, sex work-related characteristics like duration of sex work, average
45 monthly income, place of sex work, and sex work-related mobility, alcohol use, illicit drug use,
46 and HIV status. To determine intra-regional sex work-related mobility, we asked the
47 participants where they provided sexual services. We considered FSWs operating both in rural
48 and urban localities to be mobile since they move long distances to do sex work. The only
49 dependent variable was the client-perpetrated GBV.
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53 The outcome variable for this study was client-perpetrated GBV. We adopted the study
54 questionnaire that assessed for client-perpetrated GBV from previous research conducted
55 among FSWs in Kampala, Uganda (28). We asked each participant whether her client(s) ever:
56 refused to pay for sexual services (economic violence), verbally abused (insulted) her
57 (emotional violence), physically abused/beat her (physical violence), or forced her to have
58 sex/raped her (sexual violence). Reporting either economic, emotional, physical, or sexual
59 violence by male clients was considered client-perpetrated GBV.
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Data management and statistical analysis

Data were entered and cleaned in EPI INFO 7 and then exported to STATA 14.0 for analysis. Univariate results were described using either frequency with corresponding proportions for categorical variables or mean with corresponding standard deviations for continuous variables. To examine the associations between independent factors and client-perpetrated GBV, we conducted both bivariate and multivariate logistic regression analyses. We reported bivariate analyses using unadjusted odds ratios (uOR) with corresponding confidence intervals (CI) and p-value.

Using the significant ($p < 0.20$) independent variables at bivariate analysis, we constructed a multivariate logistic regression model to examine factors associated with the client-perpetrated GBV. Controlling for age, marital status, and monthly income, we entered all eligible independent variables into the multivariate logistic regression model at the beginning stage of model building. We utilized the backward elimination method and sequentially removed each factor with the least significant p-value while testing the model fit using the goodness-of-fit test until we obtained the best fit model. Finally, we described multivariable results using adjusted odds ratios (aOR) with corresponding 95% CIs and p-value.

After fitting the adjusted logistic regression model, we conducted sensitivity analysis and specificity analyses to estimate the model's predictive power and the likelihood to check for specification error.

Patient and Public Involvement

We involved the study participants and the public in the dissemination of the research. We shared the study findings with the relevant local authorities in the district and the NGOs providing healthcare services to the key population groups in the region. However, the complex nature of sex work made it difficult to actively involve the participants or the public in the design, conduct, or reporting plans of this study. However, the first author has been working among FSWs for more than three years. This personal experience and interactions with FSWs informed the design and conduct of the study. Additionally, the peers of FSWs were involved in the identification and tracking of the selected participants.

Results

Socio-demographic and sex work-related characteristics of study participants

We randomly sampled 380 eligible FSWs to participate in this study. However, only 302 FSWs (79.5%) were traced successfully and contacted to participate. Among these, 300 consented and enrolled in the study giving a response rate of 99.3%. The participants' mean age was 26.4 years (SD \pm 6, Range = 18-50 years), of whom most (40%) were below 25 years old. Additionally, 62.0% of the participants had no or primary education, 51.3% had migrated to Gulu, only 14.3% were married/cohabiting, and 60.7% were Catholics. Most (39.7%) of the participants had been sex workers for 3-5 years, 63.9% had sex work as their main income source and, 43.5% had low monthly income/earned below the median monthly income of FSWs in the district (200,000 UGX [60\$]) (*Table 1*).

Table 1: Socio-demographic and sex work-related characteristics of study participants

Characteristic	Number (N=300)	Percent (%)
Age (completed years)		
<25	120	40.0
25-29	85	28.3
30+	95	31.7
Education		
≤ Primary level	186	62.0
≥ Secondary level	114	38.0
District of Origin		
Gulu	146	48.7
Others	154	51.3
Married/Cohabiting*		
No	257	85.7
Yes	43	14.3
Religion		
None/others	36	12.0
Catholic	182	60.7
Protestant	48	16.0
Born Again	34	11.3
Years of sex work		
≤ 2	108	36.0
3-5	119	39.7
>5	73	24.3
Sex work is the main income source		
No	108	36.1
Yes	191	63.9
Monthly income (UGX)*		
≥300,000	114	38.1
200,000-<300,000	55	18.4
<200,000	130	43.5
Practice mobile sex work		
No	161	53.7
Yes	139	46.3
Use illicit drug		
No	216	72.0
Yes	84	28.0
Took alcohol during interview Week*		
No	107	36.3
Yes	188	63.7
Frequency of alcohol consumption		
Never	79	26.5
Occasional	52	17.5

Daily	167	56.0
Reported HIV status*		
Negative	173	57.9
Positive	126	42.1

* Missing data: marital status (2), alcohol consumption (2), income (1), and HIV status (1).

Prevalence of client-perpetrated GBV among FSWs in Gulu district

During sex work, 61.0% of the participants experienced at least one incidence of client-perpetrated GBV. The most commonly reported forms of GBV were the economic (58.7%) and emotional (52.0%) GBV. Meanwhile, sexual GBV (21.0%) was the least reported form of GBV. Further analysis showed that 32.7% of the participants reported a history of exposure to two or three different types of client-perpetrated GBV. Lastly, about one-fifth (19.0%) of the participants reported that they experienced all the four forms of client-perpetrated GBV (*Table 2*).

Table 2: Prevalence and forms of client-perpetrated GBV among study participants

Characteristics	Number (N =300)	Percent (%)
Experienced client-perpetrated GBV		
No	117	39.0
Yes	183	61.0
Client-perpetrated GBV experienced		
Economic violence	176	58.7
Emotional violence	156	52.0
Physically violence	145	48.3
Sexual violence	63	21.0
Two or three forms of violence	98	32.7
All forms of violence	57	19.0

Predictors of client-perpetrated GBV among FSWs

At bivariate level, participants who reported client-perpetrated GBV were more likely to be based in the street (uOR=12.0, 95% CI: 3.64-39.8, $p<0.001$), the club (uOR= 3.16, 95% CI: 1.66-6.00, $p<0.001$), brothel (uOR=2.91, 95% CI: 1.80-4.70, $p<0.001$), bar (uOR: 2.16, 95% CI: 1.29-3.60, $p=0.003$), or mobile (uOR=3.99, 95% CI: 2.41-6.62, $p<0.001$). In addition, illicit drug use (uOR= 2.21, 95% CI: 1.27-3.86, $p=0.005$), age (uOR=2.05, 95% CI: 1.14-3.68, $p=0.016$), and being HIV positive (uOR: 1.72, 95% CI: 1.07-2.79, $p=0.026$) were all associated with client-perpetrated GBV.

Controlling for age, marital status, and monthly income, multivariable logistic regression results showed that: street-based sex work (aOR=9.66, 95%CI: 2.78-33.5), sex work-related mobility (aOR=3.21, 95%CI: 1.83-5.64), being HIV-positive (aOR=1.90, 95%CI: 1.09-3.31), and low monthly income (aOR= 2.26, 95% CI: 1.18-4.30) all remained independently associated with client-perpetrated GBV. Regression diagnostic tests showed that the adjusted model had; good predictive power (0.77), non-significant goodness-of-fit test outcome ($p=0.97$), and no specification error (linktest hatsq, $p=0.38$) (*Table 3*).

Table 3: Factors associated with client-perpetrated GBV among FSWs

Factor	Experienced GBV		Unadjusted (95%CI)	OR	Adjusted OR (95%CI)
	Yes N (%)	No N (%)			
Age (completed years)					
<25	63(52.5)	57(47.5)	1.00		1.00
25-29	59(69.4)	26(30.5)	2.05(1.14-3.68)/*/		1.88(0.93-3.79)
≥30	61(64.2)	34(35.8)	1.62(0.93-2.82)		1.80(0.91-3.55)
Married/Cohabiting					
No	162(63.0)	95(37.0)	1.00		1.00
Yes	21(48.8)	22(51.2)	0.56(0.29-1.07)		0.56(0.27-1.18)
Monthly income (UGX)					
≥300,000	67(58.8)	47(41.2)	1.00		1.00
200,000-<300,000	35(63.6)	20(36.4)	1.23(0.63-2.38)		1.84(0.85-3.97)
<200,000	81(62.3)	49(38.8)	1.16(0.69-1.94)		2.26(1.18-4.30) *
Mobile sex worker					
No	75(46.6)	86(53.4)	1.00		1.00
Yes	108(77.7)	31(22.3)	3.99(2.41-6.62)/*/		3.21(1.83-5.63) ***
Sex work in a brothel					
No	62(47.0)	70(53.0)	1.00		---
Yes	121(72.0)	47(28.0)	2.91(1.80-4.70) /*/		---
Sex work in bars					
No	107(54.9)	88(45.1)	1.00		---
Yes	76(72.4)	29(27.6)	2.16(1.29-3.60)/*/		---
Sex work on streets					
No	139(54.9)	114(45.1)	1.00		1.00
Yes	44(93.6)	03(6.4)	12.0(3.64-39.8)/*/		9.66(2.78-33.5) ***
Sexwork in clubs					
No	128(55.4)	103(44.6)	1.00		---
Yes	55(79.7)	14(20.3)	3.16(1.66-6.00)/*/		---
Use any illicit drug					
No	121(56.0)	95(44.0)	1.00		---
Yes	62(73.8)	22(26.2)	2.21(1.27-3.86)/*/		---
Consume alcohol					
Never	43(54.4)	36(45.6)	1.00		---
Occasional	37(71.1)	15(28.9)	2.07(0.98-4.35)/*/		---
Daily	102(61.1)	65(38.9)	1.31(0.76-2.26)		---
HIV status					
Negative	96(55.5)	77(44.5)	1.00		1.00
Positive	86(68.2)	40(31.8)	1.72(1.07-2.79)/*/		1.90(1.09-3.31) *

*/ Significant at P<0.20 and entered into the multivariate model.
*p<0.05, ***p<0.001

Discussion

Our findings revealed a high prevalence of client-perpetrated GBV among FSWs and that the majority of FSWs reported emotional and economic violence. Further analysis indicated that the odds of client-perpetrated gender-based violence increased among FSWs who were street-based, mobile, HIV-positive, and had a low monthly income.

There is a high prevalence (61%) of client-perpetrated GBV among FSWs in Gulu. The most common forms of GBV were emotional and economic violence. The finding is far beyond the previous magnitude of client-perpetrated GBV (50%) among FSWs in the district (29) and is not surprising as we measured client-perpetrated GBV for the entire period of sex work while the previous study considered only the preceding six months. The current magnitude of client-perpetrated GBV is lower than that (82%) among FSWs in Kampala city, Uganda's Capital (28). In our study, FSWs had alternative income sources, unlike in the previous study where almost all the FSWs (95% versus 63.9%) depended on sex work as their only income source. Results from this study revealed a high magnitude of client-perpetrated GBV among FSWs in the post-conflict Gulu and calls for urgent public health interventions, especially in the light of the close relationship between GBV and HIV infection (30). The situation is not helped by the illegality of sex work within the country which itself perpetuates a culture of violence among FSWs and further affects their ability to seek medical support, form support networks, and report client-perpetrated GBV to authorities. Authorities and facilities ought to be equipped and supported to deal with such situations and FSWs are empowered to seek required GBV-related services.

Findings indicated that street-based FSWs were almost ten times more likely to experience client-perpetrated GBV compared to the non-street-based FSWs. The available studies agree that FSWs who work in riskier settings like streets have increased odds of experiencing client-perpetrated violence (31–33). Urgent measures are needed to protect the street-based FSWs against client-perpetrated GBV. These measures could take the form of; provision of information and safety tips, creating awareness about the legal and civil rights of FSWs, training the street-based FSWs in self-defense, organizing the FSWs into self-defense groups, providing defensive items like alarms and deterrent sprays, or developing warning systems use by FSWs to inform their colleagues of potentially violent clients (34). There is also a need to extend GBV services to FSWs to ease their access to care where needed. Moreover, it is high time that safer places are created for FSWs, and the NGOs or civil society could play a role in advocating for these or supporting the creation of such spaces. More participatory research is also required with FSWs to find out how streets can be made safer for them.

Secondly, FSWs who practiced mobile sex work have increased odds of experiencing client-perpetrated GBV. The literature on the relationship between sex work-related mobility and exposure to client-perpetrated GBV is scarce. However, our finding is consistent with previous studies reporting that mobile FSWs were at increased odds of client-perpetrated GBV in India, Tanzania, and Canada (8,9,35). This is because mobile FSWs tend to have less control over their work environment yet male clients of FSWs tend to refuse to use condoms with the new FSWs (35). This category of FSWs also requires special attention especially in the fight against HIV and should be targeted with appropriate interventions.

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3 Thirdly, our findings showed that FSWs living with HIV were at increased odds of reporting
4 client-perpetrated GBV. This is in agreement with previous studies showing that living with
5 HIV in the general population (36) as well as among the FSWs (7,37) increased a woman's
6 odds of experiencing GBV. The relationship between HIV and client-perpetrated GBV could
7 be mediated through accidental exposure of HIV status to clients, HIV stigma, and depression.
8 However, it's worth noting that the relationship between GBV and HIV is bidirectional
9 because studies have indicated that people who experienced GBV were more likely to get HIV
10 infection (38–40). This is because FSWs affected by GBV are less likely to use condoms
11 consistently (14,15) hence putting the FSWs at greater risk of acquiring HIV infections from
12 their male clients as well as transmitting the HIV to their intimate partners, children, and
13 clients. Policymakers and healthcare programmers need to integrate GBV interventions
14 within existing HIV programs to provide the required support to FSWs and reduce the rate of
15 new HIV infections driven by high prevalence (33%) among the FSWs (41).
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21 Lastly, client-perpetrated GBV did not show any significant relationship with income at the
22 bivariate level. However, at the multivariate level, client-perpetrated GBV showed a strong
23 positive association with low monthly income. Specifically, FSWs earning below the median
24 monthly income of FSWs in the district were almost three times more likely to report client-
25 perpetrated GBV compared to the relatively higher-income earners. Only a few studies
26 examined the relationship between client-perpetrated GBV and FSWs' monthly income. In
27 Tanzania, the income level did not significantly affect the occurrence of client-perpetrated
28 GBV (9). However, in Northern Ethiopia FSWs with low earning were more likely to suffer from
29 client-perpetrated GBV (42). FSWs with low earnings may engage in riskier behaviors, are less
30 likely to negotiate for safer sex with their clients, and may operate in risky places. This
31 underscores the need for economic empowerment among FSWs to provide them alternative
32 income sources or improve their welfare. Lastly, client-perpetrated GBV among FSWs is multi-
33 dimensional, thus GBV prevention interventions in this population should be targeted
34 especially among low earning FSWs, mobile FSWs, and street-based FSWs.
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39 **Strengths and limitations of the study**

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41 Our study had several strengths: unlike most previous studies among the FSWs that used the
42 non-probability methods of participant selection, we utilized a simple random sampling
43 technique to select our sample. Thus, study participants were representative of the FSWs in
44 the area, and the study findings more generalizable for similar settings. The study limitations
45 were: the information collected may have been negatively influenced by recall bias since we
46 asked FSWs about their personal experience of client-perpetrated GBV since joining sex work.
47 Besides, we implored some sensitive information relating to sex work that might have been
48 difficult to answer and thus underreported. However, we interviewed FSWs in such a way that
49 we reduce any chance of information bias.
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53 **Conclusion**

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55 Our findings revealed a high magnitude of client-perpetrated GBV among FSWs in Gulu
56 district, Northern Uganda. Further results indicated that FSWs who were street-based,
57 mobile, HIV-positive, and low-income earners had increase odds of client-perpetrated GBV
58 and should be targeted by public health interventions to prevent and better deal with the
59 consequences of client-perpetrated GBV among this group.
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List of abbreviation

AIDS: Acquired Immunodeficiency Syndrome, ART: Antiretroviral Therapy, aOR: Adjusted Odd Ratios, CI: Confidence Interval, FSWs: Female Sex Workers, GBV: Gender-Based Violence, HIV: Human Immunodeficiency Virus, TASO: The AIDS Support Organization, UGX: Ugandan Shillings, uOR: Unadjusted Odd Ratios.

Ethics approval and consent to participate

We obtained ethical clearance for this study from the Makerere University School of Public Health Higher Degrees, Research, and Ethics Committee. Each participant provided written informed consent. We maintained participants' privacy and confidentiality throughout the different processes of participant's enrollment into the study and data collection and analysis.

Consent for publication

Not applicable

Data sharing statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request to oumasimple@gmail.com.

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Competing interests

The authors declare that they have no competing interests.

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Contributorship

SO conceived and designed the study, collected and entered data, conducted data analysis, interpreted the findings, and wrote the first draft of the manuscript. RN, AC, and NMT conceived the study, supported data analysis, interpretation of results, and critically reviewed the draft manuscript. All authors approved the final manuscript for publication.

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	5
		(b) Describe any methods used to examine subgroups and interactions	5
		(c) Explain how missing data were addressed	4
		(d) If applicable, describe analytical methods taking account of sampling strategy	5
		(e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8

		(b) Report category boundaries when continuous variables were categorized	6-8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Client-perpetrated gender-based violence among female sex workers in conflict-affected Northern Uganda: A cross-sectional study

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3 **Client-perpetrated gender-based violence among female sex workers in conflict-affected**
4 **Northern Uganda: A cross-sectional study**
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Abstract

Study objective: To determine the prevalence and associated factors of client-perpetrated gender-based violence among female sex workers in conflict-affected Northern Uganda.

Design and settings: We conducted a cross-sectional study among female sex workers in conflict-affected Gulu district in Northern Uganda.

Participants: The study participants included 300 female sex workers aged 18+ years. The participants were selected using simple random sampling from a database of female sex workers maintained at a national non-governmental organization in Gulu.

Outcome measure: The outcome measure was self-reported exposure to client-perpetrated gender-based violence.

Methods: We utilized a pre-tested semi-structured questionnaire to collect data on socio-demographic characteristics, sex-work-related characteristics, alcohol use, illicit drug use, HIV status, and self-reported exposure to client-perpetrated gender-based violence. Then, data was entered into EPI INFO 7 and analyzed using STATA 14.0.

Results: Among participants, 61.0% reported client-perpetrated gender-based violence. Economic (58.7%) and emotional (52.0%) violence were the most common forms of client-perpetrated gender-based violence in this population. Independently, being: street-based (adjusted OR=9.66, 95%CI: 2.78-33.5), mobile (adjusted OR=3.21, 95%CI: 1.83-5.64), HIV-positive (adjusted OR=1.90, 95%CI: 1.09-3.31), and low-income earner {<200,000 UGX monthly} (adjusted OR= 2.26, 95% CI: 1.18-4.30) were positively associated with exposure to client-perpetrated gender-based violence.

Conclusions: There is a high prevalence of client-perpetrated gender-based violence among female sex workers in conflict-affected Northern Uganda. Furthermore, female sex workers who were street-based, mobile, HIV-positive, and low-income earners were more likely to experience client-perpetrated gender-based violence. The ministry of health and the development partners need to provide targeted public health interventions to prevent and manage the rampant gender-based violence among this underserved population.

Strengths and limitations of this study

- This work is among the first studies on client-perpetrated gender-based violence among female sex workers in conflict-affected settings.
- Likewise, the study samples were representative and generalizable since they were selected using a probability sampling technique.
- However, we asked female sex workers about their past exposures to client-perpetrated gender-based violence and could have resulted in recall or information biases.

Introduction

Gender-based violence (GBV) refers to harmful acts directed at individuals based on their gender (1). Examples of GBV include sexual, physical, mental, and economic harm inflicted in public or private and the threats of violence, coercion, and manipulation (1). GBV is a violation of human rights that can be life-threatening (1) and thus need close attention, especially among vulnerable populations like female sex workers (FSWs). Although hostility from the more than 20 years of the Lord's Resistant Army (LRA) war in Northern Uganda has ceased, the region has not achieved complete reconciliation, societal integration, and economic recovery (2). In addition, the LRA conflict has led to increased vulnerability to HIV infection (3), gender-based violence (4), and depression (5) in Northern Uganda.

GBV is rooted in gender inequality, abuse of power, and harmful norms that leave survivors unable to achieve legal, social, political, and economic equality in society (6). Vulnerable groups like FSWs are at increased risk of exposure to GBV (7) because of the rampant alcohol use and illicit drug use among FSWs (8), which increases their odds of GBV (9). In addition, there is a high level of intimate partner violence among FSWs in Northern Uganda, which in turn may lead to client-perpetrated GBV (10). Furthermore, FSWs in Gulu are highly mobile (8) and thus at a greater risk of client-perpetrated GBV (11,12). Then, the illegality of sex work in Uganda (13) makes it difficult for FSWs to prevent or seek management for GBV through social support networks, access to social services, or access to legal or GBV services (14,15).

If left untreated, GBV can lead to poverty, alcohol abuse, inconsistent condom use (16,17), reduction in condom self-efficacy (18), poor sexual and reproductive health (19), and mental disorders (20–23). Thus, there is an urgent need to screen, prevent, and manage GBV among FSWs in conflict-affected Northern Uganda. This requires an in-depth understanding of the epidemiology of GBV among FSWs to guide the development of context-specific GBV interventions by the ministry of health and development partners. Therefore, we conducted this study to determine the prevalence and associated factors of client-perpetrated gender-based violence among female sex workers in conflict-affected Northern Uganda.

Methods

Study setting, design, and population

We conducted a cross-sectional study among FSWs operating in Gulu district in Northern Uganda. In Uganda, FSWs have the highest burden of HIV infections in this population (24). Northern Uganda remains negatively impacted by the LRA conflict since many people have not fully recovered from the more than 20 years of war that devastated social and economic livelihoods. Currently, more than 80% of the inhabitants of Gulu practice subsistence farming (25). Of estimated 1425 FSWs who operate in the district (26), the majority live and work in Gulu municipality. Almost all FSWs in the region get HIV treatment, care, or prevention services from The AIDS Support Organization (TASO). TASO is a national Non-Governmental Organization (NGO) (27) highly specialized in HIV services provision in Uganda. In Gulu, TASO Gulu clinic had mapped all (1300+) FSWs who operate in the district. The updated FSWs' database contains sex work venues, hang-out places, mobile phone contacts, and residence. This study was limited to only the FSWs who were operating in Gulu and aged 18+ years. We excluded FSWs who were less than 18 years of age due to the ethical dilemma of obtaining parental consent among adolescent FSWs who do sex work without parental knowledge yet live with their parents or guardians.

Sample size and sampling

A sample size of 380 participants was determined using Cochran [1963,1975] (28) formula as part of a project that studied depression among FSWs in Gulu and presented elsewhere (8). We identified 789 eligible FSWs from the database then used a simple random sampling to select 380 potential participants using an online random number generator. To minimize non-response bias, we reached out to FSWs by telephone or their peers to schedule appointments, physically traced them using existing mapping information or met them during their clinic days. We successfully tracked and contacted 302 out of 380 selected FSWs, of whom 300 were consented and interviewed within the conducive places of their choice.

Data collection

We collected data between March and June 2020. Using a pre-tested semi-structured questionnaire developed in English and translated into Acholi language (*Luo*), we conducted face-to-face interviews to collect information from each study participant. Before data collection, we pre-tested the study tools among 20 FSWs in the neighbouring Amuru district to check for consistency in question interpretation and language appropriateness. The first author and a trained female research assistant collected data in either Acholi or English depending on the participant's literacy level and language preference. Independent variables included socio-demographic characteristics (like age, education, religion, and marital status), sex work-related characteristics (like duration of sex work, average monthly income, place of sex work, and mobility), alcohol and illicit drug use, and HIV status. We determined intra-regional sex work-related mobility by asking study participants about localities where they provided sexual services. We considered FSWs operating both in rural and urban localities to be mobile since they move long distances to do sex work. The only dependent variable was client-perpetrated GBV. The outcome variable for this study was client-perpetrated GBV. We adopted the study questionnaire for assessing client-perpetrated GBV from previous research conducted among FSWs in Kampala, Uganda (29). We asked each participant whether her client(s) ever: refused to compensate her for sexual services (economic violence), verbally abused (insulted) her (emotional violence), physically abused/beat her (physical violence), or forced her to have sex/raped her (sexual violence). Reporting either economic, emotional, physical, or sexual violence by male clients was considered client-perpetrated GBV.

Data management and statistical analysis

Data were entered and cleaned in EPI INFO 7 then exported to STATA 14.0 for analysis. Univariate results were described using either frequency with corresponding proportions or mean with corresponding standard deviations as appropriate. We ran bivariable logistic regression analyses to examine the relationships between client-perpetrated GBV and various independent factors. We reported bivariable results using unadjusted odds ratios (uOR) with corresponding confidence intervals (CI) and p-values. Then, we considered all independent variables with $p < 0.20$ for inclusion in multivariable logistic regression (30). Controlling for age, marital status, and monthly income, we entered all eligible independent variables into a multivariable logistic regression model at the beginning stage of model building. We utilized the backward elimination method and sequentially removed each factor with the least significant p-value while testing model fit using the goodness-of-fit test until we obtained the best fit model. We described results from the multivariable logistic regression model using adjusted odds ratios (aOR) with corresponding 95% CIs and p-values. After fitting the

multivariable logistic regression model, we conducted sensitivity and specificity analyses to estimate the model's predictive power and linktest to check for specification error.

Participant and public involvement

We involved study participants and the public in the dissemination of study findings. We shared study findings with relevant local authorities in Gulu and NGOs that provide healthcare services to FSWs in the region. The complex nature of sex work made it difficult to actively involve participants or the public in study design, study conduct, or reporting plans. However, the first author has been working among FSWs for more than three years. This personal experience and interactions with FSWs informed study design and conduct. Additionally, peers of FSWs were involved in the identification and tracking of participants.

Results

Socio-demographic and sex work-related characteristics of study participants

We randomly sampled 380 eligible FSWs for this study. However, we successfully traced only 302 (79.5%) participants and contacted them to participate, of whom 300 were consented and enrolled with a response rate of 99.3%. The participants' mean age was 26.4 years (SD \pm 6, Range = 18-50 years), of whom 40% were below 25 years old. Additionally, 62.0% of the participants had no or primary education, 51.3% migrated to Gulu, only 14.3% were married/cohabiting, and 60.7% were Catholics. Among the study participants, 39.7% had been FSWs for 3-5 years, 63.9% earn money mainly through sex work, and 43.5% had low monthly income/earned below the median monthly income of FSWs (200,000 UGX [60\$]) (*Table 1*).

Table 1: Socio-demographic and sex work-related characteristics of study participants

Characteristic	Number (N=300)	Percent (%)
Age (completed years)		
<25	120	40.0
25-29	85	28.3
30+	95	31.7
Education		
\leq Primary level	186	62.0
\geq Secondary level	114	38.0
District of Origin		
Gulu	146	48.7
Others	154	51.3
Married/Cohabiting*		
No	257	85.7
Yes	43	14.3
Religion		
None/others	36	12.0
Catholic	182	60.7
Protestant	48	16.0
Born Again	34	11.3

Years of sex work		
≤ 2	108	36.0
3-5	119	39.7
>5	73	24.3
Sex work is the only income source		
No	108	36.1
Yes	191	63.9
Monthly income (UGX)*		
≥300,000	114	38.1
200,000-<300,000	55	18.4
<200,000	130	43.5
Practice mobile sex work		
No	161	53.7
Yes	139	46.3
Use illicit drug		
No	216	72.0
Yes	84	28.0
Took alcohol during interview Week*		
No	107	36.3
Yes	188	63.7
Frequency of alcohol consumption		
Never	79	26.5
Sometimes	52	17.5
Daily	167	56.0
Reported HIV status*		
Negative	173	57.9
Positive	126	42.1

* Missing data: marital status (2), alcohol consumption (2), income (1), and HIV status (1).

Prevalence of client-perpetrated GBV among FSWs in Gulu district

During sex work, 61.0% of the participants experienced at least one incidence of client-perpetrated GBV. The most common forms of GBV were economic (58.7%) and emotional (52.0%) violence, while the least common form of GBV was sexual violence (21.0%). Further analysis showed that 32.7% of the participants reported a history of exposure to two or three different types of client-perpetrated GBV. Lastly, about one-fifth (19.0%) of the study participants reported experiencing all four forms of client-perpetrated GBV (*Table 2*).

Table 2: Prevalence and forms of client-perpetrated GBV among study participants

Characteristics	Number (N =300)	Percent (%)
Experienced client-perpetrated GBV		
No	117	39.0
Yes	183	61.0
Client-perpetrated GBV experienced		
Economic violence	176	58.7
Emotional violence	156	52.0

Physically violence	145	48.3
Sexual violence	63	21.0
Two or three forms of violence	98	32.7
All forms of violence	57	19.0

Predictors of client-perpetrated GBV among FSWs

At bivariate level, participants who experienced client-perpetrated GBV were more likely to be based in the street (uOR=12.0, 95% CI: 3.64-39.8, $p<0.001$), the club (uOR= 3.16, 95% CI: 1.66-6.00, $p<0.001$), brothel (uOR=2.91, 95% CI: 1.80-4.70, $p<0.001$), bar (uOR: 2.16, 95% CI: 1.29-3.60, $p=0.003$), or mobile (uOR=3.99, 95% CI: 2.41-6.62, $p<0.001$). In addition, illicit drug use (uOR= 2.21, 95% CI: 1.27-3.86, $p=0.005$), age (uOR=2.05, 95% CI: 1.14-3.68, $p=0.016$), and living with HIV (uOR: 1.72, 95% CI: 1.07-2.79, $p=0.026$) were all positively associated with client-perpetrated GBV. After controlling for age, marital status, and monthly income, multivariable logistic regression results showed that: street-based sex work (aOR=9.66, 95%CI: 2.78-33.5), mobility (aOR=3.21, 95%CI: 1.83-5.64), living with HIV (aOR=1.90, 95%CI: 1.09-3.31), and low monthly income (aOR= 2.26, 95% CI: 1.18-4.30) all remained positively associated with client-perpetrated GBV. Regression diagnostic tests showed that the adjusted model had; good predictive power (0.77), non-significant goodness-of-fit test outcome ($p=0.97$), and no specification error (linktest hatsq, $p=0.38$) (Table 3).

Table 3: Factors associated with client-perpetrated GBV among FSWs

Factor	Experienced GBV		Unadjusted OR (95%CI)	Adjusted OR (95%CI)
	Yes N (%)	No N (%)		
Age (completed years)				
<25	63(52.5)	57(47.5)	1.00	1.00
25-29	59(69.4)	26(30.5)	2.05(1.14-3.68)*/	1.88(0.93-3.79)
≥30	61(64.2)	34(35.8)	1.62(0.93-2.82)	1.80(0.91-3.55)
Married/Cohabiting				
No	162(63.0)	95(37.0)	1.00	1.00
Yes	21(48.8)	22(51.2)	0.56(0.29-1.07)	0.56(0.27-1.18)
Monthly income (UGX)				
≥300,000	67(58.8)	47(41.2)	1.00	1.00
200,000-<300,000	35(63.6)	20(36.4)	1.23(0.63-2.38)	1.84(0.85-3.97)
<200,000	81(62.3)	49(38.8)	1.16(0.69-1.94)	2.26(1.18-4.30) *
Mobile sex worker				
No	75(46.6)	86(53.4)	1.00	1.00
Yes	108(77.7)	31(22.3)	3.99(2.41-6.62)*/	3.21(1.83-5.63) ***
Sex work in a brothel				
No	62(47.0)	70(53.0)	1.00	---
Yes	121(72.0)	47(28.0)	2.91(1.80-4.70) */	---
Sex work in bars				
No	107(54.9)	88(45.1)	1.00	---
Yes	76(72.4)	29(27.6)	2.16(1.29-3.60)*/	---
Sex work on streets				
No	139(54.9)	114(45.1)	1.00	1.00
Yes	44(93.6)	03(6.4)	12.0(3.64-39.8)*/	9.66(2.78-33.5) ***
Sexwork in clubs				

No	128(55.4)	103(44.6)	1.00	---
Yes	55(79.7)	14(20.3)	3.16(1.66-6.00)/*/	---
Use illicit drug				
No	121(56.0)	95(44.0)	1.00	---
Yes	62(73.8)	22(26.2)	2.21(1.27-3.86)/*/	---
Consume alcohol				
Never	43(54.4)	36(45.6)	1.00	---
Sometimes	37(71.1)	15(28.9)	2.07(0.98-4.35)/*/	---
Daily	102(61.1)	65(38.9)	1.31(0.76-2.26)	---
HIV status				
Negative	96(55.5)	77(44.5)	1.00	1.00
Positive	86(68.2)	40(31.8)	1.72(1.07-2.79)/*/	1.90(1.09-3.31) *

*/ Significant at $P < 0.20$ and entered into the multivariable model.

* $p < 0.05$, *** $p < 0.001$

Discussion

There is a high prevalence of client-perpetrated GBV (61.0%) among FSWs in Gulu. It is worth noting that there is a gap in the literature on client-perpetrated GBV among FSWs in conflict-affected settings. Moreover, the current magnitude of client-perpetrated GBV among FSWs in Gulu is much lower than in Kampala (82%) (29). This could be because, in our study, a much smaller proportion of FSWs solely depended on sex work for income (63.9%) than in Kampala (95%). In light of a close relationship between HIV infection and GBV (31), the ministry of health and health care managers need to develop a robust GBV intervention to address the GBV situation among FSWs in Uganda. There is also a need to navigate the legal challenge of criminalizing sex work in the country (13). Otherwise, the illegality of sex work will continue to perpetuate violence against FSWs and affect their ability to seek medical support, form support networks, or legal action against the perpetrators. Likewise, the ministry of health and health managers should equip and support FSWs to deal with GBV.

Several factors increase the odds of client-perpetrated GBV among FSWs. Importantly, street-based FSWs were ten times more likely to experience client-perpetrated GBV than FSWs who conduct sex work elsewhere. Available studies are in agreement with current findings (32–34). Therefore, targeted measures are urgently needed to protect FSWs who operate on the street. These measures could include: provision of information and safety tips, creating awareness about legal and civil rights of FSWs, training street-based FSWs in self-defense, forming self-defense groups, providing defensive items like alarms and deterrent sprays, or developing warning systems for FSWs to inform their peers of potentially violent clients (35). It is high time NGOs and civil society organizations advocate for safe places for FSWs. There is also a need for more participatory research on how to make streets safer for FSWs. In addition, mobile FSWs were three times more likely to report client-perpetrated GBV than their non-mobile counterparts. This agrees with available reports among FSWs in India, Tanzania, and Canada (11,12,36). Mobile FSWs have less control over their work environment, yet male clients often refuse to use condoms with new FSWs (36). Therefore, mobile FSWs require special attention, especially in the fight against HIV. Likewise, HIV-positive FSWs had an increased odd of experiencing client-perpetrated GBV. This finding agrees with previous studies among people living with HIV (37) and FSWs (7,38). Research has shown that this is a bidirectional relationship (39,40). Besides, FSWs who suffer from GBV are at greater risk of HIV transmission due to inconsistent condom use (16,17). Thus, the ministry of health and healthcare managers need to integrate GBV interventions within the existing HIV programs to

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3 reduce HIV infections driven by the high prevalence of HIV (33%) among FSWs (41). Lastly,
4 FSWs with low income were twice more likely to experience client-perpetrated GBV. Only a
5 few studies examined the relationship between client-perpetrated GBV and income. In
6 Tanzania, income level did not affect client-perpetrated GBV (12). However, the current
7 finding agrees with a study among FSWs in Ethiopia (42). Low-income earning FSWs may
8 engage in riskier sexual behaviors, have poor negotiation for safer sex with clients, or operate
9 in unsafe places like the street. Thus, there is a need for economic empowerment to provide
10 FSWs with alternative sources of income or improve their welfare.
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13 **Strengths and limitations of the study**

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15 Unlike most previous studies among FSWs that used non-probability sampling methods, we
16 utilized a simple random sampling technique to select our sample. Study participants were
17 representative of FSWs in the area and more generalizable for FSWs in similar settings. This
18 study had some limitations: data collected may have been negatively influenced by recall bias
19 since we asked FSWs about their personal experience of client-perpetrated GBV. Besides, we
20 implored some sensitive information relating to sex work that might have been difficult to
21 answer and thus underreported. However, we interviewed FSWs in such a way that we reduce
22 any chance of information bias.
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25 **Conclusion**

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27 There is a high prevalence of client-perpetrated GBV among FSWs in conflict-affected
28 Northern Uganda. Further analysis indicated that street-based, mobile, low-income earning,
29 and HIV-positive FSWs were more likely to experience client-perpetrated GBV. Therefore, the
30 ministry of health and the development partners need to provide targeted public health
31 interventions that prevent and manage GBV among this underserved population.
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34 **List of abbreviation**

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37 AIDS: Acquired Immunodeficiency Syndrome, ART: Antiretroviral Therapy, aOR: Adjusted
38 Odd Ratios, CI: Confidence Interval, FSWs: Female Sex Workers, GBV: Gender-Based
39 Violence, HIV: Human Immunodeficiency Virus, TASO: The AIDS Support Organization,
40 UGX: Ugandan Shillings, uOR: Unadjusted Odd Ratios.
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43 **Ethics approval and consent to participate**

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45 We obtained ethical clearance for this study from Makerere University School of Public Health
46 Higher Degrees, Research, and Ethics Committee (No: 2017/HD07/2063U). Each participant
47 provided written informed consent. We maintained participants' privacy and confidentiality
48 throughout the different processes of participant enrollment, data collection, analysis, and
49 reporting.
50

51 **Consent for publication**

52
53 Not applicable
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56 **Data sharing statement**

57 The datasets used and analyzed during the current study are available from the corresponding
58 author on reasonable request to oumasimple@gmail.com.
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Competing interests

The authors declare that they have no competing interests.

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Contributorship

SO conceived and designed the study, collected and entered data, conducted data analysis, interpreted the findings, and wrote the first draft of the manuscript. RN, AC, and NMT conceived the study, supported data analysis, and critically reviewed the draft manuscript. All authors approved the final manuscript for publication.

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	4
		(b) Describe any methods used to examine subgroups and interactions	4
		(c) Explain how missing data were addressed	4
		(d) If applicable, describe analytical methods taking account of sampling strategy	4
		(e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5
		(b) Indicate number of participants with missing data for each variable of interest	6
Outcome data	15*	Report numbers of outcome events or summary measures	6-7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8

		(b) Report category boundaries when continuous variables were categorized	6-8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-9
Generalisability	21	Discuss the generalisability (external validity) of the study results	9
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.