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Patterns of Gender-Based Violence and Associations with Mental Health and HIV Risk Behavior among Female Sex Workers in Mombasa, Kenya: A Latent Class Analysis

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Abstract

Gender-based violence (GBV) is common among female sex workers (FSWs) and is associated with multiple HIV risk factors, including poor mental health, high-risk sexual behavior, and sexually transmitted infections (STIs). Prior studies have focused on GBV of one type (e.g. physical or sexual) or from one kind of perpetrator (e.g., clients or regular partners), but many FSWs experience overlapping types of violence from multiple perpetrators, with varying frequency and severity. We examined the association between lifetime patterns of GBV and HIV risk factors in 283 FSWs in Mombasa, Kenya. Patterns of GBV were identified with latent class analysis based on physical, sexual, or emotional violence from multiple perpetrators. Cross-sectional outcomes included depressive symptoms, post-traumatic stress disorder (PTSD) symptoms, disordered alcohol and other drug use, number of sex partners, self-reported unprotected sex, prostate-specific antigen (PSA) in vaginal secretions, and a combined unprotected sex indicator based on self-report or PSA detection. We also measured HIV/STI incidence over 12 months following GBV assessment. Associations between GBV patterns and each outcome were modeled separately using linear regression for mental health outcomes and Poisson regression for sexual risk outcomes. Lifetime prevalence of GBV was 87%. We identified 4 GBV patterns,

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Compliance with Ethical Standards:

Conflict of Interest: Sarah Roberts declares that she has no conflict of interest. Brian Flaherty declares that he has no conflict of interest. Ruth Deya declares that she has no conflict of interest. Linnet Masese declares that she has no conflict of interest. Jacqueline Ngina declares that she has no conflict of interest. R. Scott McClelland declares that he has no conflict of interest. Susan Graham declares that she has no conflict of interest.

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labeled *Low* (21% prevalence), *Sexual* (23%), *Physical/Moderate Emotional* (18%), and *Severe* (39%). Compared to women with *Low GBV*, those with *Severe GBV* had higher scores for depressive symptoms, PTSD symptoms, and disordered alcohol use, and had more sex partners. Women with *Sexual GBV* had higher scores for disordered alcohol use than women with *Low GBV*, but similar sexual risk behavior. Women with *Physical/Moderate Emotional GBV* had more sex partners and a higher prevalence of unprotected sex than women with *Low GBV*, but no differences in mental health. HIV/STI incidence did not differ significantly by GBV pattern. The prevalence of GBV was extremely high in this sample of Kenyan FSWs, and different GBV patterns were associated with distinct mental health and sexual risk outcomes. Increased understanding of how health consequences vary by GBV type and severity could lead to more effective programs to reduce HIV risk in this vulnerable population.

Keywords

Gender-based violence; Female sex workers; Sexual risk behavior; Mental health; Latent class analysis

Introduction

Since the beginning of the HIV epidemic, female sex workers (FSWs) have faced a disproportionate burden of disease, with odds of HIV infection over 13 times higher than in the general population (1). Increased vulnerability to HIV among FSWs is due to a constellation of behavioral and structural factors, including multiple partnerships, inconsistent condom use, high levels of stigma and discrimination, gendered power dynamics, criminalization of sex work and lack of legal protections, and reduced access to health services (2).

The HIV epidemic also overlaps with an epidemic of gender-based violence (GBV) among FSWs, driven by many of the same structural factors (3–10). Longitudinal studies in the general population have linked GBV to incident HIV and other sexually transmitted infections (STIs) (11–13). Though studies among FSWs are predominantly cross-sectional, the majority show similar associations of GBV with prevalent STIs or STI symptoms (3,7,10,14–17). As well as sharing root causes such as gendered power dynamics, violence may directly increase HIV/STI risk through biologic pathways such as genitoanal injury and inflammation; behavioral mechanisms such as unprotected vaginal sex, anal sex, and increased numbers of sex partners; psychological sequelae including depression, PTSD, and substance abuse; and partner characteristics, including an increased prevalence of HIV and STIs among perpetrators (11,18–20). A recent modeling study estimated that an intervention that reduced physical and sexual GBV to near-zero levels among FSWs in Kenya could avert approximately 20,000 HIV infections among FSWs and an additional 45,000–53,000 HIV infections in the general adult population in a 5-year period (21). This substantial impact highlights the need for programming to reduce GBV and related HIV/STI risk in this population.

Existing studies of GBV in FSWs have used inconsistent and limited definitions of violence. Literature from the general population shows that physical, sexual, and emotional GBV each

increase HIV risk, and that there is a dose-response effect based on GBV severity and frequency (12,22,23). Effects of violence on HIV risk may also vary by perpetrator type, including clients, police, pimps, or regular partners such as husbands or long-term boyfriends (6,24,25). Yet most assessments among FSWs address only a subset of violent experiences, such as lifetime history of forced sex, any physical or sexual violence due to sex work in the past week, or client-perpetrated violence in the past 6 months (3,16,26). In particular, few studies address emotional violence or violence from regular partners (5,17,25,27). When studies use limited definitions, women experiencing other forms of GBV are characterized as “unexposed”, which can lead to attenuation of the true effect of violence on HIV risk (28,29). Furthermore, most studies dichotomize violence exposure into any versus none, ignoring gradients of severity and frequency. Although there are advantages to understanding the effects of specific GBV types or perpetrators (30,31), most women experience multiple, overlapping types of violence (12,32–34), which may have a cumulative effect on HIV risk. Narrow definitions of GBV fail to capture the entirety of women’s experiences and may underestimate the prevalence and consequences of violence.

An alternative approach is to use person-centered methods to describe patterns of GBV that women sustain from multiple partners throughout the life course (30). Studies in North America have used latent class models to identify subgroups of women experiencing similar GBV patterns, and have shown that specific patterns predict different mental health (35,36) and sexual behavior outcomes (37). However, GBV patterns have not been studied in FSWs. Characterizing women’s overall experiences will contribute to a better understanding of the cumulative impact of GBV on risk of HIV infection. In addition, if specific patterns are associated with distinct HIV risk factors, or a greater degree of overall risk for HIV, it may be possible to tailor interventions for women with different GBV experiences, to maximize effectiveness (38). The current study had two objectives: to characterize patterns of GBV among FSWs in Mombasa, Kenya using latent class analysis, and to determine whether the GBV patterns were associated with mental health and sexual risk behavior outcomes in multivariable models, controlling for potential confounding.

Methods

Study population and setting

The Sexual Violence Study (SV Study) was a cross-sectional study conducted from March 2014 through May 2015 among FSWs in Mombasa, Kenya. Mombasa is an economic center in coastal Kenya with a large population of FSWs; approximately 4%–6% of adult women have engaged in sex work in the past 12 months (39,40). Most sex work is based in bars and nightclubs (60–70%), followed by homes and the street (40,41). A substantial proportion of FSWs sell sex on a part-time basis to supplement their primary income (42). Sex work is criminalized by national and municipal laws, and 25%–50% of FSWs report physical or sexual violence in the past 12 months, from clients, police, strangers, or intimate partners (43,44).

Participants were enrolled from the Mombasa Cohort, a prospective cohort study of risk factors for HIV acquisition and transmission initiated in 1993. Detailed procedures have been published (45). Eligibility criteria include: age 16 and older, residing within 1-day

commuting distance to the study clinic, self-identifying as exchanging sex for payment in cash or in kind, and able to provide informed consent. To participate in the SV Study, women also had to be HIV seronegative per their last HIV rapid test, conducted monthly as part of Mombasa Cohort procedures, and could not be currently menstruating, pregnant, or <6 weeks post-partum. Separate written informed consent was obtained for the additional SV Study procedures. Trained counselors conducted standardized paper-based face-to-face interviews with participants in a private setting in their preferred language (English or Kiswahili). Women who reported violence or screened positive for depression, PTSD, or substance abuse were offered counseling on site or referral to other facilities. The study was approved by ethics committees at the University of Washington and the Kenyatta National Hospital.

Measures

Exposure—GBV was assessed using a modified version of the World Health Organization Violence Against Women Instrument (VAWI) (33), which assessed lifetime experience of 13 specific acts of physical, sexual or emotional violence from regular partners such as husbands or long-term boyfriends. We adjusted the questions to also capture violence from casual partners and clients. To improve reporting accuracy (19), we added two questions from the Sexual Experiences Survey on forced sex arising from drug use or non-violent coercion (46,47). For each specific act experienced, women were asked about timing (past 12 months, >12 months ago); frequency (one, few, many times); and relationship to the perpetrator. To assess violence from non-partners (i.e., strangers or acquaintances with whom the participant had not engaged in a consensual sexual relationship), we asked if the participant had ever been beaten, physically mistreated, or forced to have sex, by anyone other than a husband, boyfriend, or client.

Outcomes—Mental health symptoms were assessed with the following tools, which have been well-validated and used successfully in multiple studies in African populations (48–54):

- The Patient Health Questionnaire-9 (PHQ-9) for depressive symptoms (score range 0–27; 10 indicates moderate to severe depression) (55).
- The PTSD Checklist - Civilian version (PCL-C) for PTSD symptoms (score range 17–85; 30 indicates a positive screen for PTSD) (50,51,56).
- The Alcohol Use Disorders Identification Test (AUDIT) for disordered alcohol use (score range 0–40; 8 indicates a moderate to severe alcohol use problem) (57).
- The Drug Abuse Screening Test (DAST) for abuse of substances other than alcohol (score range of 0–10; 3 identifies moderate to severe drug abuse) (58,59).

Sexual risk behavior was assessed at the SV Study visit by several self-reported and biological measures:

- Self-reported number of sex partners in the past 3 months

- Any unprotected sex in the past week, defined by the self-reported total number of vaginal sex acts exceeding the self-reported number of vaginal sex acts with a condom.
- Detection of prostate-specific antigen (PSA), a biomarker for unprotected sex, in vaginal swabs using the ABACard rapid test (Abacus Diagnostics, West Hills, CA). This test can detect PSA within 24–48 hours after unprotected sex, but sensitivity is low after 24 hours (60,61).
- Any unprotected sex as indicated by either PSA or self-report. This combined measure serves to partially correct for the low sensitivity of the self-reported measure by reclassifying women with biological evidence of underreporting.

Although the SV Study was cross-sectional, we were able to measure HIV and STI incidence in the year following the SV Study visit based on tests conducted during monthly follow-up visits for the Mombasa Cohort Study, from which all participants were drawn. HIV screening was performed at every visit using the Determine HIV 1/2 rapid test (Alere International Ltd, Ireland). All positive screening tests were confirmed with Uni-gold HIV rapid test (Trinity Biotech, Ireland). Discordant rapid tests were resolved with the Vironostika HIV-1 Uni-Form II Ag/Ab ELISA (bioMérieux, Marcy l'Etoile, France). Endocervical swabs were tested quarterly for gonorrhea, chlamydia, and trichomoniasis by Aptima nucleic acid amplification tests (Hologic, San Diego, CA). STIs were treated according to Kenyan national guidelines, and no test-of-cure was performed.

Additional variables—At the SV Study visit, we collected data on primary occupation, income, household size, financial hardship, parity, years in cohort, and partnership characteristics for each of the last 5 sex partners in the 3 months. We also used data collected at enrollment into the Mombasa Cohort, including nationality, education, sex work venue (e.g. bar, nightclub, home), years engaged in sex work prior to cohort enrollment, age at first sex, and usual amount charged for sex.

Statistical Analysis

Objective 1: Characterization of patterns of GBV using latent class analysis (LCA)—We created indicator variables for the LCA model by condensing the act-specific GBV data into 4 categorical variables, derived from a previous study of GBV among women in the general population (29) (Table I). Emotional partner violence was characterized by frequency (none, few times, or many times) and as moderate (e.g. insulted, belittled, or humiliated) or severe (e.g. scared, intimidated, or threatened). Physical partner violence was characterized only as moderate (e.g. slapped, pushed, or shoved) or severe (e.g. hit, kicked, choked, or used a weapon against), because moderate physical GBV was relatively rare at any frequency, and severe physical GBV usually occurred many times. Because all sexual GBV was considered severe, the indicator for sexual partner violence described frequency only (none, 1–2 acts, few acts or many acts). The indicator for non-partner violence was limited to type (none, physical only, or sexual [with or without physical]), because we did not collect data on severity of non-partner violence, and most women (85%) reported that this type of violence had occurred once only.

We fit models with 1–5 classes and pre-specified the following criteria for selection of the best-fitting model: absolute fit (G^2 likelihood ratio statistic); relative fit, including the Akaike information criteria (AIC), Bayesian information criteria (BIC), consistent AIC (CAIC) and adjusted BIC (aBIC); entropy (a summary measure of variability in class assignment); parsimony; class size; and scientific interpretation of the classes (62). Each model was run with 1000 random starting values to ensure model identification. From a theoretical perspective, it was important to ensure that the final model included one class of women with little or no experience of GBV, to provide an appropriate reference class for our subsequent analyses (28). Therefore, we used parameter restrictions to create one class where the probability of any physical, sexual, and emotional partner violence and any non-partner sexual violence were each 5%. After selecting a final model, women were assigned to classes based on the highest posterior probability of class membership.

Objective 2: Determination of whether the GBV patterns were associated with multiple mental health and sexual risk behavior outcomes—We examined between-class differences in mental health symptom scores and indicators of sexual risk behavior using bivariable and multivariable regression models with robust standard errors, with separate models for each outcome. For each model, all other GBV patterns were compared to the reference class of women with little to no GBV.

Mental health outcomes were modeled with linear regression to estimate the difference in scores across classes for each scale (i.e., PHQ-9, PCLC, AUDIT and DAST). We used Poisson regression models to estimate each of the other parameters of interest:

- For the outcome of number of sex partners, the Poisson model estimated the relative difference in the number of sex partners in the past 3 months. This analysis excluded 6 outliers reporting 200 sex partners but included all other participants.
- For each unprotected sex outcome (self-report, PSA, and the combined measure), the Poisson model estimated the prevalence ratio for unprotected sex.
- For the HIV/STI incidence outcome, the Poisson model estimated the incidence rate ratio for any diagnosed STI (e.g., HIV, gonorrhea, chlamydia or trichomoniasis) in the year following the SV Study visit. Incidence rates were calculated based on the number of person-years from SV Study enrollment until either the 1-year follow-up date, the last test date (for participants with <1 year of follow-up), or the date of HIV seroconversion. Participants could have multiple STI outcomes, but consecutive infections of the same STI without an intermittent negative test result were considered persistent and were counted only at first detection. We also calculated incidence rates for HIV only, in the entire cohort and for each GBV pattern, using the same methods, but did not conduct hypothesis testing due to the small number of incident HIV infections.

The multivariable analyses considered potential confounding by demographic and partnership characteristics, sexual behavior, and financial hardship (63,64), selected based on causal diagrams. Variables were retained in the model if they resulted in meaningful changes (>10%) to the effect estimates. We employed the modified BCH approach to

account for uncertainty in GBV class assignment resulting from the latent class model (65–67). This procedure creates an expanded dataset with one record for each latent class for each subject and assigns a set of weights based on the classification errors. Subsequent regression analyses were conducted using survey data analysis methods with robust standard errors, to account for the BCH weights and for multiple records per subject.

Latent class analyses were conducted in Stata 14.1 using the Stata LCA Plugin (69). The BCH weights were obtained by replicating the LCA in MPlus 7.4 (70), and then exported into Stata to conduct the weighted regression analyses.

Results

Participant Characteristics

The study enrolled 283 women with median age of 33.5 years (interquartile range [IQR] 27.2–40.6) and a median of 8 years of education (IQR 7–12) (Table 1). Nearly all (93%) had worked as an FSW in the past 2 months, but only 31% considered sex work their primary occupation. Participants experienced substantial financial insecurity: 69% had run out of money for basic needs in the past year and 80% reported that their financial future was uncertain or very uncertain.

GBV Prevalence

Lifetime prevalence of physical, sexual, or emotional GBV from partners was 87%, and past-year prevalence was 40%. Fifty-nine percent (59%) reported lifetime GBV from regular partners, 25% from clients, and 19% from casual partners. Table I describes lifetime GBV prevalence grouped by the latent class indicator variables of physical, sexual, and emotional partner violence and non-partner violence. Lifetime prevalence was 63% for physical partner violence, 44% for sexual partner violence, and 60% for emotional partner violence. Additionally, 56% of women reported any lifetime experience of non-partner violence: 30% with physical non-partner violence only, and 26% with non-partner sexual violence.

Patterns of GBV

Fit statistics for each latent class model are shown in Table II. The 4-class model was selected based on 1) clear, interpretable classes; 2) minimum AIC; 3) relatively small BIC, CAIC, and aBIC; and 4) adequate identification. The first class, labeled *Low GBV*, included women with little to no GBV and comprised 21% of the population (Table III). By design (due to parameter restrictions), women in this class had a 5% probability of any partner violence, and a 5% probability of non-partner sexual violence. The other 3 classes arose from natural clustering around the pre-specified *Low GBV* class. The second class included 23% of the population and was labeled *Sexual GBV*. Women in this class had a 59% probability of sexual partner violence and a 49% probability of non-partner sexual violence, substantially higher than in the overall cohort. The third class, labeled *Physical/Moderate Emotional GBV*, comprised 18% of the population. The probability of physical violence in this class was 85%, evenly split between moderate and severe. There was a 62% probability of moderate emotional violence few or many times, but no severe emotional violence. The last class was characterized by severe violence of all types, and was labeled *Severe GBV*.

This was the largest class, at 39% of the population. The probability of severe physical and emotional partner violence was 80%–90%, and the probability of sexual violence was >50% from partners and 35% from non-partners. The classes were similar on most measures of socio-demographic characteristics, sex work history, and financial security (Table S1 in Supplementary Materials). Only income was significantly associated with class membership: 29% of women in the *Sexual GBV* class had weekly income above 2000 KSh, compared to 47%–56% of women in the other classes ($p=0.02$).

Associations between GBV Latent Classes and Mental Health

Table IV shows the associations between the classes and PHQ-9, PCLC, AUDIT, and DAST scores. Mean scores were low for all outcomes, especially for the DAST, as drug use other than alcohol was infrequently reported in this population. However, scores were above the clinically relevant thresholds for 4.9%–40.9% of women across the range of GBV classes and mental health outcomes (Table IV). In adjusted linear regression models, compared to the *Low GBV* class, women in the *Severe GBV* class had significantly higher PHQ-9 scores (beta = 1.5, 95% confidence interval [CI]: 0.02–3.1), PCLC scores (beta = 3.7, 95% CI: 0.6–6.8), and AUDIT scores (beta = 3.9, 95% CI: 1.8–6.0). Women in the *Sexual GBV* class had significantly higher AUDIT scores than women in the *Low GBV* class (beta = 3.7, 95% CI: 0.5–6.9). Women in the *Physical/Moderate Emotional GBV* class did not have higher scores than women in the *Low GBV* class for any mental health outcome. There were no associations between GBV patterns and DAST scores.

Associations between GBV Latent Classes and Sexual Risk Behavior

1) Number of sex partners—The median number of sex partners in the past 3 months was low, ranging from 2.5 to 4 partners across the classes (Table V). However, 28% of women in the *Severe* class and 38% in the *Physical/Moderate Emotional* class reported 10 partners. In adjusted models, women in the *Severe* class had nearly 4 times as many partners as women in the *Low GBV* class (adjusted risk ratio [aRR] 3.78, 95% CI 1.95–7.32, $p<0.001$) and women in the *Physical/Moderate Emotional* class had 5 times as many partners (aRR 5.05, 95% CI 1.85–13.75, $p=0.002$).

2) Unprotected sex—The proportion of women with recent unprotected sex was similar by the self-report and PSA measures (12%–27% across the classes, Table V). Because few women were positive by both measures, the proportion with unprotected sex by the combined measure was substantially higher (25%–46%). The self-report, PSA, and combined outcomes were consistent in showing that women in the *Physical/Moderate Emotional GBV* class had the highest prevalence of unprotected sex. The adjusted prevalence ratio (aPR) for unprotected sex for the *Physical/Moderate Emotional* class was significantly higher than for the *Low GBV* class with the combined outcome (aPR 2.01, 95% CI 1.02–4.33, $p=0.045$) but not with either of the individual outcomes. There were no significant differences in unprotected sex by any measure when comparing the *Severe* or *Sexual GBV* classes to the *Low GBV* class.

3) HIV/STI incidence—Twenty percent of women (57/283) had no STI testing after the SV Study visit and were excluded from the HIV/STI incidence analysis. An additional 65

women (23%) contributed less than 1 year of follow-up. Combined STI/HIV incidence rates ranged from 19.2 per 100 person-years (PY) in the *Low GBV* class to 33.7 per 100 PY in the *Physical/Moderate Emotional* class (Table VI), but differences across the classes were not statistically significant. For HIV only, incidence rates were 2.9 per 100 PY for the entire cohort (95% CI 1.31–6.47), 4.6 per 100 PY in the *Low GBV* class (95% CI 1.14–18.23), 2.6 per 100 PY in the *Sexual GBV* class (95% CI 0.36–18.24), and 7.6 per 100 PY in the *Physical/Moderate Emotional GBV* class (95% CI 2.45–23.56) (data not shown). No incident HIV infections were observed in the *Severe GBV* class.

Discussion

This study identified 4 latent classes that represent distinct patterns of GBV among FSWs, with distinct mental health and sexual risk profiles. Women in the *Severe GBV* class had higher mental health symptom scores and more sexual risk behavior than women in the *Low GBV* class. Women in the *Sexual GBV* class had higher AUDIT scores, but similar sexual risk behavior to women in the *Low GBV* class. In contrast, women in the *Physical and Moderate Emotional GBV* class reported more sexual risk behavior, but their mental health scores did not differ from women in the *Low GBV* class.

Broadly, our findings are consistent with previous studies using LCA in the general population, which have shown that GBV patterns explain variance in mental health and sexual risk behavior. Most of these studies have been based in the United States and Canada (35–37,71). However, in the study from which we adapted our indicator variables, Heise used LCA to classify intimate partner violence (IPV) among women from the general population in Peru, Brazil, Namibia, and Ethiopia (29). She found that each site had a class of extreme, systematic IPV, a class of sexual-dominant IPV, and a class of less severe IPV with or without emotional violence, and that each IPV pattern was associated with different health outcomes, including suicidal thoughts, unwanted pregnancy, and poor general health status.

Our study extends this literature by examining patterns of GBV in an FSW population in sub-Saharan Africa. Despite incorporating violence from other perpetrators, our LCA revealed similar GBV patterns to that of Heise, but the prevalence of the most severe class was substantially higher in our cohort (40% versus 13%–25% across 6 sites), as might be expected given the high vulnerability of FSWs to violence. A comparison of findings on the associations with health outcomes is hampered by the different outcome measures employed in each study. Future research should examine whether GBV patterns and relationships to health outcomes are reproducible across different studies and populations.

Although other studies have described associations between GBV and mental health or sexual risk behavior among FSWs, ours is the first to examine GBV patterns, capturing violence from multiple perpetrators, of varying type and severity. The LCA allowed us to capture several important dimensions of violence in a small number of representative classes. In doing so, we were able to avoid limitations of previous studies that have restricted their analysis to only one type of violence at a time, or grouped all types of violence together. Instead, we could identify women at elevated risk for specific health outcomes as a

result of their distinct experiences of GBV. Our findings suggest that a one-size-fits-all approach to HIV prevention may not be appropriate for GBV survivors, and there may be benefits to tailoring interventions based on GBV experiences. Women with different GBV patterns might benefit from emphasis on certain topics, or from different lengths or frequencies of intervention sessions. For example, women in the *Sexual* GBV class could be offered an intervention with more emphasis on harmful drinking and strategies to prevent or diffuse threats of sexual violence, and less emphasis on partner reduction or unprotected sex. Women in the *Physical and Moderate Emotional* class could be offered an intervention that aims to improve condom negotiation skills in the context of violent relationships, while devoting less time to mental health issues. By targeting issues that are more salient to particular groups of women, this approach may improve intervention uptake and retention, and ultimately effectiveness (38). Alternatively, in interventions that work with small groups of women in a participatory manner (72–74), grouping women with similar violence patterns may increase intervention efficacy if women can share effective strategies to address their common experiences.

Examination of GBV patterns may be important for intervention evaluation as well as design. Evaluations may show that an intervention worked well for women with some GBV patterns and poorly for those with other patterns, or may explain why an intervention worked well in one study setting but poorly in another (62). For example, an intervention to increase condom use may not show efficacy among women with predominately sexual GBV, but may be highly effective among women with the physical and moderate emotional GBV pattern, for whom the baseline risk of unprotected sex is higher.

Nearly 9 in 10 FSWs in our sample had experienced emotional, physical, or sexual violence in their lifetime — substantially more than the 47% lifetime prevalence in the general population of Kenyan women (75). We also observed high rates of unprotected sex and HIV/STI incidence, consistent with findings from studies among FSWs around the world (3,4,6,7,9,16,23,43,76). These high rates of GBV and HIV risk persist despite longstanding risk reduction campaigns promoting condom use, HIV testing and risk reduction counseling, and STI screening and treatment, and highlight the urgent need for approaches that address a wide range of GBV and HIV risk factors and acknowledge the broader context of risk. The intersection of GBV, poor mental health, and HIV is driven largely by gender power imbalances and by the traumatic effects of GBV. The lack of employment opportunities for women is a primary reason women enter sex work in sub-Saharan Africa (2). Women in our study described significant financial vulnerability, and nearly all partners of all types provided financial support. Male clients can wield power over sex workers with the threat of non-payment, capitalizing on women's economic vulnerability, or by refusing to use condoms. Women who argue are subject to violence and may be risking their economic survival. Perpetrators of GBV are themselves more likely to engage in high-risk behavior and to be infected with HIV or other sexually transmitted infections (STIs), increasing women's risk of infection during coerced sex (92,93). Stigma, discrimination, and criminalization of sex work prevent women from reporting or seeking redress for violence and limit their access to social and health services, including testing and treatment for HIV and STIs (77). Experience of GBV can be a traumatic event with significant psychological sequelae, including depression, PTSD, and substance abuse (78–82), and symptoms of these

mental health conditions, such as low self-esteem or hyperarousal, may increase women's high-risk sexual behaviors (19,83–87). In addition, fear of further violence and feelings of powerlessness or low self-esteem may directly impact HIV risk by reducing their ability to refuse sex or negotiate condom use, even from partners who are not known to be perpetrators (88–91).

Ultimately, a combination of behavioral, structural, and biomedical interventions will be needed to address both GBV and HIV-related risks among FSWs. These interventions will have to address mental health symptoms, substance abuse, stigma, criminalization, and lack of gender and financial empowerment, in addition to the traditional risk reduction counseling and skill-building around condom negotiation (94). For example, rather than telling FSWs to reduce the number of sex partners and give up sources of income, a better approach may be to provide access to other methods of HIV prevention such as pre-exposure prophylaxis (PrEP) for financially vulnerable women (94), or to reduce financial vulnerability through microfinance or vocational training programs (95).

This study had several strengths. We used validated instruments for GBV and mental health assessments, including an act-specific measurement of GBV that provided multiple opportunities for disclosure and did not require women to identify as battered or abused. We used biological markers of unprotected sex to help address the limitations of self-reported behavior, and analyzed prospective data on HIV and STI infections in the year following GBV assessment. We were able to control for several important confounders, including financial insecurity, which is a strong predictor of GBV, poor mental health, and sexual risk behavior (96,97). The *a priori* structuring of the “low GBV” comparison class was also a strength. LCA is usually conducted in an “exploratory manner”, without parameter restrictions, to describe natural clustering in the data. However, the exploratory approach does not ensure the existence of a no- or low-violence class that can serve as a reference group when the classes will be used as an exposure variable in additional analyses. To address this, some latent class analyses of GBV have created a no-violence class based on observed response patterns, where women reporting no violence have 100% probability of membership in this class, and women reporting any violence have 0% probability, making the no-violence class directly observed rather than latent (29,35,98). By allowing a 5% probability of each type of GBV in the reference class, we ensured that the class was predominantly composed of women reporting no GBV, while allowing a small possibility of measurement error in violence reporting. However, our analysis was still largely exploratory, allowing natural clustering around the pre-specified *Low GBV* class. A limitation of this approach is that the resulting classes may not generalize to other populations or settings.

Several additional limitations should be noted. First, despite the use of validated tools, GBV, mental health symptoms, and sexual risk behavior may have been underreported due to the sensitive nature of these subjects. Second, participation in the Mombasa Cohort may have provided counseling or access to health care that reduced the risk or sequelae of GBV, and this could limit the generalizability of our findings. Third, due to the cross-sectional study design, we cannot establish the direction of the association between GBV and our mental health and sexual behavior outcomes. However, the findings for sexual behavior were similar to the prospective findings for HIV/STI incidence. Fourth, due to a small sample size

divided into 4 exposure groups, we had low power to detect differences in sexual risk behavior between the GBV classes. This was compounded by the need to account for uncertainty in latent class assignment, which increased the variability of our estimates (99). Lastly, high rates of loss to follow-up limited our HIV/STI incidence analysis. We have previously shown that women in this cohort who become lost to follow-up have lower HIV risk behaviors, but that this did not bias estimates of HIV risk (100). If the same is true for our present analysis, the estimates of incidence may be biased upward, but the measures of association between GBV class and HIV/STI incidence would still be valid.

Conclusion

Gender-based violence is endemic among FSWs and is associated with significant health effects, including poor mental health and HIV/STI risk. By employing a person-oriented analysis, we show that FSWs experience a substantial burden of physical, sexual, and emotional violence from multiple perpetrator types, and that different patterns of GBV experience are associated with different behavioral risk factors and mental health profiles. To be most effective, interventions should address women's comprehensive experiences and offer a wide range of approaches to address the sequelae of GBV, including violence prevention and safety strategies, mental health services, condom negotiation skills, PrEP programming, legal protections against stigma and discrimination, and both gender and financial empowerment. Tailoring intervention approaches based on patterns of GBV exposure may increase both effectiveness and efficiency. Given the complex web of risk factors and mechanisms for HIV risk, a multi-faceted approach is essential to reduce the burden of violence and HIV in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table I**Participant Characteristics**

	N	%
Total	283	100%
<i>A. Demographic Characteristics</i>		
Age (median, IQR)	33.5	27.2–40.6
Education (median, IQR)	8	7–12
Years since enrollment in Mombasa Cohort (median, IQR)	3.1	1.2–9.8
Weekly income >2000 KSh	134	47.4
Sex work in past 2 months	262	93.2
Sex work is primary occupation	89	93.2
Workplace		
Bar/Restaurant	133	47.2
Nightclub	115	40.8
Home/Other	34	12.1
Believes financial future is uncertain	58	20.5
Ran out of money for basic needs, past year	194	68.6
<i>B. Lifetime GBV Prevalence</i>		
<i>Physical partner^a violence</i>		
None	106	37.5
Moderate (slap or push)	45	15.9
Severe (hit, kick, choke, weapon)	132	46.6
<i>Sexual partner^a violence</i>		
None	159	56.2
Once or twice	41	14.5
Few times	25	8.8
Many times	58	20.5
<i>Emotional partner^a violence</i>		
None	112	39.6
Moderate (insult or belittle), once/few times	33	11.7
Moderate (insult or belittle), many times	40	14.1
Severe (scare or threaten), any frequency	98	34.6
<i>Non-partner^b violence</i>		
None	124	43.8
Physical only	84	29.7
Sexual	74	26.2

IQR: Interquartile range; KSh: Kenyan Shilling; GBV: Gender based violence

^aPartner violence refers to violence from any consensual sexual partner, including regular partners, casual partners, and clients.

^bNon-partner violence refers to violence from strangers or acquaintances with whom the participant has not initiated a sexual relationship.

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Table II

Latent class model statistics

Model	DF	LL	G ²	AIC	BIC	CAIC	aBIC	Entropy	% Solution
1-class	137	-2202.8	2184.7	2196.7	2218.6	2224.6	2199.5	1.00	100
2-class	126	-1216.3	211.7	245.7	307.7	324.7	253.8	0.79	100
3-class	115	-1183	145.1	201.1	303.2	331.2	214.4	0.71	100
4-class	104	-1171	121.3	199.3	341.5	380.5	217.8	0.72	68
5-class	93	-1161	101.1	201.1	383.3	433.3	224.8	0.71	40 ^a

DF: Degrees of freedom; LL: Log likelihood; AIC: Akaike information criteria; BIC: Bayesian information criteria; cAIC: consistent AIC; aBIC: adjusted BIC

^aNot identified

Table III

Class indicators and descriptions

	Class membership & item response probabilities			
	Low	Sexual	Physical/Moderate Emotional	Severe
Estimated prevalence	20.9%	23.0%	17.5%	38.6%
Women in study sample assigned to class, n (%)	60 (21.2%)	52 (18.4%)	61 (21.6%)	110 (38.9%)
<i>Distribution within classes:</i>				
No physical	95.0%	50.8%	14.8%	8.7%
Moderate physical	3.3%	27.1%	42.4%	4.0%
Severe physical	1.7%	22.1%	42.8%	87.3%
No sexual	95.0%	41.3%	80.3%	34.0%
Sexual 1–2 times	2.1%	22.5%	19.7%	13.6%
Sexual, few times	0.9%	21.0%	0.0%	9.7%
Sexual, many times	1.9%	15.1%	0.0%	42.7%
No emotional	95.0%	60.4%	36.2%	0.0%
Moderate emotional, few times	0.0%	10.7%	39.4%	6.0%
Moderate emotional, many times	0.0%	23.6%	22.5%	12.4%
Severe emotional	5.0%	5.3%	1.9%	81.6%
No non-partner violence	75.4%	9.8%	67.6%	37.3%
Physical non-partner violence only	19.6%	41.5%	32.4%	27.4%
Sexual non-partner violence	5.0%	48.7%	0.0%	35.3%

Note: To aid with interpretation of the class characteristics, probabilities over 50% are highlighted in bold-text, and gray shading shows probabilities <50% which are important for class interpretation either individually or in groups.

Table IV

Associations between GBV classes and mental health outcomes

Outcome	Class	Based on modal class assignment	BCH-Weighted Linear Regression ^a			
			Crude	Adjusted		
			β (95% CI)	β (95% CI)	p	p
<i>PHQ-9 Score^b</i>						
		Moderate - Severe Depression N (%)				
	Low	4 (6.8%)	reference	reference		
	Sexual	8 (15.4%)	2.7 (0.3–5.2)	2.1 (–0.5–4.7)	0.03	0.11
	Physical/Moderate Emotional	4 (6.6%)	–0.5 (–2.4–1.5)	–0.6 (–2.2–1.1)	0.64	0.51
	Severe	14 (12.7%)	1.8 (0.2–3.4)	1.5 (0.0–3.1)	0.03	0.047
<i>PCL-C Score^c</i>						
		PTSD Screen+ N (%)				
	Low	5 (8.3%)	reference	reference		
	Sexual	8 (15.4%)	2.8 (–1.2–6.9)	2.0 (–2.5–6.5)	0.17	0.38
	Physical/Moderate Emotional	9 (14.8%)	0.1 (–3.6–3.8)	–0.7 (–4.7–3.3)	0.95	0.74
	Severe	24 (21.8%)	4.4 (1.2–7.6)	3.7 (0.6–6.8)	0.007	0.02
<i>AUDIT Score^d</i>						
		Moderate - Severe Alcohol Use Problem N (%)				
	Low	17 (28.3%)	reference	reference		
	Sexual	18 (34.6%)	2.8 (–0.6–6.2)	3.7 (0.5–6.9)	0.10	0.02
	Physical/Moderate Emotional	18 (29.5%)	0.7 (–1.9–3.3)	1.4 (–1.1–4.0)	0.59	0.27
	Severe	45 (40.1%)	3.5 (1.2–5.7)	3.9 (1.8–6.0)	0.003	<0.001
<i>DAST Score^e</i>						
		Moderate - Severe Drug Abuse N (%)				
	Low	3 (5.0%)	reference	reference		
	Sexual	5 (9.6%)	0.3 (–0.3–0.8)	0.1 (–0.5–0.7)	0.32	0.68
	Physical/Moderate Emotional	3 (4.9%)	0.2 (–0.3–0.7)	0.1 (–0.4–0.6)	0.39	0.67
	Severe	8 (7.3%)	0.4 (–0.0–0.8)	0.24 (–0.2–0.7)	0.07	0.25

^aThe BCH-weighted regression accounts for uncertainty in GBV class assignment resulting from the latent class model by creating an expanded dataset with one record for each latent class for each subject and assigning a set of weights based on the classification errors. Regression analyses are conducted using survey data analysis methods with robust standard errors to account for the BCH weights and for multiple records per subject.

^bAdjusted PHQ-9 model controls for education, income, workplace, and borrowing money. Moderate/severe depression is defined as a PHQ-9 score ≥ 10 .

^cAdjusted PCLC model controls for education, income, charge for sex, years in cohort, occupation, and borrowing money. A positive PTSD screen is defined as a PCLC score ≥ 30 .

^dAdjusted AUDIT model controls for age, income, and charge for sex. Moderate to severe alcohol use problem is defined as an AUDIT score ≥ 8 .

^eAdjusted DAST model controls for age at first sex, years as FSW before cohort enrollment, and nationality. Moderate to severe abuse of drugs other than alcohol is defined as a DAST score ≥ 3 .

Table V

Associations between GBV class and sexual risk behavior

Outcome	Class	BCH-Weighted Poisson Regression ^d				
		Crude		Adjusted		
Number of sex partners, past 3 months ^b	Median (IQR)	Relative Increase (95% CI)	P	Relative Increase (95% CI)	P	
	Low	2.5 (1–9)	reference		reference	
	Sexual	3 (2–9)	1.01 (0.40–2.52)	0.99	1.49 (0.52–4.29)	0.46
	Physical/Moderate Emotional	3 (1–20)	3.54 (1.43–8.77)	0.006	5.05 (1.85–13.75)	0.002
	Severe	4 (1–15)	3.03 (1.53–6.00)	0.002	3.78 (1.95–7.32)	<0.001
Any unprotected sex, past week ^c	N (%)	Prevalence Ratio (95% CI)	P	Prevalence Ratio (95% CI)	P	
	Low	7 (11.7%)	reference		reference	
	Sexual	10 (19.2%)	2.09 (0.54–8.12)	0.29	1.73 (0.45–6.62)	0.42
	Physical/Moderate Emotional	17 (27.9%)	3.37 (1.01–11.28)	0.049	2.43 (0.74–8.03)	0.14
	Severe	20 (18.2%)	1.89 (0.60–5.97)	0.28	1.62 (0.52–5.04)	0.40
Positive PSA test ^d	N (%)	Prevalence Ratio (95% CI)	P	Prevalence Ratio (95% CI)	P	
	Low	11 (18.3%)	reference		reference	
	Sexual	10 (18.2%)	1.08 (0.37–3.12)	0.89	0.67 (0.22–2.00)	0.47
	Physical/Moderate Emotional	16 (26.2%)	1.66 (0.68–4.10)	0.27	1.39 (0.52–3.69)	0.51
	Severe	19 (17.3%)	0.96 (0.42–2.19)	0.92	0.81 (0.35–1.87)	0.62
Combined outcome: Any unprotected sex by PSA or self-report ^e	N (%)	Prevalence Ratio (95% CI)	P	Prevalence Ratio (95% CI)	P	
	Low	15 (25%)	reference		reference	
	Sexual	19 (36.5%)	1.71 (0.76–3.87)	0.19	1.44 (0.64–3.21)	0.38
	Physical/Moderate Emotional	28 (45.9%)	2.31 (1.11–4.81)	0.03	2.01 (1.02–4.33)	0.045
	Severe	35 (31.8%)	1.42 (0.71–2.82)	0.32	1.33 (0.69–2.59)	0.39

Abbreviations: IQR interquartile range; CI confidence interval; PSA prostate-specific antigen

The BCH-weighted regression accounts for uncertainty in GBV class assignment resulting from the latent class model by creating an expanded dataset with one record for each latent class for each subject and assigning a set of weights based on the classification errors. Regression analyses are conducted using survey data analysis methods with robust standard errors to account for the weights and for multiple records per subject.

^bModel for number of sex partners adjusts for age, nationality, income, household size, charge for sex, years in cohort, age at first sex, occupation, having a current intimate partner, and running out of money to survive in the past 3 months. Excludes 3 observations with missing data.

^cModel for self-reported unprotected sex adjusts for education, years in cohort, and having a current intimate partner. Excludes 1 observation with missing data.

^dModel for PSA adjusts for age, occupation, having a partner who drinks, having a partner who is wealthy, and having an intimate partner. Excludes 1 observation with missing data.

^eModel for combined outcome adjusts for income and charge for sex. Excludes 1 observation for missing data.

Table VI

Associations between GBV class and HIV/STI incidence^a (n=226)

Class:	Cases	PY at risk	Incidence per 100 PY	BCH-Weighted Poisson Regression ^b		
				Crude IRR (95% CI)	P	Adjusted IRR (95% CI)
Low	8	41.52	19.27	reference		reference
Sexual	9	35.13	24.62	1.49 (0.42–5.26)	0.54	1.41 (0.35–5.69)
Physical/Moderate Emotional	12	35.40	33.90	2.18 (0.63–7.57)	0.22	2.03 (0.56–7.44)
Severe	22	76.29	28.84	1.66 (0.58–4.73)	0.34	1.57 (0.51–4.90)

Abbreviations: CI confidence interval; STI sexually transmitted infection; HIV human immunodeficiency virus; IRR incidence rate ratio; PY person-years

^aHIV/STI incidence includes chlamydia, gonorrhea, trichomoniasis, and HIV. Adjusted model controls for age, household size, and having a partner who drinks to get drunk at least a few times/week.

^bThe BCH-weighted regression accounts for uncertainty in GBV class assignment resulting from the latent class model by creating an expanded dataset with one record for each latent class for each subject and assigning a set of weights based on the classification errors. Regression analyses are conducted using survey data analysis methods with robust standard errors to account for the weights and for multiple records per subject.