
# Exploring violence, poor mental health and harmful substance use among FSWs in Nairobi and their association with hair cortisol levels.

Mamtuti Panneh

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Department of Infectious Disease Epidemiology and International Health

Faculty of Epidemiology and Population Health

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| | |
|---|---|
| **Supervisors** | Prof John Bradley<br>Professor of Medical Statistics<br>Department of Infectious Disease Epidemiology and International Health<br>London School of Hygiene and Tropical Medicine, UK<br><br>Prof Mitzy Gafos<br>Professor of Social Science/Global Health<br>Department of Global Health and Development<br>London School of Hygiene and Tropical Medicine, UK<br><br>Dr Tara Beattie (left on October 9th, 2023)<br>Associate Professor<br>Department of Global Health and Development<br>London School of Hygiene and Tropical Medicine, UK |
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# Declaration

I, Mamtuti Panneh, declare that the work presented in this thesis is my own in collaboration with others who have been acknowledged appropriately and roles clearly defined. Where information has been derived from other sources, I confirm that this has been indicated or properly referenced in the thesis. I also confirm that I have read and understood the school's definition of plagiarism and cheating as outlined in the Research Degrees Handbook and in the Academic Manual 2024-25.

Name: Mamtuti Panneh

Signed: 

Date: 9th January 2025

# Abstract

**Background and Aim:** Female sex workers (FSWs) in sub-Saharan Africa face increased risks of adverse life events such as violence, poor mental health, and harmful substance use, which are linked to increased vulnerability to HIV. However, the connection between these exposures and HIV acquisition may not be fully explained by behavioural risk factors alone. Stressful life events can impair the hypothalamic-pituitary-adrenal (HPA) axis, influencing cortisol production, which plays a crucial role in health, including immune function. Dysregulated cortisol levels are associated with higher T-cell activation (e.g., CD8+), which may increase susceptibility to HIV infection. The aim of my PhD is to explore stressors, specifically violence, poor mental health and harmful substance use, among FSWs in Nairobi and examine the relationship between cortisol levels and these exposures.

**Methods**: My PhD is a longitudinal mixed-methods study using data from the Maisha Fiti study of 1,003 FSWs in Nairobi, Kenya. For the qualitative component, participants shared their life stories through semi-structured interviews, discussing their entry into sex work, experiences of violence, mental health, and substance use. I thematically analysed 40 baseline interview transcripts in Nvivo to explore their lifetime mental health experiences and perceived risks. Quantitative data were collected via a behavioural-biological survey at baseline and follow-up. Participants reported recent violence, poor mental health, and harmful substance use, while hair samples were collected to measure cortisol via Enzyme-linked immunoabsorbent Assay (ELISA) technique. I used linear regression to assess associations between these categories of exposures and hair cortisol levels at baseline and longitudinal data to analyse changes in cortisol over time in relation to the trajectories of violence, mental health, and substance use. My thesis consists of three manuscripts: a qualitative study on FSWs' experiences of mental health and other psychological stressors in their lives (Paper 1) and two quantitative studies investigating the association between hair cortisol with violence, mental health, and substance use cross-sectionally at baseline (Paper 2) and longitudinally using data at baseline and endline (Paper 3).

**Findings**: Qualitative analysis revealed that 28 out of 40 participants reported poor mental health, driven by poverty, limited education, inadequate job opportunities, lack of family support, harmful gender norms, intimate partner violence, relationship breakdowns, and family bereavement. Sex work further exacerbated their mental health due to sexual risks and ongoing violence from police and clients. Quantitatively, baseline data from 425 HIV-negative participants showed a high prevalence of recent violence (89.3%), including physical (54.6%), sexual (49.4%), emotional (77.0%), and financial (66.5%) violence. Mental health issues were prevalent, with 23.7% reporting moderate/severe depression, 11.6% moderate/severe anxiety, 13.5% post-traumatic stress disorder (PTSD), and 10.8% recent suicidal thoughts. Harmful alcohol or other substance use was reported by 48.8%. Physical and/or sexual violence and harmful alcohol and/or other substance use were independently associated with increased hair cortisol concentrations at baseline (HCC). Longitudinally, HCC levels decreased significantly from baseline to endline, with change in HCC levels at endline linked to trajectories of physical violence as well as physical and/or sexual violence.

**Conclusion:** FSWs in Nairobi face significant mental health challenges, driven not only by the high-risk sex work environment but also by structural factors like intimate partner violence, poverty, and relationship breakdowns before entering sex work. Quantitative findings suggest that physical/sexual violence and harmful substance use may disrupt the HPA axis, potentially linking these exposures to increased HIV infection risk among FSWs. Findings in this PhD highlight the urgent need for targeted interventions addressing stressors such as violence, poor mental health and harmful substance use among FSWs in Nairobi. There is also a critical need for support interventions for women and girls experiencing distressful events to prevent poor mental health and subsequent entry into sex work.

# Acknowledgement

This PhD has been an exciting journey and a challenging rollercoaster, mainly due to personal and life challenges. I battled an unknown illness for almost three years into my PhD, experienced a divorce, remarried, and faced the heartbreak of a miscarriage. I am, therefore, profoundly grateful for the gift of life and to everyone who supported me academically and psychologically during this journey. Your unwavering support has brought me to this point. Many people contributed towards the accomplishment of this PhD and would like to mention the following:

First, I owe tremendous gratitude to my supervisors for their insights, guidance, patience, relentless support, and substantial feedback, all of which helped to make my PhD journey an incredible learning experience. I am particularly grateful to my first supervisor, Prof John Bradley, for his guidance throughout my PhD, especially during the statistical analysis phase. I am also enormously thankful to my second supervisor, Prof Mitzy Gafos, for her insights across all stages of my research, especially during my qualitative data analysis and for constantly checking in on my well-being. Additionally, I am thankful to Dr Tara Beattie, who opened the door to this PhD by accepting the supervision of my work and allowing me to join the Maisha Fiti research team, where she served as principal investigator (PI).

I sincerely appreciate the Maisha Fiti research team in Kenya, at the University of Toronto and at the London School of Hygiene and Tropical Medicine (LSHTM). Though I could not participate in the data collection phase due to the impact of the COVID-19 pandemic, you took me in wholeheartedly and guided me throughout. My heartfelt thanks to Dr Joshua Timani, Mary Wanjiru, Rhoda Wanjiru, Emily Nyariki, and Polly Ngurukiri in Kenya, Prof Rupert Kaul and James Pollock at the University of Toronto as well as Prof. Helen Weiss, Prof Janet Seeley, Pooja Shah, Alicja Beksinska and Tanya Abramsky at LSHTM for their support, especially in times when I needed urgent assistance with anything related to the Maisha Fiti study. Special thanks to my collaborators, Dr Abdelbaset A. Elzagallaai, Dr Michael J. Rieder and Dr Qingming Ding at Western University, Canada, for training me on hair cortisol analysis and for analysing the hair samples for my PhD.

I could not reach this far without the support of my wonderful family. I am blessed to have them in my life. Thank you, Mum and Dad, for your prayers, unconditional love, and belief in girls' education. Thanks to my siblings —Isatou Begay Panneh, Omar Panneh, Lamin Panneh, Dawda Cole, and Baboucarr Bahoum, for their support, abundant love, and for believing in me.

I want to express my sincere appreciation to my PhD friends at LSHTM, especially Dr Blessings Kapumba, for their motivation, fruitful discussions, and fun evening hangouts. To my friends in the Gambia, particularly Dr. Hassan Njie and Dr. Isatou Drammeh, thank you for your motivation and support.

Last but not least, I am grateful to my dear husband, Abdoulie Kassama, for sharing life's journey with me and showering me with love, care and peace, which made completing this PhD possible.

*A vital life lesson I gained in my PhD journey is never to give up, no matter what life throws at you. With every hardship comes ease, and resilience and hard work can always lead to light at the end of the tunnel.*

# Acronyms and Abbreviations

| | |
|---|---|
| **ACEs** | Adverse Childhood Experiences |
| **CDC-PEPFAR** | Centre for Disease Control- U.S President's Emergency Plan for Aids Relief |
| **ELISA** | Enzyme-linked immunoabsorbent Assay |
| **FSWs** | Female Sex Workers |
| **HCC** | Hair Cortisol Concentration |
| **HIV** | Human Immunodeficiency Virus |
| **HPA** | Hypothalamic-Pituitary-Adrenal Axis |
| **IDIs** | Individual In-depth Interviews |
| **STIs** | Sexually Transmitted Infections |
| **IPV** | Intimate Partner Violence |
| **LMICs** | Low and Middle-Income Countries |
| **LSHTM** | London School of Hygiene & Tropical Medicine |
| **OR** | Odds Ratio |
| **PHDA** | Partner for Health and Development in Africa |
| **PI** | Principal Investigator |
| **PTSD** | Post-Traumatic Stress Disorder |
| **SES** | Socio-economic Status |
| **SWOP** | Sex Workers Outreach Programme |
| **SSA** | Sub-Saharan Africa |
| **UNAIDS** | Joint United Nations Programme on HIV/AIDS |

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# Chapter 1 Introduction

## 1.0 Overview

In this PhD thesis, I explore the experiences of female sex workers (FSWs) in Kenya regarding various stressors, particularly violence, poor mental health, and harmful substance use, and to understand whether the associations between these stressors and increased vulnerability to infections, particularly human immunodeficiency virus (HIV) could be through biological mechanisms such as the stress response system. This chapter serves as an introduction to the research, divided into sections that outline:

- the global/public health significance of this research.
- evidence of FSWs' vulnerabilities to stressors and HIV risk globally and in Kenya.
- evidence of the stress response system as a possible pathway linking stressors and increased infection risk.
- the definition of the term "female sex worker' as used in this thesis.
- the scope of the thesis, structure and my role and contributions.

The next chapter of this thesis provides a more in-depth discussion of the background of this PhD based on a literature review.

## 1.1 The global/public health problem

According to global estimates, approximately 40-42 million individuals are engaged in sex work, with over 90% of them being female and many being victims of human trafficking (1). Sex workers, regardless of gender, disproportionately face health disparities, including high rates of violence, poor mental health, harmful substance use, and HIV infection (2-5). These vulnerabilities are primarily influenced by structural, social and community-level factors such as criminalisation, stigmatisation, and discrimination against sex work, punitive law enforcement, hazardous work environments, gender and economic disparities and access to health care (5, 6). For instance, criminalisation fosters punitive policing, heightening sex

workers' vulnerability to violence and hindering their ability to negotiate safer sex (5). This exacerbates risks of physical health problems (e.g., injuries and HIV infection), mental health issues (e.g., depression, anxiety, post-traumatic stress disorder (PTSD) and harmful substance use (e.g., alcohol and illicit drugs such as cocaine and cannabis) (5).

FSWs commonly experience violence, poor mental health and harmful alcohol or other substance use, which are often associated with each other (1, 4, 7, 8). Despite the pervasive occurrence of violence against women and girls worldwide, with 31% experiencing lifetime physical/sexual violence from an intimate partner or non-intimate partner (9), FSWs, especially in sub-Saharan Africa (SSA), face even higher levels of violence (10). For example, a systematic review focusing predominantly on FSWs found a prevalence of 57% for lifetime physical violence and 42% for lifetime sexual violence by intimate or non-paying sexual partners (4). A 2011 cross-sectional study among FSWs in south India revealed that FSWs experience multiple forms of violence perpetrated by different groups of people in their workplaces, including their clients, police and fellow sex workers; within their communities, such as private militias, neighbours, and religious groups; and through domestic violence from intimate partners (11). In addition to the criminalisation of sex work, the stigma surrounding sex work, challenging outdoor work environments, economic hardships, gender disparities, and personal factors such as harmful alcohol and illicit drug use also contribute significantly to the risk of violence among FSWs (4).

A recent global systematic review showed that the pooled prevalence of illicit drug use among FSWs was 29% (8). A systematic review among FSWs in low and middle-income countries (LMICs), indicated a pooled prevalence of harmful alcohol consumption of 41%, with regional variations observed (Sub-Saharan Africa: 38%; Latin America and the Caribbean: 44%; East, South, and Central Asia and Pacific: 47%) (7). Harmful alcohol and drug use are prevalent within the context of sex work, with FSWs often resorting to these substances as coping mechanisms to navigate the daily challenges they encounter, including staying alert during long working hours and engaging with multiple sex partners (7, 8, 12). Although harmful alcohol and other substance use may increase the risk of violence, FSWs who experience violence are also more likely to use harmful substances as a coping mechanism (13).

The experience of traumatic events can negatively affect FSWs' mental health (14). A systemic review and meta-analysis by Beattie et al. showed that mental health problems are highly prevalent among FSWs in LMICs, with a pooled prevalence of 41.8% for depression, 21% for anxiety, 19.7% for PTSD, 22.8% for suicide ideation and 6.3% for suicide attempt (2). Some of the risk factors of poor mental health among FSWs include stigma, violence, particularly workplace violence, alcohol and illicit drug use, higher-risk sexual behaviours such as inconsistent condom use, and physical health problems such as HIV and sexually transmitted infections (STIs) (1, 2).

FSWs represent one of the most vulnerable populations facing heightened risk of poor health outcomes, including HIV (1, 15). The median HIV prevalence among FSWs globally stands at 3.9%, but those in SSA face higher risks, with an estimated median prevalence of 20% (16). According to recent findings, the relative risk of HIV infection among FSWs in 2020 was 26 times higher compared to other adult women (15). Evidence also showed that violence, harmful alcohol and substance use, and mental health problems are generally associated with increased HIV risk (17-20), including among FSWs (1, 21, 22). However, the pathways linking these exposures, particularly violence, to increased HIV risk among FSWs may not be fully explained by behavioural and occupational risk pathways (23). For example, a systematic review of epidemiological studies in SSA found strong evidence of an association between HIV and physical violence and emotional violence, respectively, but no evidence of an association between HIV and sexual violence (23). This suggests that the association between HIV and violence at a broader societal level cannot be solely attributed to HIV transmission during instances of sexual violence, as this may depend on the prevailing HIV prevalence in the community. Although it's plausible that the experience of violence, harmful alcohol and other substance use, as well as poor mental health, may lead to higher risk sexual behaviours (e.g., condomless sex), thereby increasing FSWs' vulnerability to HIV infection, there may be other possible indirect pathways to acquisition (18, 19, 24). Notably, previous research indicates that the experience of traumatic or stressful events such as violence may increase the susceptibility to HIV infection through biological or physiological pathways, which influence the systemic immune response (24, 25); however, these potential pathways are less understood. Understanding these biological pathways, particularly the physiological stress response system,

will be crucial for identifying intermediate points to target during the development of HIV prevention interventions and treatment for survivors of violence, individuals with poor mental health, and those with a history of substance use (24).

### 1.1.1 Female sex workers in Kenya

In Kenya, where the research for this thesis was conducted, the population of FSWs is among the highest in SSA. The latest findings in 2011/2012 indicate that approximately 5% of urban females in Kenya are engaged in sex work (ages 18–49) or subjected to commercial sexual exploitation (ages 15–17) (26). This rate contrasts with lower figures in other SSA countries, such as 0.76%-1% in South Africa and 2% in Cameroon (27). FSWs in Kenya, like their counterparts elsewhere, face heightened risks of adverse life events, mainly stemming from pervasive social stigma and discrimination, poverty, unequal gender and social norms, the criminalisation of sex work, and unfavourable working conditions (28-30). In Kenya, the legal status of sex work is complex because it is not criminalised by federal law but prohibited by municipal by-law, as is the situation in Nairobi County (31). This quasi-criminalised nature of sex work creates an environment that increases FSWs' risks of violence from various perpetrators, including law enforcement officers who unlawfully arrest and assault them for selling sex and deter them from seeking justice (29, 32). Recent findings among FSWs in Kenya showed that police discrimination and violence are associated with reduced condom use and delay in accessing healthcare services, which can potentiate the acquisition of HIV and other STIs (32). FSWs in Kenya are disproportionately affected by HIV, with the prevalence estimated to be almost five times higher among FSWs (29.3%) compared to that of the general population of Kenyan women (6.6%) (29).

Moreover, although violence against women in the general population is high (lifetime prevalence of 47%) and often linked to physical/sexual intimate partner violence (IPV), FSWs tend to report significantly higher rates, with overlapping types of violence from multiple perpetrators (33, 34). Baseline findings from the Maisha Fiti study of FSWs in Nairobi showed that 81% of FSWs experienced recent (past six months) violence (physical, sexual and/or emotional) from any perpetrator, with 31% and 55% reporting physical and/ or sexual violence

from an intimate partner and a non-intimate partner, respectively (35). In the same study cohort, almost half (49%) had symptoms of depression, and 30% engaged in harmful alcohol consumption (30, 35, 36). Findings from a mixed-methods study among the Maisha Fit study cohort also showed the interrelated link between the experience of violence, harmful alcohol and other substances and poor mental health among FSWs in Nairobi (30).

## 1.2 Physiological stress response systems- the hypothalamic-pituitary-adrenal (HPA) axis

During stress, defined as a state of a real or perceived threat to homeostasis, the central nervous system becomes activated, resulting in complex bi-directional interactions between the endocrine, nervous, and immune systems, collectively called the stress response system (37, 38). Activating the stress response system leads to several behavioural (e.g., improved cognition and increased awareness) and physiological changes (e.g., increased heart rate, increased respiratory rate and inhibition of general bodily processes such as immunity and digestion) with the overall goal of maintaining homeostasis (37). Stress is caused by stressors, which can be any environmental, physical, social, psychological, or physiological stimuli that activate the central nervous system (38).

One of the main neuroendocrine systems in the stress response system is the hypothalamic-pituitary-adrenal (HPA) axis (38), which consists of the hypothalamus, pituitary gland, and adrenal gland, as shown in **Figure 1.2** (39)**.** Stress can activate the HPA axis, producing the stress hormone cortisol, released for several hours during acute stress until optimal cortisol concentration is achieved before returning to systemic homeostasis through negative feedback (40). However, repeated or long-term stress may result in dysregulated cortisol levels often characterised by hypercortisolism in the early onset, which may lapse to reduced levels (hypocortisolism) over time (41, 42). Cortisol plays a crucial role in regulating and supporting most vegetative functions. Hence, disruption in its production can deleteriously impact health (40). For example, in a normally functioning HPA axis, the cortisol produced suppresses the immune response to protect the body from damage caused by inflammation. However, dysregulated HPA-axis and altered cortisol levels due to chronic stress lead to chronic

inflammation and immune dysfunction, which elevate susceptibility to infections, including HIV, as well as prolong infectious disease episodes (38). Some studies highlighted the inflammatory effect of cortisol dysregulation as a recognised factor in diseases such as HIV (43), Coronavirus (COVID-19) (40), mental health and cognitive diseases (e.g. insomnia, depression, anxiety, Alzheimer's) (44, 45). The inflammatory system is an essential component of the physiological stress response systems, with increasing evidence indicating that stress can activate an inflammatory response, and excessive inflammation is known to directly contribute to the pathophysiology of stress-related disorders or diseases (46). The link between stress, immunity, and disease is complex and has reciprocal effects (i.e. they mutually influence each other) (45).

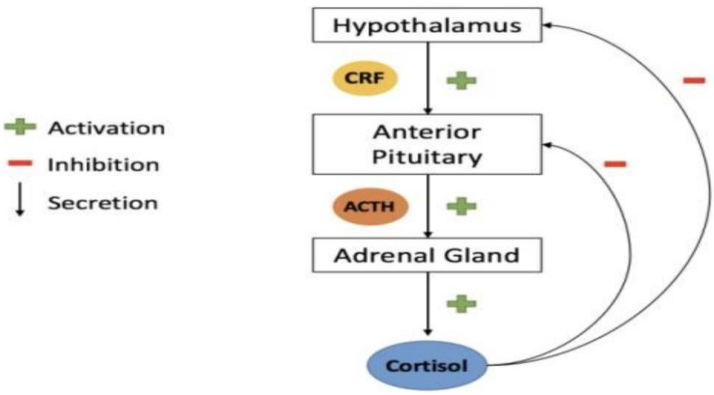


**Figure 1.2.** Activation of the Hypothalamic-pituitary-adrenal (HPA) (39).

## 1.3 Study rationale and scope

Despite the considerable burden of stressors among FSWs in Kenya, there exists a gap in qualitatively understanding the context of sex work and women's exposure to stressors. Additionally, although emerging evidence suggests associations between violence, mental health problems, harmful alcohol, and other substance use with cortisol levels, the results have been inconsistent (47-50). For instance, the relationship between violence and cortisol levels has been associated with both hypercortisolism and hypocortisolism, with some studies reporting no evidence of association (47). Currently, there is a paucity of research on how cortisol production is related to violence, poor mental health and harmful substance use among FSWs and if cortisol levels change over time in response to significant stressful events.

Moreover, several studies have measured cortisol using blood, saliva, or urine, which only capture short-term cortisol levels, therefore hampering the assessment of the relationship between long-term stress exposure and HPA axis functioning. Hair cortisol analysis offers a reliable method for retrospectively measuring cortisol levels over several months. I addressed these research gaps in my PhD by utilising qualitative and quantitative data from the Maisha Fit study, a three-year longitudinal mixed-methods investigation of FSWs in Nairobi, Kenya, conducted from June 2019 to January 2021. I used the qualitative data to explore FSWs' experiences of stressors in their lives, while the quantitative data was used to examine the associations between violence, mental health problems, and substance use problems with hair cortisol levels.

## 1.4 Definition of sex workers

Due to the ubiquitous and varied forms of sex work, it is vital to define the term 'sex worker" as used throughout this PhD research. According to the USAIDS's definition in 2012, a sex worker refers to:

> *"female, male, and transgender adults and young people (18 years of age and above) who receive money or goods in exchange for sexual services, either regularly or occasionally."* (51)

This definition is broad and combines the varying forms of sex work, ranging from more structured and organised forms to less formalised arrangements such as transactional sex. In formalised sex work, individuals self-identify as sex workers and receive compensation, whether monetary or other goods, for sexual services rendered. Conversely, in transactional sex, individuals engage in sexual activities in exchange for material benefits but may not necessarily identify themselves as sex workers. However, the understanding of transactional sexual relationships has evolved due to their nuanced nature, complexity, and varying interpretations (52). For example, some researchers have argued that labelling women engaged in transactional sexual relationships as sex workers might carry stigma since the act entails not only economic transactions but also emotional ones (53). Due to the distinct dynamics of HIV transmission among women identifying as 'sex workers' compared to those engaged in

transactional sex, UNAIDS underscored the importance of distinguishing between the two, especially among young women in SSA (54).

HIV researchers in SSA differentiated transactional sex from sex work, defining it as:

> *"a sexual relationship or act(s), outside of marriage or sex work, motivated primarily by the expectation of material gain, where love and trust are also sometimes present (involved/concerned/at play)" (55).*

For this PhD, the definition of sex work is based on the formalised construct as defined by the USAIDS in 2000:

> *''any agreement between two or more persons in which the objective is exclusively limited to the sexual act and ends with that and which involves preliminary negotiations for a price.''*

This definition excludes women specifically engaging in transactional sex and includes all genders (male, female, cisgender and transgender). However, this PhD research and the Maisha Fiti study focused on women who self-identified as FSWs. In addition, although the term "women who sell sex" is recently generally preferred to "FSWs" to avoid defining women based on their jobs, for this PhD, the term FSWs is used throughout as in several other studies, including the Maisha Fiti study (10).

## 1.5 Structure of the thesis

This thesis is prepared in a research paper style consisting of eight chapters, including a short introduction of the background in **Chapter 1**.

**Chapter two** provides a more in-depth introduction to the background of this PhD, where I conducted a narrative review of the literature about violence, mental health, harmful

substance use, and cortisol levels among FSWs. It also highlights the research gaps addressed in this PhD

**Chapter three** is a short chapter that presents the research aim, questions, and overall goal of this PhD, as well as a description of the study setting and an overview of the data collection process of the Maisha Fiti study.

**Chapter four** presents the conceptual frameworks underpinning the qualitative and quantitative components of this PhD. It also provides details about my research methodology, reflection on my position in this PhD research, and information about the ethical approvals and considerations involved in this PhD.

**Chapter five** presents a qualitative research paper (Paper 1) published in the BMC Public Health Journal. I used data from the baseline individual in-depth interviews (IDIs) collected in the Maisha Fiti study to examine FSWs' mental health experiences and perceived risks. In this paper, I address the first research question of this PhD by presenting the context of FSWs' experiences of various stressors through their recounts of personal mental health experiences and their perceived risks.

**Chapter six** presents a research paper (Paper 2) published in the Discover Mental Health Journal. I used the cross-sectional baseline survey data of Maisha Fiti's study to examine the associations between the experience of violence, poor mental health, and harmful substance use with hair cortisol concentration (HCC) levels. I address my second PhD research question in this paper.

**Chapter seven** presents the third research paper (Paper 3), which is undergoing peer review in PLOS Global Health Journal. I used the baseline and endline data collected in the Maisha Fiti study to examine longitudinal changes in HCC levels and whether the change in HCC levels was due to the experiences of violence, poor mental health or harmful substance use. I address my last PhD research question in this paper.

**Chapter eight** is the discussion section, where I synthesise the main findings from my three PhD manuscripts. I then discuss my research's limitations before describing its implications for policy and future research, and finally, I present the conclusion.

## 1.6 Role of students and collaborations contributing to the thesis

The conceptualisation of this PhD research commenced in September 2019, shortly after the initiation of data collection for the Maisha Fiti study at baseline. Driven by my interest in exploring violence, mental health, and substance use among vulnerable populations, I initiated discussions with the Principal Investigator (PI) of the Maisha Fiti study, Dr Tara Beattie, who welcomed my involvement and utilisation of the collected data for my PhD, particularly the hair samples, which was collected to measure cortisol levels as a biomarker of stress. I actively engaged in the conceptualisation process of my PhD project by conducting literature reviews, identifying research gaps related to hair cortisol levels among FSWs, and submitting my PhD proposal for approval by Dr Beattie and Prof John Bradley. Following this, I applied for the Commonwealth PhD Scholarship in October 2019, and it was granted in December 2020 after experiencing delays due to the COVID-19 pandemic.

Initially, I planned to join the Maisha Fiti research team in Kenya to participate in the data collection at follow-up. However, due to the delay in funding and travel restrictions imposed by the COVID-19 pandemic, I commenced my PhD studies remotely from my home country, The Gambia, from January 2021 to September 2021.

Although I was not directly involved in the data collection process of the Maisha Fiti study, I actively contributed to data cleaning, analysis, and manuscript writing for publication over the years. For the quantitative data, I played a crucial role in cleaning the datasets and merging the behavioural and lab data for each time point. Additionally, I assisted in coding key variables in the datasets and saved them as Do files. I also actively took part in the analysis of the qualitative interview data of the Maisha Fiti study, which involved a series of collaborative meetings to discuss the emerging themes and interpret the findings.

In my PhD thesis, which has distinct aims from the broader Maisha Fiti study, I managed the hair samples collected for cortisol measurement. These samples were shipped from Kenya to the University of Toronto, and I transported them to the Robarts Research Institute at Western University, Canada, for analysis. I spent a week at the Robarts Research Institute sorting the hair samples based on my sampling frame, learning the technique of hair cortisol analysis, and assisting in analysing the first batch of samples. I developed the analysis plan for my PhD, conducted all the data analysis, and prepared drafts of all manuscripts under the guidance of my supervisors. My PhD research was supported by the laboratory team at Western University in Canada and the larger Maisha Fiti team, which included members from the London School of Hygiene & Tropical Medicine (LSHTM), Partner for Health and Development in Africa (PHDA) in Kenya, and the University of Toronto, Canada. Below is a list of the contributors to this thesis. More details on those who contributed to the data collection process of the Maisha Fiti study and their respective roles are added in Chapter 3, **Table 3.3.3.**

**Table 1.6** List of contributors to PhD research

| Role | Institution (Name) |
|---|---|
| Implementation | **PHDA:** Joshua Kimani; Rhoda Kabuti; Mary Kung'u; Helen Babu; Emily Nyariki; Jennifer Liku; The Maisha Fiti study Champions (Daisy Oside, Agnes Atieno, Faith Njau, Mary Akinyi, Demitila Gwala, Ruth Kamene, Wendy Watata); Community liaison members (Elizabeth Rwenji, Evelyn Ombunga and Ibrahim Lwingi)<br>**LSHTM:** Tara Beattie; Janet Seeley; Helen A Weiss<br>**Toronto University;** Rupert Kaul |
| Social Science team | **PHDA:** Joshua Kimani; Rhoda Kabuti; Mary Kungu; Helen Babu; Emily Nyariki; Jennifer Liku<br>**LSHTM:** Tara Beattie; Janet Seeley; Pooja Shah |
| Clinical team | **PHDA:** Zaina Jama**;** Chrispo Nyabuto, Monica Okumu and Anne Mahero |
| Laboratory Team | **PHDA:** Erastus Irungu; Peter Muthoga; Wendy Adhiambo<br>**Toronto University;** Rupert Kaul; James Pollock<br>**Robarts Research Institute at Western University:** Michael J Rieder; Abdelbaset A. Elzagallaai; Qingming Ding |
| Data Management | **PHDA**: Pauline Wanja, Polly Ngurukiri |

| | |
|---|---|
| Epidemiology and Statistical Analysis: | **LSHTM:** John Bradley; Helen A Weiss; Tanya Abramsky; Alicja Beksinska; Tara Beattie; Mitzy Gafos |
| Supervisors | **LSHTM:** John Bradley; Mitzy Gafos; Tara Beattie |

## 1.7 PhD research funding

This PhD was funded by the Commonwealth Scholarship Commission, which covered my living costs and some of my research costs (e.g., analysing hair cortisol levels). The commission did not play any role in the design of the study, the data collection process, manuscript writing, or editing. LSHTM also contributed to my tuition fees and provided financial support during unforeseen circumstances.

# Chapter 2 Literature Review

## 2.0 Overview

I conducted a narrative review focusing on violence, poor mental health, and harmful substance use among FSWs; followed by a review of cortisol levels and associated factors. This chapter is divided into five sections. In the first three sections, I provide a summary of evidence on FSWs and violence, FSWs and poor mental health, and FSWs and harmful alcohol and other substance use. In each section, I initially present a global picture of the prevalence and factors associated with these stressors using predominantly systematic reviews and meta-analysis studies from the literature, with specific examples from LMICs, including SSA, before delving into the situation in Kenya. Section 4 summarises research on cortisol levels and associated factors, primarily from systematic reviews and meta-analysis studies. Since research on cortisol levels specifically among FSWs is limited, this section does not explicitly focus on FSWs. Finally, in the last section, I present an outline of the gaps in the literature that I intend to address in this PhD.

## 2.1 Female sex workers and violence

FSWs face high levels of violence globally, with 41%-65% experiencing physical and/or sexual violence in their lifetime (4), compared to 30% (95% confidence interval: 26%-34%) in the general population of women aged 15 years and above (9). They experience multiple forms of violence, including physical, sexual, psychological/emotional, and economic, perpetrated by a range of individuals, including clients, non-paying or intimate partners, police, and fellow sex workers (10, 56). A systematic review of sex workers' experience of violence globally revealed that the country-level lifetime prevalence of physical and/or sexual violence by intimate or non-paying partners ranged from 4% to 73% (4). Additionally, 45% to 75% experienced physical and/or sexual workplace violence (e.g., perpetrated by clients, police, pimps, or other third parties) in their lifetime, with physical violence ranging from 19% to 67% and sexual violence from 14% to 54% (4). While numerous studies concentrated on physical and sexual violence, economic violence (e.g., client refusing to pay after sexual service) and emotional violence

(verbal abuse/insult) have been reported to be among the most prevalent forms of violence experienced by FSWs (56-59). In Africa, FSWs face heightened vulnerability to violence, with a recent scoping review indicating that the lifetime prevalence of a particular form of violence perpetrated by clients among FSWs in Eastern and Southern Africa ranged from 21% in Malawi (physical and sexual violence) to 82% in Uganda (any physical, sexual, verbal or economic violence) (10).

FSWs' vulnerability to violence is primarily linked to major structural factors such as the stigmatisation and criminalisation of sex work, their high-risk work environment, and personal and psychosocial factors such as marital status, alcohol use and depression, alongside gender and economic inequities (4). In many settings, especially across numerous African countries, sex work is deemed illegal, perpetuating stigma and increasing the risk of discrimination against FSWs, particularly while they are working (10, 60). These factors significantly contribute to shaping FSWs' susceptibility to violence from various perpetrators, including clients, law enforcement, non-paying/intimate partners, and domestic violence from relatives (4, 6). The criminalisation of sex work also hinders the reporting and monitoring of violence within the sex work context, particularly when perpetrated by law enforcement personnel (61). Instances of unlawful arrest and police exploiting the marginalisation of FSWs to torture, extort, rape, and assault them have been documented in different parts of the world, including SSA (10, 21). Police violence increases the likelihood of physical and sexual violence from other perpetrators and the risk of HIV/STIs (21). For example, a study among FSWs in Uganda revealed that police harassment compelled FSWs to hasten negotiations with clients, showing an association with increased odds of client physical/sexual violence (62). In addition, a systematic review and meta-analysis study found that repressive policing of sex workers was linked with heightened risks of physical/sexual violence from various perpetrators (2.99, 95% CI 1.96–4.57), condomless sex (odds ratio 1.42, 95% CI 1.03–1.94) and HIV/STIs (OR 1.87, 95% CI 1.60–2.19)(21).

The sex work environment, where FSWs solicit and serve clients, significantly influences their vulnerability to violence. Street-based FSWs, compared to indoor sex workers, have higher risks of violence, HIV-related risk behaviours, and overall poor health (4, 21, 63). Their

increased vulnerability is closely tied to brutal policing, leading to the displacement of street-based FSWs from their workplaces to unsafe environments and increasing the likelihood of arrest by law enforcement officers and violence from clients and other members of the community (63, 64). A systematic review and meta-analysis study found that sex workers exposed to repressive policing had higher odds of experiencing physical or sexual violence from clients compared to their unexposed counterparts (OR 2.71, 95% CI 1.69–4.36) (21). Violence from clients often occurs during or is exacerbated by condom negotiation, disagreements over the type of sexual activity (e.g., oral, anal), clients' refusal to pay after services, threats of reporting to the police, and alcohol use by clients and/or sex workers (65). For example, a cross-sectional study in Ghana found that FSWs who refrained from alcohol before sex in the past six months and those who abstained from drug use in the past year had a lower risk of experiencing physical or sexual violence from clients and other non-established sexual partners compared to their unexposed counterparts (66).

The legal status of sex work in Kenya is complex. While federal law does not criminalise it, some municipalities, such as in Nairobi County, have by-laws that prohibit it (31). This quasi-criminalized status, along with structural factors like social stigma and poor working conditions, heightens FSWs' vulnerability to violence and dissuades them from seeking justice (31, 32). Violence against women in the general population in Kenya is high, with the 2022 demographic and health survey revealing that 34% and 30% of women aged 15-49 have experienced physical violence and sexual violence at some point in their lives, respectively (67). However, women engaged in sex work often report significantly higher rates, with overlapping types of violence from multiple perpetrators (36). In a cross-sectional study conducted among FSWs in Nairobi in 2019, approximately 90% experienced violence in the past 12 months. Of these, about 81% reported violence from clients, 79% from intimate partners, and 50% from other perpetrators (e.g. police, family members) (68). In the same study, emotional violence was the most common form of violence, with a prevalence of 67% from intimate partners, 74% from clients, and 49% from other perpetrators, compared to physical violence (58% from intimate partners, 52% from clients, and 40% from other perpetrators) and sexual violence (57% from intimate partners, 69% from clients, and 23% from other perpetrators) (68). Similarly, a high burden of violence was reported among FSWs

in the Maisha Fiti study, with baseline findings indicating that approximately 81% experienced violence (physical/sexual/emotional) from any perpetrator, 69% experienced physical/sexual violence from an intimate partner, and 55% experienced physical/sexual violence from a non-intimate partner in the past six months (36). Moreover, qualitative studies among FSWs in Kenya revealed pervasive experiences of physical and sexual violence in their working environment, often triggered by sex acts that FSWs considered degrading as well as negotiations around condom use and payment (29, 69). FSWs' vulnerability to violence in this region, akin to other parts of the world, is substantially exacerbated by financial hardships, gender power imbalances, the criminalisation of sex work, and the cultural beliefs perpetuating the notion of men's entitlement to sex without payment (69). Research in Kenya has also shown that FSWs who experience violence are more likely to engage in higher-risk sexual behaviours, such as having multiple sex partners and engaging in unprotected sex. They face an increased risk of HIV infection, harmful substance use, and mental health challenges, including depression, anxiety, and PTSD (68, 70-72). Findings from the Maisha Fiti study at baseline revealed that recent physical or sexual violence among FSWs in Nairobi was independently associated with adverse childhood experiences (ACEs), age at first sex, intimate partner relationships, lack of additional income beyond sex work, having dependents, experiencing recent hunger, encountering police arrests, engaging in harmful substance use, and participating in recent condomless sex (36).

## 2.2 Female sex workers and poor mental health

FSWs are disproportionately vulnerable to psychological health issues, presenting a significant public health concern in many countries, particularly in LMICs (2). A recent review and meta-analysis study reported pooled prevalence rates of mental health problems among FSWs in LMICs, including 42% for depression, 21% for anxiety, 20% for PTSD, 41% for psychological distress, 23% for recent suicide ideation, and 6.3% for recent suicide attempts (2). Comorbidity of mental health problems among FSWs is common (1), as demonstrated by a cross-sectional study in South Africa, where 32.7% of FSWs had depression and PTSD (73).

FSWs' vulnerability to poor mental health is associated with various risk factors such as sex work-related risks (e.g. violence, high-risk sexual behaviour and harmful substance use), stigma, violence from multiple perpetrators, including intimate partners, physical health problems such as HIV infection, experiencing violence in childhood, poverty, low educational attainment, and low socioeconomic status (1, 2, 74). Findings from a systematic review of mental health among FSWs showed that the experience of workplace violence predicts psychological distress and has been associated with a range of poor mental health problems (1). Additionally, violence from the police in the form of arrests and raids was respectively linked with current depression and a suicide attempt in the past three months in India (54, 55). Although a broad body of literature showed that women experiencing violence are at a greater risk of mental health problems, research has also shown that women with mental health problems, especially depression, are significantly more vulnerable to violence, suggesting a bidirectional relationship (75-78). Also, previous research mainly focused on the uni-directional relationship between mental health and violence, with mental health problems often predicting violent behaviours (77). However, recent findings demonstrate that adults with mental health disorders had 4-6 times higher victimisation rates compared to those without mental health disorders, and they are more likely to be victims of violence than perpetrators (76, 79). Moreover, adverse childhood experiences such as childhood abuse, neglect and a dysfunctional household have been associated with the development of distinct mental and physical health problems throughout the lifespan (80, 81) and with evidence of dose-response associations (82). For example, a study in South Africa reported that FSWs' experience of childhood abuse was associated with both depression and anxiety and was a key risk factor for sex work entry (83).

Furthermore, associations between mental health problems and harmful alcohol or other substances among FSWs have been reported. For example, in Togo, a cross-sectional study showed that FSWs who reported harmful alcohol use were three times more likely to suffer from psychological distress (84). The use of illicit drugs among FSWs has been linked with depression, with depression among illicit drug users being twice as high compared to non-users (2). In 2019, a cross-sectional community-centric national study in South Africa further showed that FSWs who used drugs to cope with sex work were significantly more likely to experience

depression and have PTSD (74). The location of sex work is another sex-work-related risk for poor mental health among FSWs, with street-based sex workers being more vulnerable compared to those working in private spaces (1). However, a study in Mexico found that indoor FSWs are more prone to substance use than outdoor sex workers (85), which could increase their risk of poor mental health (1).

There is evidence for an association between mental health problems and higher-risk sexual behaviours, including HIV/STI prevalence among FSWs. A systematic review and meta-analysis among FSWs found evidence of an association between higher depression scores and inconsistent condom use (odds ratio (OR) = 2.57, $p < .001$) (58). Two studies have also found that FSWs with a higher number of clients per week had an increased risk of having PTSD (86, 87). A systematic review and meta-analysis of FSWs in LMICs revealed that FSWs with a mental health problem are more likely to be living with HIV compared to those without mental health problems (2). The relationship between mental health and increased vulnerability to HIV risk behaviours has been explained as the influence of maladaptive thoughts related to mental health on one's emotions and behaviours (88). For instance, Yuen et al. explained that individuals with mental health problems may harbour negative thoughts about themselves and their future, potentially leading to decreased motivation in self-care. Consequently, this could elevate their likelihood of engaging in high-risk behaviours (88).

Although research on mental health in Kenya is limited, particularly among FSWs, findings from the Maisha Fiti study showed that mental health problems among FSWs in Kenya surpassed those in the general population (35). For instance, depression affected 23.2% of FSWs compared to 4.4% in the general population, while anxiety affected 11% of FSWs compared to 3.1% in the general population (35, 89). The prevalence of PTSD among FSWs in Nairobi was 14%, suicidal thoughts 10%, and 2.6% for suicide attempts (35). The baseline results of the Maisha Fiti study revealed independent associations between depression, anxiety, PTSD, and recent suicidal behaviours (suicidal attempts and/or ideation) with recent physical/sexual violence, harmful alcohol/substance use, recent financial challenges leading to hunger, and increased number of reported ACEs (35). Additionally, PTSD was linked with increased prevalence of chlamydia infection; recent suicidal behaviours were associated with

low education and socioeconomic status, and social support had a protective effect against poor mental health (35). Longitudinal findings within the same study cohort indicated that the presence of any mental health problems (depression/anxiety/PTSD) and recent suicidal behaviours were both linked to recent violence from non-intimate partners and recent experiences of hunger (90). Moreover, suicidal behaviours were associated with engaging in additional employment alongside sex work (90). Although in Kenya, poor mental health has been linked with higher risk HIV behaviours, and people living with HIV are more likely to experience poor mental health (91, 92), there is limited research examining these relationships, specifically among FSWs.

## 2.3. Female sex workers and harmful substance use

Globally, the harmful use of alcohol and other substances is a major public health concern linked with adverse effects on physical and mental health, including injuries and premature death (93, 94). According to a global report from 2015, the prevalence of heavy episodic alcohol use (past 30 days) was 18.4%; daily tobacco smoking was 15.2%; cannabis use was 3.8%; and amphetamine, opioid, and cocaine use in the past year were 0.77%, 0.37%, and 0.35%, respectively (94). The use of substances such as alcohol has long been recognised as an essential aspect of the sex work industry, with research showing a higher prevalence of substance use among FSWs than among women not engaged in sex work (95, 96). A global literature review revealed that alcohol use before or during sex work ranges from 19% to 76.5% among FSWs (96). Among FSWs in LMICs, a systematic review and meta-analysis study found that 26% (95% CI: 17–36%) used alcohol daily, and 41% (95% CI: 31–51%) were hazardous/harmful/dependent alcohol users (7). FSWs who use alcohol are more likely to use drugs such as cannabis, heroin, cocaine and hallucinogens (7). A recent systematic review has shown that globally, the prevalence of lifetime illicit drug use among FSWs was 29% (95% CI 24–34%) (8), and cocaine is the most commonly reported substance use among FSWs (1). In Mozambique, a cross-sectional study of FSWs conducted from 2019 to 2020 reported a prevalence of 47% and 13.3% for hazardous alcohol drinking and drug use in the past 12 months, respectively (22). Another cross-sectional study conducted at two different sites in South Africa found that 56% were binge drinkers (AUDIT-C scale; cut-off 10), and 29%

reported drug use within the past 12 months (96). The wide variation in the use of harmful substances in different settings is attributed to cultural differences and other environmental factors (96). Additionally, the heroin market in Africa has experienced rapid expansion, with reports in Tanzania and Kenya indicating a concerning trend: women who use heroin often engage in sex work and adopt high-risk injection practices, predisposing them to HIV and other blood-borne infections (97, 98). While some women may enter sex work to support their illicit drug use habits, research has also shown that sex work can predispose harmful alcohol use, which, over time, increases the risk of illicit drug use (99).

Although alcohol and other substances are prevalent in the sex work industry, FSWs working in clubs or bars tend to consume alcohol more than street-based FSWs (95). The variance in alcohol consumption patterns among FSWs based on their workplaces primarily relates to factors such as the availability, accessibility, and acceptability of alcohol, as well as safety concerns. For instance, street-based FSWs, who may have less protection compared to venue-based FSWs, are more likely to abstain from drinking to maintain self-control (95). Both FSWs and their male clients also use alcohol and other drugs to facilitate participation in sex work. The use of alcohol and drugs to assuage women's embarrassment in selling sex by enhancing assertiveness in soliciting clients or getting into the mood for sex work has been reported by FSWs worldwide, including Mexico (99), India (100), Uganda (101) and South Africa (102). In addition, FSWs may face heightened vulnerability to harmful substance use due to the unique risks associated with their occupation, including violence from different perpetrators and structural inequities such as stigma, discrimination, poverty, and gender disparities (7, 95, 96). These factors, combined with elevated rates of HIV and other STIs, create an environment where substance use becomes a coping mechanism and exacerbates health risks, including mental health problems among FSWs (8, 95).

Numerous studies consistently report an association between violence, especially sexual violence, and substance use among FSWs (4, 95). A recent cross-sectional survey among FSWs in South Africa revealed that those who experienced physical or sexual violence in the past year from either intimate or non-intimate partners had higher reported drug use. However, no evidence of association was found between violence and binge drinking (96). Similarly, in

Mozambique, a cross-sectional study found that FSWs who reported illicit drug use and hazardous alcohol use were more likely to experience physical and sexual violence (22). In a recent systematic and meta-analysis study of alcohol use among FSWs in LMICs, most studies did not use validated tools to measure alcohol use, and sometimes, those that did had different cut-off scores (7). According to the authors, this variability in methodology may explain the inconsistent findings and make comparisons between studies challenging.

To cope with the stigma and violence due to aggressive policing practices, FSWs sometimes resort to alcohol and drug use (103, 104). For example, evidence of a positive association between binge drinking in the past 12 months and police sexual coercion was reported in Russia (104), however, a cross-sectional study among FSWs in Mexico found no evidence of an association between police arrest and hazardous alcohol use (105). While the experience of violence may increase the risk of harmful substance use, the use of harmful substances, especially illicit drugs, from both FSWs and their clients may also increase the risk of violence, including police arrest and incarceration (101, 106). A qualitative study in Uganda reported a high level of alcohol consumption among FSWs, with reports of alcohol use increasing the risk of violence and unprotected sex (101).

Numerous studies have shown a close link between substance use and increased sexual risk behaviours, including unprotected sex (e.g. low condom use) (7, 95, 101, 106). A systematic review and meta-analysis study revealed evidence of an association between harmful alcohol use and inconsistent condom use among FSWs in LMICs (7). The association between substance use and unprotected sex has been documented among FSWs in SSA, including those who engage in hazardous drinking in Mozambique (22), psychoactive substance users in Nigeria (107), individuals with high levels of drug or alcohol use in Tanzania (108), those with frequent alcohol use (not binge drinking) in Zimbabwe (109) and those with problem drinking in Uganda (110). FSWs who use alcohol or drugs are also prone to having a larger volume of clients (110). The harmful use of substances among FSWs increases the risk of HIV/STIs, although findings have been inconsistent (95, 110, 111). In India, drug-using FSWs who were more likely to use alcohol were also more likely to test positive for active syphilis and Chlamydia infection compared to non-drug users (111). Moreover, a review and meta-analysis

study of FSWs in LMICs revealed that harmful alcohol use was associated with drug use and STIs but not with HIV. In SSA, findings from a cohort study among FSWs in Uganda showed that HIV prevalence was associated with problem alcohol use at enrolment but not during follow-up (110). Similarly, a survey conducted in Mozambique from 2019 to 2020 highlighted a correlation between harmful alcohol consumption and both HIV prevalence and self-reported STIs among FSWs (22). In the same study, illicit drug use was positively associated with self-reported STIs in the last year but not with HIV. The association between alcohol and drug use with HIV and other STIs can be explained by the impact of these substances on decision-making, leading to higher-risk sexual behaviours; their biological effects on HIV/STI transmission, progression and treatment adherence; and their effects on risk-taking as well as the sharing of contaminated drug injecting tools (e.g., syringes and cotton) (19, 111-113).

Furthermore, associations between harmful alcohol or illicit drug use and mental health problems have been reported among FSWs (2, 95). A systematic review and meta-analysis among FSWs in LMICs by Beattie et al. found evidence of associations between alcohol use and suicidal behaviour, as well as between illicit drug use and depression (2). In Togo, a cross-sectional study showed that FSWs who reported harmful alcohol use were three times more likely to suffer from psychological distress (84). Recently published research in South Africa showed that FSWs who used drugs to cope with sex work were significantly more likely to have depression and PTSD (74).

In Kenya, as in other regions, alcohol and substance use are prevalent among FSWs. For example, in the Maisha Fiti study, approximately 30%, 22%, and 17% of FSWs reported harmful alcohol, amphetamine, and cannabis use, respectively, as measured by validated tools (30). Another study among 301 FSWs in Kenya (Nairobi) conducted in 2017 found 98% reporting current psychoactive substance use (114). In the same study, 95.6% reported alcohol use in the past year (50.2% were high-risk drinkers) and were currently using cannabis (61.5%), khat (47.2%) and tobacco (30.9%). Findings from a randomised controlled trial in Mombasa, Kenya, also reported a high prevalence of harmful alcohol use (35.3%) and substance use (excluding alcohol) in the past six months (34.5%), with a high frequency of khat use in the past month (30.2%) (115). There is also an emergence of heroin in Kenya, with research

documenting the overlap between sex work and drug-related risk behaviours (98, 116). This led to the inception of a medication-assisted treatment (MAT) program in Kisumu to address the growing concerns around heroin use (98). A qualitative study among FSWs in Kenya revealed that, in addition to using alcohol and other drugs, FSWs often smoke cocktails of drugs containing heroin prior to sex work (98). Poly-drug use among FSWs is prevalent (30, 117), as evidenced by a recent cross-sectional study in Mombasa, where 98% of FSWs tested positive for more than one drug (117). The use of alcohol and other drugs during sex work to withstand sex work-related pressure, relaxation, gain the courage to negotiate with clients and be able to fight potentially abusive clients have been reported by FSWs in Kenya (30, 98).

Research among FSWs in Kenya also showed that alcohol and other substance use are associated with a range of overlapping syndemic social and occupational risk factors across their life course. For instance, baseline findings of the Maisha Fiti study showed that harmful alcohol, cannabis, and amphetamine use were significantly associated with higher adverse childhood experience scores and recent violence from clients. A cohort study of 400 HIV-negative FSWs in Mombasa revealed that compared to non-drinkers, women with harmful drinking were four and eight times more likely to report sexual violence and physical violence, respectively (118). Research among FSWs in Kenya also showed that FSWs who use alcohol and other drugs are prone to engaging in higher-risk sexual behaviours (30, 118), report a higher number of sexual partners (30), and have a higher prevalence of HIV compared to abstainers (116, 118). In a qualitative study conducted in Kenya, FSWs revealed that frequent drinking with clients before sex could lead to 'blackouts' and make them forget about condoms or agree to engage in condomless sex with clients for higher pay (119). In the same study, FSWs additionally recounted their vulnerability to condomless sex for higher pay due to poverty and the desire to cater for their children's needs. The higher prevalence of HIV among FSWs who use harmful substances was evidenced in a cohort study in Kenya, which found that the adjusted hazard ratio of HIV incidence was 10 (95% CI = 1.1-87.9) times higher among FSWs who reported hazardous drinking compared to non-drinkers (118). Evidence of a marginal association between trading sex for drugs and injecting heroin, as well as between needle or syringe sharing and HIV among FSWs who inject drugs, has been revealed in Kenya (116). In addition, baseline findings in the Maisha Fiti showed evidence of associations

between harmful use of alcohol, cannabis, and amphetamine with increased odds of depression/anxiety (30). Other factors that showed evidence of associations with the use of alcohol or other substances among FSWs in Kenya include being younger, having lower socio-economic status (SES), being married, being a Muslim and experiencing food insecurity (30). An alcohol reduction intervention among FSWs in Kenya led to a significant decrease in participation in sex work and experiencing specific forms of violence, particularly physical and verbal abuse by clients, six months after the intervention (115).

## 2.4 Cortisol and associated factors

Cortisol, a biomarker of chronic stress, has attracted considerable attention due to its potential association with various health outcomes (120). Several studies have examined diverse physiological and psychological stressors and their impact on cortisol levels across different populations. Understanding the factors influencing cortisol levels is crucial for unravelling the complex relationship between stress and health. Findings from a systematic review by Staufenbiel et al. and a meta-analysis study of hair cortisol by Stalder et al., based on aggregated data of 124 (sub) samples (total N = 10,289) found several factors such as the experience of major life events (e.g. divorce and violence), physical stressors, chronic stress, various mental health problems, age, sex and salivary cortisol measures associated with HCC in adults (48, 121).

Research on the association between violence and cortisol levels, especially in adults, is limited and with inconsistent findings, likely due to variations in the severity, timing, and type of violence experienced, as well as differences in cortisol measurement methods (42, 47, 122-124). A systematic review by Statufenbiel et al. suggests that HCC generally increases in individuals with recent/ongoing chronic stress related to adverse life events, compared to their unaffected counterparts (48). Additionally, childhood trauma has been shown to have a lasting effect on HPA axis functioning (125, 126), with a review suggesting a pattern of low cortisol reactivity in adults who experienced violence in childhood, although there is inconsistency in findings across studies (127). To address these inconsistencies, a cohort study revealed that girls subjected to sexual violence in childhood initially exhibited elevated cortisol levels

compared to unexposed counterparts, which transitioned to blunted levels during adolescence and adulthood, supporting the attenuation hypothesis (128). According to the attenuation hypothesis, the HPA axis goes through an adaptive phase to sustain periods of hypercortisolism by downregulating cortisol production following a stressor, which results in hypocortisolism (128).

Furthermore, HPA axis dysfunction is linked with stress-related psychiatric symptoms and disorders such as depression, anxiety and PTSD, although there are differences in results between diagnoses (48). A systematic review of published research on cortisol and mental health problems in humans reported that generally, individuals with major depression have elevated cortisol levels while those with anxiety disorders have reduced levels (48). A similar decrease in cortisol levels among individuals with PTSD has been reported, with research indicating that following a traumatic event, cortisol levels initially increase and subsequently decrease below the baseline level (48). For example, a longitudinal study initially noted a significant increase in hair cortisol levels one month after a single traumatic earthquake event among both female adolescents who developed PTSD and those who did not. However, it observed a subsequent significant decline in cortisol levels in the PTSD group compared to the non-PTSD group up to seven months after the event (129). Evidence from a longitudinal study of children and adolescents exposed to war in Syria and residing in informal tented settlements in Lebanon showed that HCC decreased over time following the end of war exposure, however, PTSD symptoms were associated with a small increase in HCC (130). The authors argued that a possible reason for the small increase in HCC among participants with PTSD symptoms might be attributed to ongoing stressors in their new environment. Interestingly, the authors found war exposure influenced HCC partially through PTSD symptoms and vice versa, albeit to a lesser extent, creating a bidirectional relationship (130). In terms of the relationship between cortisol and suicidal behaviours, studies have reported conflicting results (131-134). A meta-analysis study on cortisol levels and suicidal behaviour found no evidence of an association between cortisol and suicide attempts (135). However, significant age-dependent associations were observed, with studies with a mean sample age below 40 years showing increased cortisol levels, while those with a mean age above 40 exhibited decreased levels (135).

Previous research has evidenced that alcohol and other drug use trigger the body's response to stress (136-138). According to Duplessis-Marcotte et al., the link between alcohol use and the HPA axis/cortisol levels is a complex bidirectional relationship as alcohol stimulates the HPA axis, leading to increased cortisol, and higher cortisol increases the desire to consume more alcohol as a stress-coping mechanism (139). Current research suggests a complex relationship between alcohol use and cortisol levels. A systematic review by Chen et al. showed that several studies consistently reported blunted cortisol levels among chronic alcohol users compared to light drinkers, suggesting that individuals at risk for alcoholism may be less responsive to physical and psychological stress (49). In contrast, a study by Price and Nixon reported elevated HCC among chronic alcohol users and lower levels during abstinence (140). Stalder et al. found that alcoholics in acute withdrawal states had three to fourfold higher hair cortisol levels compared to abstinent alcoholics or healthy controls (50). The inconsistencies or insignificant results in the relationship between alcohol use and cortisol levels shown in some studies have been linked with potential confounders such as duration of alcohol abstinence and comorbidities such as PTSD (49). Similar to alcohol use, a review revealed that acute marijuana use was associated with increased cortisol levels, which is blunted in marijuana-dependent individuals compared to controls (141). A current review of studies on drug-induced stress responses by Wemm and Sinha (136) summarised findings on the direction of phasic HPA axis response in both acute and dependent users. It found that acute alcohol, nicotine and cannabis users generally have increased cortisol levels while binge/heavy/dependent users have reduced cortisol levels compared to controls. However, acute opioid users tend to have lower cortisol levels while inconsistent results exist for binge/heavy/dependent users.

Cortisol is pivotal in immune response, as it interacts bidirectionally with immune cytokines to uphold immune system balance and exerts anti-inflammatory effects. For instance, in normal homeostasis, research has shown that exposure to stress and subsequent release of cytokines such as interleukin (IL)-6 and tumour necrosis factor-alpha (TNF-α) trigger the release of cortisol, which, through its anti-inflammatory effect, suppresses the further release of cytokines (142). However, chronically elevated cortisol levels can be pro-inflammatory and have been linked to heightened levels of inflammatory cytokines, including CRP (143), leading to

widespread inflammation and impairing the immune response system (45). Some studies have highlighted the inflammatory effect of cortisol dysregulation in a variety of health conditions such as Fibromyalgia syndrome, mental health problems (e.g. depression and anxiety), sleep disorders (e.g. insomnia) and cognitive diseases (e.g. Alzheimer's) (40). For example, hypercortisolism and inflammation are known to be two of the most consistent findings among depressed patients and are often associated with each other (144). Some immune profiles, such as CD4+ T-cell activation and diminished regulatory T-cell (Treg) frequency, have been consistently found to be associated with HIV susceptibility (145). Research has also shown that cortisol contributes to the regulation of T-cell activation, which influences HIV infection progression (146). A 2014 cross-sectional study examining the biological pathways mediating the association between violence and increased HIV risk found that psychological and physical IPV, independent of sexual IPV, was associated with CD4+ T-cell activation among HIV-negative women (145). According to the authors, this suggests a stress-induced immune pathway supporting the link between HIV susceptibility among women who experienced physical and psychological IPV.

A meta-analysis on determinants of cortisol levels in humans highlighted age, sex, hair washing frequency, hair treatment, and oral contraceptive use as important covariates of HCC (121). However, the associations were relatively weak, particularly for hair-washing frequency, hair treatment, and oral contraceptive use, with small effect sizes and borderline statistical significance. The study revealed higher HCC in men compared to women, a positive association between HCC and age, and negative associations between HCC and hair-washing frequency, hair treatment, and oral contraceptive use.

Lastly, to my knowledge, only one study globally has investigated cortisol levels and associated factors among FSWs (25). This cross-sectional study was conducted in Mombasa, Kenya, investigating the relationships between GBV and hair cortisol levels and inflammation. The study found that FSWs who were recently (past 12 months) exposed to GBV (physical/sexual/emotional) had higher HCC than their opposite counterparts. The study, however, found no evidence linking HCC with mental health problems such as depression and PTSD, nor to alcohol or other substances, including tobacco, khat and marijuana.

### 2.4.1 Research gaps

Based on my literature review, several research gaps exist regarding FSWs' experiences of various stressors globally and in Kenya. Below are the gaps I aim to address in this PhD thesis:

1. The literature shows that FSWs in different parts of the world are highly vulnerable to violence and mental health problems relating to the sex work environment and other stressful events in their lives. Despite this, few studies globally and none in Kenya have qualitatively explored FSWs' accounts of stressful live events and their mental health experiences, both before and after entering sex work.

2. Evidence suggests that stressors such as violence, poor mental health, and harmful substance use could cause HPA axis dysfunction, hence affecting cortisol levels. However, there is limited research on this topic, and what is available shows inconsistent findings on how cortisol production is related to exposure to these stressors and whether cortisol levels change over time in response to significant distressful events. Only one cross-sectional study has investigated cortisol levels among FSWs (25). Longitudinal studies are needed to better understand the relationship between various stressors and cortisol levels among FSWs.

# Chapter 3 Study Objectives, and Setting

## 3.0 Overview

This chapter is organised into three sections. The first section outlines the aim, research questions, and overarching goal of my PhD research. The second section describes the study setting, Nairobi, and includes key statistics such as the poverty rate, total population, and HIV prevalence, generally and specifically among FSWs. This chapter also includes a brief overview of the sex work outreach program (SWOP) in Nairobi and the services offered to FSWs. The final section details the broader Maisha Fiti study, focusing on the recruitment of study participants and the data collection process.

## 3.1 Aim and questions

In this PhD, I aim to explore stressors, specifically violence, poor mental health and harmful substance use in the lives of FSWs in Nairobi and investigate how cortisol levels relate to exposures to these stressors. The overarching goal is to understand FSWs' vulnerability to violence, poor mental health and harmful substance use and whether these factors work through the stress response system, affecting cortisol levels. This thesis addresses three main research questions as follow:

(1) What are the lifetime experiences of mental health, and other psychological stressors among FSWs in Nairobi, Kenya?
(2) Is the experience of violence, poor mental health, and harmful substance use associated with hair cortisol levels?
(3) Do hair cortisol levels change over time according to recent exposures to violence, poor mental health, and harmful substance use?

This research will advance our understanding of the relationship between the experience of violence, poor mental health, and harmful substance use with increased HIV acquisition risk,

by investigating whether these stressors affect the biological stress response system, a pathway that could link stress to poor health through HPA axis/cortisol dysfunction.

## 3.2 Study setting

This study was conducted in Nairobi, Kenya's capital city. Based on the 2019 census, Nairobi was the most populated and dense of the 47 counties of Kenya (147). The population in Nairobi in 2019 was approximately 4.4 million people (2.19 million males vs 2.20 million females), with a density of 6,247 per square kilometre, compared to the national population and density of 47.6 million and 82 per square kilometre, respectively (147). Nairobi is Kenya's political, economic, and cultural hub, hosting significant economic activities.


**Figure 3.2.** Map of Kenya showing Nairobi city and other provincial counties. *Source: https://www.alamy.com*

While poverty rates in Kenya have declined from 46.8% in 2005/06 to 36.1% in 2015/2016, significant disparities persist among counties (148). For instance, in the North Eastern counties, approximately 70% of the population lives below the poverty line, contrasting starkly with Nairobi, where the poverty rate stands at 16.7% (148). Despite Nairobi boasting the lowest poverty rate overall, poverty and living conditions in informal settlements are far worse than in the rest of the city, with women disproportionately affected (148).

Nairobi is also home to a substantial proportion of Kenya's FSWs, hosting nearly one-fourth of the country's FSW population of 167,940 (149). Moreover, a 2011/2012 geographical mapping exercise in Kenya identified Nairobi as having the highest concentration of sex work venues, with over 2,500 active sex work venues (26). These venues, categorised in accordance with Kenya's National Guidelines for HIV/STI Programmes for Sex Workers, encompass diverse settings such as street-based, home-based, road (truck)-based, sex den-based, venue-based, escort services, and massage parlours (26).

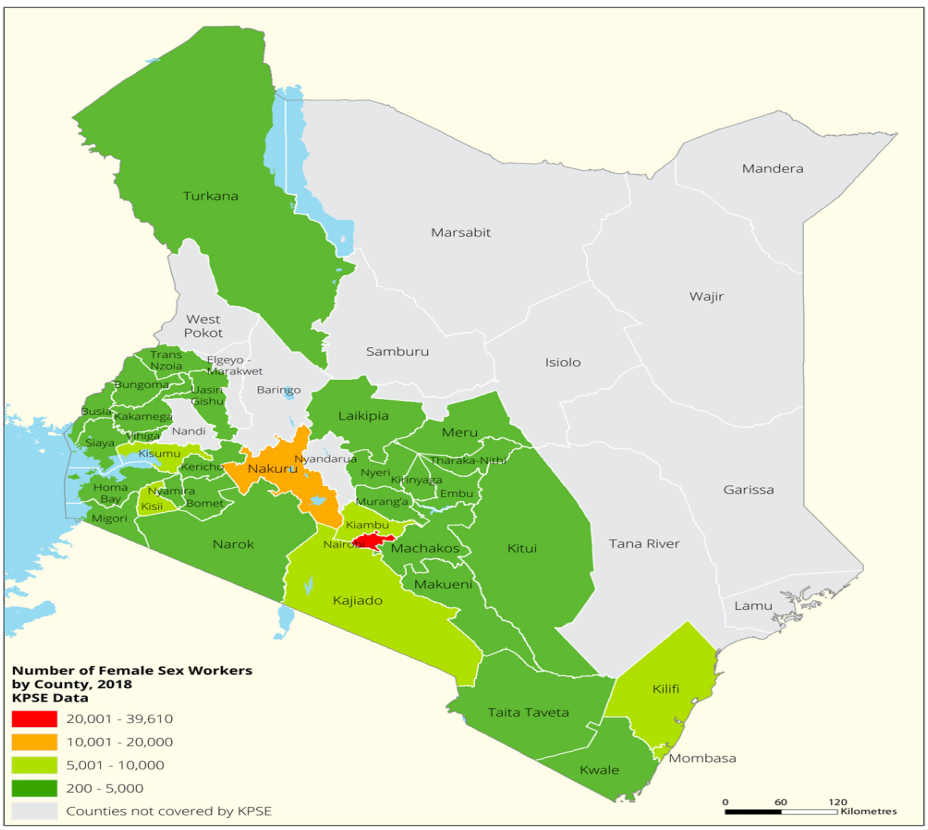


**Figure 3.2.b** Number of FSWs in Kenya by county (149).

The HIV prevalence in Nairobi County exceeds the national average, standing at 6.1% compared to 4.8%, with women bearing a higher burden than men at 7.5% versus 4.7% (150). FSWs in this region constitute a significant proportion of key populations at heightened risk of HIV infection. In 2015, the prevalence of HIV among FSWs in Nairobi was estimated to be 29.5% (95 % CI: 24.7-34.9) (151). To address the escalating HIV epidemic in Kenya, particularly among vulnerable groups like FSWs, the SWOP was established in 2008 under the management of PHDA and the University of Manitoba, with funding from the Centre for Disease Control- U.S President's Emergency Plan for Aids Relief (CDC-PEPFAR) initiative. Through seven clinics in Nairobi, SWOP provides comprehensive clinical services, including HIV and STI prevention and treatment, distribution of condoms, counselling, and addiction rehabilitation services to FSWs and men who have sex with men. These services are delivered by trained and non-judgmental staff familiar with FSWs' challenges. Additionally, each clinic employs a team of outreach workers and peer educators who focus on sex work venues, offering assistance to FSWs who have experienced violence during sex work and guiding them to SWOP clinics for appropriate medical, counselling, and legal support.

## 3.3 Description of the Maisha Fiti study

The Maisha Fiti study was a three-year longitudinal mixed-methods research project conducted with FSWs in Nairobi, Kenya. Initiated in 2019, the Maisha Fiti study aimed to explore the relationships between violence against women, mental health issues, harmful alcohol and drug use, and their biological impact on inflammation in the body and genital tract, which may increase the risk of HIV acquisition. The study's development, including my PhD, was inspired by discussions at the 2015 Tackling the Structural Drivers of HIV (STRIVE) research consortium meeting, where experts on violence against women and girls and HIV gathered to examine the epidemiological pathways linking violence to HIV and identify research gaps (152). Emerging evidence from the meeting suggested that violence and traumatic events could have biological effects on immune and hormonal functions, potentially contributing to increased HIV susceptibility. Following the meeting, a key priority was to investigate the

various indirect pathways connecting violence with heightened HIV acquisition risk. The PI of the Maisha Fiti study, Dr Tara Beattie, attended this meeting, which motivated her to explore these biological pathways among FSWs in Nairobi, Kenya.

The design of the Maisha Fiti study was done in consultation with the FSW community and the SWOP clinics in Nairobi. It was advertised as a study on women's health and well-being to minimise the risk of stigma, discrimination, and violence among participating women. Participants in the study were randomly selected from a pool of 29,000 FSWs registered in the seven SWOP clinics. Each FSW attending a SWOP clinic is assigned a unique barcode for identification. The eligibility criteria for the selection of participants included FSWs who: (i) were aged 18-45 years, (ii) attended a SWOP clinic in the past 12 months, and (iii) had no chronic illness (excluding HIV) such as diabetes, rheumatoid arthritis, asthma, or TB infection that could impact the immune system. Selected women were telephoned and informed by research team members about the study in English or Swahili. Those who were interested were invited to visit the study clinic, where they received detailed information about the study and were enrolled after providing written informed consent. As explained elsewhere (35), the desired sample size for the Maish Fiti study was 1000 FSWs. However, 1200 FSWs were selected to allow for non-response and non-eligibility since additional exclusion criteria during enrolment were current pregnancy (using urine pregnancy test) or breastfeeding, as these affect host immunology. A total of 1003 FSWs were enrolled in the study between January and December 2019, as shown in **Figure 3.3.**

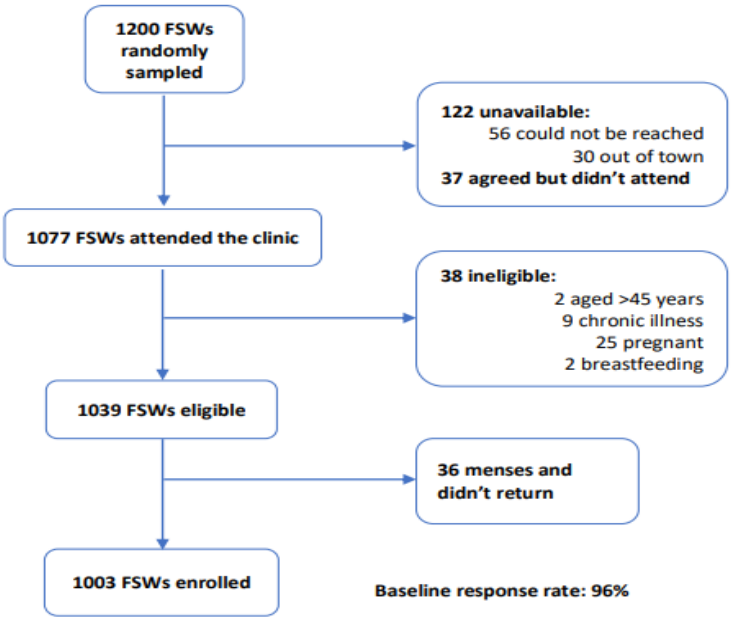


**Figure 3.3**. Selection of Study Participants in the Maisha Fiti Study

Follow-up data collection was scheduled 6-12 months after enrolment and started in January 2020. Data for 365 participants were collected between Jan-March 2020. However, the onset of the COVID-19 lockdown in Kenya in March 2020 led to a pause in data collection, which resumed in June 2020. Due to the delay and the likely change in women's experiences due to COVID-19, all women were re-surveyed (n=877) from June 2020 to January 2021. Data collected between January and March 2020 were called midline data, and those collected between June 2020 and January 2021 were called endline data.

### 3.3.1 Behavioural-biological Survey

At every study visit at the dedicated SWOP clinic in Nairobi, quantitative data were collected in which participants completed a behavioural survey, and samples were collected for the biological tests. The questionnaire for the behavioural survey at baseline was designed by researchers in the Maisha Fiti study and administered to participants by trained research staff. It consists of sections covering a wide range of topics such as background characteristics, income, sexual behaviours, STIs and HIV experiences, testing and treatment, intravaginal washing practices, violence, stigma, mental health problems and substance use. In some sections and where applicable, data were collected using validated study tools adapted to the

study setting. The survey questionnaire was modified at midline and endline to include additional questions related to the COVID-19 pandemic.

Through face-to-face interviews conducted in either Kiswahili or English, clinical team members and the two research assistants of the Maisha Fit study (listed in **Table 3.3.3)** administered the survey questionnaires to participants. Although the behavioural survey questionnaire captured a wide range of FSWs' experiences, it lasted for more than an hour per participant. The length of this may have been tiring and may cause a burden to respondents, thereby affecting the data quality or response rate. However, some practical findings suggest that questionnaire length bears little/ insignificant relationship to data quality/ response rate (153, 154).

After women responded to the behavioural survey, biological samples, including urine and blood, were collected for biological tests. For example, urine samples were provided to test for gonorrhoea and chlamydia infection using the GeneXpert Assay. Blood samples were used to test for HIV, syphilis, and CRP levels using rapid HIV tests, rapid plasma regain assay, and Nano checker reader, respectively. Positive HIV results were confirmed using HIV DNA GeneXpert. Hair samples from the posterior vertex of the head were used to test for cortisol levels. The samples collected and analysed in the Maisha Fiti study are shown in **Appendix A**

### 3.3.2 Qualitative interviews

During the first phase of behavioural and biological data collection in October 2019, 40 women who had completed baseline behavioural and biological surveys were randomly selected to participate in IDIs. This random selection was done by selecting every 25$^{th}$ participant who completed the behavioural-biological survey, resulting in a total sample size of 40 FSWs at baseline. This sample size was deemed adequate for data saturation based on previous experience and available time and resources. There was an underrepresentation of younger women in the random sampling; thus, in July 2020, at follow-up (at endline), seven more women were randomly selected to be interviewed from all women aged 18-24 who were enrolled in the study. Two female Kenyan researchers fluent in both Kiswahili (the local

language) and English interviewed the same participants at baseline and endline. The researchers interviewed 40 women at baseline (October 2019) and the same women at endline (July 2020). At baseline, a total of 40 women were interviewed. The interviews were semi-structured, and women were asked to detail their life stories by narrating specific events in their lives relating to:

(1) childhood experiences, education, sources of livelihood, early relationships
(2) sex work commencement and sex work life,
(3) violence by different perpetrators,
(4) mental health experiences, stigma, alcohol, and substance use
(5) use of antiretroviral HIV prevention or treatment (PEP/PrEP/ARV)
(6) aspirations and plans.

Interviews were recorded, and recordings were transcribed verbatim. If interviews were not conducted in English, they were transcribed and then translated into English. The study principal investigator and coordinators performed quality checks to ensure that relevant data were correctly captured during the interview and in the transcripts.

All research tools were translated into Kiswahili, pretested, piloted, and modified based on team feedback. Also, all the women who participated in the Maisha Fiti study consented to participate and signed the consent form, which has both the English and Kiswahili versions. Participants at each study visit were given refreshments and 500 KSH as reimbursement for travel and work costs. The Maisha Fiti study in-depth interview guides for baseline and endline are in **Appendices B** and **C** respectively.

### 3.3.3 The Maisha Fiti study data collection team

Due to the COVID-19 travel restrictions and closure of most universities, which affected the commencement of my PhD and scholarship as an international student, the data collection of the Maisha Fiti study had ended before I joined the team. The Maisha Fiti study data collection team included a study coordinator, two female qualitative social scientists, two research

assistants, three community liaison members, a clinical team (a doctor, two nurses and a counsellor), three laboratory technicians and seven peer educators (the Maisha Fiti study champions). The data collection team consisted of locally employed staff with experience working with FSWs in SWOP clinics or conducting research on FSWs in Nairobi, Kenya. Given the sensitivity of the topics discussed, all in-depth interviews and behavioural surveys were conducted by female researchers to help participants feel safer and engage in more open and honest discussions, thereby enhancing data quality. Additionally, all Maisha Fiti study team members underwent a three-week training on handling confidential information and responding to distress during interviews. The table below includes the names of team members who contributed to the data collection process.

**Table 3.3.3.** Maisha Fiti Study Qualitative, Quantitative and Biological Data Collection team

| **Maisha Fiti study data collection team** | **Contribution** |
|---|---|
| Rhoda Wanjiru | Study coordinator |
| Jenifer Liku and Emily Nyariki (social scientist) | Qualitative (IDIs) |
| Mary Kung'u and Hellen Babu (research assistants)<br>Chrispo Nyabuto, Monica Okumu, Anne Mahero and Zaina Jama (clinical team) | Quantitative (Behavioural survey) |
| Pauline Wanja and Polly Ngurukiri | Data entry |
| Elizabeth Rwenji, Evelyn Ombunga and Ibrahim Lwingi (Community liaison members) | Mobilization and follow up |
| Daisy Oside, Agnes Atieno,<br>Faith Njau, Mary Akinyi, Demitila Gwala, Ruth Kamene, Wendy Watata (The Maisha Fiti Study Champions) | Mobilization and follow up |
| Peter Muthoga, Erastus Irungu, Wendy Adhiambo (lab team) | Lab sample collection |

# Chapter 4 Conceptual Framework and Research Methodology

## 4.0 Overview

In this chapter, I present the conceptual frameworks that form the foundation of both the qualitative and quantitative components of my PhD research. I provide a detailed account of the research methodology, illustrating how these frameworks informed the analysis of my data. Additionally, this chapter includes a reflexivity statement, in which I critically reflect on my positionality and consider how my subjectivity and potential biases may have influenced the research process. The final section of the chapter addresses the ethical approvals and considerations involved in my study.

## 4.1 Overview of the conceptual framework of this PhD

A conceptual framework is an analytical model or map that includes the concepts, theories, emergent ideas or assumptions, variables, and relationships that guide the design and analysis of the research (155, 156). A conceptual framework was vital in my PhD research as it explained the practical and theoretical importance of my research topic and detailed how I analysed and answered my research questions.

In this section, I provide an overview of the conceptual frameworks that underpin the qualitative and quantitative components of this PhD research. First, I discuss a framework that depicts the distal determinants of poor mental health among FSWs in low-income settings. This framework qualitatively explores the factors influencing psychological or poor mental health in the lives of FSWs in Kenya, guiding the analysis and results presentation for research question 1 in Paper 1. Second, I explain the frameworks developed to examine the factors associated with HCC levels among study participants, both at baseline and longitudinally. These frameworks guided research questions 2 and 3 analysis, presented in Papers 2 and 3, respectively.

### 4.1.1 Conceptual framework-qualitative research

For the qualitative research, I adapted a conceptual framework proposed by Shahmanesh et al. about the determinants of poor mental health and suicidal behaviours among FSWs in Goa, India (157). According to Shahmanesh et al., the distal determinants of poor mental health and suicidal behaviours among FSWs in Goa were categorised into four main groups: social factors, gender-disadvantage factors, sexual risk factors, and physical health factors. Each of these categories encompasses various elements (157). For instance, socio-economic, demographic, and cultural factors were classified under social factors; violence, autonomy, and childlessness were classified under gender-disadvantage factors; sex work, condom use, number of sexual partners, and concurrency were classified under sexual risk factors; and sexual health, HIV, STIs, and substance use were classified under physical health factors. I adapted the framework by Shahmanesh et al. to my PhD research setting because it was specifically proposed for FSWs at risk of different stressors in a low-resource setting, similar to Nairobi. The proposed four main determinants are also similar to those identified through my literature review. Finally, the framework is simple to understand and flexible, as each of the four determinants is broad and can contain different elements based on context.

In this PhD research, I hypothesised that four main distal determinants—social factors, gender disadvantage factors, sexual risk factors, and physical health factors—shape the lifetime mental health experiences of FSWs in Nairobi, Kenya, similar to that of Shahmanesh et al. (157). These determinants are interrelated, as illustrated in the conceptual framework in Figure 4.1.1. The framework guided the analysis and presentation of findings in Paper 1, where I used the baseline qualitative data to investigate FSW's lifetime poor mental health experiences and perceived risks in Nairobi, Kenya.

Below is a description of the elements included in the four distal determinants of poor mental health, as illustrated in my conceptual framework in Figure 4.1.1.

**Social factors:** This category includes socioeconomic factors such as poverty, literacy, and education, alongside the death of a close family member and the presence of harmful social norms in Nairobi that impact the mental well-being of women and FSWs.

**Gender disadvantage factors:** This includes gender-related disadvantage factors that FSWs may have experienced prior to entering sex work, rather than being solely a result of the sex work environment. It encompasses experiences of IPV (e.g., physical, psychological, sexual, and financial abuse) as well as childhood abuse. Kindly note I added IPV under gendered factors to better illustrate how IPV before sex work may act as a push factor leading to higher risk sexual behaviours including sex work entry, while IPV after entering sex work may be linked to new vulnerabilities, such as stigma, and other factors related to sex work.

**Sexual risk factors:** This covers risks related to sex work, such as violence from various perpetrators including clients, police and the broader community. It also includes condom use and the number of paying sexual partners. The arrow between sexual risk factors and gender disadvantage factors illustrates how, for instance, sexual risk factors such as having multiple sexual partners may increase the risk of experiencing gender disadvantage factors like IPV.

**Physical health factors:** This includes conditions related to physical health, such as HIV, STIs, injuries, disabilities, and harmful substance use. Some of these conditions may have arisen due to the inherent risks of sex work or prior to entry into the profession.

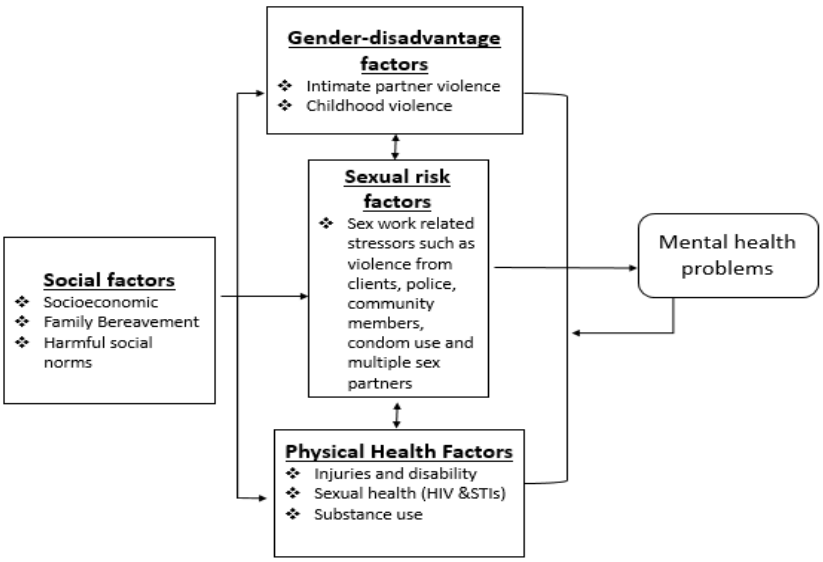


**Figure 4.1.1** A conceptual framework for the social risk factors for subsequent mental health problems among FSWs in Nairobi, Kenya, adapted from Shahmanesh et al.

### 4.1.2 Conceptual framework-quantitative research

While the determinants and elements of poor mental health included in the conceptual framework for the qualitative component of this thesis could influence HCC levels, I employed a different conceptual framework for the quantitative component. This decision was made because the relationships between these elements and HCC levels are not clearly illustrated in the conceptual framework. Additionally, the framework does not adequately depict the relationships between my primary exposure variables of interest (violence, mental health problems, and harmful substance use) and other distal exposures (such as potential confounders). Therefore, it may not be the most suitable framework for the quantitative aspect of this research.

Using the eco-social life-course theory of disease distribution (158) and based on my literature, I developed a conceptual framework to examine whether violence, poor mental health, and alcohol and other substance use were associated with HCC levels (**Figure 4.1.2**). The eco-social theory explains how societal and ecological contexts can be biologically embodied, resulting in societal health and disease disparities over time (158). The theory typically describes the associations between exposures and diseases, focusing on how socio-political disparities such as income, education level, and power dynamics at different levels result in health inequalities (159).

This conceptual framework is ideal for this study because it fully captures the syndemic oppressive societal experiences in the lives of FSWs as highlighted in the literature and the qualitative findings of this thesis, which may affect HCC levels. The blue rectangles represent the main exposure variables of interest, i.e. violence, mental health problems and harmful substance use. I focused on the categories of these main exposure variables because FSWs commonly experience them in Kenya (68, 114) and have all been associated with an increased risk of HIV infection among FSWs (1, 21, 22). The yellow sphere is the outcome variable, HCC levels, while the orange rectangles represent the potential confounders upstream to both the main exposures and outcome. This framework guided the analysis of paper 2, in which I used the baseline quantitative data to ascertain whether recent violence, poor mental health, and harmful substance use were associated with HCC levels.

I hypothesised that recent experiences of violence, mental health problems and harmful substance use at baseline would be independently associated with increased HCC levels.

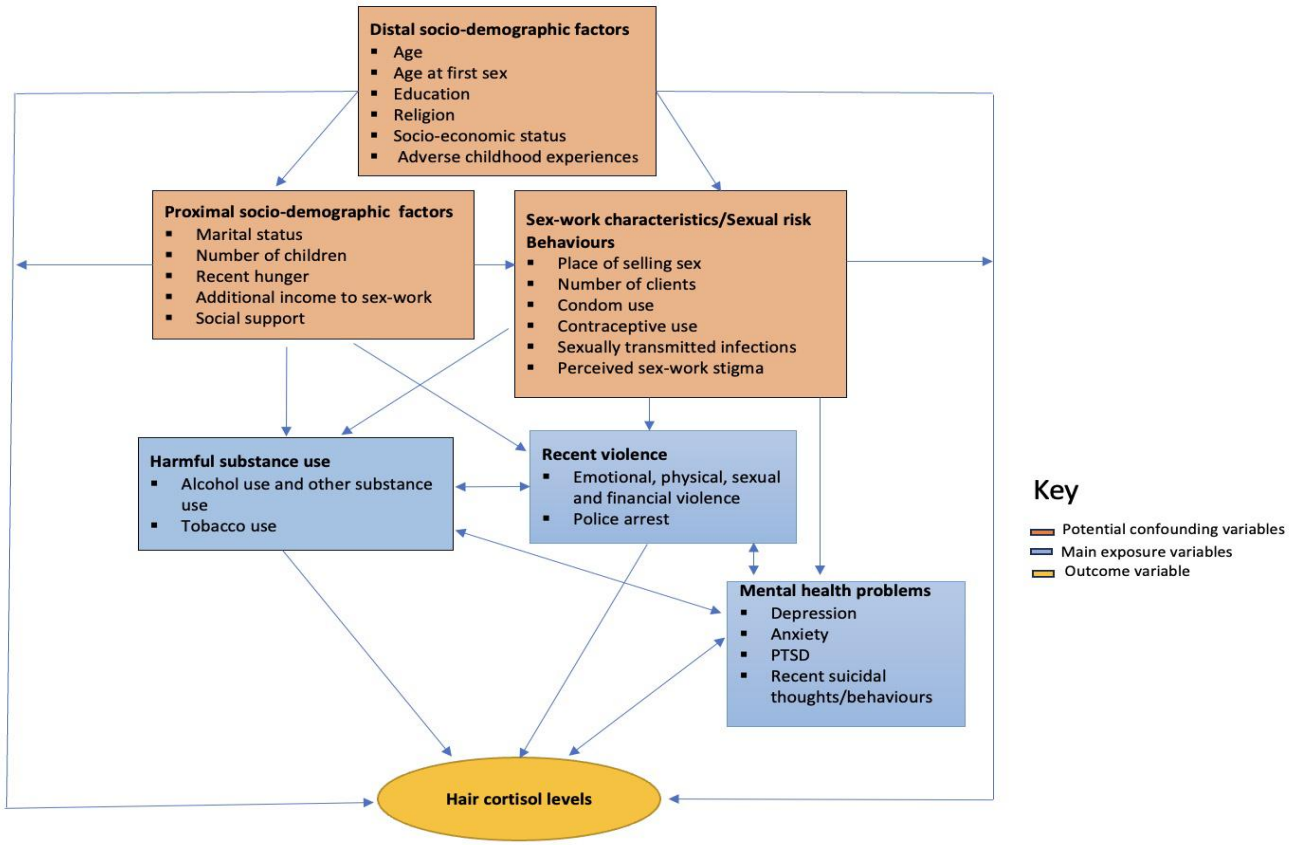


**Figure 4.1.2.** A conceptual framework illustrating the potential risk factors influencing hair cortisol levels among female sex workers in Nairobi, Kenya.

For the longitudinal analysis presented in paper 3, I adapted the conceptual framework used at baseline to account for longitudinal associations, the impact of COVID-19 (yellow rectangle), and the influence of counselling (green rectangle) on HCC (**Figure** 4.1.2.b). Counselling was added to the framework because some participants received psychological counselling from the Maisha Fiti study counsellor, SWOP clinic, or other healthcare providers prior to endline, which could affect HCC levels or modify the associations between my main exposures and HCC levels (160).

The COVID-19 pandemic was also incorporated into the framework due to its widespread stress-related impact. A prospective cohort study in the UK reported a substantial increase in cortisol levels among adults in response to the pandemic (161). A systematic review and meta-analysis study also revealed that patients with severe COVID-19 infections had higher cortisol levels than those without (162). Conversely, lower serum cortisol levels have also been observed among patients with long-term COVID-19 infections (163).

I could not assess the direct effect of COVID-19 through illness in my PhD because participants were not tested for COVID-19 due to a shortage of COVID-19 test kits in Kenya at that time. Also, the indirect effects of COVID-19 through income loss were not directly measured. However, the trajectory of recent hunger (classified under proximal socio-demographic factors) from baseline to endline could be considered as a proxy for income loss due to the effect of the COVID-19 pandemic.

The framework below guided the analysis in paper 3, where I examined changes in HCC levels from baseline to endline and whether these changes were due to the experiences of violence of various forms, poor mental health, and harmful substance use.

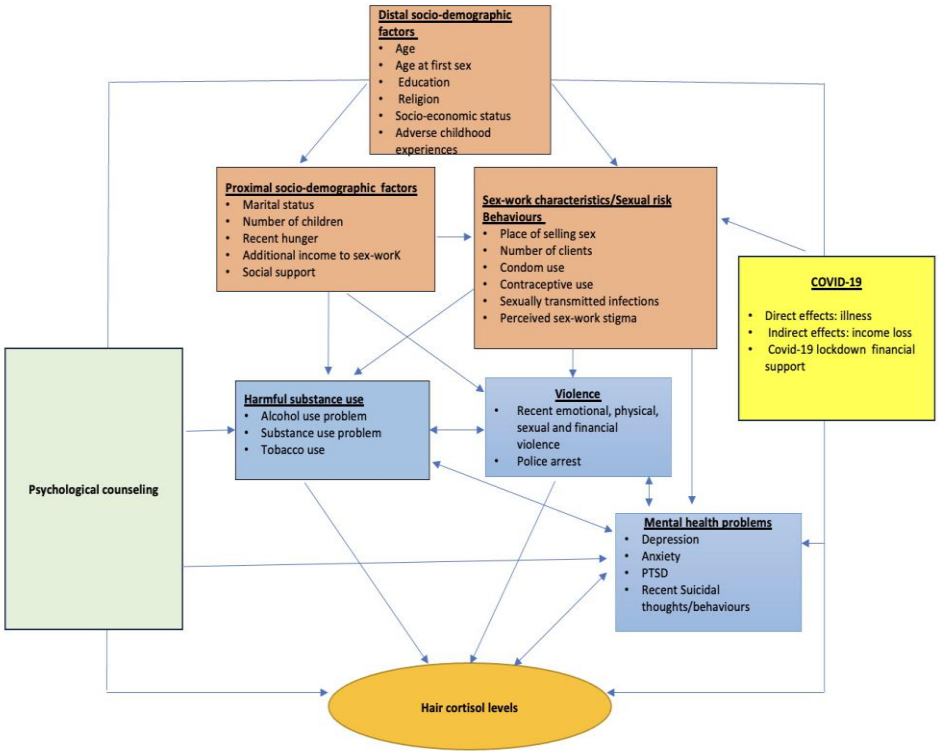


**Figure 4.1.2.b.** A conceptual framework illustrating the potential risk factors influencing cortisol levels among female sex workers in Nairobi, Kenya, over time.

## 4.2 Overview of PhD research methodology

For my PhD, I conducted secondary data analyses utilising the mixed-methods data collected in the Maisha Fiti study to achieve the overarching aim of my PhD. The combination of these data enriched my understanding of FSW's experiences of various stressors over time and how these may affect their increased susceptibility to poor health outcomes, notably by influencing cortisol levels, as depicted in the conceptual frameworks. While each research paper within this PhD thesis delineated the methodology employed to address the specific research questions, this section provides an overview of the qualitative and quantitative methods.

### 4.2.1 Qualitative methodology

I utilised the baseline semi-structured in-depth interview data collected in the Maisha Fiti study to answer my first research question, presented in Paper 1. According to DiCicco-Bloom and Crabtree, a semi-structured interview follows an initial framework of predefined open-ended questions but allows for adaptation and expansion through probing and commentary as the interviewer engages with the interviewee(s) (164). This methodology offers flexibility, permitting adjustments to research questions while staying focused on the overall study aim. Although semi-structured interviews can take various forms, including face-to-face, group, individual and in-depth formats, the semi-structured in-depth interview stands out as one of the most effective and commonly employed techniques in qualitative research, particularly within health research (164). It facilitates the collection of in-depth information from respondents while ensuring the study's focus remains intact (165). This method is frequently used to gather information about personal experiences, attitudes, and beliefs about a particular topic of interest (164), making it ideal and highly effective for exploring FSWs' experiences of mental health and other psychological stressors.

**Data analysis**

Before starting my PhD, the Maisha Fiti research team had thematically analysed and coded the baseline IDIs in NVivo. Although the Maisha Fit study research team included codes about participants' knowledge of mental health problems and their personal experiences, it did not include codes for participants' perceived mental health risks based on their personal mental health experiences. The Maisha Fiti team provided me with their compiled coding memo and the raw transcripts. The transcripts contained some key Kiswahili words, especially those related to participants' definitions and understanding of mental health. For Paper 1, I used the 40 raw transcripts at baseline to revise and recode the codes in the compiled memo using Nvivo and thematically added codes on participants' perceived mental health risks based on their personal experiences using the steps described by Braun and Clarke (166). Thematic analysis is a widely used qualitative method for identifying, analysing, and reporting patterns or themes within data. Compared to other analysis methods, such as grounded theory and narrative

analysis, it is easy, quick, and theoretically flexible, making it employable within a range of theoretical frameworks (166).

There are different approaches to coding data in thematic analysis, such as inductive and deductive methods (167). The inductive approach is data-driven, in which the coding of the data and themes is not based on a pre-existing coding frame or the researcher's analytic preconception. However, Braun and Clarke argue that researchers can't free themselves from their theoretical thinking during coding (166). Deductive thematic analysis, in contrast, is driven by the researcher's theoretical knowledge or interest in the area. It tends to produce a less rich data description than the inductive approach (167). In Paper 1, I employed an inductive thematic analysis approach by inductively identifying codes from the transcripts and then organising the themes and sub-themes guided by the conceptual framework shown in Figure 4.1.1 and presented in Chapter 5 (Figure 1). Throughout the thematic analysis process, I periodically organised collaborative meetings with the Maisha Fiti's qualitative analysis team and my supervisors to discuss the themes and make amendments based on feedback received (coding framework in **Appendix D**). These meetings were also helpful in contextualising the data and in discussing the meaning of some Kiswahili words to facilitate the interpretation of findings. I then later joined the Maisha Fiti study follow-up data analysis team (including Dr Tara Beattie) to thematically analyse all the follow-up IDIs, consisting of 47 participants. We created the codebook and summarised the key findings into a memo masterfile. Using findings from the follow-up data, I actively contributed as a second author with the Maisha Fiti research team (**Appendix E**) about FSWs' experiences during the COVID-19 pandemic.

### 4.2.2 Quantitative methodology

I answered research questions 2 and 3 using data from the behavioural survey and the biological test results in the Maisha Fiti study. Although the Maisha Fiti study had a large sample size of 1003 participants, I carried out a sample size calculation for this thesis to get an idea of the minimum sample size needed. This was calculated using the estimated standard deviation of hair cortisol levels (1.7) and a mean cortisol level of 2.57 pg/mg among women obtained from

the literature (42). The mean difference and expected effect size were set at 0.5, with a power of 80% and a 95% significance level, giving a minimum sample size of 366.
Although the behavioural questionnaire captured a wide range of participant data, I focused on my main exposure variables and possible covariates guided by my conceptual frameworks (**Figures 4.1.2 and 4.1.2.b**).

For the laboratory test data, I focused on the hair cortisol level data (the main outcome variable), CRP level data, and HIV and STI (gonorrhoea, chlamydia, and syphilis) test results. HIV testing initially took place at the study site using a rapid test kit, with positive results confirmed at Kenyatta National Hospital using the HIV DNA GeneXpert. Blood samples for CRP levels, collected only from HIV-negative women, as well as samples for STI testing, were also analysed at Kenyatta National Hospital. Some of the samples analysed in the Maisha Fiti study that are incorporated in this PhD Research are listed in **Table** 4.2.2.

**Table 4.2.2.** Samples collected and analysed in the Maisha Fiti study used in this PhD Research

| **Sample collected** | **Health conditions assessed (Method)** |
|---|---|
| Urine | • Pregnancy test (Rapid pregnancy test kit)<br>• C.trachomatis & N.gonorrhoea (GeneXpert Assay) |
| Blood test | • C-reactive protein (CRP) test conducted among HIV negative participants (Nano checker reader)<br>• *Treponema pallidum* (syphilis), defined as a positive RPR of any titre (Rapid plasma regain assay)<br>• HIV (Rapid test, positive tests confirmed using HIV DNA GeneXpert) |
| Hair Samples | • Cortisol levels (ELISA technique) |

The hair samples, which were each wrapped in aluminium foil with the scalp end of the hair identified by a paper sticker, were shipped from Kenyatta National Hospital to the Maisha Fiti team at the University of Toronto. I then transported these samples to Western University in

London, Ontario, Canada, for analysis. I spent a week with the lab team at Western University, where I sorted the hair samples and received training in HCC analysis. Under the guidance of the lab team, I assisted in measuring the length of all the hair samples from HIV-negative women collected at both baseline and endline.

At baseline, 746 of the 1,003 participants in the Maisha Fiti study were HIV-negative (168), and 736 (98.7%) of them provided hair samples. A total of 877 FSWs participated at follow-up (endline), of whom 649 were HIV-negative. Among the HIV-negative participants at endline, 627 (96.6%) provided hair samples. Several women who provided hair samples had extremely short hair or samples with fewer than 50 strands, which were insufficient for HCC testing assays. We excluded samples less than 2 cm long, resulting in 425 women with viable hair samples at baseline. Of these, 285 had viable hair samples at endline.

Using the proximal 2 cm of hair from the scalp, representing cumulative cortisol concentration over the 2.5 months prior to the survey (based on the average African hair growth rate of 0.79 cm per month(169)), cortisol was analysed using an established ELISA technique (170), expressed as nanograms per gram (ng/g) of hair mass. I assisted in analysing the first batch of samples while at the lab at Western University before returning to the UK.

**Data analysis**

Analysis of the quantitative component of this PhD was restricted to HIV-negative FSWs with HCC data. This is because although HIV causes immune dysregulation and affects cortisol levels, it is impossible to control for HIV status during analysis due to differing antiretroviral therapy adherence among FSWs living with HIV(171, 172). Also, since the overall goal of this PhD is to guide the design of programmes for HIV prevention among FSWs, I focus on how stressors among HIV-negative participants may increase their risks of HIV infection.

**In paper 2,** I used the baseline behavioural-laboratory survey data to examine whether the experience of violence, poor mental health and harmful alcohol and substance use were independently associated with HCC levels. I used linear regression models to examine the

associations between the main outcome variable (HCC levels) and the key exposure variables. Linear regression was used because the outcome was a continuous variable (173). I log-transformed the outcome variable, HCC levels, using natural logarithms for all parametric statistical analyses due to its skewed distribution. Log transformation is one of the most common population data transformations used to transform skewed data to conform to an approximate normality (174). This can reduce the variability in the data, which can help meet the normality, linear relationships and homoscedasticity assumptions for parametric statistical analyses such as linear regression models (175). Because transformation changes the unit and distribution of the data, back-transformation is essential to interpret the results (175). For example, I exponentiated (back-transformed) the mean cortisol levels of the transform data to generate the geometric mean, which is less affected by the skewed data than the arithmetic mean. Also, because HCC was the outcome variable in all the linear regression models built, all estimated regression coefficients were exponentiated to generate the geometric mean ratio. For example, if the estimated regression coefficient of the association between log HCC and age were 0.2, the geometric mean ratio would be $e^{0.2}$=1.22. This means that for a unit increase in age, HCC increases by 22%.

Since I was interested in the associations between the different forms of violence (emotional, financial, physical, and sexual violence), different mental health problems (anxiety, depression, PTSD, and suicidal behaviours) and harmful substance use (alcohol, tobacco, and other substances) with HCC levels, I analysed the components under each category of these exposures in different multivariable models to avoid multicollinearity. This is because the components under each category of exposures may be related and have a high overlap. For example, the categorisation of the different forms of violence, mental health problems and harmful use of substances in this study were not mutually exclusive, which could lead to overlap between components under each category of exposures. Multicollinearity occurs when two correlated predictors are placed in the same multivariable regression model, which may lead to unstable p-values used for assessing statistical significance, resulting in unrealistic and incorrect interpretations (176).

In Paper 3, I examined the trajectories of various forms of violence, experiences of mental health issues, and the use of harmful substances and how they are associated with changes in HCC from baseline to endline. I did not specifically assess how different forms of mental health issues were linked to changes in HCC at endline due to the low incidence of individual mental health problems at endline. Instead, I combined them into a single category representing the experience of any mental health issue (depression, anxiety, PTSD, or suicidal behaviour). The change in HCC levels at endline was defined by dividing the HCC at endline by the HCC at baseline (i.e. ratio of change). The analytical methods used in Paper 3 are similar to those in Paper 2. Further details of the analysis methods employed in Papers 2 and 3 can be found in Chapters 5 and 6, respectively.

## 4.3 Reflexivity

Reflexivity in research is the act of self-reflecting and carefully evaluating how one's subjectivity, context and biases, such as beliefs, assumptions, judgment systems and worldview, shape the research process (177, 178). By bringing biases and unchecked assumptions to the surface, reflexivity can help reduce questionable research practices that affect the credibility and verifiability of research (178). Although reflexivity has been an integral part of qualitative research for decades, the use of it in quantitative research has been increasingly applied in recent years (178).

As I employed mixed methods to answer my PhD research questions, I continuously reflected on my positionality in my qualitative and quantitative research processes. My reflexivity in my qualitative research process focused on the interpretivism paradigm, which is grounded in subjectivism and relativism, recognising that the researcher's experiences and perspectives can influence the research process (177). First, as a non-Kenyan and a non-FSW who had never visited Kenya before the commencement of my PhD, I walked into my PhD research mainly with an outsider identity. One of the significant disadvantages of being an outsider in research is that it may jeopardise acceptance and the level of trust between participants and researchers, which may reduce the quality of data collected (179). This potential bias on my side wasn't present in my PhD as I couldn't participate in the data collection of the larger Maisha Fiti study

due to COVID-19 travel restrictions. Data in the Maisha Fiti study was collected by a team of Kenyan researchers who were familiar with the setting and fluent in English and the native language, Kiswahili. Also, trust was built between FSWs and the larger SWOP program, where participants were drawn.

During the analysis and interpretation of my qualitative research findings, my outsider role made me easily distance myself emotionally from some contextual findings, which may reduce personal bias and lead to a more objective analysis and interpretation of the findings (180). However, as an outsider, I may have missed or misunderstood the relevance of some cultural or contextual issues while interpreting my research findings. My zeal to understand the context of sex work in Kenya led to my first visit to Nairobi. During this visit, I had a first-hand experience of visiting sex work venues and met with FSWs who willingly discussed their day-to-day experiences, challenges, and life stories with us (myself, the study PI and other research team members).

Moreover, as a young Gambian woman who has experienced negative events in her life, including violence and battling with poor mental health for years, I had some elements of an insider identity since I could resonate with study participants with high vulnerability to negative stressful events. During analysis, I was aware that my perception and experiences could influence my analysis and interpretation of findings, so I tried as much as possible to analyse and interpret the qualitative data with an "open mind." Also, because I was part of the Maisha Fiti study qualitative data analysis team, which was familiar with the data collected, I organised meetings with the team to discuss the analysis and interpretation of my PhD findings. These meetings were crucial in discussing context-related findings and my interpretation of the data with the research team, which may mitigate or reduce any undue influence I may have had or any context-related interpretation.

Furthermore, my reflexivity in my quantitative research methodology was rooted in the positivism paradigm, underpinned by objectivism and realism. Positivists acknowledge that a discoverable reality exists independent of the researcher or participants and can be understood, identified, and measured objectively using scientific methods (181). However, evidence showed that due to the decisions that analysts of quantitative data make during the data analysis

process, the analysis of quantitative data may not be free from biases and entirely objective (178). Although reflectivity is vital through every stage of the quantitative research methodology (178), for my PhD, I mainly reflected on my analysis and interpretation of my research findings. Firstly, in order to reduce research practices that may impact the credibility of my PhD findings such as hypothesising after analysing the data, I openly shared my research questions, hypotheses and analysis plan with my supervisors, the Maisha Fiti research team and during my upgrading at LSHTM prior to having access to the Maisha Fiti study quantitative data. Moreso, since HCC levels can be influenced by a range of biological, psychological and environmental factors, I acknowledge that my selection of variables for the quantitative component of this thesis was restricted to the variables collected in the Maisha Fiti study. This might have led to the exclusion of some important variables such as physical activity (182) that may influence cortisol levels but were not captured in the Maisha Fiti study, potentially introducing bias in my findings. However, the effect of these potential biases might be minimal since my research findings were consistent with what's available in the literature. Additionally, the analysis and interpretation of my research findings mainly focused on my three categories of exposure variables of interest (i.e. violence, mental health and harmful substance use). This limited me in emphasizing the results of other exposure variables adjusted for during analysis.

Lastly, I would like to acknowledge that my PhD experiences have shown me the importance of research collaboration and working in an interdisciplinary research team. Although I missed the data collection period of the Maisha Fiti study in person, the strong Maisha Fiti research team made me feel present in Kenya at a distance by supporting and answering any questions about the data collection process.

## 4.4 PhD ethical approval and considerations

My PhD study and all analyses are nested within the scope of the Maisha Fiti study, which has been ethically approved by the Kenyatta National Hospital-University of Nairobi Ethics Review Committee (REF P778/11/2018), Research Ethics Committees at the London School of Hygiene and Tropical Medicine (REF 16229-3), and the University of Toronto (REF 37046). I received ethical approval from the Research Ethics Committees at LSHTM for my PhD

research and was granted access to the Maisha Fiti study data by my then first PhD supervisor, Dr Tara Beattie, who was the PI of the Maisha Fiti study. Appendices **F** and **G** contain the LSHTM ethical approval documents for this PhD thesis and the Maisha Fiti study, respectively.

To avoid participants being stigmatised, discriminated and violated, the Maisha Fiti study was advertised as *'a study on women's health and wellbeing'*. Also, due to the sensitivity of the topics in the Maisha Fiti study and to maintain confidentiality, anonymised study numbers were issued to each participant, and pseudonyms were used in place of real names during the transcription of interviews. The dataset I used for this PhD included these study numbers and had no personally identifiable information. The datasets obtained were all stored on my computer and were password-protected. I also completed the LSHTM-organized online ethics course (certificate in **Appendix H**), further enhancing my understanding of ethical matters when conducting global/public health research.

All information related to the study was orally communicated to study participants in English, Swahili, or other Kenyan dialects of the potential participant's preference (the information and informed consent form are in **Appendix I**). They also had the opportunity to ask questions about the study before signing the consent form. The Maisha Fiti study carefully ensured informed consent was obtained from participants before enrolling them and before the IDIs (consent form for IDIs in **Appendix J**). Additionally, although research compensations help to reduce the financial burden and inconveniences inflicted on participants, they may lead to undue influence. Considering the study population and the context of sex work in Kenya, the sum of 500KSH (£2.89) reimbursement for travel and work costs and refreshments given to study participants was appropriate with none or the minimal possibility of undue influence on the study population.

# Chapter 5 Research Paper 1.

*Mental health challenges and perceived risks among female sex workers in Nairobi, Kenya*

## 5.0 Overview

The experience of adverse psychological events is frequently reported in the lives of FSWs, with some events occurring as early as childhood. Sex work also increases women's vulnerability to violence and other stressful situations, predisposing them to poor mental health and suicidal behaviours. In Kenya, although quantitative findings report FSWs' increased vulnerabilities to poor mental health mainly related to their life experiences, no qualitative study, to our knowledge, has investigated poor mental health and associated risks.

Through IDIs with FSWs in Nairobi, Kenya, this paper provides evidence of their lifetime mental health experiences and perceived risks. The findings show that poor mental health is both a driving factor on the pathway into sex work and a consequence of sex work among participants. Factors such as poverty, low levels of education, poor job opportunities, harmful gender norms, and the experience of violence all contribute to poor mental health and subsequent entry into sex work. Moreover, the negative consequences of sex work, such as increased sexual risks and violence from various perpetrators, including police and clients, further exacerbate poor mental health in this vulnerable population. The findings emphasise the importance of addressing key risk factors, such as poverty and violence against women and girls, to reduce entry into sex work and improve mental health.

This manuscript was published in BMC Public Health in November 2022. The abstract was also accepted for an oral presentation at the "AIDS 2022" conference in Montreal, Canada, which I attended in person with a scholarship awarded by the organisers, the International AIDS Society. This conference hosted over 15,000 delegates worldwide, across different professions, such as policymakers, researchers, and advocates. After my oral presentation, I was invited to join the panel for further discussions and to answer any questions from the audience. The title of my presentation was "Exploring the Mental Health Experiences and

Perceived Social and Sexual Risks Among Female Sex Workers in Nairobi, Kenya." The abstract has been published in the Journal of the International AIDS Society (183). I also presented the findings from this paper at the Annual STI/HIV Collaborative Retreat at the Nairobi Serena Hotel in 2023. This conference allowed me to disseminate my PhD findings to individuals from the Ministry of Health in Kenya, policymakers, fellow researchers, and the community of FSWs in Nairobi. Below is a copy of the exact version of the published paper.

London School of Hygiene & Tropical Medicine
Keppel Street, London WC1E 7HT
T: +44 (0)20 7299 4646
F: +44 (0)20 7299 4656
www.lshtm.ac.uk

# RESEARCH PAPER COVER SHEET

**Please note that a cover sheet must be completed for each research paper included within a thesis.**

## SECTION A – Student Details

| | | | |
|---|---|---|---|
| **Student ID Number** | 2003982 | **Title** | Mrs |
| **First Name(s)** | Mamtuti | | |
| **Surname/Family Name** | Panneh | | |
| **Thesis Title** | Exploring violence, poor mental health and harmful alcohol/substance use among FSWs in Nairobi and their association with hair cortisol levels. | | |
| **Primary Supervisor** | Prof. John Bradley | | |

**If the Research Paper has previously been published please complete Section B, if not please move to Section C.**

## SECTION B – Paper already published

| | | | |
|---|---|---|---|
| Where was the work published? | BMC Public Health | | |
| When was the work published? | November 24th, 2022 | | |
| If the work was published prior to registration for your research degree, give a brief rationale for its inclusion | NA | | |
| Have you retained the copyright for the work?* | **Yes** | Was the work subject to academic peer review? | **Yes** |

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| | |
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| **Supervisor Signature** | [redacted] |
| **Date** | 9th January 2025 |
| | |

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RESEARCH Open

# Mental health challenges and perceived risks among female sex workers in Nairobi, Kenya

Mamtuti Panneh[1*], Mitzy Gafos[1], Emily Nyariki[1], Jennifer Liku[2], Pooja Shah[1], Rhoda Wanjiru[2], Mary Wanjiru[2], Alicja Beksinska[1], James Pollock[3], The Maisha Fiti Study Champions[2], Zaina Jama[2], Hellen Babu[1], Rupert Kaul[4], Janet Seeley[1], John Bradley[5], Joshua Kimani[2†] and Tara Beattie[1†]

**Abstract**

**Background:** Female sex workers (FSWs) in Kenya are at an increased risk of violence, poverty, police arrest, and problematic alcohol and other substance use, all of which are linked to poor mental health and suicidal ideation. Despite the psychological stressors experienced by FSWs, there are no published qualitative methods research investigating their mental health experiences in Kenya. In this paper, we draw on data from in-depth interviews to examine FSWs' lifetime mental health experiences and perceived risk factors.

**Methods:** We used baseline in-depth interviews of the Maisha Fiti longitudinal study of FSWs in Nairobi. We randomly selected 40 FSWs from 1003 FSWs who attended a baseline behavioural-biological interview as part of the Maisha Fiti study. The interview guide was semi-structured, and participants were asked to detail their life stories, including narrating specific events such as entry into sex work, experiences of violence, mental health experiences, and use of alcohol and other substances. Interviews were recorded in Kiswahili/ English and transcribed in English. Data were coded and thematically analysed in Nvivo (v.12).

**Results:** Results indicated that the majority of participants understood 'mental health' as 'insanity', 'stress', 'depression', and 'suicide'; nevertheless, a number described mental health symptomatically, while a few believed that mental health problems were caused by witchcraft. Interestingly, poverty, low levels of education, poor job opportunities, a lack of family support, harmful gender norms, intimate partner violence and subsequent relationship breakdowns, and family bereavement all contributed to poor mental health and subsequent entry into sex work. In addition, the consequences of sex work, such as sexual risks and ongoing violence from police and clients, further exacerbated poor mental health.

**Conclusions:** There is a need for both micro- and macro interventions to address poverty and violence against FSWs in Kenya, thereby reducing mental health problems. Addressing violence against women and girls may also reduce entry into sex work. Improving mental health literacy and providing mental health intervention services for 'at-risk' populations such as FSWs should enhance coping strategies and help-seeking efficacy.

**Keywords:** Mental health, Suicide, Intimate partner violence, Poverty, Female sex workers, Sex-work related risk

†Joshua Kimani and Tara Beattie are joint last authorship.

*Correspondence: Mamtuti.Panneh@lshtm.ac.uk

[1] LSHTM, Department for Global Health and Development, London, UK Full list of author information is available at the end of the article

## Introduction

According to the World Health Organization (WHO), mental health is defined as "a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community" [1]. Poor mental health can lead

to mental health conditions such as depression, anxiety and post-traumatic stress disorder (PTSD) which affect our thinking, behaviours and interaction with others [2]. The burden of poor mental health is increasing globally, particularly among key vulnerable populations such as female sex workers (FSWs). Global estimates in 2010 showed that mental ill-health, neurological disorders and harmful substance use were the leading causes of years lived with disability, accounting for 1 in every 10 lost years of health [3]. Estimates were even higher in 2016, in which 19 and 7% of years lived with disability and ability-adjusted life years were attributed to mental and addictive disorders, respectively [4]. Mental health greatly affects the quality of life and, if untreated, can lead to premature death due to ill health or suicide [5]. The WHO estimates that there are over 700,000 suicides every year, with about 77% occurring in low-and middle-income countries (LMICs) [6]. The risk and outcome of mental health problems, including suicide, have been linked with a wide range of demographic, socioeconomic, neighbourhood, and relationship factors [5, 7].

FSWs are defined as girls and women who regularly or occasionally receive money in exchange for sexual services [8]. Entry into sex work may be precipitated by negative psychological events such as separation from parents, intimate partner violence (IPV), and childhood violence [9–11]. Sex work itself increases vulnerability to structural factors such as marginalization, stigma and discrimination, and gender inequality [12]. Sex work also involves occupational hazards such as unlawful police arrest, violence, deception, human immunodeficiency virus (HIV), other sexually transmitted infections (STIs), and harmful alcohol and other substance use [12, 13]. Both structural and occupational risks can predispose FSWs to psychological health problems and suicide [5, 12, 14–16]. A recent review and meta-analysis of mental health among 18,524 FSWs in LMICs reported the pooled prevalence of various mental health problems, with high estimated levels of depression (41.8%), anxiety (21.0%), PTSD (19.7%), physiological distress (40.8%), mood disorders (28.8%), recent suicide ideation (22.8%) and attempts (6.3%) [5].

The WHO estimated in 2011 that 6.6% (urban) and 5.1% (rural) of women in Kenya had exchanged sex for money in the past year [17]. Indeed, findings from the baseline quantitative Maisha Fiti study in Nairobi found that one quarter (25%) had either moderate or severe depression or anxiety and 14% had PTSD [18]. These common mental health problems were associated with a range of factors including poverty, violence and increased harmful alcohol/drug use [18]. Violence against FSWs is prevalent in Kenya with a recent survey among 220 FSWs in Nairobi reporting that 81 and 79% of respondents had experienced client-perpetrated and intimate partner-perpetrated violence, respectively, in the past 12 months [19]. This study reported a high prevalence of depression (56.8%) and generalised anxiety (39.1%), both of which were independently significantly associated with a recent violent experience [19]. FSWs in Kenya are also at high risk of violence from the police with respondents in a survey in 2015 reporting having experienced high levels of arrest for selling sex (62%) as well as verbal (59%) and physical (45%) abuse at least once in the past 12 months [20]. Violence against FSWs is associated with higher levels of psychological stress and has been linked with negative health effects such as increased HIV [21, 22]. In addition, alcohol use among FSWs in Kenya is common, with about 66 and 34% of FSWs engaging in hazardous and harmful drinking, respectively [23]. Alcohol consumption among FSWs has been linked with higher risk sexual behaviour, poor uptake of HIV services, and increased risk of violence and mental health problems [5, 23, 24].

Despite the substantial body of evidence demonstrating the increased risk of violence, police arrest, and harmful alcohol use among FSWs in Kenya, there is a paucity of research on their mental health experiences and needs. A limited number of quantitative studies have investigated mental health and associated risk factors among FSWs in Kenya [19, 25, 26], including quantitative research from the baseline Maisha Fiti study, but there is little research using qualitative research methods to understand FSWs' mental health experiences and determinants. This paper uses qualitative, in-depth interviews with FSWs enrolled in the Maisha Fiti study in Kenya to investigate their lifetime mental health experiences and perceived risk factors. Findings from this study will add to the existing literature by providing contextual and in-depth interpretations of the mental health findings obtained in epidemiological studies.

## Methods

### Study setting

This study was conducted in Nairobi, Kenya's capital city. The population in Nairobi in 2019 was estimated to be 4.4 million people, and about half were female [27]. Although poverty in Kenya is high (36%), there is a huge poverty gap between counties [28]. For example, the population living below the poverty line ranges from 16.7% in Nairobi to 68% in counties in the Northeastern province [28]. Due to economic reasons, migration from rural areas to Nairobi in search of work is a common phenomenon, especially among youth. Despite the city of Nairobi recording the lowest poverty rate, poverty and living conditions in informal settlements are far worse than in the rest of the city, with women disproportionally affected

[28]. Nairobi also accounts for the highest number of FSWs (about 40,000) in the country, with approximately 2000 'hotspots' where women sell sex [29]. There are different types of hotspots including bars (most common), guest houses, particular streets, and uninhabited buildings. Compared to other counties, FSWs in Nairobi have a strong network of self-help groups and support from the Sex work Outreach Program (SWOP) clinics, which provide health services and psychological support free of charge.

### The Maisha Fiti study

The Maisha Fiti study is a longitudinal mixed-methods observational study enrolling FSWs in Nairobi County, Kenya. A key objective was to assess the prevalence, severity, and frequency of FSWs' experience of violence, mental health morbidity, and problematic alcohol and other substance use, and how these differ by HIV status. The data collection was in 3 phases, baseline (Jan- Dec 2019), midline (Jan- March 2020), and endline (June 2020-Jan 2021). However, qualitative data were collected at baseline and endline only. This paper uses baseline qualitative data to explore FSWs' lifetime mental health experiences.

### Study site, data collection, and management

Since 2005, Partners for Health and Development in Africa have been managing SWOP clinics providing services to FSWs in Nairobi through funding from the Centre for Disease Control-President's Emergency Plan for AIDS Relief. The clinical services provided by SWOP include HIV, STI, and tuberculosis testing and treatment, as well as the provision of condoms, counselling, and drug and alcohol risk management services. At the time of the Maisha Fiti study, there were seven SWOP clinics in Nairobi County, each of which had at least two clinical staff, a pharmacist, two HIV testing and treatment counsellors, a team of outreach workers and peer educators, and two peer advocacy violence workers. About 33,000 FSWs have enrolled in SWOP (biometric registration with fingerprints), 16,000 of whom were in active follow-up at the time of this study. Sample size calculations and participant selection have been described in detail elsewhere [18]. In brief, 1200 participants were randomly selected from a list of all FSWs (though the SWOP clinic attendance lists of clinic barcodes) who had attended any of the seven SWOP clinics within 12 months preceding the start of the study, were 18–45 years old, not pregnant or breastfeeding, and had no chronic illness such as diabetes, rheumatoid arthritis, asthma, or TB infection in the past 6 months. Information about the Maisha Fiti study was disseminated to SWOP clinic attendees through study peer educators and community mobilizers based at the SWOP clinics. The study staff initially contacted selected FSWs by telephone and explained the study. Interested women were invited to attend the study clinic in downtown Nairobi, where they were provided with detailed study information (both written and verbally). Those who were eligible and consented were enrolled in the behavioural-biological survey and were also advised that they may be additionally invited to participate in in-depth qualitative interviews at a future date. Prior to the study start, all study team members (including peer educators) participated in a three-week training programme, which included modules on violence and mental health and how to respond to distress during an interview. A referral pathway was developed for participants reporting recent violence, mental health problems or suicidal behaviours during the quantitative or qualitative survey interviews. This included an immediate referral to a specialist counsellor employed in the clinic as part of the study team, as well as onward referral to specialist psychiatric and violence intervention services on an as-needed basis. The study team also provided depression (Healthy Activity Programme) [30] and harmful drinking (Counselling for Alcohol Problems) [31] brief psychological intervention training to HIV testing and treatment counsellors based at each of the seven SWOP clinics and participants could access additional support from these counsellors if they chose to.

Of the 1003 FSWs randomly selected for the behavioural-biological survey, 40 were randomly selected and invited to participate in the qualitative in-depth interviews. The in-depth interviews followed a semi-structured interview guide and were carried out by two trained Kenyan female researchers fluent in both Kiswahili and English. Participants were asked to detail their life stories, including narrating specific life events such as entry into sex work, experiences of violence, mental health experiences, use of alcohol and other substances, as well as the use of pre-exposure prophylaxis, post-exposure prophylaxis and antiretroviral. To avoid language barriers while responding to questions, participants were asked to choose the language they were most comfortable with (Kiswahili and/ or English). This helped minimize the risk of losing participants' intended meaning or misinterpretation, therefore increasing the validity of the data collected. Despite most participants choosing to mainly communicate in Kiswahili, all the interviews were a mixture of Kiswahili and English.

All recordings were uploaded to a secure server at Partners for Health and Development for Africa (PHDA) and then destroyed. Interview transcripts did not include participant names. All interview documents were stored on secure servers at PHDA and the London School

of Hygiene and Tropical Medicine. These were password-protected, and access was restricted to qualitative research team members only.

## Conceptual framework

When exploring suicidal behaviours among female sex workers in Goa, Shahmanesh et al. [32] proposed that social factors, gender-disadvantage factors, sex work-related sexual risk factors and physical health factors were distal determinants of poor mental health and suicide. For this study, we adapted this hierarchical conceptual framework based on a review of the literature and from our quantitative mental health findings, which drew on eco-social and life course theory [18, 33]. We hypothesised that socio-economic factors, familial factors, harmful social norms, gender-based violence, sex work-related violence and risk, physical and sexual health factors and substance use, were all potential determinants affecting FSWs' lifetime mental health experiences (Fig. 1). We used the framework to qualitatively explore FSWs perceived risk factors of poor mental health, both before and after their entry into sex work. The conceptual framework informed the analysis of the data and the presentation of the results.

## Data analysis

The analysis in this paper focused on participants' understanding of mental health through their definitions of mental health and depression and their experiences and perceived risk factors of poor mental health. The interviews were recorded, transcribed verbatim, and translated into English. Data were analysed thematically, and this started while interviews were still ongoing. During data collection, daily debrief meetings with the qualitative interviewers, the study PIs, the study coordinator, and the study research assistants, provided a multi-disciplinary, multi-cultural, and multi-linguistic platform to explore women's experiences of sex work and mental health in the Kenyan political, socio-economic, and socio-cultural context. These sessions were seminal in identifying themes of importance as well as topics that needed further probing in subsequent interviews. Following each interview, the interviewer wrote detailed notes about the interview, including observations which would not be captured during the audio recording (such as a participant's demeanour). These formed the 'scripts' which complimented the transcribed transcripts. Through the knowledge gained during the debrief meetings, the team started identifying emerging patterns and ideas of interest from the data. The scripts and transcripts were imported into Nvivo (V.12) for data organisation,

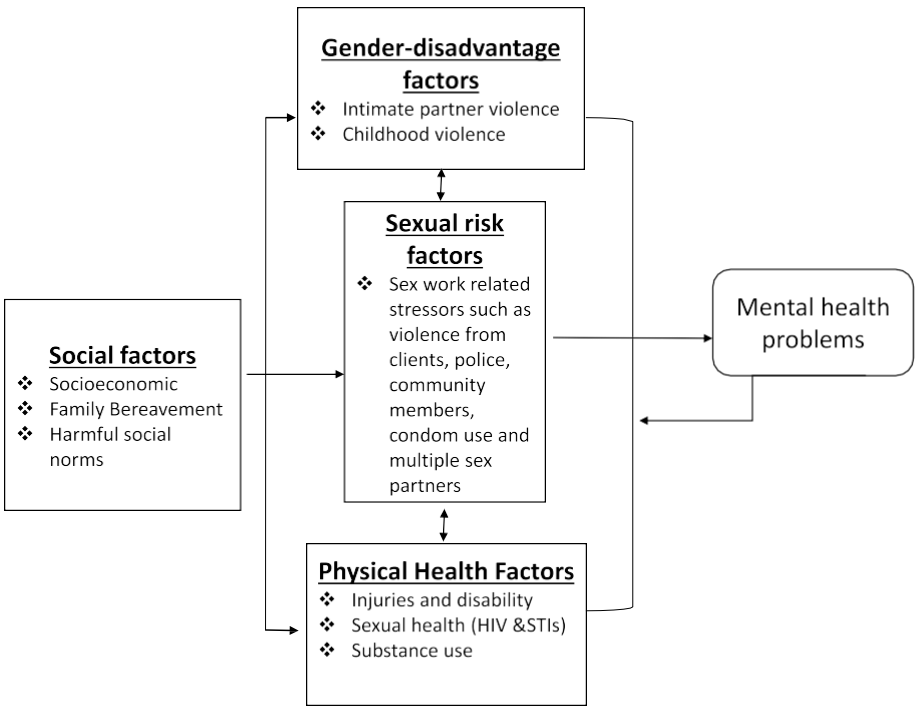


**Fig. 1** A conceptual framework for the social risk factors for subsequent mental health problems among FSWs in Nairobi, Kenya adapted from Shahmanesh et al.

coding and managing thematic analysis. Inductive data-driven codes were identified from the initial interviews and then organised into themes and sub-themes guided by the conceptual framework. The coding framework was updated, and coding revised iteratively. Data interpretation was further explored in a series of collaborative analytic working groups. The translated words of participants are presented as quotes and used to illustrate key themes. The socio-demographic characteristics and HIV status of the participants displayed in Table 1 were obtained from the baseline behavioural and biological survey data of the Maisha Fiti study, respectively. The behavioural survey captures data on socio-demographic, sexual behaviour, recent alcohol, and drug use, sexual and reproductive health, past and recent violence experience, mental health morbidity (depression, anxiety, suicidality, PTSD), and intravaginal washing practices, using validated tools as previously described (reference) The biological tests included HIV, STIs, pregnancy, systemic inflammation, cortisol levels, etc.

### Ethical approval and consent to participate

The Maisha Fiti study was ethically approved by the Kenyatta National Hospital – University of Nairobi Ethics Review Committee (KNH ERC P778/11/2018), the Research Ethics Committees at the London School of Hygiene and Tropical Medicine (Approval number: 16229) and the University of Toronto (Approval number: 37046). Participation in the study was voluntary, and women provided written informed consent before enrolling. Due to the potential societal marginalisation of FSWs and the sensitivity of the topics discussed, maintaining confidentiality was a key part of the study team training. Anonymised study numbers were issued for each participant, and pseudonyms were used in place of real names during interview transcription. Women were interviewed during their visit to the SWOP study clinic in a private space in which their conversations could not be overheard and were reassured of the confidentiality procedures at the start of each interview.

## Results

### Study population

The 40 FSWs interviewed had a mean age of 32 years (range: 21–44 years) and half were brought up in rural areas. All participants had some form of basic education, 11 participants had completed secondary school and three received higher education. Thirty-three participants had been married or had cohabited with a sexual partner. However, at the time of the interview, only four were married or were living with a partner. Furthermore, half of the study participants commenced sex work between 18 and 24 years old and four started before

**Table 1** Socio-demographics of Study Participants (*N*=40)

| Variables | N (%) |
|---|---|
| Age | |
| 18–24 | 7 (17.5%) |
| 25–34 | 19 (47.5%) |
| 35+ | 14 (35.0%) |
| Raised in | |
| Rural | 20 (50%) |
| Urban | 20 (50%) |
| Education Level | |
| Some primary | 2 (5%) |
| Completed primary | 14 (35%) |
| Some secondary | 10 (25%) |
| Completed secondary | 11 (27.5%) |
| Higher education | 3 (7.5%) |
| Marital Status | |
| Ever married/co-habited with a sexual partner | 33(82.5%) |
| Never married/co-habited with a sexual partner | 7(7.5%) |
| Current Marital Status | |
| Single | 12 (30%) |
| Live-in partner | 2 (5%) |
| Married | 2 (5%) |
| Separated | 19 (47.5%) |
| Divorced | 1 (2.5%) |
| Widowed | 4 (10%) |
| Number of Live children | |
| None | 3 (7.5%) |
| 1–2 | 26 (65.0%) |
| 3–4 | 9 (22.5%) |
| ≥ 5 | 1 (2.5%) |
| Missing | 1(2.5%) |
| Children born prior to entry into sex work | |
| None | 4 (10%) |
| ≥ 1 | 29 (72.5%) |
| Maybe* | 4 (10%) |
| Missing | 3 (7.5%) |
| Age of entry into sex work ** | |
| < 18 | 4 (10%) |
| 18–24 | 20 (50%) |
| 25–34 | 16 (40%) |
| 35+ | 0 (0%) |
| HIV diagnosis | |
| HIV positive diagnosis | 9 (22.5%) |
| HIV negative diagnosis | 31 (77.5%) |
| HIV and entry into sex work*** | |
| Diagnosed before entry into sex work | 2 (22.2%) |
| Diagnosed after entry into sex work | 7 (77.8%) |

* had first child same year as starting sex work

** Entry to sex work is described as women regularly starting to have sex for money

*** Responses of the nine women who were HIV positive

age 18. Most participants had children, and the majority of them had their first child before entry into sex work. Nine participants were living with HIV with seven testing positive after entry into sex work (Table 1).

### Understanding of mental health

In terms of participants' knowledge of mental health, five said they had no idea how to define mental health. For example, when one participant was asked what comes to her mind when she hears about mental health, she said:

> *"I do not know. Does it mean someone is healed?"* ***(MF 113).***

However, although most participants could not provide a clear definition of mental health, based on their personal and second-hand experiences they could link it with stress (Dhiki, $n = 23$), depression (Msongo wa mawazo, $n = 17$), insanity (Pagawa, $n = 16$), suicide (Kujitia kitanzi, $n = 6$) and harmful substance use (Mad- awa za kulevya, $n = 3$). Other descriptions included someone being mentally disturbed or having mental issues (kusumbuka akili) and excessively ruminating (kufikiria sana). Respondents who were interviewed either wholly or partially in English also defined mental health as 'craziness' or 'madness' (referring to 'insanity'), described as being hospitalised or wandering the streets collecting rubbish. However, other participants linked it with witchcraft (Uchawi/urogin = 7) or physical illnesses (Ugonjwa wa kimwilin = 2) such as STIs (Magongwa ya zinaa) and diabetes (Kisukari). The words in brackets were the local terms they used to describe mental health.

The quotes below illustrate how study participants defined mental health, with some linking it to mental health problems such as stress, insanity, and suicide:

> *"[it is] a person who is insane. I am okay because I am not crazy. People are known to be crazy when they start walking naked or speaking to themselves" (MF 186).*

> *"Maybe you have piled too much stress in your mind that you are defeated you don't have direction, you are just there. You could even be crossing, and you get hit by a car and you are just there. It is like you are there and you are not there" (MF 497).*

> *"They become mad. Let us say someone has disagreed with her husband. Her husband chased her with all the children, and you do not know where to begin, food etc. and you do not have a job, thoughts come to your mind…until you think of committing suicide"* ***(MF 208).***

Participants were also specifically asked if they could define 'depression', and most linked it with stress, with several respondents using the two terms interchangeably and often described as 'thinking too much' (Kufikiri sana). However, some participants ($n = 6$) distinguished between mental health as a clinical condition and depression as societal stress. Below are the responses from two participants who were asked if depression is a mental illness:

> *"Depression is when one is stressed. While mental sickness is when one is insane. With mental sickness, the brain is not functioning well. While with depression the brain is functioning okay, but you are stressed"* ***(MF 113).***

> *"It is not madness. It is something disturbing her in the mind but not madness. There is a problem"* ***(MF 017).***

### Determinants of mental ill-health

Of the 40 FSWs interviewed, 28 described personal experiences of poor mental health, whether described as mental health issues, stress, depression, or PTSD; seven women reported previous suicidal ideation. All but one of these participants narrated the factors that they perceived precipitated the mental health episode. The most reported risk factor was intimate partner violence, followed by poverty, sex work-related risks such as violence from clients, or the death of a family member. Infrequently mentioned factors included physical disability and harmful substance use. We mapped the reported risk factors against i) social factors, ii) gender disadvantage factors, iii) sexual risk factors, and iv) physical health, as the four main distal determinants of suicide and mental health among FSWs, depicted by the conceptual framework Fig. 1.

I) Social Factors

The main themes that emerged in relation to social risk factors for poor mental health were poverty and family bereavement. These findings are presented below.

### Poverty

Poverty among FSWs was described as a key social determinant influencing poor mental health and thoughts of suicide among FSWs. Out of the 28 respondents who narrated their own mental health experiences, eight of them specifically linked it with poverty. Almost all of them were once married or cohabited with a partner and had one or more children, although none of them received child support from the fathers of their children after being divorced or separated. Relationship breakdown

plunged them into poverty. Several of them had no parents and received no support from relatives. As the sole source of income, respondents struggled to provide basic needs for themselves and their children, such as food and school fees, and they struggled to care for other family members. Some respondents reported having to borrow money to provide for their children's basic needs:

> *"Those are very tough times because issues follow each other like you have not paid rent, books are needed and no food. It can really be very bad. I am alone without a penny, and I have nobody to assist me, so I look for where to borrow money"* ***(MF 033).***

Reports of mental health problems such as suicidal thoughts, being stressed and depressed due to financial challenges were frequently narrated:

> *"I had thought I will buy poison; I kill all my children, and I kill myself and life would end. Now I did not have even the money (to buy poison). Now I said if I get even thirty bob (shillings), I will ask how much Rat kill is, and I give all my children and I drink also and we all die at night"* ***(MF 497).***

> *"Sometimes I feel like running away from that house. Because you find that there is nobody to help me. Then I ask myself, if I go, my grandmother will struggle so much, and she might die. Here again is my younger brother, what will happen to him if I go? There are times you get very broke like weekdays. You wonder what to do because, these old people are looking up to you; they need to eat, to pay rent, yes"* ***(MF 240).***

Furthermore, as highlighted by the conceptual framework, poverty influences other determinants of poor mental health such as higher risk sexual behaviours and increased risk of violence (Fig. 1). Findings in this study demonstrated that most of the women who reported poverty as the main cause of their poor mental health experiences explained how financial stress and their desire to care for their children, motivated them to start sex work. Several of them did not complete their secondary education, could not find a better job for survival, and received no financial support. Their only option was to sell sex for 'quick money', which had the potential to further increase their vulnerability to poor mental health:

> *"You see I was not getting support from anybody and remember my mother had thrown me out maybe if she supported me, I could not have gone into sex work. By the way, this job I was not introduced to it by anybody. I was not very bright, and this was the only way out to get quick money. So, I started going to the bar and that is how I started sex work"* ***(MF 033).***

### Death of a family member

The impact of the death of loved ones on FSWs' mental well-being surfaced in the interviews. Some respondents reported symptoms of stress and depression following the death of a family member, especially when the deceased had provided financial support. Reports of financial stress after the death of a spouse or parent(s) were recounted by some women, this precipitated their entry into sex work as they had no other means of survival. For example, when one of the participants was asked about depression, she explained:

> *"Me I would say I am like that (that she is depressed). I used to have so many more thoughts than normal because I don't have my people. Here is my child and I had to do this job (sex work). Sometimes when I think about it, I just cry. I would imagine if I had my parents or my family, I would not do this work"* ***(MF 0208)***.

Another participant wept during the interview as she told how she was alone with her children when her husband who used to provide for them had died:

> *"By 2017 my husband died and left me alone: I am alone bringing up my children [weeps]. It has been very difficult because when my husband died, they (husband's relatives) took everything from me and only left me with a bed"* ***(MF 0547).***

As a coping mechanism, a participant explained that she had started using cannabis to assist her to recover from the tragic death of her husband who was murdered by an unknown assailant:

> *"Then I would cry a lot, nowadays I don't. Plus I also learnt something, you know when you go through so much pain you get something to relieve yourself. I smoke a lot of cannabis, me I smoke a lot of cannabis. It helps me with those challenges now"* ***(MF 0569).***

The family of her late husband accused her of being the killer of her husband, which added to her stress.

II) Gendered Disadvantage

Intimate partner violence was the most reported gendered disadvantage causing mental health problems among respondents.

### Intimate partner violence (IPV)

All the IPV-related mental health problems narrated by respondents occurred during their previous relationships before sex work commencement. Almost half ($n$ = 11) of the participants who reported experiencing poor mental health linked it to their previous experiences of IPV.

Previous IPV also accounted for the highest number of participants reporting suicidal thoughts (4 out of 7). Other mental health symptoms due to IPV were also reported, such as depression, PTSD and living in fear.

Although respondents narrated the experience of IPV in all forms (i.e., physical, verbal, emotional, economic, and sexual violence), physical violence was the most frequently reported. Several women described how they were beaten and verbally abused by their previous intimate partners. For example, one woman explained how she was beaten by her husband until he broke her leg. Respondents described social norms that sanction a man's right to assault a wife physically and sexually, and that society expects women to endure the pain husbands inflict. As such, some described how they had to stay in their marital homes with abusive partners until they could not handle the stress of the marriage anymore. All the 11 respondents who reported IPV from their previous partners either asked for a divorce or escaped from their marriages/relationships to start a new life with their children.

The quotes below illustrate respondents' explanations of how their IPV experiences affected them mentally and led to suicidal thoughts:

> *"Instead of giving you love, he gives you beating. So when you reflect you even have suicidal thoughts like I used to look at myself and wonder I don't have a mother and I am suffering with these children I feel that death was a better option" (**MF 0393).***

> *"I would feel like even killing myself. I used to think about going back home but I told you that my grand- mother used to tell me that a woman is to endure. Now I am enduring, and if I go home what will I say" **(MF 520).***

Reports of being frustrated and stressed due to IPV were also described:

> *"I even looked old because of stress and many frustrations. This person (husband) is with you in the house and he does not want to look for a job other than sitting at home. So you even wonder what is happening. Just try asking whether he will go to work and he will rain blows on you" **(MF 0004).***

Furthermore, because of the notion that a woman should endure pain, and since several respondents were either orphans or raised by a single parent, they could not rely on family members so had to look for their accommodation and survive alone after separating from their husbands. All women except one had children with their intimate partners so starting life over again with their children was a challenge as they received no support from the fathers of their children. This resulted in several of them entering sex work for survival since most had not completed school and couldn't find a job that could provide for their needs and that of their children. Despite their financial struggles, several respondents vowed never to return to their ex-husbands:

> *"We (respondent and children) used to sleep down on the mattress because I did not have a bed and I had sworn that come rain or sunshine I can never go back to that man who had married me. I needed peace and so I could not go back. That is how my job started (sex work) and I would go to the clubs looking for clients and I did very well and I was able to support my child" **(MF033).***

III) Sexual risk factors

In terms of sexual risk factors, issues related to sex work were the most commonly reported theme, and it was the third most reported perceived cause of poor mental health experiences among respondents. Almost all respondents who related their poor mental health to sex work-related risk factors either got into sex work due to poverty, mainly after the experience of IPV or the death of close family members. This illustrates the inter-relationships between the distal factors of suicide and mental health as illustrated in the conceptual framework.

### Sex work-related

Despite sex work being a good source of income for most respondents, it was noted as a stressful and risky job. Some respondents described sex work-related mental health challenges, such as violence from clients refusing to pay after sex or being beaten and forced into condomless sex. In addition to risks from clients, reports of the city Askaris (police) chasing FSWs and demanding to be bribed in cash or through sex were narrated. These experiences significantly affected respondents psychologically:

> *"When you are arrested by the Council (police) it is a risk because you will be arrested and the Council police will want to sleep with you, he sleeps with you and he does not pay you and he will still take you to court" **(MF 0012).***

> *"Once you are found on the streets walking, whether it is the police or Council you will have to go (being chased away)" **(MF 0012).***

One respondent narrated being stressed and living in fear for her life due to her work:

*"Me I tell you this sex work job, sometimes it gives me stress. If I had been stabbed or hurt, I think about if I die because of this job who would be left with this child. I just think about many things"* ***(MF 0208).***

In addition, the mental health impact of not knowing one's HIV status after forced condomless sex with a client was narrated by two respondents. One of the respondents said she did not go to the hospital when the incident happened as she was not aware of her options to reduce her risk of HIV. However, the other respondent did go to the hospital for post-exposure prophylaxis although she struggled to take the pills as she found them too big. She threw them in the toilet when her client tested HIV negative. Below are the quotes for the two respondents narrating their mental health experiences following a condomless sex encounter:

*"Basically, I was unhappy and restless. I was stressed so much so people noticed. He (regular client) even noticed and would tell me 'babe you seem so stressed', I told him it's because I didn't know my status or yours"* ***(MF 0113).***

*"I felt like my heart was burning. It affected me so much because I was wondering whether he had infected me with the virus, or with sexually transmitted diseases, or what does he want with me, is he a devil worshipper or what, uh! For a number of days, I was feeling I don't want to go to work, I would stay like that bored"* ***(017).***

Lastly, sex work also exposes FSWs to violence and stigma in their communities, which is the reason why a lot of FSWs tend to hide their job from neighbours and family members. Reports of FSWs being physiologically affected by the stigma they experienced in their communities were narrated. The quote below shows a description of a respondent's experience of verbal abuse from a neighbour and how that affected her:

*"Psychological (violence) is when you find someone is insulting you before your own children calling you a prostitute. 'You prostitute' and such before your children. So sometimes you just suffer alone"* ***(MF 0058).***

IV) Physical Health Factors

In relation to the fourth domain of the conceptual framework, only a few women related their poor mental health to physical disabilities or harmful substance use. These findings are presented below.

### Physical health and disability

A few study participants ($n = 3$) perceived poor physical health or disability as the cause of their mental health issues. This included one participant losing an eye when a client hit her with a soda bottle and another who had an elongated growth around her labia, which she linked with reconstructive surgery she had after being raped at 3 years old. Interestingly, the stress of living with HIV was mentioned by only one participant.

The woman who lost her eye described how her disability affected her mental wellbeing:

*"I was used to using my two eyes so after I lost one eye it was very stressful when crossing the road because I was not used to using one eye to check if the road is clear. I used to get very stressed and like where I stayed, there was a highway so I used to wait for people so that we can cross the road together and other times I could hold someone's hand so that we cross the road together. It took me a while to get used to using one eye and I was stressed for about one year to acclimatize" (MF033).*

### *Harmful substance use*

Although several women described their use of alcohol and other harmful substances, such as cannabis and bhang, for courage and as a coping mechanism while at sex work, only one participant explicitly linked it to poor mental health. The participant claimed to have nearly killed her child due to drug use:

*"I held that child and I wanted to kill him, I held a knife and said this thing why is it stressing me. When I held the knife like this, I felt a sharp cut in my heart, my senses came back and I asked myself, God, what do I want to do? So I was like if I kill this child, I am the one with a problem"* **MF 423).**

The woman panicked and she promised herself to never smoke cannabis again.

## Discussion

Our findings demonstrate that poor mental health is both a driving factor on the pathway into sex work and a consequence of sex work for many women. We show that factors such as poverty, low levels of education, poor job opportunities, family bereavement, the lack of family support, maternal responsibilities, harmful gender norms, IPV, and subsequent relationship breakdowns, all contribute to poor mental health and subsequent entry into sex work in Kenya. Although sex work helps women mitigate some of the factors that influenced their entry into the industry, such as providing an income and enabling women to support their families, the sexual risks involved in sex work, ongoing violence from police and clients, and, in a few cases, the physical harm and harmful substance use consequences of sex work, exacerbate poor mental health.

In this study, most participants defined mental health in terms of psychotic health conditions, such as insanity, to the exclusion of psychological health conditions, such as stress. However, although few women specifically defined symptoms as mental health conditions, some participants could describe symptoms of stress and depression. These findings are consistent with previous studies in Kenya with youth and the general community, which noted that members may not know the terms for specific mental health problems but can describe them based on symptoms [34, 35]. Our study also highlighted the belief in supernatural causes of mental ill-health, which has been demonstrated previously with the general population and is linked to patients and their carers seeking pluralistic treatment from traditional and faith healers, as well as biomedical healthcare providers [35, 36]. Poor mental health literacy is known to be one of the major barriers to seeking professional biomedical mental health care in sub-Saharan Africa (SSA) [37]. For example, community-based mental health literacy radio programmes in Malawi and Tanzania showed significant improvements in knowledge and mental health-seeking behaviour among youths in the intervention-targeted areas compared to those who were not exposed to the intervention [37].

Our study demonstrates that FSWs in the Maisha Fiti cohort are vulnerable to several mental health challenges. This is consistent with the high burden of poor mental health that was demonstrated quantitatively in the larger study cohort [18]. A substantial proportion of participants had experienced mental ill-health before entering sex work. Poor mental health as a driver on the pathway into sex work was linked to stressful life events such as marital breakdowns related to IPV, lack of family support, maternal responsibilities, poverty, and lack of other opportunities. IPV in Kenya is closely linked with gender inequality and harmful social norms, compromising women's ability to have autonomy over their bodies and to resist, or in many cases, especially in marriage, seek protection from, or recourse in response to IPV [38]. The psychological distress of experiencing IPV was a key factor in participants seeking a divorce. However, divorce in the absence of financial support or viable employment options, particularly in the context of children to feed, was frequently a driving factor that pushed women towards sex work. Interestingly, all the IPV-related mental health problems narrated by respondents in this study occurred before sex work commencement. A possible reason for this could be because most of the women interviewed had divorced or separated from their abusive most significant relationships to date before becoming sex workers. It may also be due to social desirability bias, and the women wishing to portray themselves as having escaped from such difficult relationships.

Poverty is a well-established risk factor for poor mental health [39, 40] both directly and indirectly, by increasing the risks of food insecurity, IPV, and entry into sex work [5]. The distress of food insecurity and women's desire to provide for their children's basic needs consistently emerged as a driver into sex work and has been reported elsewhere [41–43]. Loss of financial support due to the death of a close family member, such as a parent, a partner or after a divorce is a stressful event that not only mentally affects women but also a push factor into sex work commencement to cover household needs [44]. Poverty is the main driver pushing women into sex work across the globe, particularly in SSA [41, 45, 46].

In Kenya, the legal status of sex work is complex. It is not criminalised by federal law but may be prohibited by municipal by-law, as is the situation in Nairobi County [47, 48]. This quasi-criminalised nature of sex work, combined with structural factors such as social stigma and poor working conditions, increases the risk of violence against FSWs and deters them from seeking justice if/when violence occurs [49, 50]. Violence from clients and police is common for FSWs. Client-related violence most frequently occurs concerning negotiations around condoms and payment [49]. Whereas participants' experience of violence or coercion from the police mostly occurs in the course of the police enforcing sex work as unlawful. Thus, police exploit FSWs due to the unlawful status of sex work, by demanding bribes, sex, and confiscating items such as money from FSWs who often fear being arrested due to lack of legal protections. Reports of FSWs being unlawfully arrested, tortured, sexually abused, and assaulted by the police have been documented in this study and others conducted in Kenya [51]. Police exploitation has been associated with an increased risk of violence from clients, for example, forcing FSWs to hurriedly accept clients without properly negotiating terms and thereby increasing the risk of fractious agreements and the potential for violence [52]. In addition, aggressive policing tactics have been shown to force street-based FSWs to relocate to unfamiliar and less safe places where they are at higher risk of violence, such as being forced into sex without condoms by clients, and robbery or rape by criminals [53, 54]. These not only mentally drain FSWs but also increase their risks of HIV and other STIs.

Physical health factors occurred due to the impact of the higher-risk sex work environment and were not reported as drivers into sex work. For example, physical disability resulting from the experience of physical violence from a client has been reported in this study. Physical disability affects engagement in productive activities, leading to poor mental health and quality of life [55]. Moreover, HIV infection is also known to predispose to

increased physiological and psychological health problems among FSWs [5]. Although a known association, it was only mentioned by one participant in this study. This is similar to the findings among the Maisha Fiti study cohort showing no evidence of an association between HIV and mental health problems [18]. Possible explanations for the low mental health impact of HIV among HIV-infected respondents could be that they were less affected by their HIV diagnosis due to access to free Antiretrovirals (ARVs), or due to other social support provided by FSW Community-Based Organisations (CBOs) and SWOP peer educators, which helped them cope with their HIV status [56, 57]. Interestingly, despite substance use being a well-established risk factor for poor mental health and commonly utilised by participants to cope with the challenges of sex work, only one of the respondents mentioned drug use as a perceived risk factor for their mental health problems. Findings from the larger Maisha Fiti cohort showed evidence of an association between harmful alcohol/drugs and common mental health problems although the direction of causality could not be ascertained [18]. The low report of alcohol/drug-related mental health problems could be due to social desirability bias or participants' poor knowledge of harmful alcohol and drug use as potential risk factors for poor mental health. These may make them only narrate their mental health experiences of other stressful events such as poverty, which has been associated with both harmful alcohol/drugs and common mental health problems [18, 58]. Alternatively, most of the women interviewed may not be harmful alcohol/drug users.

Overall, the key findings in this study are the profound mental health impacts of poverty and violence on the lives of women and girls in Kenya: these need urgent attention to reduce the risks of entry into sex work and sex work-related mental health problems. Poverty alleviation strategies such as micro-finance interventions may benefit women and girls who have experienced negative events such as divorce or are single mothers, thereby reducing the risks of entry into sex work. Micro-finance interventions empower the poor, particularly women, and are known to be more effective when combined with other strategies such as better education, development training and other livelihood enhancement measures [59]. Similarly, with evidence that violence prevention and mitigation interventions are effective for women and FSWs in SSA [60–62], such interventions should be set in place in Kenya with tactics to ensure that women who experience violence are referred for mental health sup- port. This can be addressed in parallel with community-based awareness campaigns against harmful social norms associated with gender-based violence.

This study had limitations. Due to the sensitive nature and stigma attached to mental health, respondents were not directly asked if they had experienced mental health challenges. Their mental health experiences were captured through probing how specific events in their lives affected them psychologically. Therefore, there is a possibility that some participants' mental health experiences were not captured. Nonetheless, even if they had been asked directly some women would not have responded either because they may not have considered some events as mental health issues or may not have wished to talk about them. The interviewers in this study were highly trained in probing to answer the Maisha Fiti research aims when permitted by respondents. Furthermore, responses may have been subjected to social desirability bias to sensitive topics such as sex work and harmful substance use. However, the main strength of this study was that women were recruited from the SWOP program that had established and trusted relationships with the FSWs, therefore limiting the risk of social desirability bias. Trust is known to reduce response bias by motivating respondents to engage in more open and honest discussions [63, 64]. Another strength of this study is that participants were randomly selected from a larger cohort of FSWs in Nairobi, thereby increasing the generalisability and validity of the findings in the study. Lastly, although participants' perceived mental health risk factors evidenced in this study fitted the four distal determinants of mental health and suicide illustrated by the hierarchical conceptual framework, findings cannot be generalised to the whole population of FSWs in Nairobi due to methodological limitations. Further research using the conceptual framework of this study to test FSWs' mental health experiences in larger studies is therefore recommended.

## Conclusion

Our work has shown that FSWs in Nairobi are vulnerable to mental health problems including suicidal thoughts. The current study demonstrates that poor mental health is not only a consequence of the higher risk sex work environment among FSWs but – along with IPV, relationship breakdown and poverty – is also a driving factor for entry into sex work. Therefore, this calls for both micro and macro interventions to address key structural drivers such as poverty and violence. There is also a need to focus on mental health literacy among vulnerable populations like FSWs and other women experiencing stressful life events. This may provide them with the knowledge to prevent and cope with common mental health problems as they arise, reduce stigma, and enhance mental health help-seeking efficacy.

## Abbreviations

FSWs: Female Sex workers; HIV: Human Immune Virus; IPV: Intimate partner violence; LMICs: Low-and middle-income countries; PTSD: Post-traumatic stress disorder; STIs: Sexually Transmitted Infections; SSA: Sub-Saharan Africa; SWOP: Sex Workers Outreach Programme; WHO: World Health Organisation.


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### Authors' contributions

MP: Methodology, Analysis, Interpretation of findings, Writing original draft MG: Supervision, Interpretation of findings, Writing-review & edit EN: Interviewer, Assisted with analysis, Interpretation of findings JL: Interviewer, Interpretation of findings PS: Assisted with analysis, Interpretation of findings, Writing- edit RW: Assisted with analysis and Interpretation of findings MW: Interpretation of findings, Writing- edit AB: Writing-review & edit JP: Writing- edit ZJ Study counsellor, Interpretation of findings HB: Interpretation of findings, Writing-edit RK: Investigation, Writing-review & edit JS: Investigation, Interpretation of findings, Writing-review & edit, JB: Supervision, Writing- review & edit JK: Investigation, Interpretation of findings, Writing-edit TB: Conceptualization, Analysis, Interpretation of findings, Writing-review & edit. The author(s) read and approved the final manuscript.


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### Availability of data and materials

The datasets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

### Declarations

### Ethics approval and consent to participate

The Maisha Fiti study was ethically approved by the Kenyatta National Hospital – University of Nairobi Ethics Review Committee (KNH ERC P778/11/2018), the Research Ethics Committees at the London School of Hygiene and Tropical Medicine (Approval number: 16229) and the University of Toronto (Approval number: 37046).

Written informed consent was obtained from all the participants in accord- ance with the ethics requirements and all methods were carried out by relevant guidelines.

### Consent for publication

Not Applicable.

### Competing interests

No author has conflicts of interest to declare.


### Author details

[1]LSHTM, Department for Global Health and Development, London, UK. [2]Partners for Health and Development in Africa, Nairobi, Kenya. [3]Department of Immunology, University of Toronto, Toronto, Canada. [4]Department of Medi- cine, University of Toronto, Toronto, Canada. [5]MRC International Statistics and Epidemiology Group, Department for Infectious Disease Epidemiology, LSHTM, London, UK.



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## Publisher's Note

# Chapter 6 Research Paper 2.

*Associations of hair cortisol levels with violence, poor mental health, and harmful alcohol and other substance use among female sex workers in Nairobi, Kenya*

## 6.0 Overview

In SSA, FSWs are particularly vulnerable to violence from various perpetrators, mental health problems and harmful substance use, all of which are associated with poor health, including increased risk of HIV infection (17-20). However, the link between these exposures and HIV acquisition is not fully understood (38). Recent studies suggest a possible biological pathway, such as the stress response system, in addition to behavioural pathways. Despite the high vulnerability of FSWs to these stressors and the high HIV prevalence among FSWs, there is limited research globally and in Kenya examining how these stressors might increase HIV vulnerability through biological pathways.

With the overarching goal of elucidating pathways of increased HIV vulnerability among survivors of various stressors, this paper examined the associations between the experience of recent violence, poor mental health, and harmful substance use with a biomarker of stress, hair cortisol. Cortisol, released when the HPA axis is activated during a stress response, plays a key role in many vegetative functions, including regulating the inflammatory response system. However, chronic or repeated stress can affect cortisol levels. For example, research indicates that increased cortisol level is associated with key markers of T-cell activation and higher T-cell activation has been linked with HIV susceptibility and progression.

Using the baseline data of the Maisha Fiti study and the baseline conceptual framework of this PhD research as a guide during analysis, findings in this study showed positive and independent associations between the experience of recent physical and/or sexual violence and harmful alcohol and/or other substance use with hair cortisol levels. These findings suggest the role of violence and harmful substance use in elevated HCC levels, which could increase HIV risk due to cortisol-related T cell activation.

Kindly note that due to the skewness of the main outcome variable, HCC levels, it was log-transformed for all analyses. The histograms in **Appendix J** illustrate the distribution of HCC levels before and after log transformation.

Lastly, this paper has been published in Discover Mental Health, an open-access journal. The findings in this paper were also accepted for an online poster presentation at the 25th International AIDS Conference (AIDS 2024) in Munich, Germany. I designed the poster and submitted online.

London School of Hygiene & Tropical Medicine
Keppel Street, London WC1E 7HT
T: +44 (0)20 7299 4646
F: +44 (0)20 7299 4656
www.lshtm.ac.uk

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| **Student ID Number** | 2003982 | **Title** | Mrs |
| **First Name(s)** | Mamtuti | | |
| **Surname/Family Name** | Panneh | | |
| **Thesis Title** | Exploring violence, poor mental health and harmful alcohol/substance use among FSWs in Nairobi and their association with hair cortisol levels. | | |
| **Primary Supervisor** | Prof. John Bradley | | |

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Research

# Associations of hair cortisol levels with violence, poor mental health, and harmful alcohol and other substance use among female sex workers in Nairobi, Kenya

Mamtuti Panneh[1] · Qingming Ding[2] · Rhoda Kabuti[3] · The Maisha Fiti study champions[3] · John Bradley[4] · Polly Ngurukiri[3] · Mary Kungu[3] · Tanya Abramsky[1] · James Pollock[5] · Alicja Beksinska[1] · Pooja Shah[1] ·Erastus Irungu[3] · Mitzy Gafos[1] · Janet Seeley[1] · Helen A. Weiss[4] · Abdelbaset A. Elzagallaai[2] · Michael J. Rieder[2] · Rupert Kaul[6] · Joshua Kimani[3] · Tara Beattie[1]

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## Abstract

Violence, poor mental health, and harmful substance use are commonly experienced by female sex workers (FSWs) in sub-Saharan Africa, all of which are associated with increased HIV susceptibility. We aimed to investigate the associations between violence, poor mental health and harmful alcohol/substance use with hair cortisol concentration (HCC) levels as a potential biological pathway linking the experiences of these stressors and HIV vulnerability. We used the baseline data of the *Maisha Fiti* study of FSWs in Nairobi, Kenya. Participants reported recent violence, poor mental health, and harmful alcohol/substance use. Hair samples proximal to the scalp were collected to measure cortisol levels determined by ELISA. We analysed the data of 425 HIV-negative respondents who provided at least 2 cm of hair sample. The prevalence of recent violence was 89.3% (physical 54.6%; sexual 49.4%; emotional 77.0% and financial 66.5%), and 29.1% had been arrested due to sex work. 23.7% of participants reported moderate/severe depression, 11.6% moderate/severe anxiety, 13.5% PTSD and 10.8% recent suicidal thoughts and/or attempts. About half of the participants (48.8%) reported recent harmful alcohol and/or other substance use. In multivariable linear regression analyses, both physical and/or sexual violence (adjusted geometric mean ratio (aGMR) = 1.28; 95% CI 1.01–1.62) and harmful alcohol and/or other substance use (aGMR = 1.31; 95% CI 1.03–1.65) were positively and independently associated with increased HCC levels. Findings suggest a role of violence and substance use in elevated HCC levels, which could increase HIV risk due to cortisol-related T cell activation. However, longitudinal and mechanistic studies are needed to confirm this hypothesis.

Joshua Kimani and Tara Beattie contributed equally.

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Mamtuti Panneh, Mamtuti.panneh@lshtm.ac.uk | [1]Department for Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK. [2]Schulich School of Medicine and Dentistry, Robarts Research Institute, Western University, London, ON, Canada. [3]Partners for Health and Development in Africa, Nairobi, Kenya. [4]MRC International Statistics and Epidemiology Group, Department for Infectious Disease Epidemiology, LSHTM, London, UK. [5]Department of Immunology, University of Toronto, Toronto, Canada. [6]Department of Medicine, University of Toronto, Toronto, Canada.

## 1 Introduction

The prevalence of lifetime intimate partner violence (IPV) among women of reproductive age (aged 15–49 years) in sub-Saharan Africa (SSA) was 33% in 2018, compared to 27% globally [1]. Female sex workers (FSWs) in SSA face a higher risk of violence compared to the general population of women, attributed to factors such as the criminalisation of sex work, as well as stigma and discrimination [2]. They are also at increased risk of developing poor mental health[3] and disproportionately engage in harmful substance use, including alcohol, often as a coping mechanism to deal with the daily challenges of sex work [4]. In addition, FSWs are at an increased risk of acquiring HIV infection and other health problems compared to women in the general population [3, 5]. For example, a report in 2019 revealed that globally, FSWs were 30 times more likely to be diagnosed with HIV compared to the general female population of women of reproductive age [6].

Similar to other parts of the world, FSWs in Kenya are at a high risk of experiencing violence, poor mental health and harmful substance use [7–9]. Recent baseline findings from the *Maisha Fiti* study in Nairobi, which provided data for this study, revealed that approximately 81% experienced violence (physical/sexual/emotional) from intimate and non-intimate partners in the past six months [9]. Almost half (49%) reported symptoms of mild, moderate/severe depression, 30% engaged in harmful alcohol use, and 31% had harmful levels of use of other illegal substances such as cannabis, cocaine, and hallucinogens [9]. The prevalence of HIV among FSWs in Nairobi is approximately 25%, estimated to be five times higher than the general population of Kenyan women [10, 11]. Although sex work in Kenya is not explicitly criminalised by federal law, municipal by-laws, such as in Nairobi County, may prohibit it [12]. This punitive quasi-criminalized nature of sex work creates an atmosphere that increases FSWs' risks of violence from various perpetrators, including law enforcement officers who unlawfully arrest and assault them for selling sex [12, 13].

There is strong evidence that violence, poor mental health, and harmful substance use can be bidirectional associated with each other [14–16]. They are also known to be strongly associated with increased HIV infection [17–20]. However, the link between these exposures, especially violence and increased HIV acquisition, may not be entirely explained by behavioural risk pathways and is not fully understood [21]. For example, a systematic review of epidemiological studies in SSA found strong evidence of an association between HIV and physical violence and emotional violence, respectively, but no evidence of an association between HIV and sexual violence [22]. This suggests that the association between HIV and violence at a broader societal level cannot be solely attributed to HIV transmission during instances of sexual violence [22]. In addition, some studies have shown that psychological stress and physical abuse (which includes violence) may induce immune activation [23, 24]. There are physiological reasons that violence, poor mental health and harmful alcohol or other substance use may increase HIV risk, for example, by activating the physiological stress response system, which can result in a range of complex bi-directional interactions between the endocrine, nervous and immune systems [21]. One of the main neuroendocrine systems in the stress response system is the hypothalamic–pituitary–adrenal (HPA) axis, which releases the hormone cortisol when activated. Cortisol, often called the "stress hormone," can indicate HPA activation in the brain [25]. It plays a crucial role in regulating most vegetative functions and is known to suppress the immune system during a physiological stress response to prevent damage to the body [21]. However, dysregulated cortisol levels due to chronic stress are known to exact pathogenic effects in the development of many conditions, including chronic inflammation [26]. For example, research suggests increased cortisol levels may fail to downregulate the inflammatory responses to viruses and other triggers [27]. Additionally, cortisol is associated with key markers of T-cell activation (e.g., CD8 + T-cells), which have been reported to be associated with HIV susceptibility and progression [28, 29]. According to Patterson et al., the link between chronic psychological stress and impaired immune regulatory responses to anti-inflammatory signals may be due to chronic stress dysregulating the HPA axis. This reduces immune cell sensitivity to cortisol,

impairs inflammatory regulation and leads to higher T-cell activation [28].

Cortisol has often been measured using blood, saliva, or urine. These measure short-term cortisol levels only, which makes understanding the relationship between long-term stress exposure and the development of stress-related health problems challenging [30]. In contrast, the analysis of cortisol in hair (scalp hair) is a reliable long-term cortisol measurement, providing a retrospective reflection of cortisol levels over several months [30, 31]. Evidence has shown dysregulated cortisol levels in adults without psychiatric disorders who have been exposed to adverse stressful environments [32]. However, research on the relationship between violence and cortisol and cortisol and mental health, respectively, have produced mixed results [33, 34]. A systematic review of hair cortisol and mental health problems generally found an increase and a decrease in cortisol levels in individuals with major depression

and anxiety (generalised anxiety disorder, panic disorder), respectively [34]. Also, there is evidence that the dysregulation of the HPA axis is linked with excessive alcohol consumption; active drinkers are known to usually have elevated cortisol levels, which gradually decrease with abstinence [35]. In contrast, a few studies have reported lower cortisol levels or insignificant findings between alcohol-dependent participants compared with healthy controls [36]. These discrepancies have been linked to the severity, timing, and type of stressors experienced as different adverse events are known to uniquely impact the HPA axis response to stress. Research has indicated that repeated or prolonged stress may initially lead to increased cortisol levels (hypercortisolism) during the beginning and early post-stress phases. However, this may transition to reduced cortisol levels (hypocortisolism) [37, 38].

FSWs' vulnerabilities to various stressors and poor physical health, including HIV infection, calls for a better understanding of how these stressors are associated with cortisol levels in this population. To our knowledge, only one study globally has previously examined cortisol levels among FSWs, which was conducted in Mombasa, Kenya [39]. In that cross-sectional study with a sample size of 283 FSWs, participants who were recently (in the past 12 months) exposed to gender-based violence (physical/sexual/emotional) had higher cortisol levels than their unexposed counterparts [39]. Using a larger sample size of 425 FSWs in Nairobi, Kenya, the aim of this current study is to examine whether recent violence of different forms, poor mental health and harmful alcohol or substance use are independently associated with hair cortisol levels. Given the evidence indicating that repeated stress may elevate cortisol levels at the beginning and early post-stress phases [37, 38], we hypothesised that recent experiences of violence, poor mental health, and harmful substance use may be associated with increased levels of hair cortisol. Evidence suggests that cortisol communicates with the immune system and that cortisol and systemic inflammation may be bi-directionally associated [21]. Thus, we also examined if hair cortisol levels were associated with C-reactive Protein (CRP) levels—an acute systemic inflammatory marker. Understanding the physiological relationships between violence, poor mental health, and harmful alcohol/substance use with cortisol levels, as well as between cortisol levels and systemic inflammation, is vital in determining how these exposures may increase HIV risk.

## 2 Methods

### 2.1 Study design and recruitment

This study was cross-sectional, using baseline behavioural and biological survey data collected from the *Maisha Fiti* study from June to December 2019. The design of the *Maisha Fiti* study was in collaboration with the FSW community in Nairobi and the staff and peer educators of the Sex Work Outreach Program (SWOP) clinics in Nairobi. Approximately 73% (29,000) of FSWs in Nairobi County were registered at one of seven SWOP clinics across Nairobi. Each FSW attending a SWOP clinic is assigned a unique barcode for identification. FSWs who had visited any SWOP clinic in the previous 12 months, indicating active engagement in sex work, and who met the eligibility criteria below were randomly selected to participate in the *Maisha Fiti* study.

The eligibility criteria for the sampling frame were as follows: (i) aged 18–45 years, (ii) attended a SWOP clinic in the past 12 months, and (iii) no chronic illness (excluding HIV) such as diabetes, rheumatoid arthritis, asthma, and TB infection that could impact the immune system. A total of 10,292 of the 29,000 FSWs met these criteria and were included in the sampling frame. The desired sample size was 1000 FSWs; however, 1200 FSWs were selected to allow for non-response and non-eligibility since additional exclusion criteria (assessed during study enrolment) were current pregnancy (urine samples were tested for pregnancy) and breastfeeding. The number of FSWs selected per clinic was proportional to clinic size. Women aged less than 25 years were oversampled to allow adequate power for analyses stratified by age. Selected women were telephoned and informed about the study (in English/Swahili). Those interested were invited to visit the study clinic, where they received detailed information about the study. Participation was voluntary; interested women were screened for eligibility, and those who met the criteria provided written informed consent. Details about the sample size calculation and selection of participants can be found elsewhere [9, 11]. This current paper focused on HIV-negative participants.

### 2.2 Data collection process

#### 2.2.1 Behavioural-biological surveys:

The behavioural survey captured data on socio-demographics, adverse childhood experiences (ACEs), sexual practices and behaviours, stigma, social support, violence experiences, mental health problems, and harmful substance use.

After women responded to the behavioural survey, biological samples, including urine, blood, vaginal swabs, and hair samples, were collected for biological tests. Urine samples were provided to test for gonorrhoea and chlamydia infection using GeneXpert Assay. Blood samples were used to test for HIV, syphilis and CRP levels using rapid HIV tests, rapid plasma regain assay and Nano checker reader, respectively. Positive HIV results were confirmed using HIV DNA GeneXpert. Vaginal swabs (self-collected) were used to test for bacterial vaginosis (BV; Gram's stain and Nugent scoring) and *Trichomonas vaginalis* (TV; OSOM Trichomonas Rapid Test; SEKISUI Diagnostics, LLC). Hair samples were used to test for cortisol levels, as described below.

### 2.3 Study variables

#### 2.3.1 Outcome variable

The main outcome variable was *hair cortisol concentration (HCC)*. For each participant, about 50 hair strands were cut by a research team member from the posterior vertex next to the scalp using clean scissors. The scalp end of the hair sample was labelled, and the sample was packaged in aluminum foil and stored in a cool, dry location for storage. Of the 1003 women recruited to participate in the *Maisha Fiti* study, 746 were HIV-negative at baseline [9], of whom 736 (98.7%) provided hair samples. Several of the women had either extremely short hair or hair samples with < 50 hair strands. To allow for sufficient samples to proceed with hair cortisol testing assays, we excluded samples less than 2 cm long (a hair length of about 6 cm was ideal), leaving 425 women with viable hair samples. The proximal 2 cm of hair from the scalp was analysed for cortisol concentration and represented cumulative cortisol concentration in the 2.5 months prior to the survey based on the average African hair growth rate of 0.79 cm per month [39]. Hair cortisol was analysed using an established ELISA technique [40] and expressed as nanogram/gram (ng/g) of hair mass.

#### 2.3.2 Main exposure variables

The three main categories of exposures were: (i) experience of recent violence of different forms, (ii) mental health problems, and (iii) harmful substance use.

*Violence of different forms:* We asked participants about their experiences of physical, sexual and emotional violence in the past six months from both intimate partners and non-IPs (e.g., clients, police, strangers, etc.). The WHO Violence Against Women 13-item questionnaire, which assesses the frequency and severity of violence (physical, sexual, and emotional) perpetrated by intimate partner violence (IPV) in the past 12 months, was adapted to include violence perpetrated by non-intimate partners by repeating the IP questions to ask about non-IPs [41]. We inquired about experiences of violence ever and in the past six months. For questions assessing physical violence, women who responded "yes" to any of the questions were coded as "yes"; the same approach was used to code for emotional and sexual violence. Financial/economic violence, as used elsewhere, [42] was assessed by asking respondents if, in the past six months, a client refused to pay or had to be forced to pay after sex (yes/no). Each form of violence was categorised as binary (yes/ no), irrespective of whether they had experienced other forms of violence. This means that, for example, women in the unexposed category for physical violence may nevertheless have been exposed to other types of violence, such as emotional violence. Women who experience physical and/or sexual violence tend to have multiple health implications, including increased HIV infection [43]. This definition of violence has frequently been used in other cohorts of FSWs [14, 44]. Thus, we created a combined variable for experiencing physical and/or sexual violence in the past six months. In a separate question, we also asked respondents if they had been recently arrested by police for selling sex with a binary response (Yes/No) (*Have you been arrested in the past six months because you were a sex worker?).*

*Mental health problems*: Mental health problems were measured using validated tools with high reliability and validity in Kenya. The Patient Health Questionnaire (PHQ-9) was used to measure depression symptoms (score ≥ 15 = moderate/ severe depressive disorder) [45] in the past two weeks; The Generalized Anxiety Disorder (GAD-7) questionnaire for anxiety (score ≥ 10 = moderate/severe anxiety)[46] in the past two weeks and the Harvard Trauma Questionnaire (HTQ-17) for PTSD (score ≥ 2 positive for PTSD) [47] in the past month. These tools are all based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-1 V) [48].

Suicide risk was assessed by a two-item questionnaire, which included recent suicidal thoughts ('having thoughts about ending your life') and recent suicide attempts ('*having attempted to end your life*') in the last 30 days. Due to the small number of women reporting a recent suicidal attempt and the overlap between a recent suicide attempt and thoughts, these two items were combined into a binary variable (recent suicidal thoughts and/or recent suicidal

attempts). Research has shown that previous suicidal thoughts and/or suicide attempts increase the lifetime risk of further suicide attempts and completed suicide [49, 50].

*Harmful substance use:* The WHO ASSIST (Alcohol, Smoking and Substance Involvement Screening Test) tool was used to assess alcohol risk (cut-off scores: low risk 0–10; moderate risk 11–26; high risk 27 +) and other substance use risk (cannabis, cocaine, amphetamines, hallucinogens, sedatives and inhalant) in the last three months (cut-off scores: low risk 0–3; moderate risk 4–26; high risk 27 +) [51]. After initial exploratory analyses showed that harmful alcohol use (moderate/severe) and other substance use problems (moderate/severe) were similar with regard to HCC levels, these two measures were combined into a dichotomous variable (moderate/severe alcohol and/or other substance use problem). Tobacco use was assessed separately with a binary response for use in the past three months (Yes/No).

### 2.3.3 Conceptual framework

Drawing on the literature, our experiences in the field, and the eco-social life course theory [52], we developed a conceptual framework to guide our analyses (Fig. 1). The eco-social life-course framework theorises how societal and ecological context exposures can be biologically embodied, causing health and disease disparities [52]. In Fig. 1, the rectangles in blue are the main exposure variables of interest, while the yellow sphere is the main outcome of interest (hair cortisol levels). Orange rectangles represented variables upstream of both the exposure and outcome variables and were therefore considered potential confounders. Variable definitions for potential confounders (orange rectangles) are explained in Table 1.

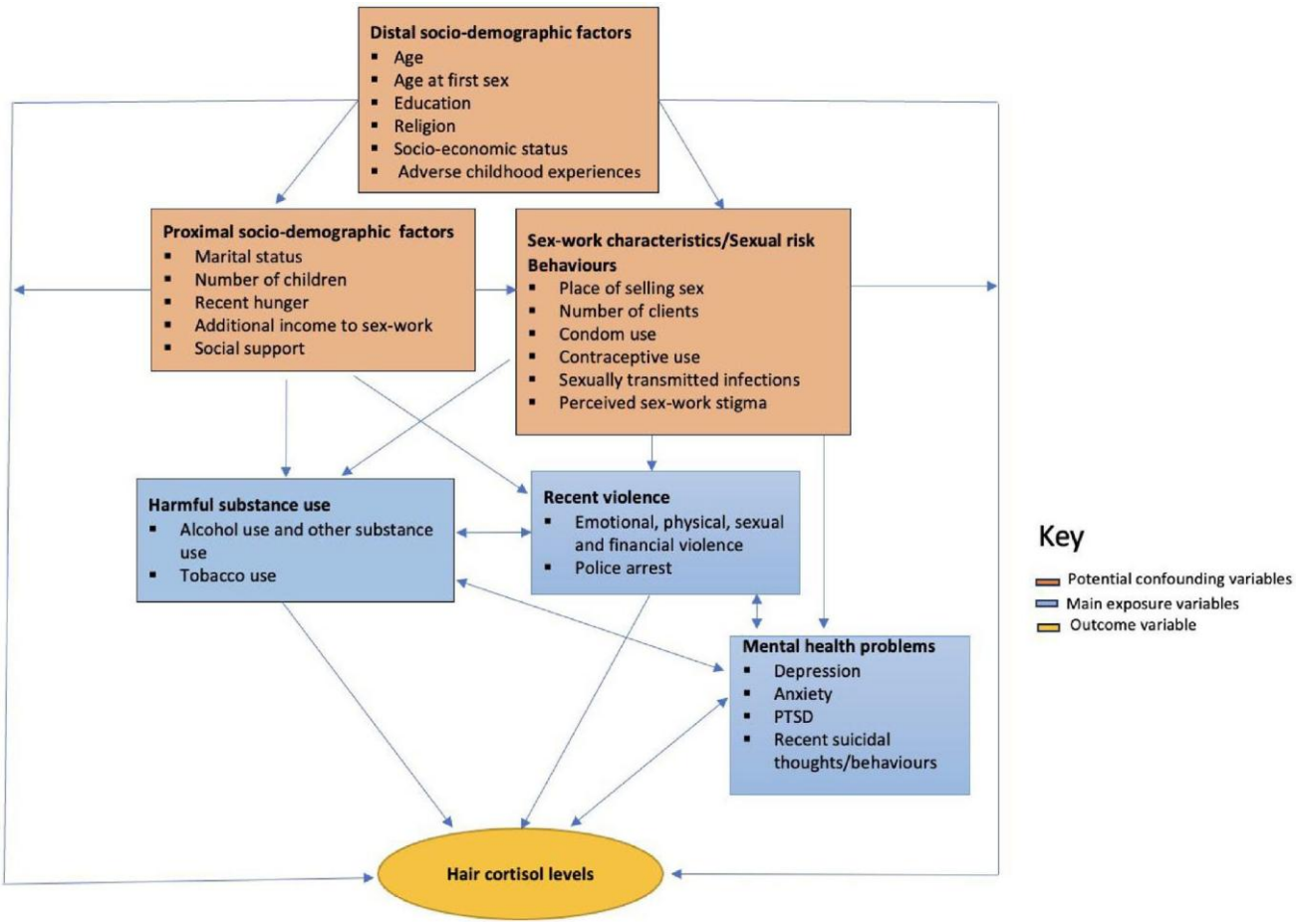


Fig. 1 A conceptual framework illustrating the potential risk factors influencing hair cortisol levels among female sex workers in Nairobi, Kenya.

Table 1 Definition of some covariates used in the study

| Variables | Question/measurement tool | Category |
|---|---|---|
| Childhood and distal Socio-demographic factors | | |
| ACEs | WHO Adverse Childhood Experiences International Questionnaire (ACE-IQ). The total number of Adverse Childhood Experiences was defined as answering yes to: When you were growing up, during your first 18 years of life, (i) Did you live with a household member who was a problem drinker or alcoholic, or misused street or prescription drugs? (ii) Did you live with a household member who was depressed, mentally ill or suicidal? (iii) Did you live with a household member who was ever sent to jail or prison? (iv) Were your parents ever separated or divorced? (v) Did your mother, father or guardian die? (vi) Did you witness violence in the home (ACE 4.6, 4.7, 4.8) (vii) Did you experience emotional violence (ACE 5.1, 5.2) (viii) Did you experience physical violence (ACE 5.3, 5.4) (ix) Did you experience sexual violence (ACE 5.5, 5.6, 5.7, 5.8) (x) Did you experience community violence (ACE 7.1–7.3) (xi) (ACE 8.1–8.4) (xii) Did you ever live on the streets? [8] | Ordered categorical variable (each ACE scores one point): < 4, 5–8, 9–12 [8] |
| Age at first sex | How old were you when you first had penile insertive vaginal sex with a male partner? | < / = 15, 16–17, 18 + |
| Socio-economic status (SES) | 14 household asset questions used in the Kenyan Demographic Health Surveys | Principle component analysis (PCA) used to compute household SES: Lower/lower middle, middle, upper middle/upper |
| Proximal Socio-demographic factors | | |
| Number of household dependants | "Not including yourself, how many people living in your household are dependent on your income?" | 0, 1, 2 + |
| Recent hunger | Thinking now about the past 7 days, have you or anyone in your family skipped a meal because there was not enough food? | No vs Yes |
| Current social support | Do you have someone who you can talk to about your problems? | Yes/sometimes vs No |



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### 2.4 Statistical analysis

Due to the skewed distribution of HCC levels, it was log-transformed for all statistical analyses. Descriptive statistics were conducted for each exposure variable and the outcome. Initial associations between HCC levels with the main exposure variables of interest and potential confounders were performed using univariate linear analyses with results in Tables 2 and 3, respectively. Violence, poor mental health, and harmful substance use variables, which were associated with HCC levels in univariate analyses ($p < 0.1$), were then taken forward for multivariable linear regression analyses adjusting for potential confounders that were associated ($P < 0.1$) with HCC levels in univariate analyses. In the multivariable regression models, we examined in separate models how violence (financial violence and physical and/or sexual violence), poor mental health (depression and PTSD), and harmful substance use (alcohol and/or other substances) were associated with HCC levels adjusted for confounders. To avoid multicollinearity and because of the high overlap among women who experienced different forms of violence, financial violence and physical and/ or sexual violence were placed in separate multivariable models. This logic was also applied to mental health problems (depression and PTSD) and harmful alcohol and substance use. To ascertain if the different exposures were independently associated with HCC levels, we created a model (Model 6) which included all significant ($p < 0.05$) exposure variables (from the previous models built) adjusted for confounders and each other. We then tested for a dose-response relationship by examining if an increasing number of exposure variables from Model 6 (i.e. no experience of recent physical and/or sexual violence and no harmful alcohol and /or other substance use vs. experience of recent physical and/or sexual violence OR harmful alcohol and /or other substance use vs. experience of recent physical and/or sexual violence AND harmful alcohol and /or other substance use) was associated with increasing HCC levels (Model 7). Finally, we examined whether HCC levels were associated with CRP levels using univariate linear regression with results in Table 3. CRP is sometimes used as a biomarker of acute systemic inflammation, with levels > 3ug/ml indicating adverse health risks, including active infection, coronary heart disease, and stress-related disorders [53, 54].

All analyses were weighted for age and adjusted for clustering by clinic. For easy interpretation, the mean of log-transformed HCC levels in descriptive analyses and the coefficients from linear regression models were exponentiated to produce geometric mean and geometric mean ratios (GMR), respectively [55]. The geometric mean ratio is the backward-transformed mean from the transformed data, while the GMR is the ratio of the means which have been backward-transformed [55]. All analyses were performed using STATA 16.1; statistical significance was set at $p < 0.05$, and variables with > 5% missing observations were reported.

## 3 Results

425 HIV-negative women provided viable baseline hair samples. The prevalence of recent (past six months) violence of any form from an IP and/or non-IP was 89.3 (95% CI: 86.1–91.9) (physical 54.6%; sexual 49.4%; physical and/or sexual 66.4%; emotional 77% and financial 66.5%), and 29.1% had been arrested by the police in the past six months because of their sex work (Table 2). Mental health problems were common, with 23.7% reporting moderate/severe depression, 11.6% moderate/severe anxiety, 13.5% PTSD and 10.8% recent suicidal thoughts and/or attempts. About half of the participants had alcohol and/or substance use problems (48.8%) (alcohol use problems 34.3%; other substance use problems 36.5%), and about 21.5% had used tobacco in the past three months (Table 2).

The mean age of study participants was 33.7 years (age range: 18–45 years). Most (84.7%) were literate and Christian (Protestants 52.8%; Catholics 39.7%). The mean age of first sex was 16.3 years, with 30.4% of FSWs reporting first sex at 15 years or less. ACEs were commonly reported, with 89.8% reporting one or more ACEs. Relatively few (7.0%) were currently married or living with a sexual partner, while the majority (66.5%) had been divorced, widowed, or separated from their partners. Almost all participants (95.2%) had at least one child. Just under half of participants (47.6%) reported having other sources of income in addition to sex work, and 29.2% reported having missed a meal in the past seven days due to financial challenges. Most of the women sold sex in non-public places (97%), and 41.6% reported a client volume of at least 5 per week. The prevalence of reported condom use at last sex was 74.4%, and 12.4% had a bacterial sexually transmitted infection (STI). Sex-work-related stigma was common (87%), and 28.1% had high CRP levels (> 3ug/ml) (Table 3).

Table 2 Violence, mental health problems, and harmful alcohol and other substance use among study participants and their relationship with log-transformed HCC levels

| | N (weighted %) (N = 425) | HCC Geometric mean ng/g[a] | P-value |
|---|---|---|---|
| Recent violence | | | |
| Financial violence | | | 0.022 |
| No | 148 (33.5) | 274.56 | |
| Yes | 272 (66.5) | 368.21 | |
| Emotional violence | | | 0.107 |
| No | 102 (23.0) | 281.67 | |
| Yes | 323 (77.0) | 347.59 | |
| Physical violence | | | < 0.0001 |
| No | 195 (45.4) | 265.7 | |
| Yes | 230 (54.6) | 397.84 | |
| Sexual violence | | | 0.295 |
| No | 222 (50.6) | 311.9 | |
| Yes | 203 (49.4) | 352.21 | |
| Physical and/or sexual violence | | | 0.001 |
| No | 149 (33.6) | 252.82 | |
| Yes | 276 (66.4) | 379.78 | |
| Any recent violence[b] | | | 0.344 |
| No | 49(10.7) | 285.63 | |
| Yes | 376 (89.3) | 337.1 | |
| Police arrest | | | 0.995 |
| No | 302 (70.9) | 331.28 | |
| Yes | 123 (29.1) | 331.02 | |
| Mental health problems | | | |
| Depression | | | 0.041 |
| None/Mild | 329 (76.3) | 310.53 | |
| Moderate/Severe | 95 (23.7) | 411.81 | |
| Anxiety | | | 0.526 |
| None/Mild | 376 (88.4) | 326.99 | |
| Moderate/severe | 49 (11.6) | 365.06 | |
| PTSD | | | 0.013 |
| Negative | 365 (86.5) | 312.43 | |
| Positive | 56 (13.5) | 482.16 | |
| Suicidal thoughts and/or attempt | | | 0.949 |
| No | 379 (89.2) | 331.68 | |
| Yes | 46 (10.8) | 327.27 | |
| Harmful substance use | | | |
| Alcohol use problem[c] | | | < 0.0001 |
| Low risk | 276 (65.7) | 287.2 | |
| Moderate/high risk | 146 (34.3) | 431.91 | |
| Other substance use problem [c,d] | | | 0.015 |
| Low risk | 262 (63.5) | 299.16 | |
| Moderate/high risk | 162 (36.5) | 394.18 | |
| Tobacco use | | | 0.895 |
| No | 333 (78.5) | 329.64 | |
| Yes | 92 (21.5) | 336.98 | |
| Alcohol and/or other substance use problem | | | 0.001 |
| No | 212 (51.2) | 277.28 | |
| Yes | 213 (48.8) | 399.02 | |

Table 2 (continued)

[a]Geometric mean is the backward-transformed mean from the transformed data

[*]P-values were calculated using simple linear regression

[b]Refers to any recent financial, emotional, physical, or sexual violence

[c]Alcohol /other substance use problem: low risk 0–10; moderate/high risk 11 +

[d]Other substances (cannabis, cocaine, amphetamines, hallucinogens, sedatives, and inhalants) excluding tobacco smoking and alcohol

Table 3 provides more details about participants' characteristics. When we compared the characteristics of participants in this study with those of the 321 HIV-negative participants who were excluded from this analysis due to insufficient hair samples, the participants were broadly similar (Supplementary Materials: Tables S1 and S2).

### 3.1 Relationship of HCC levels with violence, mental health problems and harmful alcohol/substance use

The mean HCC was 331.20 (95% CI 294.7–372.2). In univariate analysis, recent financial violence, physical violence, physical and/or sexual violence, depression, harmful alcohol use, other substance use problems, and harmful alcohol and/ or substance use were all associated with higher HCC ($p < 0.05$). In multivariable analyses (Table 4), there was no evidence of associations between either financial violence (adjusted GMR (aGMR) = 1.19; 95% CI 0.90–1.56) (Model 1) or depression (aGMR) = 1.24; 95% CI 0.92–1.66) (Model 3) and HCC levels, with weak evidence of an association between PTSD (aGMR) = 1.40; 95% CI 0.96–2.05) and HCC (Model 4). However, after adjusting for known confounders, we did find evidence that women who reported (i) recent physical and/or sexual violence (Model 2) and (ii) alcohol and/or other substance use problems (Model 5) had higher HCC levels compared to their unexposed counterparts When these last two interrelated exposures were included in the same model (Model 6), there was evidence that recent physical and/or sexual violence (aGMR) = 1.28; 95% CI 1.01–1.62) and recent alcohol and/or other substance use problems (aGMR = 1.31; 95% CI 1.03- to 1.65) were independently associated with increased HCC. Interestingly, we also found evidence of a dose-response with an increasing number of exposures associated with an increasing HCC level (Model 7).

Potential confounding variables which showed evidence of association with HCC levels were higher socio-economic status levels (SES) (vs. lower SES level) (aGMR = 0.72; 95% CI 0.54–0.95), one or more children (vs. no children) (aGMR = 2.24; 95% CI 1.10–4.58) and non-condom use at last vaginal sex (aGMR 1.27; 95% CI 1.00–1.63).

### 3.2 Relationship between HCC levels and CRP levels

When we examined the association between HCC and CRP levels, we found no evidence of an association in univariate regression ($p = 0.709$) (Table 3).

## 4 Discussion

We found a high prevalence of recent violence experiences, common mental health problems and harmful alcohol and substance use among FSWs in Nairobi, Kenya. Moreover, we found evidence of positive and independent associations between HCC levels and (i) recent physical and/or sexual violence and (ii) alcohol and/or other substance use problems.

Several studies have examined violence against women in the general population and HCC [56]. However, most of those studies focused on a specific form of violence or combined all forms of violence (e.g., physical, sexual or emotional) into one variable. This makes it hard to fully comprehend how different forms of violence impact cortisol production. In addition, the paucity of studies with high-risk groups such as FSWs means it is not known how violence impacts cortisol production in different populations. In our research with FSWs, we found evidence that the recent experience of physical and/or sexual violence was associated with high HCC levels. This suggests a biological pathway linking the experience of recent violence and the stress-response system with an increase in HCC, which may continue over time before it is attenuated [37]. However, due to the limitation of cross-sectional studies in making causal inferences, longitudinal studies are needed to assess the direction of causality. Women who experienced physical and/or sexual violence have been reported to have a higher risk of HIV infection and mental health problems [43]. Although sexual violence as a separate

Table 3 Characteristics of study participants and associations with log-transformed HCC levels

| Characteristic | N (weighted %) (N = 425) | HCC Geometric mean ng/g[a] | P-value* |
|---|---|---|---|
| Distal-demographic factors | | | |
| Age | | | 0.640 |
| < 25 | 119 (16.1) | 325.1 | |
| 25–34 | 155 (42.5) | 352.75 | |
| 35 + | 151 (41.4) | 312.71 | |
| Age at first sex | | | 0.10 |
| < / = 15 | 130 (30.4) | 361.78 | |
| 16–17 | 148 (33.8) | 371.71 | |
| 18 + | 143 (35.80) | 279.5 | |
| Literacy | | | 0.507 |
| Illiterate | 61 (15.3) | 360.96 | |
| Literate | 364 (84.7) | 326.08 | |
| Religion | | | 0.373 |
| Catholic | 172 (39.7) | 364.01 | |
| Protestant | 220 (52.8) | 307.52 | |
| Muslim/others/none | 33 (7.5) | 338.87 | |
| Socio-economic status | | | 0.081 |
| Lower/lower middle | 161 (37.2) | 370.62 | |
| Middle | 76 (17.4) | 380.56 | |
| Upper middle/upper | 188 (45.4) | 286.45 | |
| Total number of ACEs reported[b] | | | 0.002 |
| 0 to 4 | 110 (25.4) | 240.02 | 0.595 |
| 5 to 8 | 246 (58.6) | 355.84 | |
| 9 to 12 | 69 (16.0) | 424.96 | |
| Marital Status | | | |
| Single | 125 (26.5) | 346.55 | |
| Married or cohabiting | 28 (7.0) | 250.16 | |
| Separated/divorced /widowed | 272 (66.5) | 335 | |
| Number of Children** | | | 0.043 |
| None | 24 (4.8) | 187.23 | |
| 1–2 | 274 (66.5) | 366.69 | |
| 3 + | 101 (28.6) | 285.8 | |
| Number of household dependents | | | 0.739 |
| 0 | 82 (17.8) | 332.81 | |
| 1 | 117 (25.4) | 308.11 | |
| 2 + | 226 (56.8) | 341.57 | |
| Recent Hunger | | | 0.981 |
| No | 305 (70.8) | 331.62 | |
| Yes | 119 (29.2) | 330.62 | |
| Have other source (s) of income | | | 0.482 |
| Yes | 198 (47.6) | 345.73 | |
| No | 227(52.4) | 318.52 | |
| Social support | | | 0.204 |
| No | 119 (27.5) | 370.27 | |
| Yes | 306 (72.5) | 317.5 | |
| Sex-work characteristics/sexual risk behaviours | | | |
| Place of selling sex | | | 0.546 |
| Lodge/hotel/rented room/home | 406 (97.0) | 336.09 | |
| Public places | 13 (3.1) | 277.59 | |

Table 3 (continued)

| Characteristic | N (weighted%) (N = 425) | HCC Geometric mean ng/g[a] | P-value* |
|---|---|---|---|
| Number of clients /weeks | | | 0.888 |
| < 5 | 246 (58.5) | 337.7 | |
| 5 + | 173 (41.6) | 332.31 | |
| Condom use last sex | | | 0.044 |
| Yes | 313 (74.4) | 311.19 | |
| No | 112 (25.6) | 397.08 | |
| Contraceptive use | | | 0.702 |
| No | 61 (14.5) | 349.71 | |
| Yes | 364 (85.5) | 328.16 | |
| Bacterial STI prevalence (Chlamydia/Gonorrhoea/syphilis)[b] | | | 0.519 |
| 0 | 368 (87.6) | 336.44 | |
| 1 + | 57 (12.4) | 296.59 | |
| Experienced previous abortion/still birth** | | | 0.793 |
| No | 222 (54.1) | 325.7 | |
| Yes | 177 (45.9) | 336.28 | |
| Reports any sex-work related stigma | | | 0.678 |
| No | 58 (13.0) | 360.26 | |
| Yes | 361 (87.0) | 333.17 | |
| Systemic inflammation | | | |
| CRP Level (ug/ml)[c] | | | 0.709 |
| ≤ 3 | 309 (71.9) | 339.98 | |
| > 3 | 111 (28.1) | 323.19 | |

[a]Geometric mean is the backward-transformed mean from the transformed data

*P-values were calculated using simple linear regression

**Missing n = 26

[b]Bacterial STI prevalence: defined as a positive test for gonorrhoea, chlamydia and/or syphilis infection

[c]CRP level: None-low inflammation ≤ 3; high inflammation > 3

variable was not found to be associated with HCC levels in univariate analysis, it is theoretically unlikely that physical violence, but not sexual violence, would increase HCC. We likely did not see associations between sexual violence and HCC levels, as our reference category for sexual violence included women who had experienced physical violence [22]. Our combined physical and/or sexual violence variable had a cleaner reference category and found evidence of an association with HCC. Although we could have examined associations between women who experienced sexual violence only without physical violence, and HCC levels the sample size was too small to have sufficient power to allow this. In practice, most women who experience sexual violence will also experience physical violence and thus it makes most sense to analyse this as a combined variable.

We found evidence of a positive association between HCC and alcohol and/or substance use problems, even after adjusting for physical and/or sexual violence. Our findings are consistent with the literature from other populations, suggesting that substance use, such as alcohol, may be associated with increased cortisol levels [57]. For example, a study of 23 alcoholics in the acute withdrawal phase and 25 abstinent alcoholics as controls found three to four-fold higher HCC among the alcoholics compared to the controls [36]. Cigarette or tobacco smoking was not associated with HCC in our study, which aligns with findings in the literature [57]. The survey conducted among FSWs in Mombasa, Kenya, found a similar lack of evidence between tobacco smoking and HCC [39]. Although some FSWs consume harmful substances as part of sex work or to cope with the stresses of sex work [4, 58], the same harmful substances may exacerbate poor mental health [26]. Even though participants in our study with depression, anxiety and PTSD had higher HCC levels in univariate analyses, the associations did not remain significant after adjusting for potential confounders. A study of FSWs in Mombasa, Kenya, found similar insignificant findings between HCC and depression and PTSD [39]. Mental health problems such as anxiety, depression and PTSD have been associated with HCC in other non-FSW populations, but

Table 4 Multivariable linear regression of factors associated with log-transformed HCC levels

| | | Crude GMR (CI) | P-value | Adjusted GMR (CI)* | P-value |
|---|---|---|---|---|---|
| Model 1 (N = 391) | Financial Violence | | | | |
| | No | Reference | | | |
| | Yes | 1.34 (1.04–1.73) | 0.022 | 1.19 (0.90–1.56) | 0.219 |
| Model 2 (N = 395) | Physical and/or Sexual Violence | | | | |
| | No | Reference | | | |
| | Yes | 1.50 (1.18–1.90) | 0.001 | 1.29 (1.02–1.64) | 0.034 |
| Model 3 (N = 394) | Depression | | | | |
| | No | Reference | | | |
| | Yes | 1.33(1.01–1.74) | 0.041 | 1.24 (0.92–1.66) | 0.16 |
| Model 4 (N = 391) | PTSD | | | | |
| | No | Reference | | | |
| | Yes | 1.54 (1.10–2.17) | 0. 013 | 1.40 (0.96–2.05) | 0.082 |
| Model 5 (N = 395) | Alcohol and/or other substance use problem | | | | |
| | No | Reference | | | |
| | Yes | 1.44 (1.15–1.80) | 0.001 | 1.32 (1.04–1.67) | 0.02 |
| Model 6 (N = 395) | Physical and/or Sexual Violence | | | | |
| | No | Reference | | Reference | |
| | Yes | 1.50 (1.18–1.90) | 0.001 | 1.28 (1.01–1.62) | 0.044 |
| | Alcohol and/or other substance use problem | | | | |
| | No | Reference | | Reference | |
| | Yes | 1.44 (1.15–1.80) | 0. 001 | 1.31 (1.03–1.65) | 0.025 |
| Model 7 (N = 395) | Exposure counts[a] | | | | 0.002[b] |
| | 0 | Reference | | Reference | |
| | 1 | 1.42 (1.04–1.95) | | 1.23 (0.89–1.70) | |
| | 2 | 1.98 (1.44–2.71) | 0.0001 | 1.65 (1.19–2.29) | 0.007 |
| | Socio-economic status | | | | |
| | Lower/lower middle | Reference | | Reference | |
| | middle | 1.03 (0.78–1.36) | | 0.97 (0.72–1.30) | |
| | upper middle/upper | 0.77 (0.60–0.99) | 0.081 | 0.72 (0.54–0.95) | 0.04 |
| | Number of Children | | | | |
| | 0 | Reference | | Reference | |
| | 1–2 | 1.95 (0.88–4.37) | | 2.24 (1.10–4.58) | |
| | 3 + | 1.53 (0.68–3.44) | 0.043 | 1.55 (0.76–3.16) | 0.004 |
| | Condom use last sex | | | | |
| | Yes | Reference | | Reference | |
| | No | 1.27 (1.01–1.62) | 0.044 | 1.27 (1.00–1.63) | 0.05 |

*Adjusted for age at first sex, socioeconomic status, total ACEs, number of children, condom use in last sex and SWOP clinic

[a]Exposures included the experience of physical and/or sexual violence and harmful alcohol and/or substance use (0 = no experience of recent physical and/or sexual violence and no harmful alcohol and/or other substance use; 1 = experience of recent physical and/or sexual violence OR harmful alcohol and/or other substance use; 2 = experience of recent physical and/or sexual violence AND harmful alcohol and/ or other substance use)

[b]Test of linearity p-value

findings have been inconsistent [57]. The heterogeneous findings may be attributed to differences in the characteristics of study populations [59].

Findings in this study suggest a role of violence and substance use in elevated HCC levels. Increased HCC has been associated with a range of health conditions, including cardiovascular diseases, diabetes mellitus, metabolic diseases, and immune function impairment [26]. Although our study found no evidence of an association between HCC and

CRP levels, cortisol is known to play a key role in regulating the immune system, including T-cell activation. Hence, increased HCC levels may contribute to an increased likelihood of acquiring HIV in this population at high risk for HIV [26]. However, prospective longitudinal studies and mechanistic studies that measure the incidence of HIV infection, susceptibility, and HIV-relevant immune function are needed to test this hypothesis in this vulnerable population.

### 4.1 Strengths and limitations

A strength of our study is the large random sample of FSWs included and the use of validated tools to measure violence, mental health problems, alcohol and substance use problems and HCC. Limitations include the cross-sectional study design, so we can neither assume a temporal relationship nor infer causality, as well as the useability of only around 56% of hair samples provided due to extremely short hair or hair samples with too few strands. Our focus on women with useable 2 cm of hair meant the hair sample time frame (past 2.5 months) may not have matched the violence exposure timeframes (past six months) or the mental health (past two weeks) time frames. Additionally, CRP is a non-specific marker of acute inflammation [60], so it could pick up any infections that participants experienced on the day of blood sampling (e.g., flu) but might miss inflammation that might have occurred weeks prior. This could potentially impact the ability to detect an association between HCC and CRP levels if such an association exists. Another possible bias could be that the characteristics of participants in this study may differ from the overall HIV-negative and the baseline participants of the *Maisha Fiti* study in general. However, this bias may be minimal as the prevalence of our main exposure variables and other characteristics of study participants in this study are similar to that of the overall HIV-negative participants (Supplementary Materials: Tables S1 and S2) and the baseline cohort of the *Maisha Fiti* study published elsewhere [8, 9, 11]. Furthermore, our exposure measures were retrospective, with the possibility of recall bias. Nonetheless, studies have revealed a moderate concordance between prospective and retrospective reporting of similar measures [61, 62]. Also, this study may be prone to underreporting sensitive issues, including our exposure measures, meaning the prevalence we reported may be underestimated. In addition, we did aim to include all known confounders from the literature to adjust for our analyses; however, it is plausible that we missed important confounders. Lastly, there is a need for prospective and retrospective research on cortisol, especially in defining the normal reference range in different populations.

## 5 Conclusion

In conclusion, among FSWs in Nairobi, we find independent positive associations between HCC levels and recent physical and/or sexual violence and alcohol and/or substance use problems, with a cumulative dose-response relationship seen with increasing exposures. This suggests that increased HCC due to violence and harmful substances could be associated with increased HIV-1 acquisition risk; however, there is a need for more research to understand this further. Moreover, future studies could investigate how other more relevant biomarkers of the inflammatory systemic response system are associated with violence, harmful alcohol/substance use and HCC in this population. Together, this will be useful in understanding how FSWs' experiences of violence, poor mental health and harmful alcohol/substance use may increase their risk of HIV through biological pathways.

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Author contributions M.P, T.B, J.B, and M.G conceptualized and planned the analyses of this paper. M.P analysed the data and wrote the first draft of the manuscript supervised by T.B, J.B, and M.G; T.B, J.K, R.K, H.W, J.S, R.H.K, M.K devised the data collection; P.N and M.P carried out data preparations; Q.M, A.A.E and M.J.R led the lab-based hair cortisol analyses while E.I led the analyses of other biological lab data in Kenya. All authors reviewed and revised the manuscript.

Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Declarations

Ethics approval and consent to participate This study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Ethical approval for the study was granted by the Kenyatta National Hospital—University of Nairobi, Ethics Review Committee (KNH ERC P778/11/2018), the Research Ethics Committees at the London School of Hygiene and Tropical Medicine (Approval numbers: 16229 for the *Maisha Fit* study and 16229-01 for Mamtuti's PhD research) and the University of Toronto (Approval number: 37046).

Competing interests The authors declare no competing interests.



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## Supplementary

**Table S1.** Comparison of the prevalence of violence, mental health, and substance use disorder among study participants (N=425) and the HIV-negative participants who were excluded in the study (N=321)

| | **Total 425 N (%)** | **Total 321 N (%)** |
|---|---|---|
| | | |
| **Financial violence** | | |
| No | 148 (33.5) | 102 (32.3) |
| Yes | 272 (66.5) | 218 (67.7) |
| **Emotional violence** | | |
| No | 102 (23.0) | 85(26.4) |
| Yes | 323 (77.0) | 236(73.6) |
| **Physical violence** | | |
| No | 195 (45.4) | 147 (43.1) |
| Yes | 230 (54.6) | 184 (56.86) |
| **Sexual violence** | | |
| No | 222 (50.6) | 162 (50.1) |
| Yes | 203 (49.4) | 159 (49.9) |
| **Physical and / or sexual violence** | | |
| No | 149 (33.6) | 110 (34.4) |
| Yes | 276 (66.4) | 211 (65.6) |
| **Any recent violence**[a] | | |
| No | 49(10.7) | 42 (13.2) |
| Yes | 376 (89.3) | 279 (86.8) |
| **Police arrest** | | |
| No | 302 (70.9) | 226 (68.6) |
| Yes | 123 (29.1) | 95 (31.4) |
| **Depression** | | |
| None/Mild | 329 (76.3) | 252 (76.8) |
| Moderate/Severe | 95 (23.7) | 69 (23.2) |
| **Anxiety** | | |
| None/Mild | 376 (88.4) | 294 (91.4) |
| Moderate/severe | 49 (11.6) | 27 (8.6) |
| **PTSD** | | |
| Negative | 365 (86.5) | 272 (84.9) |
| Positive | 56 (13.5) | 46 (14.1) |
| **Suicidal behaviours** | | |
| No | 379 (89.2) | 292 (90.6) |
| Yes | 46 (10.8) | 29 (9.5) |
| **Alcohol use problem**[b] | | |
| low risk | 276 (65.7) | 210 (65.5) |
| moderate/high risk | 146 (34.3) | 110 (34.5) |
| **Other substance use problem** [b,c] | | |
| low risk | 262 (63.5) | 213 (67.5) |
| moderate/high risk | 162 (36.5) | 107 (32.6) |
| **Tobacco use** | | |
| No | 333 (78.5) | 260 (80.8) |
| Yes | 92 (21.5) | 61 (19.3) |

| | | |
|---|---|---|
| **Alcohol and/or other substance use problem** | | |
| No | 212 (51.2) | 160 (50.63) |
| Yes | 213 (48.8) | 161 (49.4) |

[a]refers to any recent financial, emotional, physical, or sexual violence
[b] alcohol /other substance use problem: low risk 0-10 moderate/high risk 11+
[c]other substances (cannabis, cocaine, amphetamines, hallucinogens, sedatives and inhalant) excluding tobacco smoking and alcohol.

**Table S2.** Comparison of the characteristics of study participants (N=425) and the overall HIV-negative participants of the Maisha Fiti study (N=746)

| **Characteristic** | **Total 425 N (%)** | **Total 321 N (%)** |
|---|---|---|
| **Age** | | |
| <25 | 119 (16.1) | 81 (14.3) |
| 25-34 | 155 (42.5) | 131 (46.8) |
| 35+ | 151 (41.4) | 109 (38.9) |
| **Age at first sex** | | |
| </=15 | 130 (30.4) | 122 (39.0) |
| 16-17 | 148 (33.8) | 88 (25.5) |
| 18+ | 143 (35.80) | 108 (35.5) |
| **Literacy** | | |
| illiterate | 61 (15.3) | 49 (16.59) |
| literate | 364 (84.7) | 272 (83.41) |
| **Religion** | | |
| Catholic | 172 (39.7) | 114 (35.2) |
| Protestant | 220 (52.8) | 165 (53.2) |
| Muslim/others/none | 33 (7.5) | 40 (11.6) |
| **Socio-economic status** | | |
| Lower/lower middle | 161 (37.2) | 138 (41.9) |
| middle | 76 (17.4) | 61 (18.9) |
| upper middle/upper | 188 (45.4) | 122 (39.2) |
| **Total number of ACEs reported** | | |
| 0 to 4 | 110 (25.4) | 86 (27.6) |
| 5 to 8 | 246 (58.6) | 182 (56.0) |
| 9 to 12 | 69 (16.0) | 53 (16.4) |
| **Marital Status** | | |
| Single | 125 (26.5) | 94 (26.2) |
| Married or cohabiting | 28 (7.0) | 29 (9.1) |
| Separated/divorced /widowed | 272 (66.5) | 198 (64.8) |
| **Number of Children*** | | |
| None | 24 (4.8) | 22 (2.8) |
| one to two | 274 (66.5) | 216 (69.8) |
| 3+ | 101 (28.6) | 74 (27.5) |
| **Number of household dependents** | | |
| 0 | 82 (17.8) | 58 (16.7) |
| 1 | 117 (25.4) | 72 (21.2) |
| 2+ | 226 (56.8) | 191 (62.1) |
| **Recent Hunger** | | |

| | | |
|---|---|---|
| No | 305 (70.8) | 206 (63.7) |
| Yes | 119 (29.2) | 114 (36.3) |
| **Have other source (s) of income** | | |
| Yes | 198 (47.6) | 130 (40.5) |
| No | 227(52.4) | 191 (59.5) |
| **Social support** | | |
| No | 119 (27.5) | 88 (28.0) |
| Yes | 306 (72.5) | 233 (72.0) |
| **Place of selling sex** | | |
| Lodge/hotel/rented room/home | 406 (97.0) | 312 (97.2) |
| Public places | 13 (3.1) | 9 (2.9) |
| **Number of clients /weeks** | | |
| <5 | 246 (58.5) | 190 (58.5) |
| 5+ | 173 (41.6) | 131 (41.5) |
| **Condom use last sex** | | |
| yes | 313 (74.4) | 246 (77.7) |
| No | 112 (25.6) | 74 (22.3) |
| **Contraceptive use** | | |
| No | 61 (14.5) | 53 (16.4) |
| Yes | 364 (85.5) | 268 (83.6) |
| **Bacterial STI prevalence (Chlamydia/Gonorrhoea/syphilis) [a]** | | |
| none | 368 (87.6) | 284 (89.7) |
| One+ | 57 (12.4) | 37 (10.3) |
| **Experienced previous abortion/still birth*** | | |
| No | 222 (54.1) | 186 (60.2) |
| Yes | 177 (45.9) | 116 (39.8) |
| **Reports any sex-work related stigma** | | |
| No | 58 (13.0) | 46 (15.0) |
| Yes | 361 (87.0) | 274 (85.0) |

*Missing n=26

[a]Bacterial STI prevalence is defined as a positive test for gonorrhoea, chlamydia and/or syphilis infection.

# Chapter 7 Research Paper 3.

*Associations between cortisol concentrations in hair samples and violence, poor mental health, harmful alcohol, and other substance use: A longitudinal study of female sex workers in Nairobi, Kenya.*

## 7.0 Overview

A huge gap in the literature is the lack of longitudinal studies to better understand the relationship between stressors and HCC among FSWs. As shown in Chapter 2, only one study examined HCC levels among FSWs, which was cross-sectional and mainly focused on the relationship between violence and HCC levels.

After reporting evidence of positive associations between HCC levels and violence as well as harmful substance use cross-sectionally in this thesis, presented in Paper 2, I used the longitudinal data from the Maisha Fiti study to examine how HCC changed between the two-time points and whether a change in HCC at endline was due to the experience of violence, poor mental health, and harmful substance use. I used the baseline data and the endline data collected in the Maisha Fiti study, which included data on FSWs' experiences before the COVID-19 pandemic and during the COVID-19 pandemic/lockdown in Kenya, respectively.

Findings in this longitudinal study indicate that HCC significantly decreased from baseline to endline. Also, the prevalence of violence, mental health problems and harmful substance use decreased between the two-time points. Results from multivariate regression analyses showed a relationship between the trajectories of physical violence and physical and/or sexual violence with reduced HCC levels at endline, but the uptake of psychological counselling modified the associations.

Paper 3 has been submitted to *Plos Global Public Health* for publication.

London School of Hygiene & Tropical Medicine
Keppel Street, London WC1E 7HT

T: +44 (0)20 7299 4646
F: +44 (0)20 7299 4656
www.lshtm.ac.uk

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| **First Name(s)** | Mamtuti | | |
| **Surname/Family Name** | Panneh | | |
| **Thesis Title** | Exploring violence, poor mental health and harmful alcohol/substance use among FSWs in Nairobi and their association with hair cortisol levels. | | |
| **Primary Supervisor** | Prof. John Bradley | | |

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PLOS Global Public Health

# Longitudinal assessment of changes in hair cortisol levels and associations with violence, poor mental health and harmful substance use among female sex workers in Nairobi, Kenya

--Manuscript Draft--

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| **Corresponding Author:** | Mamtuti Panneh, Masters<br>London School of Hygiene & Tropical Medicine<br>London, UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND |
| **Order of Authors:** | Mamtuti Panneh, MMSc* |
| | Tara Beattie, PhD |
| | Qingming Ding, PhD |
| | Rhoda Kabuti, MSc |
| | The Maisha Fiti study champions4φ |
| | Polly Ngurukiri, BA |
| | Mary Kungu, BA |
| | Tanya Abramsky, MSc |
| | James Pollock, BScH |
| | Alicja Beksinska, BMBS |
| | Erastus Irungu, MSc |
| | Janet Seeley, PhD |
| | Helen A Weiss, DPhil |
| | Abdelbaset A Elzagallaai, PhD |
| | Michael J Rieder, PhD |
| | Rupert Kaul, PhD |
| | Joshua Kimani, BMChB |
| | Mitzy Gafos, PhD** |
| | John Bradley, PhD** |

| | |
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| **Abstract:** | Female sex workers (FSWs) in sub-Saharan Africa commonly experience violence, mental health problems, and harmful substance use. Stressful life events can harm the functioning of the hypothalamic-pituitary-adrenal (HPA) axis, serving as a pathway to increased poor health, including HIV susceptibility through cortisol levels. In this paper, we examine changes in hair cortisol concentration (HCC) levels and associations with experiences of violence, mental health problems and harmful substance use among FSWs in Nairobi, Kenya. We used baseline and endline data from the Maisha Fiti study of FSWs in Nairobi. Participants reported recent violence, poor mental health, and harmful alcohol/substance use at both time points. Hair samples proximal to the scalp were collected to measure HCC levels determined by ELISA technique. We analysed data from 285 HIV-negative respondents who provided a 2cm of hair sample at baseline and endline. Multivariable linear regression models were used to assess the associations between the trajectory of the main exposure variables and the change in HCC levels at endline. Findings showed that HCC levels decreased significantly (p- value = 0.001) from baseline (mean HCC = 316 ng/g) to endline (mean HCC = 238.1 ng/g). Reported prevalence of violence, mental health problems and harmful alcohol/other substances decreased. There was evidence of associations between change in HCC at endline and the trajectories of physical violence (p-value=0.007) and physical and/or sexual violence (p-value = 0.048). There was weak evidence of an association between the trajectory of exposure to emotional violence but no evidence of other associations. These findings suggest that physical violence and physical and/or sexual violence may lead to HPA axis dysfunction, possibly serving as a pathway linking violence to increased poor health, including HIV acquisition. However, further research with repeated measurements and a larger sample size is needed to examine the associations between violence, HCC levels, and HIV infection. |

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# Longitudinal assessment of changes in hair cortisol levels and associations with violence, poor mental health and harmful substance use among female sex workers in Nairobi, Kenya.

Mamtuti Panneh, MMSc[1]*, Tara Beattie, PhD[2], Qingming Ding, PhD[3], Rhoda Kabuti, MSc[4], The Maisha Fiti study champions[4], Polly Ngurukiri, BA[4], Mary Kungu, BA[4], Tanya Abramsky, MSc[2], James Pollock, BScH[5], Alicja Beksinska, BMBS[2], Erastus Irungu, MSc[4], Janet Seeley, PhD[2], Helen A Weiss, DPhil[6], Abdelbaset A. Elzagallaai, PhD[3], Michael J Rieder, PhD[3], Rupert Kaul, PhD[7], Joshua Kimani, MBChB[4], Mitzy Gafos, PhD[2**], John Bradley, PhD[6**]

[1]Department of Infectious Disease Epidemiology and International Health, London School of Hygiene & Tropical Medicine, London, UK. Mamtuti.Panneh@lshtm.ac.uk.
[2]Department for Global Health and Development, London School of Hygiene & Tropical Medicine, London, UK.
[3]Robarts Research Institute, Schulich School of Medicine and Dentistry, Western University, London, ON, Canada.
[4]Partners for Health and Development in Africa, Nairobi, Kenya.
[5]Department of Immunology, University of Toronto, Toronto, Canada
[6]MRC International Statistics and Epidemiology Group, Department for Infectious Disease Epidemiology, LSHTM, London, UK
[7]Department of Medicine, University of Toronto, Toronto, Canada.

*Corresponding author: Email Mamtuti.panneh@lshtm.ac.uk/ tutipanneh@gmail.com

** Authors contributed equally

# Abstract

Female sex workers (FSWs) in sub-Saharan Africa commonly experience violence, mental health problems, and harmful substance use. Stressful life events can harm the functioning of the hypothalamic-pituitary-adrenal (HPA) axis, serving as a pathway to increased poor health, including HIV susceptibility through cortisol levels. In this paper, we examine changes in hair cortisol concentration (HCC) levels and associations with experiences of violence, mental health problems and harmful substance use among FSWs in Nairobi, Kenya. We used baseline and endline data from the Maisha Fiti study of FSWs in Nairobi. Participants reported recent violence, poor mental health, and harmful alcohol/substance use at both time points. Hair samples proximal to the scalp were collected to measure HCC levels determined by ELISA technique. We analysed data from 285 HIV-negative respondents who provided a 2cm of hair sample at baseline and endline. Multivariable linear regression models were used to assess the associations between the trajectory of the main exposure variables and the change in HCC levels at endline. Findings showed that HCC levels decreased significantly (p-value = 0.001) from baseline (mean HCC = 316 ng/g) to endline (mean HCC = 238.1 ng/g). Reported prevalence of violence, mental health problems and harmful alcohol/other substances decreased. There was evidence of associations between the trajectories of physical violence (p-value=0.007) and physical and/or sexual violence (p-value = 0.048) with decreased HCC at endline. There was weak evidence of an association between the trajectory of exposure to emotional violence but no evidence of other associations. These findings suggest that physical violence and physical and/or sexual violence may lead to HPA axis dysfunction, possibly serving as a pathway linking violence to increased poor health, including HIV acquisition. However, further research with repeated measurements and a larger sample size is needed to examine the associations between violence, HCC levels, and HIV infection.

# Introduction

Female sex workers (FSWs) in sub-Saharan Africa (SSA) are at heightened risk of adverse life events such as violence, poor mental health and harmful alcohol and other substance use, which have been associated with negative health outcomes, including increased risk of HIV acquisition (1, 2). Vulnerabilities of FSWs to violence, poor mental health and harmful alcohol and other substance use have been linked to the criminalisation of sex work, the risks inherent in the sex work environment, as well as the intersecting socio-economic and structural inequalities (e.g., poverty, low education and gender inequality) they face from as early as childhood (2-4). According to the UNAIDS, the risk of HIV was 26 times higher among FSWs worldwide in 2020 compared to women of the same age not engaged in sex work (5).

Similar to other SSA countries, FSWs in Kenya are at an increased risk of adverse life experiences, mainly linked to poverty, stigma and discrimination, gender inequality, the criminalisation of sex work and high-risk working conditions (1, 6, 7). Although violence against women is generally high in Kenya, with 47% of women aged 15-49 years ever experiencing physical/sexual violence in their lifetime, FSWs tend to report significantly higher rates. For example, a recent finding from a cross-sectional study conducted among FSWs in Nairobi found that approximately 90% experienced violence in the past 12 months. Of these, 81% reported violence from clients, 79% from intimate partners, and 50% from other perpetrators (e.g. police, family members) (8). Baseline findings from the Maisha Fiti study of FSWs in Nairobi, from which participants for this study were drawn, indicated that nearly 50% reported symptoms of depression, 38% reported symptoms of anxiety, and 30% engaged in harmful alcohol consumption (4).

There is strong evidence of associations between the risk of HIV infection and violence (9, 10), mental health problems (11) and harmful alcohol and other substance use (12-14). Although violence, poor mental health and harmful alcohol and/or other substance use can lead to higher-risk sexual behaviours (e.g., condomless sex), increasing FSWs' vulnerability to HIV infection, there may be other possible pathways to increased HIV acquisition (11, 15, 16). For example, a

cross-sectional study among HIV-negative women showed that physical and psychological intimate partner violence independent of sexual abuse was associated with immune activation (CD4+ activation), suggesting an immune link between violence and increased HIV susceptibility (17). Also, previous research indicates that the experience of traumatic or stressful events may increase the susceptibility to HIV infection through biological or physiological pathways (18, 19); however, these potential pathways are less understood.

Recent empirical studies suggest that stressful life events can harm the functioning of the hypothalamic-pituitary-adrenal (HPA) axis, which may serve as a pathway linking stressful life experiences and negative health outcomes (20). Activation of the HPA axis due to physiological (e.g., illness, injury, or trauma) or psychological (e.g., mental-ill health) stress leads to the production of stress hormone, cortisol (21). During acute stress, cortisol is released for several hours, and once the optimal cortisol concentration is achieved, it exerts negative feedback and returns to systemic homeostasis (21). However, long-term or repeated stress results in a dysregulated HPA axis, often characterised by hyper-or-hypo-responsiveness, which disturbs cortisol production and might lead to a condition called allostatic load, the 'wear and tear' on the body (22, 23). Research has shown that hypercortisolism mostly occurs in the early onset of trauma or stress and then lapses to reduced levels (hypocortisolism) over time as a "maladaptive response" to protect the body (22, 24, 25). Dysregulation in cortisol production due to stress is known to have a deleterious impact on health, as most bodily cells contain cortisol receptors (21). For example, cortisol plays a key role in immune regulation, including the anti-inflammation processes, and hypocortisolism might lead to increased levels of inflammatory cytokines, causing widespread inflammation (26). Also, although cortisol acts as an anti-inflammatory hormone in normal homeostasis, hypercortisolism can have proinflammatory effects due to glucocorticoid receptor resistance, which has been linked to failure to downregulate inflammatory responses to viruses (26, 27). Dysregulation in cortisol levels has been associated with higher T-cell activation (e.g., CD8+ T-cells), and research has shown that individuals with activated immune markers are more susceptible to HIV infection (28, 29).

A growing body of evidence from different populations suggests associations between violence, mental health problems and harmful alcohol and other substance use with cortisol levels, although results have been inconsistent (30-33). Among FSWs, a recent cross-sectional study in Kenya showed that FSWs who recently (in the past 12 months) experienced gender-based violence had higher hair cortisol levels than their unexposed counterparts, but no evidence of association was found for depression, post-traumatic stress disorder (PTSD) or harmful alcohol and other substance use (19). Also, baseline findings of FSWs in this current study cohort showed evidence of associations of both physical and/or sexual violence and harmful alcohol and/or other substance use with increased hair cortisol levels (34). Currently, there is a huge gap in the longitudinal understanding of cortisol levels in relation to violence, poor mental health and harmful alcohol and other substance use among FSWs. In several studies, cortisol is measured using blood, saliva, or urine, which only measure short-term cortisol levels. This makes it hard to assess the relationship between long-term stress exposure and the functioning of the HPA axis (35). In contrast, analysing cortisol in hair provides reliable long-term cortisol measurement retrospectively for several months (35, 36).

In this study, we used data from the Maisha Fiti study, a mixed-methods longitudinal study with FSWs in Nairobi. The Maisha Fiti study aimed to investigate the associations of violence, poor mental health, harmful alcohol and other substance use and the biological changes to the immune system and risk of HIV (4). Behavioural-biological surveys were conducted in the Maisha Fiti study, with baseline data collected before the start of the COVID-19 pandemic and endline data collected after the COVID-19 pandemic lockdown in Kenya. In this paper, we use the baseline and endline data to examine whether hair cortisol levels change over time from baseline to endline and if hair cortisol levels change over time based on the experiences of different types of violence, mental health problems and harmful alcohol and other substance use among HIV-negative FSWs in Nairobi. To our knowledge, this study will be the first to examine cortisol levels among FSWs longitudinally. The overarching goal is to understand whether the experiences of violence, poor mental health, and harmful use of alcohol and other substances affect the stress response system through cortisol levels, which could be a possible pathway linking these exposures to increased

risks of poor health, including HIV infection.

# Methods

## Study Design and Sampling

The Maisha Fiti longitudinal study was designed in consultation with the community of FSWs in Nairobi and the staff and peer educators working in the seven Sex Work Outreach Program (SWOP) clinics in Nairobi. Baseline data were collected from 14 June to 13 December 2019 before the onset of the COVID-19 pandemic, while endline data were collected between 11 June 2020 and 29 January 2021 after the COVID-19 lockdown in Kenya.

The SWOP clinics in Nairobi provide clinical services to 73% (29,000) of the estimated 39,600 FSWs in Nairobi. The participants for the Maisha Fiti study were randomly selected across the seven SWOP clinics in Nairobi using their unique SWOP clinic enrolment numbers. The eligibility criteria for the selection of study participants in the Maisha Fiti study were as follows:

(i) aged 18-45 years, (ii) attended a SWOP clinic in the past 12 months (as an indication of current sex work), and (iii) no chronic illness (excluding HIV) such as diabetes, rheumatoid arthritis, asthma, and TB infection that could impact the immune system. A total of 10,292 of the 29,000 FSWs met these criteria and were included in the sampling frame. The desired sample size for the Maisha Fiti study was 1000 FSWs; however, 1200 FSWs were randomly selected from the 10,292 FSWs (who met the inclusion criteria) to allow for non-response and non-eligibility since other additional exclusion criteria were assessed during enrolment including current pregnancy (urine samples were tested for pregnancy) or breastfeeding. Also, the number of FSWs selected per clinic was proportional to clinic size, and women aged less than 25 years were oversampled to allow adequate power for analyses stratified by age. Selected participants were telephoned and informed about the study. Those interested were invited to visit the study clinic, where they received detailed information about the study. Participation was voluntary; eligible participants provided written informed consent before completing the behavioural-biological survey. Details about the study

sampling have been published elsewhere (37). This current analysis focused on the HIV-uninfected participants in the Maisha Fiti study.

## Data Collection

### *Behavioural-biological surveys*

Participants completed a behavioural-biological survey at each study visit. The behavioural survey captured data on socio-demographics, adverse childhood experiences (ACEs), sexual practices and behaviours, stigma, social support, lifetime and recent violence experiences, mental health problems, and alcohol and other substance use. However, some time-invariant sociodemographic factors (e.g., age, marital status, number of children, religion, literacy, socioeconomic status) were only collected at baseline. Biological samples, including urine, blood, and hair samples, were collected for biological tests. Urine samples were provided to test for gonorrhoea and chlamydia infection using GeneXpert Assay. Blood samples were used to test for HIV and syphilis using rapid HIV tests and rapid plasma regain assay, respectively, and positive HIV results were confirmed using HIV DNA GeneXpert. Hair samples were used to test for cortisol levels. Details about the processing of hair cortisol can be found in the study variable section below.

## Ethical Considerations

The Maisha Fiti study was ethically approved by the Research Ethics Committees at the London School of Hygiene and Tropical Medicine (Approval number: 16229), the Kenyatta National Hospital – University of Nairobi Ethics Review Committee (KNH ERC P778/11/2018), and the University of Toronto (Approval number: 37046). Participation in the study was voluntary, and women provided written informed consent before enrolling. Confidentiality was maintained throughout the study, and anonymised study numbers were issued to each participant.

## Conceptual Framework

Using the eco-social life course theory (38) and drawing on the literature, a conceptual framework was developed to guide our analyses (Figure 1). The framework theorises how societal and ecological context exposures can be biologically embodied, causing health and disease disparities (38). It is based on our baseline analysis and has been adapted to include the impact of receiving psychological counselling from the Maisha Fiti study counsellor, SWOP clinic, or any healthcare provider prior to endline and the effect of COVID-19 on cortisol levels over time. The direct effect of COVID-19 through illness was hard to determine since most participants with flu-like symptoms weren't tested for COVID-19 at that time, as there was a shortage of COVID-19 test kits in Kenya. Also, the indirect effect of COVID-19 through income loss was not directly measured, but the trajectory of recent hunger could be in proximity to it. The rectangles in blue are the main exposure variables of interest, while the other rectangles are potential confounders, with the effect of counselling being a possible effect modifier. Details about the definition of some variables in the framework are shown in Table 1.

**Figure 1**. A conceptual framework illustrating the risk factors influencing hair cortisol levels among female sex workers in Nairobi, Kenya over time.

**Table 1.** Definition of exposure variables

| Variables | Tool/Question | Category |
|---|---|---|
| | **Childhood and distal Socio-demographic factors** | |
| **ACEs** | WHO Adverse Childhood Experiences International Questionnaire (ACE-IQ) (39) | Ordered categorical variable (each ACE scores one point): <4, 5–8, 9–12 (40) |
| **Age at first sex** | How old were you when you first received money/goods in exchange for sex? | </=15, 16-17, 18+ |
| **Socio-economic status (SES)** | 14 household asset questions used in the Kenyan Demographic Health Surveys | Principle component analysis (PCA) used to compute household SES: Lower/lower middle, middle, upper middle/upper. |
| | **Proximal Socio-demographic Factors** | |
| **Number of household dependants** | Not including yourself, how many people living in your household are dependent on your income? | 0, 1, 2+ |

| | | |
|---|---|---|
| **Recent hunger** | Thinking now about the past 7 days, have you or anyone in your family skipped a meal because there was not enough food? | No vs Yes |
| **Current social support** | Do you have someone who you can talk to about your problems? | Yes/sometimes vs No |
| | **Sex-work characteristics/sexual risk behaviours** | |
| **Condom use** | The last time you had vaginal sex, did you use a condom? | No vs Yes |
| **Contraceptive use** | Are you currently doing something or using any method to delay or avoid getting pregnant?<br><br>What is the method you currently use to delay or avoid getting pregnant? | No vs Yes |
| | **Recent Violence (past six months)** | |
| **Recent physical violence, sexual violence and emotional Violence** | WHO Violence Against Women 13-item questionnaire (41) | No vs Yes for each type of violence |
| **Financial Violence** | In the last six months, how many times has a client refused or had to be forced to pay you for sex you have provided? | Never vs ≥ once |
| **Recent Police arrest** | Have you been arrested in the past six-months because you are a sex worker? | No vs Yes |
| | **Mental health Problems** | |
| **Depression (past 2 weeks)** | Patient Health Questionnaire-9 (PHQ-9) (42, 43) | < 15=none/mild vs<br>≥ 15 = moderate/severe |
| **Anxiety (past 2 weeks)** | Generalised Anxiety Disorder-7 Assessment (GAD-7) (42, 44) | < 10=none/mild vs<br>≥ 10 = moderate/severe |
| **PTSD (past month)** | Harvard Trauma Questionnaire (HTQ-17) (45) | < 2= negative PTSD vs<br>≥ 2 =positive for PTSD |
| **Recent Suicidal Thoughts/Behaviours (past month)** | Having thoughts about ending your life<br>Having attempted to end your life | No vs Yes |
| | **Alcohol and other substance use problems (past 3 months)** | |
| **Harmful alcohol** | WHO ASSIST (Alcohol, Smoking and Substance Involvement Screening Test) tool (46) | score ≥ 11 moderate to high risk |
| **Other harmful substance** | WHO ASSIST (Alcohol, Smoking and Substance Involvement Screening Test) tool (46) | score ≥ 4 moderate to high risk |
| **Tobacco use** | In your life have you ever used Tobacco products?<br>In the past 3 months, how often have you used tobacco? | Never vs<br>once/twice/monthly/weekly/daily or almost everyday |
| | **Psychological counselling /COVID-19** | |
| **Psychological counselling** | In the past 6 months, have you had one or more counselling sessions with the Maisha Fiti study counsellor?<br>In the past 6 months, did you receive psychological counselling from SWOP clinic?<br>In the past 6 months, did you receive psychological counselling from any other service provider? | No vs Yes |
| **COVID-19 lockdown financial support** | Since covid-19 lockdown, did you receive any funds, food, vouchers from a government scheme? | No vs Yes |

## Study Variables

*Outcome variable*

The main outcome variable was hair cortisol concentration (HCC), with change in HCC at endline generated by dividing endline HCC by baseline HCC levels. This means that if the change in HCC at endline has a value greater than 1, it indicates an increase in HCC at endline compared to baseline. Conversely, a value less than 1 indicates a decrease in HCC at endline compared to baseline, while a value equal to 1 means there was no change, i.e., HCC was the same at both baseline and endline.

For each participant who agreed to provide a hair sample, about 50 hair strands were cut from the posterior vertex, next to the scalp, using clean scissors. The scalp end of the hair sample was labelled, packaged in aluminum foil, and stored in a cool, dry place. Of the 1003 women recruited to participate in the Maisha Fiti study, 746 were HIV-negative at baseline (47), of whom 736 (98.7%) provided hair samples. However, 425 women at baseline had a useable sample; of these, 285 had useable follow-up samples at endline. This is because several participants had either extremely short hair or hair samples with few hair strands. This led to the exclusion of hair samples less than 2cm in length (a hair length of about 6cm was ideal) to allow for sufficient samples to proceed with hair cortisol testing assays. The proximal 2cm of hair from the scalp was analysed for cortisol concentration and represents cumulative cortisol concentration over 2.5 months based on the average African hair growth rate of 0.79cm per month (19). Hair cortisol was analysed using an established enzyme-linked immunosorbent (ELISA) technique (48) and expressed as nanogram/gram (ng/g) of hair mass.

*Exposure variables*

The time-variant measures that were collected at the two-time points were recent violence of different forms, mental health problems, including suicidal behaviours, alcohol and other substance use problems, sex work characteristics, sexual risk behaviours and recent hunger as an indication of financial stress. The trajectories of all time-variant exposures were categorised into three levels: never (for both baseline and endline), baseline only, and endline (with or without

baseline). The time-invariant variables collected at baseline only were the distal socio-demographic factors and proximal socio-demographic factors (except recent hunger), while the experience of receiving psychological counselling and the impact of COVID-19 were collected at endline.

The three categories of our main exposure variables of interest were the trajectories of recent exposures to (i) violence of different forms, (ii) mental health problems, and (iii) alcohol and other substance use problems. The category of recent violence includes the different forms of violence such as physical, sexual, emotional, and financial violence, and the trajectories of each of these violence variables were created. We further created a combined variable for experiencing physical and/or sexual violence because this combination is often used in other cohorts of FSWs and because research showed that women who experience physical and/or sexual violence are more likely to have multiple health problems, including increased HIV infection (49). The trajectory of mental health problems involved participants who experienced any mental health problems (depression/anxiety/PTSD/suicidal behaviour). The category of alcohol and other substance use includes the trajectories of harmful alcohol use, other harmful substance use, and tobacco use, all treated as separate variables. Tobacco use was not included in the list of other harmful substances because it was assessed differently, as shown in **Table 1.**

In the conceptual framework above in Figure 1, all the variables upstream of the main exposures and outcome variables were considered covariates.

## Statistical Analyses

Descriptive statistics were conducted for each exposure variable, and frequencies and percentages were presented. Due to the skewed distribution of HCC levels for both time points and skewness in the change in HCC at endline, they were log-transformed for all statistical analyses. We examined the mean HCC for baseline and endline and determined if there was a significant mean difference in HCC levels across these time points using a paired t-test. The mean of change in HCC at endline with respect to each exposure

variable was also reported. For easy interpretation, the mean of HCC levels for both baseline and endline, as well as the mean of change in HCC at endline in descriptive analyses, were exponentiated to produce a geometric mean, the backwards-transformed mean from the log-transformed data.

To examine whether cortisol levels changed between baseline and endline based on the experiences of our main exposure variables (recent violence, poor mental health, and alcohol or substance use), initial associations between change in HCC at endline and the trajectories of our main exposures, as well as covariates, were assessed using simple linear regression. Key exposures that were associated with change in HCC at endline in univariate linear regression analyses ($p<0.1$) were taken forward for multivariable linear regression analyses and adjusted for confounders that were associated with a change in endline HCC ($p<0.1$) in univariate analyses. To avoid multicollinearity, we examined in separate multivariable regression models how the trajectories of the different forms of violence, mental health problems, and alcohol and other substance use were associated with a change in endline HCC, adjusting for confounders with significance set at $p<0.05$. In each multivariable regression model, we assessed for effect modification with the uptake of counselling by testing if the receiving counselling prior to endline modified the relationships between the key exposures and change in HCC at endline. The coefficients from linear regression models were exponentiated to produce geometric mean ratios (GMR), the ratio of the means that have been backward transformed. All analyses were performed using STATA 16.1, weighted for age and adjusted for clustering by clinic, with p-values obtained using the adjusted Wald test. Additionally, variables with > 5% missing observations were reported.

# Results

Among the 285 participants with follow-up cortisol measurements, the mean age was 31.9 years (CI: 31.3-32.6), with most participants in the age bracket 25-34 years (42.2%). The mean age of first sex was 16.6 years (CI: 16.2-16.9), with 30.5% reporting first sex at 15 years or younger. Most participants were literate (87.1%) and Christians (Protestants 52.8%; Catholics 40.8%). The majority (66.3%) had been divorced, widowed, or separated from their partners, and almost all (95.2%) had at least one child. Most participants (80.7%) had one or more household members depending on their income, and more than two-thirds (69.4%) reported having someone to talk to about their problems. Almost half had received counselling from either the Maisha Fiti study

counsellor, SWOP clinic or other healthcare providers, and about 18.9% received COVID-19 support from the government (Table 2). The characteristics of these study participants are similar to the 425 HIV-negative participants with cortisol results at baseline as well as the overall baseline study participants of the Maisha Fiti study published elsewhere (4).

**Table 2:** Socio-demographic characteristics of study participants (n=285)

| Study variables | N (Weighted %) | Geometric mean of the change in HCC at endline[a] | Crude geometric mean ratio (95% CI) | P-value* |
|---|---|---|---|---|
| **Age** | | | | 0.394 |
| <25 | 90 (18.6) | 0.87 | **Reference** | |
| 25-34 | 101 (42.2) | 0.67 | 0.78 (0.53 to 1.13) | |
| 35+ | 94 (39.3) | 0.80 | 0.92 (0.62 to 1.38) | |
| **Age at first sex** | | | | 0.872 |
| </=15 | 88 (30.5) | 0.76 | **Reference** | |
| 16-17 | 97 (33) | 0.79 | 1.05 (0.71 to 1.54) | |
| 18+ | 97 (36.5) | 0.71 | 0.94 (0.63 to 1.40) | |
| **Literacy** | | | | 0.567 |
| illiterate | 35 (12.9) | 0.84 | **Reference** | |
| literate | 250 (87.1) | 0.74 | 0.89 (0.59 to 1.34) | |
| **Religion** | | | | 0.508 |
| Catholic | 118 (40.8) | 0.82 | **Reference** | |
| Protestant | 144 (51.3) | 0.74 | 0.91 (0.66 to 1.26) | |
| Muslim/others/none | 23 (7.9) | 0.54 | 0.66 (0.32 to 1.36) | |
| **Socio-economic status** | | | | 0.458 |
| Lower/lower middle | 105 (35.8) | 0.80 | **Reference** | |
| Middle | 53 (17.9) | 0.61 | 0.77 (0.50 to 1.18) | |
| Upper middle/upper | 127 (46.3) | 0.78 | 0.99 (0.69 to 1.39) | |
| **Marital status** | | | | 0.352 |
| Single | 91 (27.7) | 0.83 | **Reference** | |
| Married or cohabiting | 16 (6.1) | 1.09 | 1.30 (0.61 to 2.78) | |
| Separated/divorced/widowed | 178 (66.3) | 0.70 | 0.84 (0.58 to 1.21) | |
| **Total number of ACEs reported** | | | | 0.058 |
| 0-4 | 79 (27.3) | 1.01 | **Reference** | |
| 5 to 8 | 161 (57.1) | 0.70 | 0.70 (0.50 to 0.98) | |
| 9 to 12 | 45 (15.6) | 0.58 | 0.57 (0.32 to 1.02) | |
| **Number of children** | | | | 0.0032 |
| 3+ | 60 (25.9) | 1.08 | **Reference** | |
| 1-2 | 188 (69.3) | 0.63 | 0.58 (0.42 to 0.80) | |
| None | 17 (4.8) | 1.17 | 1.08 (0.43 to 2.73) | |
| **Number of household dependents** | | | | 0.166 |
| 0 | 62 (19.3) | 0.54 | **Reference** | |
| 1 | 78 (25.8) | 0.83 | 1.52 (0.95 to 2.44) | |
| 2+ | 145 (54.8) | 0.81 | 1.48 (0.95 to 2.30) | |
| **Social support** | | | | 0.210 |

| | | | | |
|---|---|---|---|---|
| No | 89 (30.6) | 0.66 | **Reference** | |
| Yes | 196 (69.4) | 0.80 | 1.22 (0.89 to 1.66) | |
| | | | | |
| **Place of selling sex at baseline** | | | | |
| Lodge/hotel/rented room/home | 272 (96.8) | 0.73 | **Reference** | |
| Public places | 9 (3.2) | 1.13 | 1.53 (0.47 to 5.00) | 0.479 |
| | | | | |
| | | ***Collected at endline*** | | |
| **Had counselling** | | | | 0.871 |
| No | 152 (52.1) | 0.74 | **Reference** | |
| Yes | 133 (47.9) | 0.76 | 1.03 (0.75 to 1.41) | |
| | | | | |
| **Received Covid-19 financial support** | | | | 0.869 |
| No | 228 (81.1) | 0.76 | **Reference** | |
| Yes | 57 (18.9) | 0.73 | 0.97 (0.63 to 1.48) | |

[a]Geometric mean is the backward-transformed mean from the transformed data.
[*]P-value obtained using simple linear regression

Compared to baseline, the overall prevalence of all the different forms of violence, mental health problems and harmful alcohol and other substance use decreased at endline (Table 3). For time-varying co-variates, there was an increase in prevalence from baseline to endline for some, such as recent hunger (28.1% vs 51.7%), while a decrease was seen in others, such as client volume per week (>5 clients/week: 40.3% vs 17.5%) and sex-work-related stigma (86.78% vs 61.47%). More details about the change in the prevalence of time-varying variables can be found in Table 3. The trajectory changes in the experiences of the different forms of violence, mental health problems and harmful alcohol and other substances from baseline to endline are also presented in Table 3. For example, 26.9% of participants did not experience financial violence across the two-time points, 37.7% experienced financial violence at baseline only, and 35.4% experienced financial violence at endline (with/without baseline financial violence). For emotional violence, 16.2% did not experience emotional violence, 40% at baseline only, and 43.8% at endline.

The mean HCC at baseline and endline were 316 ng/g (95% CI: 271.9-367.3) and 238.1 ng/g (95% CI: 211.2-268.4), respectively, with evidence of a significantly lower HCC at endline compared to baseline (p=0.001). For the trajectories of our main exposure variables, shown in Table 3, the trajectories of exposure to recent emotional (p-value=0.012), physical (p-value= <0.001), and physical/sexual violence (p-value= <0.009) showed evidence of associations with change in HCC

at endline in univariate analyses, while weak evidence was found for alcohol use problems (p-value=0.074). The time-varying covariate that showed evidence of an association with change in HCC in univariate regression was condom use at last sex (p-value=0.013), with women who reported condom use at endline having higher HCC levels at endline (crude GMR 1.79; 95% CI: 1.21 to 2.64) compared to those who reported condom none-use at last sex throughout the two-time points. Moreover, the time-invariant variable (Table 2) that showed evidence of associations with change in HCC at endline was number of children (p=0.0032), with those with one to two children recording significantly lower HCC at endline (crude GMR 0.58; 95% CI: 0.42 to 0.80) compared to those with three or more children. Weak evidence of an association was found between the total number of ACEs reported and change in HCC (p-value=0.058).

**Table 3.** Change in HCC at endline in relation to change in violence, poor mental health, alcohol, and other substance use problems and other trajectory variables (n=285).

| Variables | N (Weighted %) | Change in Prevalence (BL vs EL) | Geometric mean[a] of the change in HCC at endline | Crude geometric mean ratio (95% CI) | P-value* |
|---|---|---|---|---|---|
| **Financial Violence** | | 65.99 vs 35.09 | | | 0.253 |
| Never | 81(26.9) | | 0.93 | Reference | |
| Baseline only | 104 (37.7) | | 0.69 | 0.74 (0.50 to 1.09) | |
| Endline (with/without baseline) | 96 (35.4) | | 0.70 | 0.75 (0.40 to 1.13) | |
| **Emotional Violence** | | 79.19 vs 43.75 | | | 0.012 |
| Never | 50 (16.2) | | 1.23 | Reference | |
| Baseline only | 111 (40) | | 0.78 | 0.64 (0.40 to 1.01) | |
| Endline (with/without baseline) | 124 (43.8) | | 0.61 | 0.49 (0.31 to 0.79) | |
| **Physical Violence** | | 53.77 vs 20.20 | | | |
| Never | 117 (40) | | 1.10 | Reference | 0.0004 |
| Baseline only | 109 (39.81) | | 0.56 | 0.51 (0.36 to 0.72) | |
| Endline (with/without baseline) | 59 (20.2) | | 0.63 | 0.57 (0.37 to 0.88) | |
| **Sexual violence** | | 47.10 vs 17.71 | | | 0.689 |
| Never | 135 (46) | | 0.81 | Reference | |
| Baseline only | 100 (36.3) | | 0.71 | 0.88 (0.61 to 1.26) | |
| Endline (with/without baseline) | 50 (17.7) | | 0.69 | 0.85 (0.55 to 1.32) | |
| **Physical and/ or sexual violence** | | 65.02 vs 28.75 | | | 0.009 |

| | | | | | |
|---|---|---|---|---|---|
| Never | 87 (28.5) | | 1.08 | Reference | |
| Baseline only | 116 (42.7) | | 0.67 | 0.62 (0.43 to 0.89) | |
| Endline (with/without baseline) | 82 (28.8) | | 0.63 | 0.58 (0.40 to 0.87) | |
| | | | | | |
| **Recent arrest** | | 29.59 vs 15.84 | | | 0.1723 |
| Never | 183 (63.5) | | 0.70 | Reference | |
| Baseline only | 59 (20.6) | | 1.01 | 1.44 (0.96 to 2.15) | |
| Endline (with/without baseline) | 43 (15.8) | | 0.67 | 0.95 (0.62 to 1.46) | |
| | | | | | |
| **Any mental Health problem** | | 29.59 vs 11.68 | | | 0.72 |
| Never | 189 (64.8) | | 0.79 | Reference | |
| Baseline only | 65 (23.6) | | 0.69 | 0.87 (0.60 to 1.26) | |
| Endline (with/without baseline) | 31 (11.7) | | 0.70 | 0.89 (0.54 to 1.45) | |
| | | | | | |
| **Alcohol use problem** | | 35.09 vs 17.08 | | | 0.074 |
| Never | 165 (58.2) | | 0.83 | Reference | |
| Baseline only | 68 (24.6) | | 0.54 | 0.65 (0.44 to 0.95) | |
| Endline (with/without baseline) | 50 (17.2) | | 0.81 | 0.97 (0.64 to 1.46) | |
| | | | | | |
| **Other substances** | | 35.6 vs 32.06 | | | 0.929 |
| Never | 152 (44.4) | | 0.73 | Reference | |
| Baseline only | 37 (12.5) | | 0.79 | 1.08 (0.67 to 1.75) | |
| Endline (with/without baseline) | 96 (32.1) | | 0.77 | 1.05 (0.73 to 1.52) | |
| | | | | | |
| **Tobacco** | | 21.87 vs 15.42 | | | 0.927 |
| Never | 213 (75.2) | | 0.74 | Reference | |
| Baseline only | 28 (9.4) | | 0.82 | 1.11 (0.52 to 2.36) | |
| Endline (with/without baseline) | 44 (15.4) | | 0.79 | 1.07 (0.69 to 1.66) | |
| | | | | | |
| | | ***Other trajectory variables*** | | | |
| **Recent hunger** | | 28.14 vs 51.68 | | | 0.833 |
| Never | 119 (40.4) | | 0.80 | Reference | |
| Baseline only | 21 (7.9) | | 0.70 | 0.87 (0.50 to 1.52) | |
| Endline (with/without baseline) | 145 (51.7) | | 0.73 | 0.91 (0.65 to 1.29) | |
| | | | | | |
| **Have other source (s) of income** | | 53.11 vs 52.71 | | | 0.696 |
| Never | 72 (25.6) | | 0.69 | Reference | |
| Baseline only | 59 (21.3) | | 0.72 | 1.04 (0.65 to 1.67) | |
| Endline only | 154 (53.1) | | 0.80 | 1.17 (0.77 to 1.76) | |
| | | | | | |
| **>5 clients /week** | | 40.30 vs 17.54 | | | 0.368 |
| Never | 148 (52.9) | | 0.83 | Reference | |
| Baseline only | 83 (29.4) | | 0.66 | 0.80 (0.56 to 1.14) | |
| Endline (with/without baseline) | 49 (17.8) | | 0.66 | 0.79 (0.52 to 1.20) | |
| | | | | | |
| **Condom use last sex** | | 26.66 vs 29.16 | | | 0.013 |
| Never | 33 (10.8) | | 0.46 | Reference | |
| Baseline only | 45 (15.8) | | 0.66 | 1.42 (0.90 to 2.23) | |

| | | | | | |
|---|---|---|---|---|---|
| Endline (with/without baseline) | 207 (73.3) | | 0.83 | 1.79 (1.21 to 2.64) | |
| | | | | | |
| **Contraceptive use** | | 85.83 vs 87.52 | | | 0.325 |
| Never | 16 (5) | | 0.51 | Reference | |
| Baseline only | 23 (7.5) | | 0.79 | 1.55 (0.70 to 3.43) | |
| Endline (with/without baseline) | 246 (87.5) | | 0.77 | 1.50 (0.88 to 2.56) | |
| | | | | | |
| **Bacterial STI (Chlamydia/Gonorrhoea/syphilis)** | | 13.54 vs 12.72 | | | 0.994 |
| Never | 217 (77.3) | | 0.75 | Reference | |
| Baseline only | 28 (10) | | 0.73 | 0.96 (0.46 to 2.00) | |
| Endline (with/without baseline) | 39 (12.7) | | 0.76 | 1.01 (0.64 to 1.58) | |
| | | | | | |
| **Experienced abortion/still birth**** | | 45.1 vs 3.12 | | | 0.936 |
| Never | 146 (53.4) | | 0.73 | Reference | |
| Baseline only | 110 (43.4) | | 0.77 | 1.06 (0.75 to 1.48) | |
| Endline (with/without baseline) | 9 (3.3) | | 0.84 | 1.16 (0.28 to 4.79) | |
| | | | | | |
| **Reports any sex-work-related stigma** | | 86.78 vs 61.47 | | | 0.419 |
| Never | 23 (8) | | 0.55 | Reference | |
| Baseline only | 88 (30.5) | | 0.80 | 1.46 (0.83 to 2.59) | |
| Endline (with/without baseline) | 171 (61.6) | | 0.76 | 1.39 (0.80 to 2.41) | |

[a]Geometric mean is the backward-transformed mean from the transformed data.
*P-value obtained using simple linear regression.
**Missing n=20

In adjusted analysis (Table 4), we found weak evidence of an association between the trajectory of emotional violence and change in HCC at endline (p-value= 0.085) (Model 1), with participants who experienced emotional violence at baseline only having insignificantly lower endline HCC (adjusted GMR 0.69; 95% CI 0.42-1.13) and those that reported emotional violence at endline having significantly lower endline HCC (adjusted GMR 0.58; 95% CI 0.36-0.94) compared to their unexposed counterparts. There was evidence of an association between the trajectories of exposure to recent physical violence (p-value= 0.007) (Model 2) and physical and/or sexual violence (p-value= 0.048) (Model 3) with change in HCC at endline. Participants who experienced physical violence only at baseline had a significantly decreased HCC at endline (adjusted GMR 0.59; 95% CI 0.42 -0.82) compared to those who did not experience physical violence. Also, compared to participants who didn't report physical and/or sexual violence throughout the two-time points, those who reported physical and/or sexual violence at baseline only (adjusted GMR

0.71; 95% CI 0.50- 1.00) and at endline (adjusted GMR 0.63; 95% CI 0.42-0.96) had significantly lower endline HCC. In addition, no evidence of an association was found between alcohol use problems and change in HCC at endline (p-value= 0.239) in multivariate regression (Model 4).

When we examined the interaction of counselling, there was evidence that the association between the trajectories of exposure to physical violence and physical and/or sexual violence, with decreased HCC at endline were stronger amongst women who received counselling compared to those who did not received counselling (Table 4). For example, among counselled women, those who experienced physical violence at baseline only (adjusted GMR 0.39; 95% CI 0.23- 0.66) or at endline (adjusted GMR 0.36; 95% CI 0.20-0.64) had significantly lower HCC at endline compared to women who didn't experience counselling. Similar findings were also found among counselled women with trajectories of exposure to physical and/or sexual violence. Among participants who did not attend counselling, HCC levels were lower (adjusted GMR 0.77; 95% CI 0.48 to 1.22) and higher (adjusted GMR 1.16; 95% CI 0.51 to 2.65) in those who experienced physical violence at baseline only and at the endline, respectively, but results were not significant. Similar patterns were found among those who experienced physical and/or sexual violence. In addition, we found weak (p-value=.0097) and no evidence (p-value=0.142) that counselling modified the effect of the associations between emotional violence and alcohol use problem with a change in HCC at endline, respectively.

**Table 4**. Associations between the trajectories of violence and alcohol use problem with change in HCC at endline-multivariable regression.

| Models | Variables | Adjusted GMR (95% CI) | P-value | Effect modification (P-value) | Did not attend counselling Adjusted GMR (95% CI) | Attended counselling Adjusted GMR (95% CI) |
|---|---|---|---|---|---|---|
| **Model 1** | **Emotional Violence** | | 0.085 | | | |
| | Never | Reference | | 0.097 | Reference | Reference |
| | Baseline only | 0.69 (0.42 to 1.13) | | | 0.83 (0.42 to 1.62) | 0.45 (0.21 to 0.95) |
| | Endline | 0.58 (0.36 to 0.94) | | | 0.72 (0.33 to 1.56) | 0.37 (0.20 to 0.71) |
| | | | | | | |
| **Model 2** | **Physical Violence** | | 0.007 | 0.002 | | |
| | Never | Reference | | | Reference | Reference |
| | Baseline only | 0.59 (0.42 to 0.82) | | | 0.77 (0.48 to 1.22) | 0.39 (0.23 to 0.66) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Endline | 0.63 (0.39 to 1.02) | | | 1.16 (0.51 to 2.65) | 0.36 (0.20 to 0.64) |
| | | | | | | |
| **Model 3** | **Physical and/ or sexual violence** | | 0.048 | 0.009 | | |
| | Never | Reference | | | Reference | Reference |
| | Baseline only | 0.71 (0.50 to 1.00) | | | 0.92 (0.58 to 1.46) | 0.46 (0.26 to 0.79) |
| | Endline | 0.63 (0.42 to 0.96) | | | 1.20 (0.61 to 2.35) | 0.37 (0.22 to 0.63) |
| | | | | | | |
| **Model 4** | **Alcohol use problem** | | 0.239 | 0.142 | | |
| | Never | Reference | | | Reference | Reference |
| | Baseline only | 0.77 (0.53 to 1.12) | | | 0.45 (0.26 to 0.79) | 1.23 (0.74 to 2.03) |
| | Endline | 1.11 (0.74 to 1.68) | | | 0.93 (0.51 to 1.70) | 1.31 (0.71 to 2.41) |

*__Models 1-4__ each adjusted for clinic, condom use at last sex, ACEs and number of children

# Discussion

In this longitudinal study of FSWs in Nairobi, we found a significant decrease in mean HCC level from baseline to endline. Within the same period, there was a decrease in the prevalence of the different forms of violence (physical, sexual, emotional, and financial violence), mental health problems and harmful alcohol and other substance use. Findings from the multivariable linear regression models showed evidence of associations between the trajectory of exposures to physical violence and physical and/or sexual violence with change in HCC at endline. However, findings showed that the uptake of counselling modified these relationships. Lastly, we found no evidence of an association between the trajectories of financial violence, harmful alcohol, and other substances with change in HCC over time, while weak evidence of an association was found for the trajectory of exposure to emotional violence.

The reduction in the prevalence of violence and harmful substance use at endline compared to baseline may be attributed to the impact of the COVID-19 pandemic. Sex work and its associated risks are known to expose FSWs to various stressors (19). However, the measures implemented in Kenya to curb the COVID-19 pandemic, such as the closure of sex work hotspots, curfews, and social distancing from March to April 2020, affected the sex work industry, potentially reducing the prevalence of sex work-related stressors among FSWs in the study cohort. For example, as we have reported elsewhere from qualitative data, the closure of most sex work hotspots during the

lockdown led to a decrease in clients, prompting some FSWs to pause or quit sex work and pursue other income-generating activities, such as selling masks, which may have reduced the overall prevalence of violent encounters with clients and law enforcement officers (50). However, the qualitative findings also reported increased violence perpetrated by clients and law enforcement officers during the COVID-19 pandemic lockdown (50). This reported increase in violence could reflect a rise in the severity and frequency of violence experienced by some FSWs rather than an increase in the overall number of violent events experienced by FSWs in the study cohort. The reduction in violence observed in this study aligns with the quantitative findings from the larger Maisha Fiti study (51). Additionally, the decline in the prevalence of alcohol and substance use reported in this study is plausible and may be linked to financial stress during the COVID-19 pandemic, as many FSWs could no longer afford alcohol and other substances (50).

The significant reduction in mean HCC levels at endline compared to baseline suggests changes in cortisol production among FSWs over time. Although the reasons for this decline are likely multifaceted, one possible explanation could involve long-term or severe stress exposure among participants, which may have led to HPA-axis dysfunction, resulting in lower HCC levels at endline, possibly following an initial increase (52). We found a significantly lower HCC at endline for participants who experienced physical violence or physical and/or sexual violence at baseline only, compared to their unexposed counterparts, which could be plausible. Research shows that following a traumatic or stressful event, cortisol levels may initially increase and subsequently decrease below baseline levels (52). Therefore, participants who experienced physical violence and physical and/or sexual violence at baseline but not at endline might show lower HCC levels at endline after an initial increase following baseline. The baseline cross-sectional findings from the same study cohort, reported elsewhere, revealed higher HCC levels among participants who had recently experienced physical and/or sexual violence (within the past six months) compared to their unexposed counterparts (34). This suggests that the timing of chronic stress effects on cortisol levels is crucial, aligning with findings reported in a meta-analysis of chronic stress and the HPA axis in humans (53). However, since this study only measured cortisol levels at two-time points, further research with repeated measurements is needed to examine how HCC levels change over

time with respect to the experience of violence. This would provide a more in-depth understanding of the impact of stress on HPA axis activation over time.

Additionally, the significantly lower HCC levels at endline among participants who experienced physical and/or sexual violence at endline (with or without baseline exposure) compared to those who weren't exposed also seems plausible. The lower HCC levels recorded could be due to severe/prolonged stress related to physical and/or sexual violence between the two-time points. Long-term chronic stress experiences eventually progress to HPA axis hypoactivity, as explained above, and the severity of violence has been linked to lower HCC levels (25, 53, 54). Our findings highlight the potential adverse effects of physical violence or physical and/or sexual violence on the health of FSWs, as reduced cortisol levels can lead to poor health outcomes, including widespread inflammation, autoimmune diseases, and chronic pain (25). Moreover, the lack of associations between the trajectories of exposure to any mental health problems and the consumption of harmful alcohol or other substances with a change in HCC levels at endline suggests that the observed change was not due to the experience of mental health problems or harmful substance use. However, these insignificant findings could be attributed to the limitations of this study as discussed below, including the sample size, reducing the power to detect any difference. Therefore, more research is needed (55).

Findings in this study showed the role of counselling in modifying the relationship between violence and change in HCC levels at endline. Amongst counseled participants, the stronger significant effect of physical violence or physical and/or sexual violence on reduced HCC at endline compared to those who did not receive counselling indicates that participants may have sought counselling due to the experience of physical and or sexual violence. Although we didn't find evidence of an association between receiving counselling and change in endline HCC levels (Table 2), a recent review showed that HCC plays a vital role in evaluating psychological and neuropsychiatric interventions, with some studies recording decreased HCC after treatment (56). Unfortunately, another limitation of our study was that we could not assess the effect of counselling services on HCC levels because participants were not randomised for counselling. However, based

on the findings in this study in terms of counselling modifying the relationship between physical and or sexual violence and HCC, as well as the effectiveness of counselling interventions reported in other studies, there is a need for similar interventions to be embedded and maintained within existing services for FSWs.

## Strengths and limitations

A major strength of our study is the use of validated tools to assess our main exposures (violence, mental health, and alcohol and/or substance use), as well as the use of longitudinal data to assess the directionality of associations between our study exposures and change in HCC levels at endline. Using hair samples to measure HCC was another strength since it enabled us to measure long-term cortisol levels retrospectively. However, a key challenge in assessing HPA-axis dysfunction over time is the interpretation of the findings since cortisol can either increase or decrease depending on the timing or severity of the stressful event (52). This could be one of the reasons why there is no established universal cut-off point for HCC measurement. Another limitation of this study includes the potential of under-reporting of sensitive issues such as condom use, mental health, and alcohol/substance use. Also, due to the retrospective nature of our key exposures, this study might be prone to recall bias. In addition, another key limitation was that only about 38% of HIV-ve women in this study had useable hair samples for both baseline and endline, which would have reduced the power of the study, biased the findings and limited generalisability. HIV status was one of the factors associated with loss of follow-up in the Maisha Fiti study, with lower follow-up among HIV-negative women (51). Since this study focused on the HIV-negative women in the Maisha Fiti study, our findings may be prone to follow-up bias. However, the characteristics of the 425 HIV-negative participants with useable hair samples at baseline are similar to the 285 participants with follow-up useable hair samples. Moreso, our focus on women with useable 2cm of hair meant the hair sample time frame (past 2.5 months based on African hair growth rate of 0.79cm per month) (19) may not have matched the recent violence exposure timeframes (past six months) or the mental health (past two weeks) time frames. This may have also caused bias in our estimates as the effect of violence on HCC, for example, may have been reduced or not fully captured if the incident of most violence occurred outside the hair

sample time frame. Lastly, another major limitation of this study is our inability to capture the direct effect of COVID-19 infection on HCC levels, as there was a shortage of COVID-19 test kits in Kenya at the time of the study period.

## Conclusion

This study is the first to examine longitudinal changes in HCC levels among FSWs and to assess how the trajectory of exposure to violence, poor mental health, and harmful alcohol and substance use affect HCC over time. Findings show that the experience of physical violence and physical and/or sexual violence may lead to lower HCC levels over time. These suggest that the experience of physical violence and physical and/or sexual violence may lead to HPA axis dysfunction, which may serve as a potential pathway linking stressors to increased HIV risk and other health problems. However, further research with repeated measurement of HCC levels is needed to explore in-depth and, with a larger sample size, the associations between violence, HCC levels, and health status, especially HIV infection.

## Declarations

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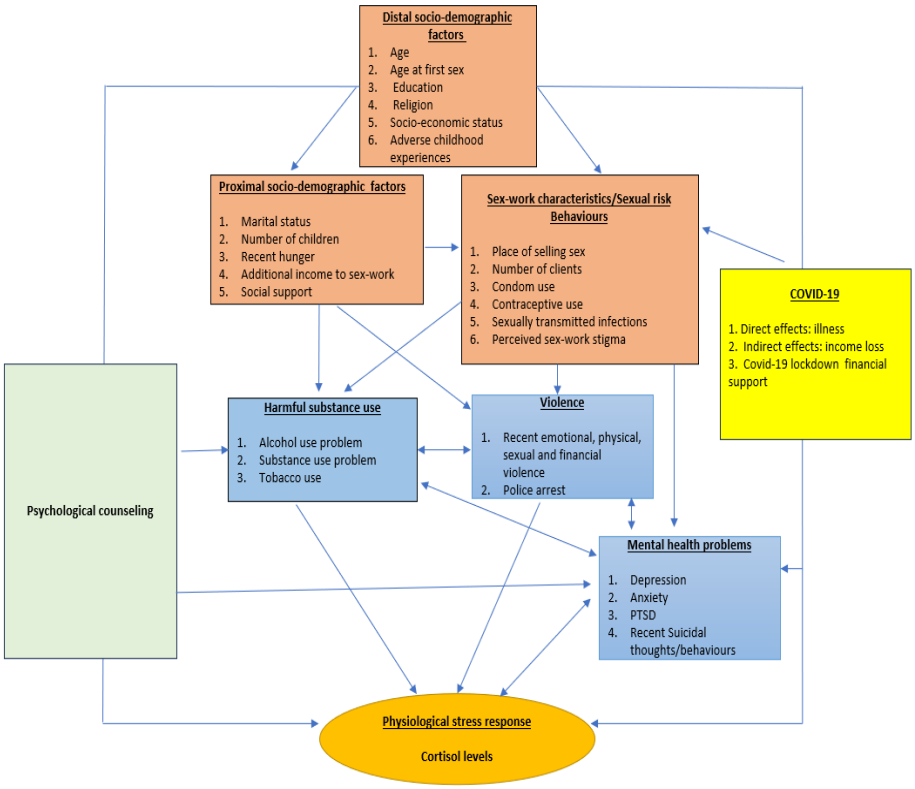
**Figure 1**.



# Chapter 8 Discussion

## 8.0 Overview

In this thesis chapter, I discuss the main findings of my PhD research as presented in Chapters 5, 6 and 7. The discussion centres around the key findings obtained from my PhD, which are divided into two parts: qualitative and quantitative findings and how these findings align with or contribute to the existing literature. I then critically assess the strengths and limitations of this PhD, followed by its implications for future research, policy and practice, and then I conclude.

## 8.1 Synthesis of Key Findings

This section summarises the key findings of my PhD research, which sets out to explore violence, mental health problems, and harmful substance use among FSWs in Nairobi; and how their experiences of these factors are associated with HCC levels. The findings contribute to (1) the contextual understanding of poor mental health and perceived associated risks in the lives of FSWs in Nairobi, Kenya and (2) providing evidence of how the stress-response system may serve as an important pathway linking stressors such as violence to an increased risk of HIV acquisition through cortisol levels.

In Paper 1 (Chapter 5), I addressed the first research question of my PhD: *What are the lifetime experiences of mental health, and other psychological stressors FSWs in Nairobi, Kenya?* This was explored using the baseline in-depth interviews (IDIs) of 40 FSWs. In this paper, I qualitatively examined FSWs' understanding of mental health, their personal experiences of mental health challenges and their perceptions of what triggered their experiences.

In Papers 2 (Chapter 6) and 3 (Chapter 7), I addressed the second (*Is the experience of violence, poor mental health, and harmful substance use associated with hair cortisol levels?)* and third (*Do hair cortisol levels change over time according to recent exposures to violence, poor mental*

*health, and harmful substance use?*) research questions of my PhD research, respectively. In Paper 2, I used the behavioural-biological data collected at baseline to answer my research question using linear regression models. In paper 3, I used the behavioural-biological data collected at baseline and endline to determine whether HCC levels would change across these time points and if a change in HCC level was associated with the experience of violence, poor mental health and harmful substance use. The synthesis of the main qualitative and quantitative findings in my PhD research are elaborated below.

### 8.1.1 Qualitative Findings (Paper 1)

Mental health knowledge among FSWs in Nairobi, Kenya

Findings in my PhD highlight that although most interviewed participants struggled to define mental health, they were able to link it with stress, depression, insanity, suicide and the use of harmful substances. Some defined mental health symptomatically, using terms such as ‘thinking too much’ (“Kufikiri sana”) and referring to insanity as "craziness" or "madness," with some even describing it as individuals who wander the streets collecting rubbish, indicative of psychosis. These results are in line with recent findings in Kenya and other SSA nations, which showed that while most community members may not know the specific names of common mental health problems, they can describe them symptomatically (184, 185).

Additionally, this PhD research highlights that some FSWs attributed mental health problems to supernatural causes, such as witchcraft and evil spirits. Such beliefs are common in Kenya, often leading patients and their carers to seek treatment from both traditional health practitioners and conventional medicine providers (185, 186). In 2013, qualitative findings among traditional healers in Nairobi revealed that the traditional healers could recognise some mental health problems, mainly relating to psychosis. However, they were limited in recognising common mental health problems such as depression (186). Poor mental health literacy remains a significant barrier to seeking conventional mental health care in SSA (187).

These findings underscore the need for mental health literacy programmes aimed at FSWs, who are vulnerable to mental health challenges. This is important as it strongly influences symptom management strategies and help-seeking behaviours. For instance, community mental health literacy radio programs have been shown to be successful in significantly improving the knowledge and mental health-seeking behaviours of youths in Malawi and Tanzania (187). Similarly, a training intervention using the WHO mhGAP-intervention Guide among community members in rural Kenya has been shown to be effective in improving mental health-related knowledge among participants (188). Mental health literacy programmes for FSWs in Kenya should be integrated into existing health and counselling services tailored to their needs.

Intimate partner violence and poverty as key perceived determinants of poor mental health and entry into sex work.

While participants in this PhD study linked their personal mental health experiences to several structural and physical health factors as discussed in Paper 1, Chapter 5, this thesis calls attention to IPV of various forms (e.g., financial, emotional, physical, and sexual) and poverty as key perceived risks to poor mental health among FSWs. This is because most study participants linked their mental health experiences with their experience of IPV in their past relationships before initiating sex work. The experience of IPV frequently led to women divorcing or escaping violent relationships to start over with their children. With little or no support from the fathers of their children and limited employment options, many of these women faced severe financial struggles, which motivated them to sex work to provide for their children's basic needs.

IPV is the most common type of violence in the world and has been shown to have adverse effects on mental health problems (189). The majority of the existing literature supports a positive association between exposure to IPV and mental ill-health among FSWs as well as women more generally (2, 74, 190, 191). To the best of my knowledge, this PhD study is the first to investigate FSWs' subjective accounts of poor psychological health, with IPV as a major perceived determinant in Kenya. The thesis findings showing IPV as a driver of sex work entry is consistent with those from qualitative studies in India (192), Uganda (193) and Benin (194). In addition,

cross-sectional and cohort studies from Russia and the USA have reported significant associations between history of IPV and sex work involvement (195, 196). One systematic review of FSWs in SSA reported that divorce or separation due to IPV is a common characteristic of FSWs in the region (28).

The experience of IPV as a contributing factor to entering sex work often overlaps with financial challenges, which emerged as a key perceived determinant of poor mental health among participants in this PhD research. FSWs frequently reported symptoms of stress, depression, and suicidal thoughts related to financial difficulties, particularly in providing for themselves and their children. The results highlight that FSWs who face poverty-related mental health challenges are often the sole breadwinners, receiving little or no support, especially from family, due to factors such as being orphaned, widowed, divorced/separated, or coming from a generally poor background. With limited education, little or no financial support, and extreme poverty, many women find it difficult to find jobs that will allow them to maintain their families—particularly their children—and turn to sex work as a means of survival. One of the main causes of sex work entry, especially in SSA, is poverty (28), which is also a known risk factor for poor mental health (197). Interventions such as cash transfer programs and rescue centres targeting divorced women and young girls who are economically pressured and experiencing distressful life events could potentially reduce poor mental health and some of the factors that push women into sex work. Evidence shows that cash transfer programs for women and girls effectively reduce the severity of poverty (198), empower women (198), decrease dependency on male sex partners for basic needs (199), reduce the experience of violence, including IPV (198, 200) and support girls in staying in school (198). The government in Kenya operates multiple cash transfer programmes to support vulnerable households. For example, the Kenyan government's Cash Transfer for Orphans and Vulnerable Children programme has been shown to be effective in keeping vulnerable girls in school (201), reducing the odds of age at first sex and early marriage (201, 202). However, there is a need for increased funding to scale up support programmes, prioritizing women and young girls who mostly get into sex work not by choice but due to financial hardships.

Poor mental health on the pathway to sex work entry and the consequence of sex work

This doctoral research revealed that many FSWs experience poor mental health around the time they initiate sex work, often linked to factors such as poverty, IPV, and the death of a close family member. Almost all the women who reported mental health experiences before sex work commencement also experienced poor mental health as sex workers. The risky environment of sex work predisposes women to violence from various perpetrators, including clients and law enforcement officers, stigma from community members and the fear of being infected with HIV due to condomless sex by clients, which all affect FSWs' psychological well-being. Numerous studies have found a link between sex work and the experience of poor mental health (1, 2). For example, condomless sex with clients and workplace violence were revealed to be contributing factors to poor mental health, including suicide, among FSWs, as reported in a systematic review of mental health among sex workers (1). Sex work is illegal in Nairobi, which heightens the vulnerability of FSWs' to violence and discrimination and contributes to worse mental health outcomes. These findings highlight the need to address the structural drivers of poor mental health among FSWs, including providing support packages such as counselling services and harm reduction programs for substance use.

Moreover, the results of this qualitative study highlight how the different determinants of poor mental health among FSWs could be interrelated, as shown in the conceptual framework (**Figure 4.1.1**). For example, women who experience poverty and IPV are more likely to enter sex work, which, in turn, can increase the risk of experiencing injuries and disabilities due to violence, as well as engage in harmful use of substances.

### 8.1.2 Quantitative Findings (Papers 2 and 3)

High prevalence of violence, poor mental health and harmful substance use at baseline, which decreased at endline

This PhD research highlights the high prevalence of violence in various forms, poor mental health, and harmful alcohol and substance use among FSWs in Nairobi, Kenya, observed at baseline. Evidence of a high burden of violence, poor mental health and harmful use of substances has been reported by other studies of FSWs in Kenya (68, 70, 115). However, these exposures showed a decline by endline during the COVID-19 pandemic as shown in Paper 3, Table 3. For example, comparing to baseline with endline, the prevalence rates were as follows: physical violence 53.77% vs 20.2%; sexual violence 47.10% vs 17.71%; emotional violence 79.19% vs 43.75%; financial violence 65.99% vs 35.09%; harmful alcohol use 35.09% vs 17.08%; harmful substance use 35.6% vs 32.06% and mental health problems 29.59% vs 11.68%.

The reduction in the prevalence of violence observed in my PhD may have multiple contributing factors. One possible explanation is the COVID-19 pandemic and related lockdowns in Kenya, which led to the closure of sex work venues. This deterred some women from selling sex, potentially reducing their risk of violence. Although qualitative studies in Kenya (203, 204), and qualitative findings from the Maisha Fiti study at follow-up (205) suggested an increased risk of violence, including police violence during the COVID-19 lockdown, the lockdown prompted some FSWs to pause or quit sex work (205). This shift may have contributed to the overall decrease in violence reported in this PhD.

Additionally, I hypothesise that the decline in the reported prevalence of violence could be attributed to loss to follow-up. Participants experiencing ongoing violence may have been less likely to return for follow-up at endline. This is plausible as the Maisha Fiti study found higher follow-up rates among FSWs not experiencing violence at endline ($p = 0.05$).

Furthermore, the reduction in alcohol use observed in this PhD could have contributed to the decrease in the prevalence of violence. The use of harmful substances among FSWs has been linked to an increased risk of violence (100, 105), and the observed reduction in alcohol use at endline may have mitigated this risk. Qualitative findings from the Maisha Fiti study at endline

also noted reduced alcohol use, which participants attributed to financial stress due to the effect of the COVID-19 pandemic (205).

The observed decline in the prevalence of poor mental health problems could be due to several factors, including participants' experiences of psychological counselling before endline. Additionally, the overall reduction in the experience of violence and the harmful use of substances observed at endline may also contribute to the reduction in the prevalence of mental health problems at endline.

Evidence of associations between the experience of physical and/or sexual violence with HCC levels cross-sectionally and with change in HCC levels longitudinally

Although some studies, mainly from non-sex worker populations, have shown evidence of an association between the experience of violence and cortisol levels, their findings have been inconsistent. These inconsistencies were primarily linked to the severity, timing, type of violence and methods used to measure cortisol (42, 47, 122-124). To my knowledge, my PhD study was the second cross-sectional study and the first to longitudinally examine how different forms of violence are associated with HCC levels among FSWs. Findings in this PhD, presented in Paper 2, showed that FSWs who experienced recent physical and/or sexual violence at baseline had higher HCC levels than their unexposed counterparts, even after adjusting for possible confounders, including harmful substance use. A cross-sectional study among FSWs in Mombasa, Kenya, also found higher HCC levels among FSWs who recently (past 12 months) experienced gender-based violence (physical, sexual or emotional). Additionally, findings in my PhD using the longitudinal data (Paper 3) revealed evidence of an association between the trajectory of exposure to physical and/or sexual violence and change in HCC from baseline to endline with FSWs who experienced physical and/or sexual violence at endline (with or without baseline experience) recording lower HCC levels at endline compared to those who didn't experience physical and/or sexual violence at both time points. This finding could be plausible as HPA axis hypoactivity,

possibly after an initial hyperactivity, has been reported among women who experienced prolonged or severe stress (42, 206, 207).

The findings in both Papers 2 and 3 highlight the potential adverse effects of physical and /or sexual violence on the health of FSWs, as both increased and reduced hair cortisol levels can be detrimental to health and may increase FSWs' HIV risk. This is because research indicates that dysregulated cortisol levels can lead to systemic inflammation, and individuals with activated immune markers are more vulnerable to HIV infection (42, 146, 208). My PhD findings suggest that the increased risk of multiple health problems, including HIV infection among women who experienced physical and/or sexual IPV as reported in a global systematic review (209), could be linked to the impact of violence on cortisol levels.

Additionally, in both Papers 2 and 3, I found no evidence of associations between HCC levels and other forms of violence, i.e. emotional and financial violence among FSWs. This shows that different forms of violence may affect the functioning of the HPA axis differently. However, the fact that no evidence of associations was obtained could also be due to methodological limitations, as the reference categories for the experiences of emotional as well as financial violence included some FSWs who experienced physical and/ or sexual violence. Although I could have focused on FSWs who experienced emotional violence only or financial violence only, the sample sizes were too small to have sufficient power. Further research with a larger sample size and a 'clean' reference category is needed to examine the associations between these two forms of violence and HCC levels among FSWs.

<u>Evidence of an association between harmful substance use with HCC levels cross-sectionally, but no evidence of an association with change in HCC levels longitudinally</u>

Findings in Paper 2 showed evidence of an association between recent use of harmful alcohol and/or other substances with higher HCC levels at baseline. Although no evidence of associations between alcohol and other substance use with HCC levels was found in a cross-sectional study of FSWs in Mombasa, Kenya (25), a recent review revealed that acute alcohol and other substance

users generally have higher HCC, while chronic users tend to have lower HCC levels compared to controls (136). The cross-sectional findings in this PhD, therefore, highlight that recent harmful alcohol and/or other substance use may stimulate the HPA-axis among FSWs, leading to increased cortisol levels, which, according to research, may increase the desire to consume more alcohol as a stress-coping mechanism (139). However, the findings in Paper 3 found no evidence of associations between the trajectories of exposure to harmful alcohol or other harmful substances and the change in HCC at endline. The lack of evidence of associations indicates that the change in HCC at endline was not linked to the harmful use of substances. The insignificant findings could also be due to methodological limitations in this PhD, described below, including possible confounders such as the duration of alcohol abstinence over time (49).

No evidence of an association between the experience of poor mental health, including suicidal behaviours with HCC levels

Although a systematic review of human hair cortisol found a link between HCC levels and stress-related psychiatric symptoms and disorders like anxiety, depression, and PTSD (48), I did not find any evidence of associations between HCC levels and the experience of mental health problems, such as PTSD, depression, or anxiety as reported in Papers 2 and 3. In a cross-sectional study of FSWs in Mombasa, Kenya, similar insignificant results were found between HCC levels and anxiety and depression (25). Furthermore, findings from this PhD also showed no evidence of an association between HCC levels and suicidal behaviours (thoughts/attempts). To the best of my knowledge, this PhD research was the first to investigate the association between cortisol levels and suicidal behaviour in FSWs; however, research from non-FSW populations has produced inconsistent findings (131-134), and a meta-analysis study also found no evidence of an association between cortisol and suicide attempts (135).

Although findings in my PhD are consistent with some in the literature, the lack of evidence reported could also be due to differences in the characteristics of FSWs compared to other study

populations as well as due to methodological limitations. For example, research has revealed persistent abnormal cortisol levels among elderly populations who recovered from depression, plus reductions in cortisol levels have not consistently been associated with clinical response to antidepressants (210, 211). This might have affected the significance of the findings in this research as some participants in the reference category who reported no experience of recent depression, anxiety, PTSD, or suicidal behaviours might already have atypical cortisol levels related to their past mental health experiences not captured in this study. This could be plausible, especially considering that the experience of adverse events, including poor mental health, is common in the lives of FSWs even before they commence sex work, as reported in Paper 1. Also, the insignificant results could be due to limitations relating to the sample size, leading to insufficient power to detect any difference, as reported in Paper 3. Further research, with repeated measurements and a bigger sample size, is needed to explore the associations between HCC levels and different mental health issues among FSWs.

## 8.2 Strengths and limitations

A major strength of this PhD research lies in recruiting participants through the SWOP clinics. Over the years, the SWOP clinic staff have built trusted relationships and strong rapport with FSWs. This trust may reduce the risk of social desirability and response bias by motivating respondents to have more open and honest discussions, particularly during the IDIs (212, 213).

Another key strength is the use of validated tools to assess the main categories of exposures to violence, mental health and harmful alcohol and/or substance use. Additionally, using both cross-sectional and longitudinal data allowed for a more in-depth understanding of the relationship between these exposures and HCC levels.

To the best of my knowledge, my PhD research is the first to explore the mental health experiences of FSWs in Kenya qualitatively. It is also the first to assess cortisol levels longitudinally within this population. Another strength of this PhD research is using hair cortisol as a biomarker for

measuring cortisol levels. Although cortisol analysis in hair is more expensive than blood, saliva, or urine, it has the advantage of assessing long-term cortisol levels, as opposed to the short-term assessments provided by other methods (214).

Despite the many strengths of this research, it also has several limitations. First, participants in the IDIs were not directly asked if they had experienced poor mental health, primarily due to the stigma attached to mental health problems in Kenya. Instead, the interviewers gathered insights into participants' experiences of mental health through probing questions about the psychological impact of specific distressing incidents in their lives. Consequently, some participants' mental health experiences may have been missed. However, even if asked directly, some participants might not have recognised some experiences as mental health issues or might be unwilling to discuss them. Nonetheless, the Maisha Fiti study interviewers were highly trained in using probing techniques to address the research aims, which included exploring participants' understanding and experiences of mental health.

In the baseline and longitudinal quantitative data analysis, I focused on HIV-negative participants who provided at least 2cm of useable hair samples. Many participants' hair samples were too short or included thin hair with few strands to be tested for cortisol levels, so they were excluded from the analysis. This could have lowered the study's power, created bias and limited generalisability. However, this bias is likely minimal, as the characteristics of study participants in Papers 2 and 3 are similar to those of the HIV-negative participants in the Maisha Fiti study cohort who were excluded from the analyses of my PhD (**Appendix L: Supplementary 1**). They also align with the characteristics of the overall baseline Maisha Fiti study cohort published elsewhere (35). Additionally, the prevalence of the main exposure variables of interest presented in Paper 2 is similar to those in Paper 3 (**Appendix L: Supplementary 2**).

Moreover, my longitudinal analysis may be subjected to follow-up bias. This stems from the fact that my quantitative data was restricted to HIV negative participants, and being HIV-ve was one of the factors associated with loss of follow-up in the Maisha Fiti study. Nonetheless, the

characteristics of the 425 HIV-negative participants in my baseline analysis are similar to the 285 participants included in my longitudinal analysis. Another limitation is my focus on participants with useable 2cm of hair. Since hair growth in African populations averages 0.79 cm per month, the hair sample reflects the past 2.5 months (19). This timeframe differs from those used to assess study participants' recent exposure to violence (previous six months), mental health (past two weeks), or harmful substance use. As a result, the regression analysis estimates could be biased due to the mismatch.

Another limitation of my PhD research is the absence of a defined cut-off value for HCC levels in healthy adults. This poses a practical challenge in interpreting findings since it may be difficult to determine whether a recorded value can be termed 'elevated' or 'reduced'. However, the use of linear regressions used in this study provides insights into how stressful experiences such as violence affect cortisol levels by comparing exposed to non-exposed groups. As seen in my PhD research, experiences of physical and/or sexual violence can either increase or decrease hair cortisol levels. This could be one of the many reasons for the absence of an established reference range for healthy HCC in adults (215)**.** The absence of an established cut-off for HCC levels, combined with the fact that the experience of physical or sexual violence is associated with either increased or decreased HCC levels indicates that HCC levels alone are insufficient as a sole marker of stress in stress-reduction interventions. Interventions aiming to reduce stress among survivors of physical or sexual violence may combine findings from hair cortisol levels and behavioural assessments for a more comprehensive understanding of survivors' stress levels.

Another limitation of this study is the potential for social desirability bias. This bias could lead to the under-reporting of sensitive issues such as condom use, violence, mental health, and alcohol/substance use. Moreover, due to the retrospective nature of my key exposure variables, this study might also be prone to recall bias. The inability to capture the direct effect of COVID-19 infection on HCC levels at endline is another limitation, as there was a scarcity of COVID-19 test kits in Kenya during the study period. Some studies have found evidence of an association between cortisol levels and being COVID-19-positive, with increased and reduced cortisol levels

reported (161, 163). Lastly, although I aimed to include all known possible confounders from the literature in my regression models, I acknowledge that some unknown confounders related to cortisol and my category of exposures may not have been accounted for.

Furthermore, another potential limitation of my PhD could be the decisions I made regarding the placement of certain factors within my conceptual frameworks. For example, while many gendered factors can contribute to social factors such as poverty or education and maybe bidirectionally linked, in my qualitative framework Figure 4.1.1., I indicated a direct relationship between social factors and gendered factors as I considered social factors as underlying influences that existed in the lives of FSWs before they entered sex work or experienced relationship breakdowns due to IPV. My approach aligns with that of Shahmanesh et al., who examined the determinants of poor mental health and suicide among FSWs in India (157). Additionally, in my quantitative framework, while one could argue that the distinction between distal and proximal socio-demographic factors is not always clear-cut, I positioned socio-economic status as a distal factor. I considered it an underlying condition that shapes FSWs' behaviours, experiences, and opportunities in a broader, more indirect way, rather than directly influencing their immediate experiences or actions. In contrast, I categorised having additional income from sources other than sex work under proximal socio-demographic factors, as it has a more immediate and direct impact on their daily lives.

## 8.3 Future research

My PhD research makes a significant contribution to understanding FSWs' experiences of various stressors in their lives and how the stress response system could be a possible pathway linking the experiences of stressors, particularly violence, poor mental health and harmful substance use, to increased poor health, including HIV susceptibility through cortisol levels. The findings and limitations call for further research to deepen our understanding of stressors in the lives of FSWs in Kenya, and the relationship between those stressors and cortisol levels.

Previous studies, both in Kenya and globally, have consistently reported an increased prevalence of violence and poor mental health among FSWs, often related to their work. The qualitative findings in this PhD revealed that many FSWs started experiencing violence, particularly IPV and mental health challenges even before entering sex work, with participants perceived mental health risks aligning with the four distal determinants of poor mental health and suicide illustrated in the conceptual framework of this PhD (**Figure 4.1.1**). However, further research is necessary due to the limitations of qualitative findings, particularly its lack of generalizability to the broader population of FSWs in Nairobi. Specifically, future studies should use this conceptual framework to quantitatively examine how FSWs' exposure to stressors, especially IPV, both before and after sex work commencement impacts their mental health.

The findings of this study suggest that physical and/or sexual violence, as well as harmful substance use, could affect cortisol levels; thus, they may be associated with an increased risk of HIV acquisition due to increased immune activation/inflammation caused by atypical cortisol levels (216, 217). However, further research is needed. For example, although this PhD found no evidence of an association between HCC levels and CRP levels, which is a non-specific marker of acute inflammation as reported in Paper 2, there is a need to investigate the associations between more relevant biomarkers of systemic inflammation such as interleukins- 6 and 8 as well as Cytotoxic T cell (CD8+ T cell) with violence, harmful substance use and HCC levels among FSWs in Kenya and in other parts of the world. Further prospective longitudinal studies are needed to fully examine the biological effects of violence and harmful substance use on HPA axis activation among FSWs. These studies should include repeated measurements of HCC levels, relevant biomarkers of systemic inflammation and their associations with HIV incidence to provide a better understanding of the relationship between these stressors and increased HIV acquisition risk among FSWs in Kenya.

Lastly, as stated in the limitations section, there is presently no standardised reference range for HCC in healthy individuals due to various factors, including differences in the analytical methodologies used to assess HCC (215). More studies are needed to develop a normal reference

range that takes into account differences in age, gender, and ethnicity for easier interpretation of HCC-level findings.

## 8.4 Implications for policy and practice

In this section, I discuss the implications of my PhD findings for policy and practice related to the experiences of violence, poor mental health and harmful substance use, as well as increased risk of poor health, including HIV among FSWs in Nairobi, Kenya.

Over the years, the government in Kenya, in collaboration with various stakeholders, including community-based organisations, have implemented several initiatives to prevent violence among FSWs. Although sex work is illegal in Nairobi, the Kenya National HIV and AIDS Strategic Plan and Kenya AIDS Strategic Framework II have recommended interventions to address stigma, discrimination and violence against FSWs. Additionally, the National AIDS and STI Control Programme (NASCOP), in partnership with civil society organisations, has set up interventions aimed at reducing violence against FSWs.

Several organisations and programmes in Kenya, such as SWOP, Kenya Sex Workers Alliance (KESWA), and the Bar Hostess Empowerment and Support Programme (BHESP), have established interventions to address this issue. This includes providing drop-in services where FSWs can report cases of violence, collaborating with police to reduce violence and harassment and ensure that cases are reported and prosecuted and offering access to healthcare, including counselling services for survivors of violence. They also run peer education programs to empower FSWs. Despite these efforts, findings from this PhD study revealed that violence against FSWs persists in Nairobi, with 89.3% of respondents reporting having experienced violence in the past six months. While there may be progress over the years in addressing violence against FSWs in Kenya, there is a need for ongoing efforts and collaborations between the Kenyan government and other key stakeholders, with a focus on addressing deep-rooted stigma and the gaps in the legal protection of FSWs.

Findings in this PhD also found evidence of an association between the experience of physical and/or sexual violence with higher/lower HCC levels, which may be detrimental to health and may increase HIV acquisition risk. The results provide valuable contextual information on the implications of violence in the lives of FSWs, which may be useful for decision-makers, stakeholders working on protecting the rights of sex workers, organisations working on HIV prevention programmes, as well as researchers in Kenya.

Additionally, the high prevalence of violence and harmful alcohol and/or substances among FSWs in Nairobi, as reported in my baseline cross-sectional findings, highlights the urgent need for effective mental health, addiction treatment and counselling services. These services could be embedded within existing HIV prevention and treatment services for FSWs. For example, results from this PhD indicated that the experience of counselling prior to endline modified the relationship between the experience of physical and/or sexual violence and HCC levels. However, I did not do a formal assessment of the counselling services, and the number of counselling sessions was not considered. As a result, there is a need for a formal evaluation of the effectiveness of available counselling services for FSWs in Kenya who experienced violence, poor mental health, and the use of harmful substances.

Qualitative findings from this PhD research revealed that relationship breakdown, IPV, and poverty were key factors that women recounted to have affected their mental health and contributed to their entry into sex work. This underscores the need for both micro and macro intervention to address structural drivers of poor mental health and entry into sex work, such as poverty and violence, particularly IPV. For instance, interventions might include support packages, such as counselling and food assistance, for women facing distressful events, especially divorce.

There is also a need for mental health literacy programs in Nairobi aimed at increasing awareness among community members, especially on the risk factors and impact of poor mental health. These programs should target women, as well as any men who may be perpetrators of violence against women and girls. The mental health literacy programme may reduce stigma, violence and discrimination against FSWs and women/girls in general and enhance mental health help-seeking

efficacy. Additionally, training healthcare workers who interact directly with FSWs to recognise mental health problems effectively is essential.

## 8.4 Conclusion

FSWs in Nairobi face high levels of violence from various perpetrators, including clients, intimate partners and law enforcement officers. They also bear a significant burden of poor mental health and engage in harmful substance use. Qualitative findings indicate that many FSWs were already experiencing poor mental health before entering sex work. Poor mental health, along with distressing events, such as IPV, relationship breakdown and poverty, was identified as a driving factor for their entry to sex work. Quantitative findings in this PhD showed evidence of associations between the experience of violence, particularly physical and/or sexual violence and harmful use of substances with increased HCC levels at baseline. There was also evidence linking the trajectory of exposure to physical and/or sexual violence over time (from baseline to endline) with changes in HCC levels at endline. These quantitative findings suggest that the experience of physical or sexual violence and harmful substance use may impair the functioning of the HPA axis, increasing the risk of HIV acquisition due to disrupted cortisol levels. However, further research is needed to fully examine this biological pathway. Findings in this PhD underscore the urgent need for targeted interventions to address stressors such as violence, mental health problems and harmful substance use among FSWs in Nairobi. There is a critical need for comprehensive support interventions for Kenyan women and girls facing distressful life events, such as divorce, to prevent poor mental health problems and subsequent entry into sex work. If we are to achieve sustainable development goal three, by ending the HIV epidemic in 2030, it is crucial to tackle key drivers, especially mental health, harmful substance use and violence, particularly among FSWs in Kenya and elsewhere in SSA.

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# Appendix

**Appendix A**. Biological samples collected and analysed in the Maisha Fiti study

| | **Methodology** | **Women who tested HIV Negative (**Day 0 and Follow-up 6 months later) | **Women who tested HIV Positive (**Day 0 and Follow-up 6 months later) |
|---|---|---|---|
| Behavioural questionnaire | Interview | ✓ | ✓ |
| HIV test | Drop of Blood for RTK | ✓ | |
| C-reactive protein test<br>Systemic T cell activation<br>HSV-2 test<br>Syphilis test<br>HIV confirmation test (new diagnoses)<br>CD4 T cell count<br>Viral Load<br>Viral sequencing – ARV drug resistance | 20ml blood sample | ✓<br>✓<br>✓<br>✓ | <br><br><br>✓<br>✓<br>✓<br>✓<br>✓ |
| Pregnancy test<br>Schistosomiasis test<br>*C.trachomatis* & *N.gonorrhoea* GeneXpert | Urine sample | ✓<br>✓<br>✓ | ✓<br>✓<br>✓ |
| *T. vaginalis* culture<br>Bacterial vaginosis by Nugent scoring<br>Microbiome | Swab 1<br>Swab 2<br>Swab 3 | ✓<br>✓<br>✓ | ✓<br>✓<br>✓ |
| Genital inflammation testing<br>Viral sequencing – ARV drug resistance | Menstrual cup work for 60-90 minutes | ✓ | <br>✓ |
| Cortisol Levels<br>ARV drug levels | Small Hair sample from back of head | ✓<br>✓ | ✓<br>✓ |

## **Appendix B.** The Maisha Fiti study baseline in-depth interview Guide

**The Maisha Fiti Study among women in Nairobi, Kenya**
In-depth Interview Guide

**SECTION 1: INTRODUCTIONS**
**Pseudonames etc**
**Jina**
Where did you grow up and with who?

Ulilewa wapi na ni nani aliyekulea?

When did you move to Nairobi and why?

Ulihamia lini Nairobi na kwa nini?

Where do you live and who do you live with now?

Unaiishi wapi na unakaa na nani sasa hivi?

Do you have children? How old are they?

Je, una watoto? Wako na umri gani?

Were you ever married? Do you have a partner now? Do they live with you?

Je, Umewahi olewa? Je, una mpenzi sasa? Je, anaishi na wewe?

**SECTION 2: FINANCIAL MANAGEMENT**

What different kinds of work do you do now to earn money?
Je, ni aina gani za kazi ambazo unafanya sasa ili kupata pesa?

How many people in your household and outside your household are dependent on your income?

Watu wangapi katika boma yako na nje ya boma yako wanategemea mapato yako?

Are you part of any savings groups now?

Je, wewe umejiunga na makundi yoyote ya uwekezaji wa akiba sasa hivi?

In times of financial stress, tell me about different ways you could raise money? **Probe.** Borrowing from shylocks / mobile lenders. Increasing client numbers.

Wakati wa shida za kifedha, niambie kuhusu njia tofauti ambazo unaweza tumia kuongeza fedha? **Ulizia kuhusu:** Kukopa kutoka kwa wafadhili wa shylocks ama simu. Kuongezea nambari ya wateja.

Can you tell me about a time recently when you faced a lot of financial stress? What happened? What was the outcome?

Je, unaweza kuniambia kuhusu wakati hivi karibuni ulipokuwa na shida nyingi za kifedha? Nini kilikuwa kimetokea? Matokeo yake ilikuwa nini?

**SECTION 3: SEX WORK**

*Sexual debut*

- How old were you when you had your first sexual relationship? Can you tell me about this?Did you consent to this?

*Kuanza kushiriki ngono*

- Ulikuwa na umri gani wakati ulikuwa na uhusiano wako wa kwanza wa ngono? Unaweza kuniambia kuhusu hili jambo? Ilikuwa kwa hiari yako?

*Sex work*

When was the first time you had sex in exchange for money or goods? **Probe.** Can you tell me about this?
When did you start regularly selling sex? **Probe.** How old were you? Can you tell me about this time in your life?
How long have you been selling sex for now? How often do you sell sex?
Where / how do you find clients? Where do you have sex with them? What type of sex do your clients usually ask for? How much do they usually pay you for sex?
Do you have any regular clients? **Probe**. How long have you known them? Can you tell me more about them?
Are there times when you might take greater risks during sex work than normal?
Who in your life knows about your sex work? **Probe.** Partner? Parents? Members of community?

*Kazi ya ngono*

Mara ya kwanza ulifanya ngono kwa mbadala wa pesa au bidhaa ilikuwa lini? **Ulizia zaidi:** Unaweza kuniambia kuhusu hili?

Ulianza lini kuuza ngono mara kwa mara? **Ulizia zaidi:** Ulikuwa na umri gani? Je, Unaweza kuniambia kuhusu wakati huu katika maisha yako?

Umekuwa unauza ngono kwa muda gani kwa sasa? Ni mara ngapi huwa unauza ngono?

Unapataje wateja na unawapata wapi? Unafanyia ngono wapi nao? Je, Wateja wako huwa wanaulizia aina gani ya ngono? Je, wao hukulipa pesa ngapi?

Je, Una wateja wa kawaida? **Ulizia zaidi**. Umewajua muda gani? Je, Unaweza kuniambia zaidi kuhusu hawa wateja?

Je, Kuna nyakati ambapo unaweza kuchukua hatari zaidi wakati wa kazi ya ngono kuliko kawaida?
Nani katika maisha yako anajua kuhusu kazi yako ya ngono? **Ulizia zaidi:** Mshiriki wa ngono/mpenzi? Wazazi? Jamii yako?

**SECTION 4: ALCOHOL AND SUBSTANCE USE**
Do you drink alcohol or take any drugs when you are meeting clients? (**Probe for:** How much, How often, Reasons for doing this?)
What are the benefits of drinking/ taking drugs when doing sex work?
What are the downsides?

Je, huwa unakunywa pombe au kutumia madawa yoyote wakati unapokutana na wateja? **(ulizia zaidi** : Ni kiasi kipi, Mara ngapi, Sababu za kufanya hili?)
Je, Ni faida gani za kunywa pombe / kutumia dawa za kulevya wakati wa kufanya kazi za ngono?
Je, hasara/madhara yake ni gani?

**SECTION 5: FACTORS ASSOCIATED WITH GENDER-BASED VIOLENCE**
Please could you tell me what you understand by the word "violence"? What do you understand by "gender-based violence"?

What different types of gender-based violence are prevalent in your community where you live?

What characteristics make a woman vulnerable to violence?

How does your community where you live react to a woman who experiences gender-based violence?
- Do you agree with this? Why/Why not?

Are there situations in life where gender based violence are acceptable?

Tell me about the types of violence sex workers experience.

If a sex worker faces gender-based violence in your community where you live, what do they do? (**Probe for**: available support and resilience mechanisms for violence survivors).

Are there men in your community/area where you livewho never use violence in any situation?
- Specific reasons for not using violence
- Alternatives for violence
- The difference between people who uses violence and those who do not

**SECTION 5: FACTORS ASSOCIATED WITH GENDER-BASED VIOLENCE**
Tafadhali unaweza kuniambia nini unachokielewa kwa neno "vurugu"? Unaelewa nini na "unyanyasaji wa kijinsia"?

Ni aina gani tofauti za unyanyasaji wa kijinsia unaoenea katika jamii unayoishi?

Ni sera gani zinafanya mwanamke awe mtaraji zaidi wa vurugu?

Je, jumuiya yako unapoishi huchukuliaje mwanamke ambaye hupata unyanyasaji wa kijinsia?

- Unakubaliana na vile wanawachukulia? Kwa nini unakubaliana ama kukataa?
Je, Kuna hali katika maisha ambapo unyanyasaji wa kijinsia unakubalika?

Niambie juu ya aina za vurugu ambazo wauza ngono hupitia.

Ikiwa muuza ngono anakabiliwa na unyanyasaji wa kijinsia katika jumuiya yako unayoishi, wanafanya nini? (**Ulizia kuhusu:** msaada wa ulioko wa kutosha na taratibu za ustahimilifu kwa waathirika wa vurugu).

Je, Kuna watu katika jamii yako / eneo ambako huishi kamwe bila kutumia vurugu katika hali yoyote?
- Sababu maalum za kutotumia vurugu
- Mibadala ya vurugu
- Tofauti kati ya watu wanaotumia vurugu na wale ambao hawatumii

**SECTION 6: EXPERIENCES OF VIOLENCE**

We know that doing sex work can be dangerous. Thinking about your safety, who are the people you need to worry about when you are selling sex? **Probe** for perpetrators.

How do you protect yourself from violence when selling sex? Are there others who protect you from violence too?

(If not covered in previous questions) Have you or any other sex worker you know personally experienced violence before? Can you tell me what happened during that time? What happened afterwards?

Have you ever been arrested or threatened with arrest by the police?

Did you discuss your experiences of violence or arrest with other people? (why/ why not?) If yes, who did you tell? What was their response? In what ways were their responses helpful? What could have made their response better?

Has the FSW community ever supported you or someone you know after violence or arrest? What did they do?

How has violence affected your life (**Probe** for: effect it had on:
- Physical wellbeing?
- Feeling about self?
- Children?
- Ability to provide for the family or go to work?
- Easy/difficult to meet friends or relatives?

Tunajua kuwa kufanya kazi ya ngono inaweza kuwa hatari. Kufikiria juu ya usalama wako, ni nani ufanya kuwa na na wasiwasi wakati unauza ngono? **Ulizia kuhusu:** wanaoanzisha/sababisha vurugu

Je, unajikingaje na vurugu wakati wa kuuza ngono? Kuna wengine ambao hukukinga dhidi ya vurugu?

**(Ikiwa haukulizwa katika maswali ya awali**) Wewe au muuza ngono unayejua binafsi aliwahi pata vurugu? Unaweza kuniambia nini kilichotokea wakati huo? Nini kilichotokea baadaye?

Je! Umewahi kukamatwa au kutishiwa kukamatwa na polisi?
Je, ulizungumzia uzoefu wako wa vurugu au kukamatwa na watu wengine? (kwa nini ndio/ kwa nini la?)
Ikiwa ndiyo ndiyo, ulizungumza na nani? Walijibuje? Je, majibu yao yalikuwa ya manufaa kwa njia gani?
Je, wangeweza kufanya majibu yao kuwa bora zaidi?

Je, jumuiya ya FSW imesaidia wewe au mtu unayejua baada ya unyanyasaji au kukamatwa? Walifanya nini?

Vurugu imeathiri maisha yako (**Ulizia kuhusu:**
- Ustawi wa kimwili?
- Kujisikia kibinafsi?
- Watoto?
- Uwezo wa kulisha familia au kwenda kufanya kazi?
- Rahisi / vigumu kukutana na marafiki au jamaa?

**SECTION 7: INTIMATE PARTNERSHIPS**
How did you meet your current/recent partner?

Tell me about your partner.
- Where did you meet and how long have you been together? Do you live together?
- How would you describe your partner? What do you like most about them and what annoys you?
- Does your partner work?
- Does your partner help you financially, emotionally, with children, at home?
- Does he know about your sex work?

Do you have any other intimate partners? Can you tell me about them?

Do you think it is important to have an intimate partner? Why?

Have you ever experienced violence from an intimate partner? Can you tell me about this?

Have children living in your household ever seen or heard you experience violence from a partner or someone else? How often was this?
- Have children in your household been hurt physically by your partner or someone else during a violent incident?

Ulikutanaje na mpenzi wako wa sasa / wa hivi karibuni?

Niambie kuhusu mpenzi wako.
- Ulikutana wapi na kwa muda gani umekuwa pamoja? Je, mnakaa pamoja?
- Je, unaweza kuelezea mpenzi wako? Unapenda nini zaidi juu yao na nini kinakukosesha?
- Je, mpenzi wako anafanya kazi?
- Je, mpenzi wako anakusaidia kifedha, kihisia, na watoto, nyumbani?
- Anajua kuhusu kazi yako ya ngono?

Je, una washirika wengine wa karibu? Je, unaweza kuniambia juu yao?

Je, Unafikiri ni muhimu kuwa na mpenzi wa karibu? Kwa nini?

Je, Umewahi kuona vurugu kutoka kwa mpenzi wa karibu? Je! Unaweza kuniambia kuhusu hili?

Je,Watoto wanaoishi katika nyumba yako wamewahi kuona au kusikia unapata vurugu kutoka kwa mpenzi au mtu mwingine? Ni mara ngapi hii?

- Kuwa na watoto katika nyumba yako wameumiza kwa mwili na mpenzi wako au mtu mwingine wakati wa tukio la ukatili?

**SECTION 8: MENTAL HEALTH**

Can you tell me what you understand by the term “mental health”? What do you understand by the term “depression”?
What do people in your community think about people who have poor mental health? **Probe for:** what do they think causes poor mental health? How do they treat them?
How would a family be expected to deal with a member having a mental illness?
What do sex workers do, when another sex worker has a mental illness?

What would you do if you were struggling with mental illness?
What do you think causes poor mental health?
Would you feel comfortable talking about mental illness to other sex workers?
Where do you think it would be best to offer mental health services?
Do you think there is stigma around mental illness in your community?

Je, unaweza kuniambia nini unachokielewa na neno "afya ya kiakili"? Unaelewa nini kwa neno "depression" matatizo ya kimawazo?
Je, watu katika jamii yako wanafikiria nini kuhusu watu walio na afya mbaya ya akili? **ulizia kuhusu:**: wanafikiria nini husababisha afya mbaya ya akili? Je! Wanawachukuaje?
Familia inaweza kutarajiwa kushughulika aje na mmoja wao aliye na ugonjwa wa akili?
Wafanya ngono wanafanya nini, wakati mfanyakazi mwingine wa ngono anapatwa na ugonjwa wa akili?
Ungefanyaje ikiwa ungepatikana na ugonjwa wa akili?
Unadhani nini husababisha afya mbaya ya akili?
Ungejisikia sawa kuzungumza juu ya ugonjwa wa akili na wafanyakazi wengine wa ngono?
Unafikiri wapi ni bora kutoa huduma za afya ya akili?
Unadhani kuna unyanyapaa juu ya ugonjwa wa akili katika jumuiya yako?

**SECTION 9: ARV KNOWLEDGE AND UPTAKE**
***HIV Testing***

Thinking back- when were you first aware of HIV in this community where you live? Do you have a sense of whether things have changed over the years? If so- how and why?

Kufikiria nyuma – ulijua kuhusu VVU katika jumuiya hii unayoishi lini? Je! Unahisi ya kwamba mambo yamebadilika kwa miaka michache iliyopita? Ikiwa ni ndio, kwa jinsi gani na kwa nini?
Do you think many women who sell sex know their HIV status? What do FSWs say about testing for HIV? Why do you think women would not wish to test for HIV now? Are there certain women who find it harder to test for HIV? Who are they and why do they find it harder to test? Where do women normally go for HIV testing? Do women ever get tested outside of a SWOP clinic? Has ARV changed FSW’s attitude to HIV testing? Are there certain women that do not wish to test for HIV?

Unafikiria wanawake wengi ambao huuza ngono(FSW) wanajua hali yao ya VVU? Je, FSW wengine wanasema nini kuhusu kupimwa VVU? Kwa nini unafikiri wanawake hawataki kupima VVU sasa hivi? Je, kuna wanawake fulani ambao wanaona vigumu kupima VVU? Ni nani na ni kwa nini wanaona kuwa vigumu kupima? Wanawake wengi huenda wapi ili kupima VVU? Je, wanawake hupimwa nje ya kliniki ya SWOP? Je, ARV zimebadilisha mtazamo wa FSW kuhusu kupima VVU? Je, kuna wanawake fulani ambao hawataki kupima VVU?

Do you think that sometimes FSWs test HIV positive but do not get in touch with any HIV services? If this happens, why? ***ARV knowledge and uptake***

Je, unadhani kwamba wakati mwingine FSW hupatikana na VVU lakini hawapatani na huduma yoyote za VVU? Ikiwa hili hutokea, kwa nini? **Maarifa kuhusu ARV na unywaji wa ARV.**

It would be really helpful to learn about your memories of ARVs in this community where you live. When were ARVs drugs first available? Are they easily available? Do people talk about taking them or not taking them? **Probe** about beliefs around treatment.

Itasaidia sana kujifunza kuhusu kumbukumbu zako za ARV katika jamii hii unayoishi. Je dawa za ARV zilipatikana wapi kwanza? Je, zinapatikana kwa urahisi? Je, Watu huzungumzia kuhusu kuzichukua au kuzitwaa? **Ulizia kuhusu** imani juu ya matibabu.

What kind of support is provided around adherence in this community where you live? How about among the sex work community?

Ni aina gani ya usaidizi unayotolewa kuhusu kuzingatia kumeza dawa zako katika jumuiya hii unayoishi? Je, na miongoni mwa jumuiya ya wauza ngono?

In your experience, do people struggle to adhere to ARVs? What makes them more and less able to adhere?

Katika uzoefu wako, watu huzingatia kumeza ARVs zao? Ni nini kinawafanya waweze ama wasiweze kuzingatia zaidi?

We were wondering about FSWs experiences accessing ARVs in this community. What are they? **Probe**: what is working well in relation to accessing ARVs and what is working less well Has this sex work community ever experienced shortages of ARVs?

Do you ever hear about people living with HIV seeking other ways of treating HIV? E.g. traditional healers, herbs, spiritual healing, immune boosters, fake ARVs on the street?

Tulikuwa tunajiuliza kuhusu mambo ambayo FSWs hupatana nayo kupata ARV katika jamii hii. Je, ni yapi? **Ulizia kuhusu:** ni nini kinachofanya kazi vizuri kuhusiana na upatikanaji wa ARV na nini hakifanyi kazi vizuri? Je, jamii hii ya wauza ngono imewahi patwa na uhaba wa ARVs?

Je! Umewahi kusikia kuhusu watu wanaoishi na VVU wakitafuta njia nyingine za kutibu VVU? Kama vile waganga wa jadi, mimea, uponyaji wa kiroho, nyongeza za kinga, ARVs bandia mitaani?

***PrEP and PEP***

Did you ever hear of ARVs being used as HIV prevention? *What do you understand by this?*

Do you think women would prefer PrEP or PEP? **Probe.** What are the reasons for this?

***PrEP na PEP***

Je, Umewahi kusikia ARV kutumika kama njia ya kuzuia VVU? Unaelewa nini na hili?
Je, unadhani wanawake wangependelea PrEP kuliko PEP? **Ulizia kuhusu.** Ni sababu za hii ni ipi?

***SECTION 10. Stigma***

Do you think there is stigma around sex work in your community where you live? Do you know of anyone who has experienced stigma because she sold sex?

Do you think there is HIV stigma in your community where you live? Do you think the availability of ARVS has made a difference to stigma here? **Probe** about in what way – increased and/or changed stigma?

**SECTION 10: UNYANYAPAA**

Je, unadhani kuna unyanyapaa kuhusu kuza ngono katika jumuiya yako unayoishi? Unajua mtu yeyote aliyepatwa na unyanyapaa kwa sababu anauza ngono?

Je, unadhani kuna unyanyapaa wa VVU katika jumuiya yako unapoishi? Je, unadhani upatikanaji wa ARVs umefanya tofauti kwa unyanyapaa hapa? **Ulizia zaidi** juu ya namna gani - kuongezeka na / au kubadili unyanyapaa?

**SECTION 11: HOPE**

What goals do you have in life? What efforts do you make to pursue your goals? What goals do you think you have succeeded in achieving?

SEHEMU YA 11: MATUMAINI

Ni malengo gani unayo katika maisha? Jitihada gani unazofanya ili kufuatilia malengo yako? Ni malengo

gani unafikiri umefanikiwa kufikia?

## **Appendix C.** The Maisha Fiti study endline in-depth interview Guide

**Maisha Fiti Qualitative Tool**
**Follow-up In-Depth Interview – Topic Guide**

Aims: To understand how covid-19 lockdown is impacting on women's lives. In particular to understand how covid-19 has impacted on their economic situation, their mental health, their HIV and covid-19 risk behaviours, and their experience of violence. We also want to understand how covid-19 is affecting ARV adherence (anecdotal reports suggesting adherence improved initially but has declined since as access to food has fallen) and to hear womens' stories around coping and resilience during this time.

**Lengo: Kuelewa jinsi kusitishwa kwa shughuli za kawaida juu ya Covid-19 kunaathiri maisha ya wanawake. Haswa kuelewa jinsi covid-19 imeathiri hali yao ya kiuchumi, afya ya kiakili , kujiweka kwa hatari ya VVU na covid-19, na kupatana na vurugu. Tunataka pia kuelewa ni jinsi covid-19 inavyoathiri utumizi wa ARV (ripoti ambazo hazijadhibitishwa zikionyesha uzingatiaji kuimarika siku za kwanza za covid-19 lakini kupunguka jinsi upatikanaji wa chakula unavyoendelea kupunguka) na kusikia hadithi za wanawake jinsi wanavyokabiliana na hali wakati huu.**

**Section 1: Introductions**
Since we met last time, can you tell me how life has been for you?
**Tangu tulipokutana mara ya mwisho, unaweza kuniambia jinsi maisha yamekuwa?**

**Section 2: Financial Management**
What are your current sources of income?
**Je! Kwa sasa mapato ya riziki ni yapi?**
(*Probe:* if same before covid-19)
*(Probe* for main source of income – is it sex work or something else?)

How has covid-19 impacted on you financially?
**Je! Covid-19 imeathiri hali yako ya kifedha vipi?**
*Probe:* Have you sold sex during lockdown? Have you earned any money through other means?

Have you or your family had to skip meals? Have you managed to pay rent? School fees?
**uliza: Je! Umeuza ngono wakati wa covid- 19? Je! Umepata pesa yoyote kupitia shughuli zingine? Je! Wewe au yeyote kwa jamii yako alikosa kula kwa sababu hakukuwa na chakula cha kutosha? Je! Umeweza kulipa kodi? karo ya shule?**

What support have you received from your regular clients or family members ( *Probe* for financial support) How have your regular clients or partners or family members supported you financially?
**Umepata msaada gani kutoka kwa wateja wako wa kawaida au familia? (*uliza msaada wa kifedha*)**
**Wateja wako wa kawaida au wapenzi au familia imekusaidia kifedha?**

Have you received any money from the government or others?
**Je! Umepokea pesa yoyote kutoka kwa serikali au wengine?**

How have you managed your finances during the covid-19 ( *Probe*: What has happened to Table banking or other savings schemes you were part of?)
**Umesimamiaje pesa zako wakati wa covid-19 (uliza: Je! Nini kimetokea kwa chama au miradi mingine ya akiba ambayo ulikuwa?)**

Have you needed to borrow money? (*Probe*: for sources)
**Je! Umehitaji kukopa pesa? (uliza: kutoka wapi?)**

You told me last time you support xx people with your income. Has that changed? (*Probe*: changes made to cope with dependants needs)
**Uliniambia mara ya mwisho unasaidia watu xx na kipato chako. Je! Hiyo imebadilika? (Probe: mabadiliko yaliyofanywa kukabiliana na mahitaji ya wategemezi)**

**Section 3: Mental Health**
How has the covid-19 lockdown impacted on you emotionally? (*Probe*: is it financial stress, low mood, loneliness etc.)
**Je! Kufungwa kwa shughuli na covid-19 kumekuathiri aje kimawazo? (Probe: ni shida za kifedha, hali ya kutokuwa na furahai, upweke nk)**

How has your alcohol and drug use been during covid-19?
**Matumizi yako ya pombe na dawa za kulevya yamekuwaje wakati wa covid-19?**

How has covid-19 affected the way you relate with your children? **Covid-19 imeathiri vipi jinsi unavyohusiana na watoto wako?**

What strategies have you found useful in helping you to cope during covid-19? Probe: How have your regular clients, partners, family, friends or others helped you to cope emotionally?
***Ni mikakati gani ambayo umeona kuwa muhimu kukusaidia kukabiliana na wakati wa covid-19? Probe: Je! Wateja wako wa kawaida, wapenzi, familia, marafiki au wengine wamekusaidia vipi kukabiliana na shida za kimawazo?***

**Section 4: Sex work**
How has covid-19 affected your sex work? (*Probe*: have you sold sex, have the charges remained the same?) **Covid-19 imeathirije kazi yako ya ngono? (Probe: umeuza ngono, je! Malipo yamebaki sawa?)**

How is this the same or different to before lockdown?
**Je! Ni vipi hii ni ile ile au tofauti na kabla ya kufungwa kwa shughuli?**

*Probe:* Where have you been selling sex? (differences or not in location e.g. same part of the city or different part of the city and typology e.g. street vs. bar). Who are your clients? Is this the same as before?
**Probe: Umekuwa ukiuza ngono wapi? (kama ni eneo tofauti k.m. ni sehemu moja ya jiji au sehemu tofauti ya jiji k.m. klabu ,barabara n.k). Wateja wako ni nani? Je! Hii ni sawa na hapo awali?**

How has condom negotiation been during covid-19?
**Majadiliano kuhusu matumizi ya kondomu na wateja yamekuwaje wakati wa covid- 19?**

Have you experienced violence from clients or police or others during lockdown? – context of violence
**Je! Umepata vurugu kutoka kwa wateja au polisi au wengine wakati wa kufungwa? – maudhui ya vurugu**

Under whose care have you left your children when selling sex during covid-19?
**Umeachia nani watoto wako wakati wa kuuza ngono wakati huu wa covid-19?**

During lockdown, what challenges have you experienced from the local community because you are a sex worker?
**Wakati wa kufungwa kwa shughuli, ni changamoto gani umezipata kutoka kwa mtaa unaoishi kwa sababu wewe ni mfanyabiashara wa ngono?**

What personal protective measures have you had to take for yourself and family during this COVID?
**Je! Ni hatua gani za kinga za kibinafsi ambazo umekuchukua wewe na familia wakati huu wa COVID?**

**Section 5: Relationships**
When we last met you told me about your intimate partner.
**Tulipokutana mara ya mwisho uliniambia kuhusu mpenzi wako.**

In case one did not report that she had an intimate partner: When we last met you told me that you did not have an intimate partner. Have you had one since then/do you have one currently?
**Ikiwa mtu hakuripoti kuwa alikuwa na mpenzi: Tulipokutana mara ya mwisho uliniambia kuwa hauna mpenzi. Je! Umekuwa na mmoja tangu wakati huo / je! Unaye sasa?**

Are you still with this person?
**Bado uko na mtu huyu?**

How has this relationship been during covid-19 (supportive, violent, no longer viable etc)
**Je! Uhusiano huu umekuwaje wakati wa covid-19 (ya dhamana,, yenye vurugu, isiyofaa tena)**

How has covid-19 affected your relationship with your regular clients?
**Covid-19 imeathirije uhusiano wako na wateja wako wa kawaida?**

**Section 6: Accessing PREP, PEP and ARVs.**
Have you been accessing SWOP services since we last met? If so, what for?
**Je! Umekuwa ukipata huduma za SWOP tangu tulipokutana mara ya mwisho? Ikiwa ni hivyo, zipi?**

***For HIV positive women:***
When we met last time, you told me you were HIV positive. Can you tell me about your ARV use during the last 6 months?
**Tulipokutana mara ya mwisho, uliniambia una VVU. Je! Unaweza kuniambia juu ya utumiaji wako wa ARV wakati wa miezi 6 iliyopita?**
*Probe:* How has lockdown affected your ARV adherence? – challenges with accessing ARV, taking it (lack of food), transport to clinics
**Uchunguzi: Je! Kufungwa kwa shughuli kumeathiri vipi matumizi yako yaARV? - Changamoto za kupata ARV, kuzimeza (ukosefu wa chakula), usafiri wa kufika kwa kliniki**

***For HIV negative or women who have not disclosed their HIV status:***
Have you taken Prep or PEP before? What were your experiences of this?
**Je! Umechukua Prep au PEP hapo awali? Je! Hisia zako kuihusu ni zipi?**

If you do take PrEP, how has adherence been? Challenges in terms of supply etc
**Ikiwa unachukua PrEP, ufuatliajiji umekuwaje? Changamoto za kupata nk**

If you don't take Prep, what are the reasons for not taking Prep?
**Ikiwa hautumii Prep, ni sababu gani za kutotumia Prep?**

**Section 7: Aspirations**
Last time we talked, we talked about your goals and dreams. Is there anything else you would like to tell me about this? Has covid-19 changed these?
**Mara ya mwisho tulipoongea, tulizungumza juu ya malengo yako na ndoto zako. Je! Kuna kitu kingine ungependa kuniambia kuya/zihusu? Je! Covid-19 imeya/zibadilisha?**

**Wrap up:**
Is there anything else you want to share / add regarding what we have discussed?
**Je! Kuna kitu kingine chochote ungetaka kunieleza / kuongeza juu ya yale ambayo tumejadili?**

# **Appendix D.** Coding framework

| Theme | | Sub-theme | | Code |
|---|---|---|---|---|
| | **Description** | | **Description** | |
| **Knowledge of mental health** | Definition of mental health, knowledge of manifestation of mental health; types of mental health and causes of mental health. | | | MH_Knowledge |
| **Personal experiences of poor mental health** | Experiences of their own mental health problems in their lives including narrations of their mental health manifestations and symptoms. | | | MH_Experiences |
| **Perceived risks of poor mental health** | Participants perceived mental health risks based on their personal experiences e.g. violence, poverty and relationship breakdown. | **Poverty** | This code captures participants' narrations of how experiencing poverty and being the sole breadwinner for their family affected their mental health, as well as how these circumstances motivated them to sex work. | Risk_poverty |
| | | **Family bereavement** | This captures participants' experiences of poor mental health linked to the death of a close family member, including how their experiences motivated them to commence sex work. | Risk_family bereavement |
| | | **Intimate Partner violence** | This code captures participants' recount of their mental health experiences due to the experience of violence perpetrated by their intimate partners before getting into sex work and how these circumstances influenced their decision to engage in sex work | Risk_IPV prior sex work |
| | | **Sex-work related** | This includes participants' mental health experiences linked to the stresses of sex work, such as violence and stigma from various perpetrators, including clients, intimate partners, police and the broader community, as well as forced condomless sex. | Risk_sexwork |
| | | **Physical Health and Disability** | The code captures participants' experiences of poor mental health linked to the experience of physical health problems such as injuries, HIV and STIs, including disabilities. | Risk_ physical/disability |
| | | **Harmful substance use** | This captures participants' mental health experiences linked to the use of harmful substances. | Risk_substance use |

**Note** the different colors under perceived mental health risks represents the mapping of perceived risk factors into social, gender disadvantage, sexual risk, and physical health factors, as illustrated in the conceptual framework (**Figure** 4.1.1) adapted from Shahmanesh et al.

# **Appendix E.** Paper 4: Surviving pandemic control measures: The experiences of female sex workers during COVID-19 in Nairobi, Kenya

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## Surviving pandemic control measures: The experiences of female sex workers during COVID-19 in Nairobi, Kenya

Hellen Babu[a]†, Rhoda Wanjiru[a]†, Mamtuti Paneh[b], Emily Nyariki[a], James Pollock[c], Jennifer Liku[a], Alicja Beksinka[b], Mary Kung'u[a], Pooja Shah[b], Tara Beattie[b], Joshua Kimani[a]‡ and Janet Seeley [b]‡

[a]Clinical research, Partners for Health and Development in Africa, Nairobi, Kenya; [b]Global Health and Development, London School of Hygiene and Tropical Medicine, London, UK; [c]Immunology, University of Toronto, Kings College, Toronto, Canada

ABSTRACT

At the beginning of the COVID-19 pandemic, the Kenya Ministry of Health instituted movement cessation measures and limits on face-to-face meetings. We explore the ways in which female sex workers (FSWs) in Nairobi were affected by the COVID-19 control measures and the ways they coped with the hardships. Forty-seven women were randomly sampled from the Maisha Fiti study, a longitudinal study of 1003 FSWs accessing sexual reproductive health services in Nairobi for an in-depth qualitative interview 4–5 months into the pandemic. We sought to understand the effects of COVID-19 on their lives. Data were transcribed, translated, and coded inductively. The COVID-19 measures disenfranchised FSWs reducing access to healthcare, decreasing income and increasing sexual, physical, and financial abuse by clients and law enforcement. Due to the customer-facing nature of their work, sex workers were hit hard by the COVID-19 restrictions. FSWs experienced poor mental health and strained interpersonal relationships. To cope they skipped meals, reduced alcohol use and smoking, started small businesses to supplement sex work or relocated to their rural homes. Interventions that ensure continuity of access to health services, prevent exploitation, and ensure the social and economic protection of FSWs during times of economic strain are required.

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Sex workers; COVID-19; non- pharmacological measures; Kenya

## Background

Most of the female sex workers (FSWs) in Nairobi, Kenya, work in settings such as bars, night clubs, on the streets and in designated rooms in lodges. In the Kenyan context, once negotiations on the terms and payments for sex are done with their clients, sex can happen in the same venues if the bars have lodgings, or other rented spaces, as well as in cars or behind buildings (NASCOP, 2020). The face-to-face nature of their work made FSWs vulnerable to hardship during the COVID-19 pandemic. The Kenyan government instituted COVID-19 preventive measures in line with the recommendation of the World Health Organization from March 2020 to October 2021. The measures

CONTACT Rhoda Wanjiru rwanjiru@phdaf.org 5th Ngong Avenue Suites, 7th Floor Room 7-9, Ngong Road Opp. Nairobi Area Police Station, P.O Box 3737-00506, Nairobi, Kenya
†Joint first authors.
‡Joint last authors.

included a nationwide lockdown, cessation of movement into and out of major cities and towns, a dusk to dawn curfew, mask mandate, and temporary suspension of non-essential businesses.

These COVID-19 regulations made it difficult for sex workers to access health services. In Kenya, the dusk-to-dawn curfew meant that places that offered sexual and reproductive health services (SRH) had fewer operating hours, a situation predicted in a United Nations Population Fund Technical Note on the possible effects of the pandemic on women (UNFPA, 2020). The physical distancing measures reduced the number of patients that health centres could care for at one time, and closure of entertainment facilities such as bars, and physical distancing directives instituted by the Ministry of Health to curb the spread of COVID-19 led to FSWs losing their livelihood (Gichuna et al., 2020; Kimani et al., 2020; Mantell et al., 2021).

Reflections from the Ebola and Severe Acute Respiratory Syndrome (SARS) pandemics show that vulnerable populations, especially women and children, are disproportionately affected due to the underpinning sociocultural contexts (Saalim et al., 2021). This has also been the case during the COVID-19 pandemic (Hassan et al., 2021; Kimani et al., 2020), with evidence from Kenya suggesting that the COVID-19 containment measures may have increased physical, sexual, verbal, and economic violence against FSWs (Mantell et al., 2021). Reports from West Africa suggest that vulnerable people may also have suffered increased inaccessibility of healthcare, exacerbated sexual and domestic violence, economic disruptions, and arbitrary police arrests (Saalim et al., 2021). While the focus was directed towards controlling the pandemic, there were unintended consequences for the vulnerable populations which we set out to document.

In this paper, we focus on the lived experiences of FSWs in Nairobi, Kenya, during the COVID- 19 pandemic and describe how individual women were affected. Our longitudinal study captured the experiences of women before the pandemic in the baseline interviews and captured their same experiences at endline as COVID-19 was ongoing. This made it possible to draw a direct com- parison of their experiences before and during the pandemic.

## Methods

### *Study setting*

Nairobi County is the capital and economic hub of Kenya with many entertainment venues that cater to individuals with disposable income and where sex work thrives. In 2017/2018, Nairobi County had the largest population of sex workers in the country accounting for 25% of the estimated 206,000 women who sell sex on a peak day in the country (NASCOP, 2020). However, COVID-19 containment measures led to a significant reduction/cessation of these activities because women engaged in sex work were left with limited daytime operating hours and could not gather at the places where they usually sought clients.

Sex workers in Nairobi access HIV prevention and care services from, among others, seven standalone Sex Workers Outreach Programme (SWOP) clinics, funded by the CDC-PEPFAR. These clinics are strategically located throughout Nairobi County and serve as safe spaces for at least 33,000 FSWs. One clinic is located in downtown Nairobi while the others are within informal settlements, to take the services closer to where the majority of sex workers live, and to cover different key sub-counties within Nairobi. All clinics provide comprehensive and accessible HIV prevention and treatment services to key populations (Female Sex Workers and Men who have Sex with Men).

### *Sampling and data collection*

Our findings come from interviews with FSWs residing in Nairobi, Kenya, collected as part of the Maisha Fiti study, a three-year mixed-methods longitudinal study that began in 2019 and enrolled a random sample of 1003 FSWs who access HIV prevention and treatment services from SWOP clinics. The overarching Maisha Fiti study aim was to explore risk factors for genital inflammation

and antiretroviral (ARV) uptake and adherence among FSWs in Nairobi. From a sample of all women aged 18–45 years who had attended a SWOP clinic in the 12 months prior to the start of the study ($n$ = 10,292), 1003 were randomly selected. Participants met the study inclusion criteria if they (i) were assigned female sex at birth, (ii) had accessed SWOP services within 12 months prior to contact with the study, (iii) did not have pre-existing health conditions (other than HIV) which would affect their immunology, and (iv) were willing to give written consent to participate in the study. In phase 1 (June-December 2019), in-depth interviews (IDIs) were conducted with a random sample of 40 of these 1003 participants. Sex workers under 25 years of age were unintentionally underrepresented in the qualitative interviews at baseline. In phase two (June 2020-March 2021), follow-up qualitative interviews were conducted with the initial 40, along with an additional 7 women aged <25. The same female interviewer interviewed the same woman at each time-point. The baseline qualitative interviews aimed to understand the interpretation and experiences of women on violence, mental health, alcohol and substance use, and how they relate to HIV risk behaviours. In these follow-up interviews, we re-visited these themes and explored how COVID-19 had impacted their lives. This current analysis uses qualitative in- depth interview data collected from 47 women in phase 2 of the study (July-August 2020), 4–5 months after COVID-19 lockdown measures had been implemented in Nairobi.

Qualitative interviews were conducted by two social scientists. Following informed consent procedures, women were asked to provide a detailed overview of their daily life, narrating specific events or aspects of their lives, including sex work, violence experiences, and how these relate to mental health, alcohol and substance use, and adherence to pre / post-exposure prophylaxis (PrEP / PEP) and anti-retroviral therapy adherence in the context of COVID-19.

All interviews were conducted in Swahili or English. Most were conducted face-to-face while some were conducted remotely by mobile phone, in order to reach FSWs who had left Nairobi since their baseline interview. During the consent process, the interviewer and participants agreed on a safe word/phrase that would alert the interviewer if the participant faced interference, such as someone walking into the room where she was answering the call. For in-person and remote interviews, after each interview, the interviewers wrote a detailed script that described the interview, including nuances that would not have been captured on audio tape (such as the woman's mood and demeanour). When women consented, the interview was also audio-recorded and subsequently transcribed and translated. For in-person interviews, both participants and interviewers wore face masks in a well-ventilated room and sat a sufficient distance apart to ensure compliance with government guidelines.

### *Ethical approvals and considerations*

Ethical approval for this study was obtained from the ethics boards at the Kenyatta National Hospital/University of Nairobi (KNH/UoN), the London School of Hygiene and Tropical Medicine, UK, and the University of Toronto, Canada. A National Commission of Science, Technology and Innovation (NACOSTI) permit was also obtained. For follow-up interviews, only participants who had consented to be contacted again by the study were invited to participate. The follow-up interviews included some additional questions on how women handled the pandemic and some interviews were conducted via the phone. Additional ethical approval was obtained from boards at the University of Nairobi, London School of Hygiene & Tropical Medicine and the University of Toronto, as due to the nature of the interviews, we needed to ensure women's safety was not com- promised through taking part in a remote interview (Bhatia et al., 2022).

At baseline and at each subsequent study visit, study participants were informed about the study through a detailed participant information sheet that was provided in a written format and read aloud to participants in English or Swahili, before participants gave their written informed consent. For follow-up remote qualitative interviews, oral consent was sought, recorded, and stored in a separate password-protected file. The audio-recorded data were uploaded to a secure server after each interview and deleted from the recording device. All data were stored using unique identifiers on a

password-protected server to maintain confidentiality. All participants received around 500KSH (5 USD) for their time and transport or air-time costs, were treated for any presenting illness, and were referred to a study counsellor for on-site or remote tele-counselling if they needed additional support.

### *Data analysis*

Prior to each follow-up interview, the qualitative interviewer re-read the transcript and script from baseline to re-familiarise themselves with women's stories before the interview. The research team (comprising TB, JS, JK, HB, RK, MK, EN, JL, JP, AB, and PS) had previously been involved in the analysis of the baseline quantitative and qualitative data and were familiar with the setting and findings from baseline (pre-pandemic). During the follow-up interview, the research team met virtually after every two in-depth interviews to discuss the interviews as they progressed. During these meetings, the interview script notes were read and discussed to first identify, then refine, and define the themes and subthemes and to develop a codebook. When all interviews had been completed, the research team members randomly chose an interview script which they all separately coded. The team then met and discussed line by line the coded interview to check whether the codebook was understood uniformly by all members. The codebook was then amended and finalised and the 47 scripts and transcripts were divided amongst the team members who coded them independently. They were then analysed by the research team thematically, using Nvivo software to manage the coding.

We used the themes generated to describe the experiences of FSWs in Nairobi during the COVID-19 pandemic. The themes included: violence, stigma, discrimination, social exclusion, access & utilisation of healthcare services, condom use/safe sex negotiation, mental health, IPV and relationships with children, and client sourcing. The interviews illustrated how broad societal factors including the criminalisation of sex work, the communities in which sex workers live, their relationships with peers, family, and partners; and individual factors such as age, income, and edu- cation interacted to create realities for the sex workers in Nairobi.

## Results and discussion

The women's ages at baseline ranged from 18 to 45 years, with most of the women being aged in their early thirties. Most of these women had some years of schooling and four of these women had tertiary-level education. Before entering sex work, 43 of the 47 women had at least one child. Pro- viding for their children was the main reason women joined sex work. The majority of women first sold sex when they were 18–24 years old. At the time of contact with the study for the follow-up interview, most of the participants were residing in Nairobi County and its environs, while a few had relocated to other towns or returned to their rural homes. All participants expressed increased risks and challenges due to the pandemic. Some had quit sex work and had entered other income-generating activities such as selling masks and tailoring, as relying on sex work had become challenging. Those who still sold sex reported having changed the areas where they sold sex and the number of clients. Although finding alternative sources of income can be presented as a positive coping mechanism, it is likely to be short-term as they cited the money was less than what they made in sex work. To set the scene for analysis of our data on women's experiences we present the narratives provided by one FSW, Summer (all names are pseudonyms), on how the COVID- 19 pandemic affected her life and how she coped.

Summer was 29 years old at the time of the baseline interview and a year older at follow-up. She lived in an informal settlement in Nairobi. When COVID-19 restrictions were instituted, Summer, like other sex workers, lost her main source of income. As a community health worker, Summer would receive a stipend of 2500KSH (25 USD) per month, but that was barely enough to feed her children, who were at home because schools were closed too. Summer's parents were also dependent on her income after retiring from their business of brewing illicit liquor.

Summer ended up selling household items, skipping meals, taking loans, and failing to pay rent. This, she reported, led to developing mental health problems. She commented:

> I have accumulated debts because I'm hardly earning any money yet I have rent to pay. I have children to feed and I am a single parent. I think I might have been depressed because of these. I have not paid rent since March (four months prior to the interview). I pay 500KSH (5 USD) per month and I easily managed that before COVID-19. Right now, I have arrears amounting to 150 USD. I have been paying in small instalments of about 15 USD. Sometimes the property owner has been so impatient with me.

Summer had lost her five regular clients and reported instances where new clients refused to pay the agreed amount for sex. Although Summer had registered for the government's economic relief programme, she did not receive any help. Additionally, she was unable to get a job with a government project that hired low-income people, as she did not have the necessary connections.

Physical and financial violence from her clients was the norm. Clients were in the habit of reversing payments made by post/online transfer, paying less, or even assaulting sex workers like her after sex. Summer recounted how she had had to run from the police one time when she was breaking the curfew in order to work. Life became hard for her and she would end up scolding her children whenever they asked for food and other necessities. She also said that despite people going through a lot of stress and needing to talk about it with others, they could not because they were stopped from meeting other people.

Access to sexual reproductive health services (SRH) was also affected by COVID-19 regulations. The SWOP clinic, where summer accesses her SRH services, was closed for a short time. Fortunately, Summer had her supply of Antiretrovirals (ARVs) and condoms and continued to use both. However, Summer mentioned that she skipped her ARV medication whenever she did not have food.

To cope with COVID-19 itself, Summer said she used sanitiser and wore masks. However, she reported that she never wore masks while having sex with clients. She kept her distance from her neighbours and limited the amount of time her children stayed outside the house. Summer said that she started to source her food supplies from a cheaper market and reduced her use of bhang (marijuana) intake. She said:

> Bhang would cost me 50ksh (0.50 USD), which right now goes to food. I also do not drink [alcohol] unless I find a friend drinking and I join in. I would like to think that I am reforming and I have become wiser. Even when things come back to normal, I do not think I will be spending as much money on Bhang as I did before. I was misusing money. I used to spend 300ksh (3 USD) on alcohol and bhang in a day and nowadays I go a week without getting as much. It has been truly eye-opening.

She said that she considered sending her children to their father in the village to reduce her expenses, but neither she nor their father could raise the necessary fare.

## Effects of COVID-19 on sex workers at the individual, community and societal levels

### *Violence (sexual, physical, financial)*

As Summer's account illustrates, FSWs were often unable to observe COVID-19 control measures such as physical distancing and isolation and therefore were profiled as 'COVID-19 spreaders' by the community. As a result, FSWs were frequently unfairly targeted by punitive COVID-19 prevention measures (UNAIDS, 2020a), and stigma and violence from community members (Reuters, 2020). Cases of police harassment and violence towards FSWs, such as forceful quarantine due to breaking curfew rules, social distancing measures, being in venues that were supposed to be closed, money and sex solicitation, and physical violence, were reported by women in our study. While this is a continuous experience by FSWs in Kenya due to the criminalisation of sex work, the participants reported this to have escalated during this period, a finding corroborated by others (Kimani et al., 2020). Although most of the respondents attempted to adapt to changes in the

operation of sex work (due to COVID-19 restrictions), for example, by contacting clients online and sleeping in clients' homes, some recounted additional risks of violence from clients, police and the community at large, mostly attributed to the context of the COVID-19 pandemic. However, it is not unusual for sex workers in Kenya to report experiencing various forms of violence from their cli- ents, law enforcement, and the public (Beattie et al., 2023; Mbote et al., 2020). The increased risks of violence during the COVID-19 pandemic reported in our qualitative interviews could be attributed to restriction measures. We were told by the women that the few clients that they found would frequently take advantage of the curfew and the desperate need of women for money, to lure them – for example to their homes until the curfew began so women were forced to stay overnight – and subsequently violate the agreed terms and conditions of sex.

### *Stigma, discrimination, and social exclusion*

Due to the criminalised nature of sex work, African countries tended to exclude sex workers from safety nets during the COVID-19 pandemic, including economic relief (Adebisi et al., 2020). Two of the women in our study reported being removed from the list of social support beneficiaries offered to single parents by the government as part of the COVID-19 relief. They said that their removal was because they were known to be sex workers in the localities where they lived. Even in countries with higher incomes such as the United States and Germany, the government required the beneficiaries of COVID-19 relief services to provide proof of loss of employment or reduced income from a business, which was a challenge for sex workers (Platt et al., 2020).

In addition to the absence of financial support, the enforcement of COVID-19 control measures in Nairobi subjected FSWs to arbitrary arrests, violence, and extortion from the police, worsening their already precarious financial position at the height of COVID-19 infections (Kimani et al., 2020).

Sex workers also reported stigma from the local community, more so because they now per- formed sex work during the day (due to the dawn-to-dusk curfew) and so were more visible to their communities. In our interviews, they said they had been accused of teaching immorality to children in the neighbourhood, plotting to steal husbands, and spreading COVID-19. In Summer's narrative, she talked about hiding from the police. Another respondent recounted how the police frequently beat and harassed her in broad daylight for selling sex because they knew she was a sex worker; her community called her a bad influence.

### *Access & utilisation of health care services*

The COVID-19 pandemic over-burdened the healthcare system resulting in resources being redirected, including the supply chain of medical supplies (Haleem et al., 2020; Iversen et al., 2020). When cessation of movement was implemented, we found that sex workers who had temporarily travelled from Nairobi were locked out, so they could not access their specific health needs, including access to HIV medicines. Furthermore, as reported by other researchers, some sex workers in Nairobi did not have the bus fare to go to their health centres due to financial stress related to COVID-19 (Gichuna et al., 2020) In Nairobi, and elsewhere globally, COVID-19 may have undermined the huge progress made in HIV prevention and treatment, by disrupting the access of key populations to HIV antiretroviral drugs, viral load monitoring, HIV pre and post-exposure drugs, STI testing and treatment, and condom distribution (Iversen et al., 2020)

However, despite the challenges mentioned above, some study participants reported being able to access these services from SWOP clinics. SWOP clinics closed only for a short period (3 weeks) as clinical services were considered essential by the Ministry of Health. SWOP services included condom provisions, Post Exposure Prophylaxis (PEP), STI screening, ARV refills, telemedicine, and counselling, among others. From the interviews, those who accessed these services reported

being happy that the clinics were operational despite the strict restriction measures that were aimed at reducing COVID-19 infections.

However, a significant number of sex workers who we interviewed reported non-adherence to ARVs, PEP, and PrEP due to a reduced number of clients, the temporary cessation of sex work, and the side effects of taking the pills when hungry. Women reported frequently missing meals due to lack of money and that their stomachs could not handle the pills when empty. Poor ARV adherence during COVID-19 due to lack of food was also reported among the general population in Kenya, especially among economically vulnerable persons (Muhula et al., 2021).

### *Condoms use & negotiation for safe sex*

Sex workers reported accepting lower pay than usual from their clients, as Summer explained in her narrative, due to economic hardships in the country. In Kenya in general, it has been reported that sex workers took less than 75% of their normal income (The Global Fund, 2020). The lockdown, quarantine, and curfew measures enacted by most countries left sex workers economically vulnerable, as well as their clients self-isolated (UNAIDS, 2020b). Night curfews and bar and hotel closures significantly reduced the places where sexual activity was requested, therefore causing an income loss (Kimani et al., 2020). In Kenya, 81% of places where sex workers seek sex are venues, such as streets, bars, lodgings and hotels. 74% of these venues are open late at night and some all night (NASCOP, 2020). The COVID-19 regulations in Kenya – closure of bars, restaurants, hotels, and night curfew starting as early as 7 pm meant few to no clients for sex workers in Kenya (Mantell et al., 2021). The decreased prospects of generating regular income from sex work due to the economic downturn may have put sex workers in a vulnerable position in terms of compromising their sexual and physical safety. Most women reported low negotiation power for both condom use and the amount charged for services. They said they often felt that clients took advantage of their economic vulnerability to demand sex without condoms.

### *Mental health*

Experiences of stigma and social exclusion among sex workers have been associated elsewhere with poorer mental health (Stockton et al., 2020). Most of our study participants said they felt lonely and isolated during the pandemic, as the places where they would meet while performing sex work were closed. The closure of public gathering places, such as bars, during the pandemic, increased their social isolation, which had an impact on their physical and mental health, as has also been found in the U.S.A. (Callander et al., 2020).

Women told us that coping with the challenges of sex work, as well as COVID-19, meant that mental health problems were reported due to stress. Stressors included a lack of money to provide for their children, stigma from the community, as they had to change operating hours and venues due to curfew, as well as increased violence. Some described how they found it difficult to eat or sleep. Others reported having friends who were sex workers committing suicide due to mental health problems resulting from a lack of money. There were additional health issues for sex workers living with HIV, that gave them the fear of getting COVID-19. Globally it has been reported that they could have faced increased mental health problems from stress and isolation, as well as, challenges in accessing care (Rana, 2020; Waterfield et al., 2021).

However, our quantitative and qualitative findings suggested a significant reduction in substance use during the COVID-19 period – indeed, this is illustrated by Summer, who reported her reduced use of marijuana in her narrative above (Beksinska et al., 2022). Many of the women told us that they could no longer afford alcohol and other recreational drugs. These findings are consistent with those conducted in Latin America among the general population during the COVID-19 pandemic, where lower income and reduced disposable income were associated with lower alcohol consumption (Garcia-Cerde et al., 2021)

## Effects of the COVID-19 pandemic on personal relationships

### *IPV and relationships with children*

During and after the pandemic, women (not just FSWs) in Kenya experienced increased sexual, physical, emotional, and economic abuse compared to men (Kimani et al., 2020).

In our study, some women reported experiencing violence from their intimate partners, which was often the result of disagreements about finances and how to meet other needs. They said that male partners often felt pressured because of their lack of income and took it out on women. Most of the participants also said that the relationship with their children was strained by the pandemic. The expectations from their children to provide food and other necessities often left the women feeling helpless, and some reported taking it out on their children; Summer talked about scolding her children more than usual, in her narrative.

An increase in violence has been reported during other pandemics. For example, after the Ebola outbreak in West Africa, there was a spike in cases of violence, rape, and sexual assault among women and girls, with teenage pregnancies increasing by 65% (Seema Yasmin, 2016). In March 2020, a few months after the outbreak of the COVID-19 pandemic, countries such as Brazil, Australia, the United States of America, and China recorded increased reports of violence against women (Bradbury-Jones & Isham, 2020; Usher et al., 2020). Quarantines and social isolation measures may expose women to exploitative relationships because they may be temporarily unable to escape abusive partners, and are exposed to coercion, violence, or victimisation in response effort (Peterman et al., 2020).

### *Client sourcing*

Most of the participants expressed difficulties in making money due to the closure of venues, cessation of movement, and night curfew. Potential clients who had also lost jobs due to depressed economic activities also had no disposable income.

Women in our study reported how the dynamics of sex work changed during the pandemic, where the venues often used for both soliciting and sex were/are closed because of containment measures. The domino effect of this was a reduced number of clients, reduced income, diminished negotiation power, and economic or physical violence. The results of our study are consistent with a study with sex workers in western Kenya where participants also reported loss of income and increased violence experiences (Mantell et al., 2021). On the Kenyan coast and in Kampala, Uganda, FSWs faced similar situations where the safety net of the regular venues/locations was replaced by underground sex work, which was more dangerous for women (Zuma et al., 2021).

Taken together, the COVID-19 control measures in Kenya did not consider sex workers, placing them in a more vulnerable economic, health and safety position. Sex workers – who are already marginalised due to criminalisation, stigma and discrimination – experienced exacerbated levels of economic, verbal and physical violence; stigma, discrimination, and social seclusion; poorer mental health outcomes; reduced accessibility to sexual and reproductive health services; and deterioration of their personal relationships including with their children. This shows that in a pan- demic response, vulnerable groups may also be denied access to social protection and other essential services if mitigation measures do not take into account their peculiar vulnerabilities.

## Strengths and limitations

The follow-up interviews in our study were building on previous interviews and analyses, with same themes explored at both time points. COVID-19 pandemic took place when our study was ongoing, and due to the longitudinal design of our study, we were able to capture the acute effects of the pandemic on this marginalised community without the risk of recall bias. Finally,

interviews at both baseline and endline were conducted by female interviewers who had already established relationships with interviewees and were familiar with their stories from baseline interviews.

Our study had limitations; for instance, the interviews were conducted when the pandemic was ongoing and the covered period three-four months after lockdown measures began included a time when the effects were acute. Additional research is needed to understand how FSWs were affected in the long-term by the effects of both the COVID-19 containment measures as well as infection with COVID-19.

The study was not initially designed to assess the effects of COVID-19 and the interview guides were adapted rapidly, before we had much experience of this pandemic. Thus, we may have missed some key issues, such as the impact of school closures on FSWs ability to work while their children were not at school.

While there was no formal help or social protection from the government, there were self-help groups and community-based organisations that offered help to the very needy. However, we were not able to explore and formerly document these in this study.

## Conclusions

Pandemics such as COVID-19 negatively affect customer-facing businesses, which include sex work. Interventions to curb the spread of infection and mitigate these effects should be designed for and with FSWs and other marginalised populations in mind, given the disproportionate burden and economic disenfranchisement, they experience. Maintaining continuity of HIV care, as well as social and mental health support systems during a pandemic, is important for the well-being of sex workers and their families. Policies to help protect sex workers from severe economic shocks should be put in place for current and future pandemics. This, however, can only be achieved if the legal framework changes and decriminalises sex work. Decriminalisation may also help reduce the stigma, discrimination and violence that was exacerbated by the pandemic. More research with FSWs (and with women in general) is needed on how pandemics affect their relationships with partners and children at the household level.

## Ethics approval and consent to participate

The Maisha Fiti study was ethically approved by the Kenyatta National Hospital – University of Nairobi Ethics Review Committee (KNH ERC P778/11/2018), the Research Ethics Committees at the London School of Hygiene and Tropical Medicine (Approval number: 16229) and the University of Toronto (Approval number: 37046).

## Consent for publication

Not Applicable.

## Acknowledgements

The Maisha Fiti Study is funded by the UKAID and the Medical Research Council (MRC). We wish to thank all of the participants, the Sex Workers Advisory Research Committee (SWARC), the Maisha Fiti study Champions; Daisy Oside, Agnes Atieno, Agnes Watata, Demitila Gwala, Ruth Kamene, Mary Akinyi, Faith Njau, and the Maisha Fiti Staff members. Author Contribution: TB conceptualised the study. TB, JK, and RW developed the protocol. HB and RW wrote the draft manuscript. TB, JS, JK, NP, MK, EN, JL, JP, AB, and PS reviewed the finalised manuscript draft. All the authors read and approved the final manuscript.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

Funding for this study was provided by the Medical Research Council and the UK Department of International Development (DFID) [grant number MR/R023182/1] under the MRC/DFID Concordat agreement.

## ORCID

*Janet Seeley* http://orcid.org/0000-0002-0583-5272

## Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reason- able request.

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# **Appendix F.** LSHTM Ethics approval for thesis

**London School of Hygiene & Tropical Medicine**
Keppel Street, London WC1E 7HT
United Kingdom
Switchboard: +44 (0)20 7636 8636
**www.lshtm.ac.uk**

**Observational / Interventions Research Ethics Committee**

Ms Mamtuti Panneh LSHTM

1 April 2022

Dear Ms Mamtuti Panneh

**Study Title:** Cortisol Levels in Relation to Violence Exposure, Mental Health Disorders, and Systemic Inflammation among Female Sex Workers in Nairobi, Kenya: a Longitudinal Cohort Study.

**LSHTM Ethics Ref:** 27396

Thank you for your application for the above research project which has now been considered by the Observational Committee via Chair's Action.

**Confirmation of ethical opinion**

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

**Conditions of the favourable opinion**

Approval is dependent on local ethical approval having been received, where relevant. **Approved documents**

The final list of documents reviewed and approved is as follows:

| Document Type | File Name | Date | Version |
|---|---|---|---|
| Protocol / Proposal | Maisha_Fiti_Protocol_2.2_ April 24 19 TB - JK1 Revised final | 24/04/2019 | final |
| Protocol / Proposal | Annex 1_Maisha Fiti Participant information and Consent Leaflet English_V2.2 24 Apr19 FINAL (2) | 24/04/2019 | Final |
| Protocol / Proposal | Annex 5. Maisha Fiti Study baseline questionnaire_ Eng Swa V2.2 24 April 2019 FINAL | 24/04/2019 | Final |
| Protocol / Proposal | Annex 6. Maisha Fiti Study_baseline_In-depth interview topic guide_v2.2 24 Apr 19 English With Swahili (1) | 24/04/2019 | Final |
| Consent form | Annex 1_Maisha Fiti Participant information and Consent Leaflet English_V2.2 24 Apr19 FINAL (2) | 24/04/2019 | Last |
| Consent form | Annex 3_Maisha Fiti_Consent for Qualitative interviews_V2.2_ 24 Apr 19 ENGLISH | 24/04/2019 | Last |
| Protocol / Proposal | Annex 5. Final approved version Ammended 11th June 2020 | 11/06/2020 | Last |

| | | | |
|---|---|---|---|
| Protocol / Proposal | Annex 7. Maisha Fiti Study_In-depth Follow-up nterview Topic Guide V1.0 6th July 2020 | 06/07/2020 | Final |
| Other | Research_Ethics_online_training_certificate_Mamtuti | 23/01/2022 | |
| Investigator CV | CV_general | 29/03/2022 | latest |
| Protocol / Proposal | PhD proposal _ethics 30/03/2022 Latest | | |

**After ethical review**

The Chief Investigator (CI) or delegate is responsible for informing the ethics committee of any subsequent changes to the application. These must be submitted to the committee for review using an Amendment form. Amendments must not be initiated before receipt of written favourable opinion from the committee.

Page 1 of 2

The CI or delegate is also required to notify the ethics committee of any protocol violations and/or Suspected Unexpected Serious Adverse Reactions (SUSARs) which occur during the project by submitting a Serious Adverse Event form.

An annual report should be submitted to the committee using an Annual Report form on the anniversary of the approval of the study during the lifetime of the study.

At the end of the study, the CI or delegate must notify the committee using the End of Study form.

All aforementioned forms are available on the ethics online applications website and can only be submitted to the committee via the website at: http://leo.lshtm.ac.uk.

Further information is available at: www.lshtm.ac.uk/ethics.

Yours sincerely,

**Professor Jimmy Whitworth**

**Chair**

ethics@lshtm.ac.uk http://www.lshtm.ac.uk/ethics/

# **Appendix G.** LSHTM Ethics approval for the Maisha Fiti study

**London School of Hygiene & Tropical Medicine**
Keppel Street, London WC1E 7HT
United Kingdom
Switchboard: +44 (0)20 7636 8636

**www.lshtm.ac.uk**

Observational / Interventions Research Ethics Committee

Dr Tara Suzanne Beattie

LSHTM

20 June 2019

Dear Beattie,

Study Title: The "Maisha Fiti" study among women who sell sex in Nairobi, Kenya

LSHTM Ethics Ref: 16229-01

Thank you for your letter responding to the Observational Committee's request for further information on the above amendment to research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above amendment to research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

Approval is dependent on local ethical approval for the amendment having been received, where relevant.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

| Document Type | File Name | Date | Version |
|---|---|---|---|
| Covering Letter | University of Toronto Approval December 2018 | 14/12/2018 | 1.0 |
| Other | Annex 1_Maisha Fiti Participant Information and Consent Leaflet_V2.0_TB - JK | 12/02/2019 | 2.0 |
| Other | Annex 1_Maisha Fiti Participant Information and Consent Leaflet_V2.0_ENGLISH TRACKED CHANGES | 12/02/2019 | 2.0 |
| Other | Annex 6. Maisha Fiti Study_In-depth interview topic guide_v2.1 English TRACKED CHANGES | 13/02/2019 | 2.1 |
| Other | Maisha_Fiti_Protocol_2.1_14Feb19 TRACKED CHANGES | 14/02/2019 | 2.1 |
| Other | Annex 5. FSW questionnaire_V2.0 TRACKED CHANGES | 14/02/2019 | 2.0 |

| | | | |
|---|---|---|---|
| Other | Maisha_Fiti_Protocol_2.1_ Feb 19 TB - JK Revised final | 19/02/2019 | 2.1 |
| Other | Annex 6. Maisha Fiti Study_In-depth interview topic guide_v2.1 English With Swahili | 21/02/2019 | 2.1 |
| Other | Annex 5. Maisha Fiti FSW questionnaire_V2.0 WITH SWAHILI - TB JK- final | 25/02/2019 | 2.0 |
| Other | Annex 3_Maisha Fiti_Consent for Qualitative interviews_V2.0_ENGLISH | 25/02/2019 | 2.0 |
| Other | Annex 2_Maisha Fiti Participant Information and Consent Leaflet_V2.0 SWAHILI | 25/02/2019 | 2.0 |
| Other | Annex 4_Maisha Fiti_Consent for Qualitative interviews_V2.0_SWAHILI | 25/02/2019 | 2.0 |
| Covering Letter | Maisha_Fiti_Protocol_2.2_ April 24 19 TB - JK1 Revised final | 24/04/2019 | 2.2 |
| Covering Letter | Annex 1_Maisha Fiti Participant information and Consent Leaflet English_V2.2 24 Apr19 FINAL | 24/04/2019 | 2.2 |
| Covering Letter | Annex 2_Maisha Fiti Participant information and Consent Leaflet_V2.2 SWAHILI FINAL - 24 Apr 2019 | 24/04/2019 | 2.2 |
| Covering Letter | Annex 3_Maisha Fiti_Consent for Qualitative interviews_V2.2_ 24 Apr 19 ENGLISH | 24/04/2019 | 2.2 |
| Covering Letter | Annex 4_Maisha Fiti_Consent for Qualitative interviews_V2.2 24 Apr 19 _SWAHILI | 24/04/2019 | 2.2 |
| Covering Letter | Annex 5. Maisha Fiti Study questionnaire_ Eng Swa V2.2 24 April 2019 FINAL | 24/04/2019 | 2.2 |



| | | | |
|---|---|---|---|
| Covering Letter | Annex 5. Maisha Fiti Study questionnaire_ Eng Swa V2.2 24 April 2019 FINAL<br><br>CHANGES HIGHLIGHTED | 24/04/2019 | 2.2 |
| Covering Letter | Annex 5. Maisha Fiti Study questionnaire_ Eng Swa V2.2 24 April 2019 FINAL | 24/04/2019 | 2.2 |
| Covering Letter | Annex 6. Maisha Fiti Study_In-depth interview topic guide_v2.2 24 Apr 19 English With Swahili | 24/04/2019 | 2.2 |
| Covering Letter | MTA Biological Study Materials - PHDA and collaborators - May 2019 final LSHTM - Signed | 28/05/2019 | 1.0 |
| Covering Letter | KNH ERC - Maisha Fiti Approval - June 7 2019 | 07/06/2019 | 1.0 |
| Covering Letter | Beattie Cover Letter 16229 June 13 2019 | 13/06/2019 | 1.0 |

After ethical review

The Chief Investigator (CI) or delegate is responsible for informing the ethics committee of any subsequent changes to the application. These must be submitted to the Committee for review using an Amendment form. Amendments must not be initiated before receipt of written favourable opinion from the committee.

The CI or delegate is also required to notify the ethics committee of any protocol violations and/or Suspected Unexpected Serious Adverse Reactions (SUSARs) which occur during the project by submitting a Serious Adverse Event form.

An annual report should be submitted to the committee using an Annual Report form on the anniversary of the approval of the study during the lifetime of the study.

At the end of the study, the CI or delegate must notify the committee using an End of Study form.

All aforementioned forms are available on the ethics online applications website and can only be submitted to the committee via the website at: http://leo.lshtm.ac.uk

Additional information is available at: www.lshtm.ac.uk/ethics

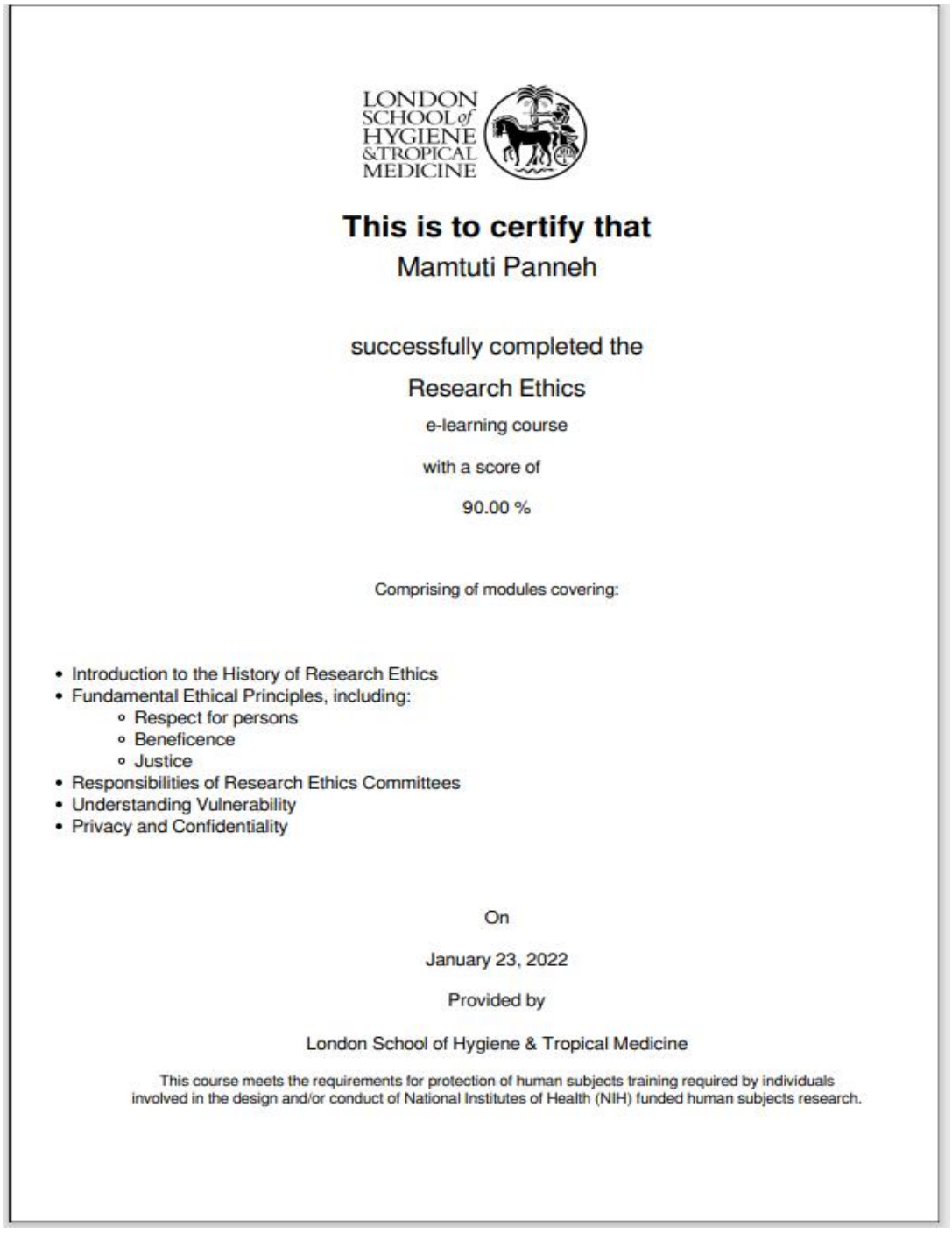
Yours sincerely,

Professor John DH Porter

Chair

ethics@lshtm.ac.uk http://www.lshtm.ac.uk/ethics/

**Appendix H.** Certificate of online ethics course from LSHTM



LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

**This is to certify that**

Mamtuti Panneh

successfully completed the

Research Ethics

e-learning course

with a score of

90.00 %

Comprising of modules covering:

- Introduction to the History of Research Ethics
- Fundamental Ethical Principles, including:
  - Respect for persons
  - Beneficence
  - Justice
- Responsibilities of Research Ethics Committees
- Understanding Vulnerability
- Privacy and Confidentiality

On

January 23, 2022

Provided by

London School of Hygiene & Tropical Medicine

This course meets the requirements for protection of human subjects training required by individuals involved in the design and/or conduct of National Institutes of Health (NIH) funded human subjects research.

**Appendix 1.** Participants' information and informed consent form of the Maisha Fiti study


The Maisha Fiti study among women in Nairobi, Kenya

**Patient Information and Consent Form**

***This information will be communicated orally in English, Swahili or other Kenyan dialect of potential participant's preference.*** **A Swahili translation of this leaflet is also available**

**Research Team:**

| | |
|---|---|
| Dr. Tara Beattie | London School of Hygiene & Tropical Medicine – Department of Global Health and Development; 15-17 Tavistock Place, London, UK |
| Dr. Joshua Kimani | UNITID/PHDA - University of Nairobi, tel. 714851, PO Box 19676, Nairobi, Kenya |
| Rhoda Kabuti | UNITID/PHDA - University of Nairobi, tel. 714851, PO Box 19676, Nairobi, Kenya |
| Erastus Irungu | UNITID/PHDA - University of Nairobi, tel. 714851, PO Box 19676, Nairobi, Kenya |
| Dr. Rupert Kaul | University of Toronto, 1 King's College Toronto, ON, Canada |
| | |
| Prof Janet Seeley | London School of Hygiene & Tropical Medicine – Department of Global Health and Development; 15-17 Tavistock Place, London, UK |
| Prof Helen Weiss | London School of Hygiene & Tropical Medicine – Department of Infectious Disease Epidemiology; Keppel Street, London, UK |

**We invite you to take part in a research study.**

We would like to invite you to join the Maisha Fiti study which has been set up by the London School of Hygiene & Tropical Medicine, The University of Toronto, and Partners for Health and Development in Africa.

We are carrying out a study of 1000 women in Nairobi to understand what factors in their lives enable them to have good health. We are particularly interested in how violence, mental health, alcohol and substance use affects their health and well-being and if these issues increase their risk of HIV infection. Our goal is to document the violence, alcohol/substance use and mental health which female sex workers experience and to understand if these intensify stress within a woman's body and increase

her risk of catching HIV. We also want to understand how violence and other factors make it more difficult for women who are living with HIV to take their ARV medications.

Before you decide whether to participate, it is important for you to understand why the study is being conducted and what is involved. Please take the time to listen to or read the following information carefully, and discuss it with others if you wish.

**Why is the study needed?**

We know that men who are violent to women are more likely to have HIV, which they may pass onto a woman when they have sex with her. In addition, some studies are suggesting that if a woman is beaten or raped, due to the trauma she experiences, changes may happen in her body that make her more likely to catch HIV through sex. We also know that violence is common for women who sell sex but we don't know if violence, alcohol/substance use or mental health make it more difficult for a woman to take her HIV drugs, and more likely that she will become unwell from HIV.

This will be the first study in Africa to look at this. At the end of the study, we will compare women who have experienced recent violence with those who have not, and look to see what changes have happened in their stress levels, and in their blood and vagina. And if these changes mean they could be more likely to catch HIV, if they have sex with a man who has HIV. We will also look to see whether violence, alcohol use and other difficulties mean that women are less likely to regularly take their ARV medicines or not. And if this means they are likely to have lower CD4 counts and drug-resistant virus strains.

The information we learn from this study will help us to design programmes and treatments to help protect women from violence and from HIV, and to better support women living with HIV to take their HIV drugs and stay well.

**Why have I been invited and am I eligible?**

We are inviting 1000 women from seven SWOP clinics across Nairobi County. Women who have recently visited a SWOP clinic in the past 12 months will be chosen at random (like a lottery) from the SWOP clinic lists.

You <u>are eligible</u> to take part in this study if you:

- Are aged 18 to 45
- Are not pregnant or breast-feeding
- Do not have a chronic illness (diabetes, rheumatoid arthritis, asthma, TB infection, cryotherapy in past 6 months)

A member of the study team will ask if you have understood this information leaflet and answer any questions that you might have before deciding whether to join. If you choose to join this study, we will assess whether you are eligible and, if you are, ask you to sign a study consent form. The consent form is included at the end of this information leaflet.

**What does taking part in the study involve?**

If you decide to join the study, you will take part for a period of one year. During this time we will ask you to come twice - at a time when you are not bleeding (menses) - to a SWOP research clinic (TRANSFORM) located at 5th Floor, Transnational Building, Mama Ngina Street in Nairobi City Center.

Taking part in the Maisha Fiti study would involve you:

- Agreeing to attend the SWOP research clinic twice during a one year period
- Completing a screening test at each visit. This involves a urine pregnancy test
- Providing a contact mobile phone number and address which the study team may use to contact you to tell you about any positive test results and to invite you for your second study visit (6 months after your first visit)
- Completing a **questionnaire** at each visit – this will take between one and one and a half hours  Collection of the following samples at each visit:
  **1. A finger prick** – to test for HIV (for women who have not had a positive HIV test before) **2. Two tubes (20mls or two tablespoons) of blood** – to test for STIs, inflammation*, and for women living with HIV to also test for CD4 T-cell numbers, Viral Load and ARV drug resistance
  **3. a urine sample** – to test for STIs, worms and pregnancy
  **4. Two genital swabs** – to test for STIs
  **5. genital fluids** (collected in a softcup) – to test for inflammation* and ARV drug resistance
  **6. a small hair sample** – to test for stress chemicals and ARV levels

*Inflammation: means changes happen in your blood or vagina increasing the number of immune cells than normal. This is important because HIV infects immune cells in the vagina (and anus). You can provide the genital samples yourself or you can ask the study doctor or nurse to help you if you prefer. If you would like to be part of this study, but do not want to give a hair sample, that is fine.

- Agreeing to give the Maisha Fiti study team permission to access relevant information from your SWOP clinic record in an anonymous form (without your name, number or any other information which could be used to identify you) e.g. date of last HIV test, date of last antibiotic prescription, TB infection
- Allowing us to share biological test results with your usual SWOP clinic. Note - we will not share with the SWOP clinics any other information you provide us, including anything you tell us in your study questionnaire or interviews.
- Agreeing to have your samples and questionnaire data stored by the Maisha Fiti study team, and used, in an anonymous form for scientific health studies which have received approval from the ethics board.
- Some of the study participants will also be invited to take part in two additional in-depth interviews about their life and experiences around sex work, violence and mental well-being (40 of the 1000 women will be asked to participate in this additional portion of the study)

**Do I have to take part?**

No, it is completely up to you. If you decide to take part you will be asked to sign a consent form. You are also free to withdraw at any time, without giving a reason. Your decision has no influence on the services you receive at any of the SWOP clinics.

**Will it cost anything to take part in the study?**

There is no cost to you for being in the study. All clinic and professional fees, diagnostic and laboratory tests performed as part of this study are provided at no cost.

**Will I receive any compensation?**

We will give you 500 Kenyan shillings at each of your study visits. This is to reimburse you for your travel costs and work time when you are at the study clinic.

**What will happen to my biological samples?**

Blood, urine, and genital samples will be processed – to test for STIs, worms and CD4 T–cell numbers.
Some blood and genital samples will be frozen and sent to overseas laboratories to test for Viral Load, ARV drug resistance, and inflammation in the blood and the vagina. Hair samples will be sent to overseas laboratories to test for stress (cortisol) and ARV levels.

Stored samples will be:

- Kept securely at UNITD, College of Health Sciences laboratories, Kenyatta National Hospital and sent to other laboratories we work with overseas with approval from the ethics board. They will not be labelled with your name or contact details, but only with a unique study number.
- Used by the study investigators for medical and health-related studies which are approved by the ethics board
- Shipped abroad where applicable for further evaluations as mentioned above. As a participant, you should not be worried as shipment of these materials will be governed by a material transfer agreement (MTA) signed by the Kenya investigators and their collaborating partners. In addition, ethics approval and the standard Ministry of Health permit will be obtained as per the Kenyan regulations for all biological materials shipped to laboratories outside Kenya. This will minimize potential use of these biological samples for unapproved studies.

**Are there any benefits for me in joining the study?**

If you join the study, we will test you for pregnancy, HIV, STIs and worms for free. If you have a positive pregnancy test, you will be advised to visit your nearest Ante-Natal Care facility. If you test positive for HIV or a treatable STI, our study team will be able to provide you with emotional and practical support, through counselling and refer you to your usual SWOP clinic for free HIV or STI treatment and management. For women living with HIV, we will conduct a CD4 T cell count and give the result to your SWOP clinic so that they can use these results to improve your HIV care. There will be no other benefits to you should you participate. However, women in other studies have said they valued being able to talk about their lives, and for someone to listen to their experiences. This study should benefit other women across Africa because the results of this study will improve our understanding of how violence increases HIV risk and affects ARV adherence. We will also know more about violence, mental health, alcohol and substance use among women who sell sex in Nairobi, which will help us to design better support and interventions for you and other women like you.

**Are there any risks for me in joining the study?**

There is a risk that participating in this study could result in you experiencing violence by someone in your community, such as your husband or partner, or the police. To minimise this risk, we will not advertise to the community where you live – including the police or city askaris - that we are conducting a study about violence. We will also not tell anyone that you have participated in the study.

There is a risk that participation in the study may cause you emotional discomfort because we will ask you questions about difficult events that may have happened in your life, such as violence and rape. You do not need to answer any questions that you do not want to answer. We will ensure that the study team receives proper training by specialised trainers, and we will provide a counsellor at the study clinic who can provide you with free counselling and support if you would like it.

There is a risk that providing biological samples for the study may cause you physical or emotional discomfort. Also, there may be some discomfort when we draw blood. However, the study team are experienced in taking blood and other biological samples.

**How will information about me be kept confidential?**

We will protect your privacy at all times. The steps taken to ensure confidentiality are detailed below:

- We will not tell anyone you have been invited to participate in the study. This includes not telling your usual SWOP clinic and your peer educator.
- When you enroll in the study, your consent to take part in the study will be recorded on a form that will contain identifiers including your name and mobile phone number. These forms will be stored in a locked cabinet at the study clinic and kept separately from the study data.
- Your samples and data will not include any personal identifying details; researchers working with your samples and data will, therefore, never know your identity. Your data will be stored using a unique, anonymous study identification number.
- Access to the study data will be password protected and will be used only by named researchers working on this study under the direct supervision of the senior scientific investigators.
- If you agree, we will share the results of your biological tests with the SWOP clinic database so you can receive appropriate treatment and support. However, we will not share any other information you tell us. This means everything you tell us in the questionnaire and interviews will be kept confidential.

**How do I withdraw if I want to do so?**

The study will be most valuable if no one withdraws from it, so it is important to discuss any concerns you may have with a member of the study team before you agree to participate. Participation in this study is voluntary. You can withdraw from the study at any time and without giving a reason but we hope that you will continue to visit your SWOP clinic.

You can withdraw by telephoning us on 0705170579 Mon to Fri: 9:00 - 17:00, by visiting us at the SWOP research clinic or by emailing maishafiti@gmail.com. This will allow us to discuss your concerns with you and address what is possible immediately.

**Who will be able to use my information and samples?**

Your anonymous information and samples will be available only to researchers who have relevant scientific and ethics approval for the planned research. Members of the local and international ethics

teams and Ministry of Health Officials may inspect and/or copy your anonymous research records for quality assurance and data analysis. Also, we will publish the research results, but your identity will remain secret.

**Can I know the results obtained from my samples?**

If we find a positive result for HIV, pregnancy, a treatable STI or for worms, you will be informed and provided with the required medicines. The results from your biological samples will be part of the SWOP clinic database and CD4+ T-cell results will also be shared with the SWOP clinical team to help in the HIV management of the individuals concerned. For those who require tracing for treatment of treatable STI or for worms, the SWOP clinic team will use the routine procedures to get in touch with you and offer advice and treatment as per the National AIDS and Control Programme (NASCOP)-Ministry of Health (MOH) guidelines.

**What happens at the end of the study?**

At the end of the study, we will hold meetings and other events where we will inform FSWs in Nairobi and other stakeholders interested in the study, what our research has found. At these meetings we will not say who has been involved in the study, but instead talk about what we have found. This information will help to design programmes and treatments to help protect women from violence and from HIV, and to better support women living with HIV to take their HIV drugs and stay well.

**Who has approved the study?**

All scientific research is reviewed by an independent group of people, called a Research Ethics Committee which is there to protect your safety, rights, wellbeing and dignity. This project has been approved by the Kenyatta National Hospital – University of Nairobi Ethics Review Committee and Research Ethics Committees at the London School of Hygiene & Tropical Medicine and the University of Toronto.

**What happens if something goes wrong?**

The risk of participants suffering harm as a result of taking part in this study is minimal. However, should you encounter any problems please get in touch with the study team immediately. We assure you that the study team will maintain confidentiality for all study participants.

**Who do I contact if I have questions or concerns?**

If you would like more information about the study or to tell us about a research-related injury, please call or contact Dr. Joshua Kimani or Rhoda Kabuti or any one of the researchers named above on +254705170579. You can also visit and talk to the study team at the SWOP research clinic (TRANSFORM) located at 5$^{th}$ Floor, Transnational Building, Mama Ngina Street in Nairobi City Center or email us: maishafiti@gmail.com.

For questions about your rights as a research participant, contact Professor Guantai, who is the chairperson of the Ethical Review Committee at the University of Nairobi, by calling 020 2726300 ext 44355, email: uonknh_erc@uonbi.ac.ke or make an appointment to see her at the Department of Medicine, at the University of Nairobi.

Thank you for taking the time to consider taking part in the Maisha Fiti study.

MAISHA FITI Study Informed Consent Signature Form

Maisha Fiti Study ID Number:

Please tick () each box if you agree with the statement to take part in the study:
**Ps: Hair samples and sharing your test results with your primary SWOP clinic is optional**

1. I confirm that I have read or had to read to me, the information leaflet dated 24 April 2019 (Version 2.2) for the above study. I have had the opportunity to ask questions, and these have been answered fully.

2. I understand that before I can enrol in the study, I will be tested for pregnancy. If I am pregnant or breastfeeding, I will not be eligible for this study.

3. I understand that if I consent to participate in this study, I will take part in two study visits – one now and one in around 6 months time. I understand that at both visits, I will be interviewed about myself and I will provide blood, urine and genital samples. If my last HIV test was negative, I will also be tested for HIV.

4. I understand that I will also be asked to provide a hair sample at each visit, and that I can still enrol in this study, even if I choose not to provide a hair sample.

5. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. This will not in any way affect the services I can get from the SWOP clinics.

6. I understand and grant permission for relevant sections of my SWOP clinic program records to be retrieved anonymously (without my name or other information that may identify me) and used by the study team

7. I give permission that my anonymised data (without my name or other information that may identify me) including my biological samples (blood, vaginal, hair, urine), can be used by the study investigators for medical and health-related studies which are approved by the ethics board

8. I give permission for my anonymised biological samples to be shipped overseas for further analyses by the

9. study investigators, such as inflammation in the softcup samples and testing for cortisol (stress) levels in hair samples.

10. I agree to provide a contact phone number and address and for this to be given to the study team co-ordinator so that they, or other members of the study team, can contact me to tell me when it is time for me to return for my follow-up visit. They can also use the number to contact me if I have a positive test result (treatable STI, worms).

11. I understand that positive test results for HIV, treatable STIs, pregnancy and worms, and CD4 Tcell counts will be given to me if positive.

12. I understand that the above results will be shared with my primary SWOP clinic if I agree to facilitate treatment and follow-up. But that all other information I provide will be kept confidential.

13. I voluntarily agree to take part in this study

Participant Name

*Signature/Thumb print*

Date

*If the potential participant is illiterate, a witness must sign below:* I have witnessed the accurate reading of the consent form to the potential participant and she had the opportunity to ask questions. I confirm that the potential participant has given informed consent freely.

*Note: the witness must be literate, should be selected by the participant and should have no connection to the research team.*

Witness Name *Signature* Date

For clinic staff:

I have explained the nature and purpose of the above study to _____ and have answered any questions they have had.

Study Staff Name *Signature* Date

## **Appendix J.** Consent form for the IDIs of the Maisha Fiti study

Maisha Fiti study among women in Nairobi, Kenya
**Consent Form for Qualitative Interviews**

Study ID Number:

Please tick (□) each box if you agree with the statement to take part in the study:

1. I confirm that I have read or had someone read to me the information leaflet dated 12th Feb 2019 (Version 2.0) for the above study. I have had the opportunity to ask questions, and these have been answered fully. □
2. I understand that the qualitative interviews are extra interviews in addition to the main Maisha Fiti study and will be used to understand more about the lives of women who sell sex. □
3. I understand that the interviews will be recorded and that the recordings will be stored securely by PHDA and LSHTM. I understand that none of my personal details, including my name, will be kept with the recording. □
4. I give permission for short extracts from my interview to be used for research purposes (including publications and reports), as long as my real name is not used. □
5. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. This will not in any way affect the services I can get from the SWOP clinics. □
6. I agree to provide a contact phone number and address and for this to be given to the study team co-ordinator so that they, or other members of the study team, can contact me to tell me when it is time for me to return for my next interview. □
7. I voluntarily agree to take part in the qualitative interviews for the above study □

Participant Name *Signature/Thumb print*

Date

*If the potential participant is illiterate, a witness must sign below:* I have witnessed the accurate reading of the consent form to the potential participant, and she had the opportunity to ask questions. I confirm that the potential participant has given informed consent freely.
*Note: the witness must be literate, should be selected by the participant and should have no connection to the research team.*

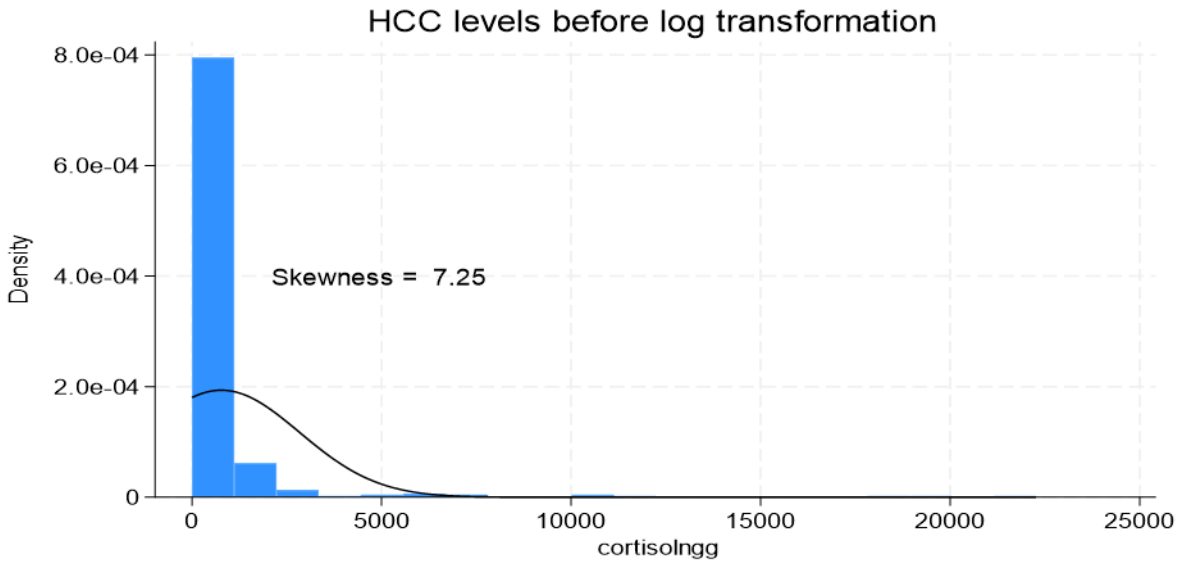
_____ _____ _____
Witness Name *Signature* Date

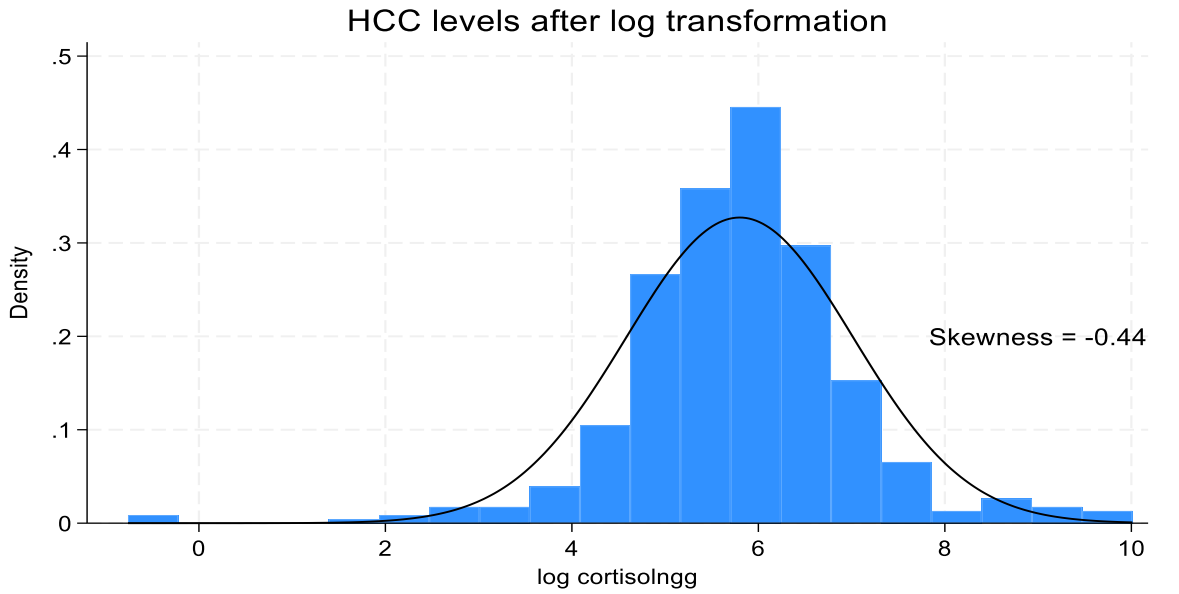
For clinic staff:

I have explained the nature and purpose of the qualitative interviews for the above study to _____ and have answered any questions they have had.

_____ _____ _____
Study Staff Name *Signature* Date

**Appendix K.** Distribution of HCC levels before and after log transformation



# **Appendix L.** Supplementary materials 1 and 2

**Supplementary 1.** Comparison of the characteristics of study participants at baseline (N=425), longitudinally (N=285), and the overall HIV-negative participants who were excluded in the study (N=321).

| **Characteristic** | **Total 425 N (%)** | **Total 285 N (%)** | **Total 321 N (%)** |
|---|---|---|---|
| **Age** | | | |
| <25 | 119 (16.1) | 90 (18.6) | 81 (14.3) |
| 25-34 | 155 (42.5) | 101 (42.2) | 131 (46.8) |
| 35+ | 151 (41.4) | 94 (39.3) | 109 (38.9) |
| **Age at first sex** | | | |
| </=15 | 130 (30.4) | 88 (30.5) | 122 (39.0) |
| 16-17 | 148 (33.8) | 97 (33.0) | 88 (25.5) |
| 18+ | 143 (35.80) | 97 (36.5) | 108 (35.5) |
| **Literacy** | | | |
| illiterate | 61 (15.3) | 35 (12.9) | 49 (16.59) |
| literate | 364 (84.7) | 250 (87.1) | 272 (83.41) |
| **Religion** | | | |
| Catholic | 172 (39.7) | 118 (40.8) | 114 (35.2) |
| Protestant | 220 (52.8) | 144 (51.3) | 165 (53.2) |
| Muslim/others/none | 33 (7.5) | 23 (7.9) | 40 (11.6) |
| **Socio-economic status** | | | |
| Lower/lower middle | 161 (37.2) | | 138 (41.9) |
| middle | 76 (17.4) | | 61 (18.9) |
| upper middle/upper | 188 (45.4) | | 122 (39.2) |
| **Total number of ACEs reported** | | | |
| 0 to 4 | 110 (25.4) | 79 (27.3) | 86 (27.6) |
| 5 to 8 | 246 (58.6) | 161 (57.1) | 182 (56.0) |
| 9 to 12 | 69 (16.0) | 45 (15.6) | 53 (16.4) |
| **Marital Status** | | | |
| Single | 125 (26.5) | 91 (27.7) | 94 (26.2) |
| Married or cohabiting | 28 (7.0) | 16 (6.1) | 29 (9.1) |
| Separated/divorced /widowed | 272 (66.5) | 178 (66.3) | 198 (64.8) |
| **Number of Children*** | | | |
| None | 24 (4.8) | 17 (4.8) | 22 (2.8) |
| one to two | 274 (66.5) | 188 (69.3) | 216 (69.8) |
| 3+ | 101 (28.6) | 60 (25.9) | 74 (27.5) |
| **Number of household dependents** | | | |
| 0 | 82 (17.8) | 62 (19.3) | 58 (16.7) |
| 1 | 117 (25.4) | 78 (25.8) | 72 (21.2) |
| 2+ | 226 (56.8) | 145 (54.8) | 191 (62.1) |
| **Recent Hunger** | | In trajectory form | |
| No | 305 (70.8) | | 206 (63.7) |
| Yes | 119 (29.2) | | 114 (36.3) |
| **Have other source (s) of income** | | | |
| Yes | 198 (47.6) | | 130 (40.5) |
| No | 227(52.4) | | 191 (59.5) |
| **Social support** | | | |
| No | 119 (27.5) | 89 (30.6) | 88 (28.0) |
| Yes | 306 (72.5) | 196 (69.4) | 233 (72.0) |
| **Place of selling sex** | | | |

| | | | |
|---|---|---|---|
| Lodge/hotel/rented room/home | 406 (97.0) | 272 (96.8) | 312 (97.2) |
| Public places | 13 (3.1) | 9 (3.2) | 9 (2.9) |
| **Number of clients /weeks** | | | |
| <5 | 246 (58.5) | In trajectory form | 190 (58.5) |
| 5+ | 173 (41.6) | | 131 (41.5) |
| **Condom use last sex** | | | |
| yes | 313 (74.4) | | 246 (77.7) |
| No | 112 (25.6) | | 74 (22.3) |
| **Contraceptive use** | | | |
| No | 61 (14.5) | | 53 (16.4) |
| Yes | 364 (85.5) | | 268 (83.6) |
| **Bacterial STI prevalence (Chlamydia/Gonorrhoea/syphilis)** [a] | | | |
| none | 368 (87.6) | | 284 (89.7) |
| One+ | 57 (12.4) | | 37 (10.3) |
| **Experienced previous abortion/still birth*** | | | |
| No | 222 (54.1) | | 186 (60.2) |
| Yes | 177 (45.9) | | 116 (39.8) |
| **Reports any sex-work related stigma** | | | |
| No | 58 (13.0) | | 46 (15.0) |
| Yes | 361 (87.0) | | 274 (85.0) |

[a]Bacterial STI prevalence is defined as a positive test for gonorrhoea, chlamydia and/or syphilis infection.

**Supplementary 2.** Comparison of the prevalence of violence, mental health, and substance use disorder among study participants (N=425) and the HIV-negative participants who were excluded in the study (N=321)

| | **Total 425 N (%)** | **Total 321 N (%)** |
|---|---|---|
| | | |
| **Financial violence** | | |
| No | 148 (33.5) | 102 (32.3) |
| Yes | 272 (66.5) | 218 (67.7) |
| **Emotional violence** | | |
| No | 102 (23.0) | 85(26.4) |
| Yes | 323 (77.0) | 236(73.6) |
| **Physical violence** | | |
| No | 195 (45.4) | 147 (43.1) |
| Yes | 230 (54.6) | 184 (56.86) |
| **Sexual violence** | | |
| No | 222 (50.6) | 162 (50.1) |
| Yes | 203 (49.4) | 159 (49.9) |
| **Physical and / or sexual violence** | | |
| No | 149 (33.6) | 110 (34.4) |
| Yes | 276 (66.4) | 211 (65.6) |
| **Any recent violence**[a] | | |
| No | 49(10.7) | 42 (13.2) |
| Yes | 376 (89.3) | 279 (86.8) |
| **Police arrest** | | |
| No | 302 (70.9) | 226 (68.6) |

| | | |
|---|---|---|
| Yes | 123 (29.1) | 95 (31.4) |
| **Depression** | | |
| None/Mild | 329 (76.3) | 252 (76.8) |
| Moderate/Severe | 95 (23.7) | 69 (23.2) |
| **Anxiety** | | |
| None/Mild | 376 (88.4) | 294 (91.4) |
| Moderate/severe | 49 (11.6) | 27 (8.6) |
| **PTSD** | | |
| Negative | 365 (86.5) | 272 (84.9) |
| Positive | 56 (13.5) | 46 (14.1) |
| **Suicidal behaviours** | | |
| No | 379 (89.2) | 292 (90.6) |
| Yes | 46 (10.8) | 29 (9.5) |
| **Alcohol use problem**[b] | | |
| low risk | 276 (65.7) | 210 (65.5) |
| moderate/high risk | 146 (34.3) | 110 (34.5) |
| **Other substance use problem** [b,c] | | |
| low risk | 262 (63.5) | 213 (67.5) |
| moderate/high risk | 162 (36.5) | 107 (32.6) |
| **Tobacco use** | | |
| No | 333 (78.5) | 260 (80.8) |
| Yes | 92 (21.5) | 61 (19.3) |
| **Alcohol and/or other substance use problem** | | |
| No | 212 (51.2) | 160 (50.63) |
| Yes | 213 (48.8) | 161 (49.4) |

[a]refers to any recent financial, emotional, physical, or sexual violence
[b] alcohol /other substance use problem: low risk 0-10 moderate/high risk 11+

[c]other substances (cannabis, cocaine, amphetamines, hallucinogens, sedatives and inhalant) excluding tobacco smoking and alcohol.