MENTAL HEALTH OF FEMALE SEX WORKERS: THE ROLE OF STRUCTURAL VULNERABILITIES AND RESILIENCE IN MENTAL DISTRESS

By
Catherine Tomko, MHS

A dissertation submitted to Johns Hopkins University in conformity with the requirements for the degree of Doctor of Philosophy

Baltimore, Maryland
March 2021

# Abstract

**Introduction:** Female sex workers (FSW) experience significant mental distress but their mental health is understudied. Structural vulnerabilities (SV) (e.g., food or housing insecurity) play a prominent role in mental distress; however, no research has examined the co-occurrence of SV indicators and their longitudinal relationship to mental distress. FSW may be able to overcome these challenges with resilience, but it has been narrowly defined in research as it relates to marginalized populations such as FSW.

**Methods:** We recruited 385 FSW in Baltimore, Maryland and followed up with the cohort at 6- and 12-months. Latent class analysis with distal outcomes was used to group FSW into 3 classes using five SV indicators (unstable housing; financial dependence on someone else; client-perpetrated physical or sexual violence; food insecurity at least weekly), to predict mental distress by class at 12-months, and to test if resilience modifies this relationship. A subset of FSW (n=18) participated in semi-structured interviews about external resilience (e.g., social support, resource utilization); themes were ascertained and compared to participants' quantitative resilience scores.

**Results:** A 3-class model fit the data best: minimal SV (i.e., low probabilities of all indicators); material needs (i.e., housing, food insecurity); and high SV (i.e., high probability of all indicators). Unadjusted mental distress score (possible range: 0-60) was 38 at baseline and 34 at 12-months. In adjusted analyses, there were no significant global ($p$=0.53) or pairwise differences (*High SV vs. Minimal SV*: $p$=0.26, *Material Needs vs. Minimal SV*: $p$=0.58) in mental distress score by class; we did not find evidence that resilience moderated the relationship. Qualitative results shed light on why internal resilience did not moderate this relationship: this measure overlooks and, in some cases in our sample, conflicts with the ways FSW describe external resilience.

**Conclusions**: Results show key co-occurring vulnerabilities salient for FSW mental health. Levels of mental distress in FSW remained high over 12 months, suggesting need

for intervention. There was no indication that internal resilience can improve this relationship and reliance on internal resilience offers an incomplete picture of the construct in FSW. Results show that structural inequities are deeply entrenched and require structural solutions.

Thesis readers: Drs. Michelle R. Kaufman, Susan G. Sherman

# Exam Committee

Michelle R. Kaufman, PhD (co-advisor)
Assistant Professor
Department of Health, Behavior, and Society


Susan G. Sherman, PhD (co-advisor)
Professor
Department of Health, Behavior, and Society

Michele R. Decker, PhD
Associate Professor
Department of Population, Family, and Reproductive Health

Rashelle J. Musci, PhD
Associate Professor
Department of Mental Health


**Committee Alternates:**
Carol Underwood, PhD
Associate Professor
Department of Health, Behavior, and Society

Emma Beth McGinty, PhD
Associate Professor
Department of Health, Policy, and Management

# Acknowledgements

It's no overstatement to say that returning to grad school changed my life. As I progressed through my Masters' and PhD programs, I grew—not only in my public health knowledge, but also in my confidence, in my commitment to justice, in my clarity of values. The past seven years at JHSPH have challenged me in new and exciting ways and I am so grateful to everyone who helped me along in my journey.

To Susan Sherman: an incredible advisor and mentor, who gave me more responsibility and intellectual freedom than I was even sure I could handle. But Susan was unfailingly confident in me and my abilities and, for that, I will forever be grateful.

To Danielle Nestadt, Saba Rouhani, Glenna Urquhart, Rebecca Hamilton White, Laura Sisson, Noelle Weicker: your encouragement and support were truly invaluable. I don't know how a year of COVID lockdown would have gone without you all. It's rare to find such a badass group of women all in one place; a group that lifts you up when you need it most. I am so incredibly lucky to have you all as colleagues and luckier to call you friends.

To Ju Park: I am forever grateful for your patience as I was learning the ropes as a PhD student (and indebted to you seemingly always responding when I yelled "JU! I need your help please!" across the office). You've provided friendship and mentorship in equal measure and for that I am so thankful.

To Brad Silberzahn and Katie Haney: two incredibly hard working and devoted people who made EMERALD happen—there wouldn't be any data for this dissertation without

the two of you. I hope that's a fair tradeoff for your personal phone numbers circulating through East and West Baltimore.

And on a personal note…

To my parents, Randy and Patty: you both instilled a love of learning in me that provided the motivation for pursuing this PhD in the first place. And the ~~delusion~~ confidence that I could pull it off. Growing up, I never heard you talk about limits on what I could achieve, only possibilities. I wish that everyone could hear that from their parents. (Also having to complete math and reading workbooks during childhood summers probably didn't hurt either.) I love you.

To my Claire and John: they say you can't pick your family, and while that's true, I would still pick you two as my siblings and friends 1,000 times over. I love you both and am blown away by how talented you both are. It helps keep me on my toes.

To my friends, especially the ones that had to hear "I can't come, I have a paper/exam/work to do" for years and years and years: thank you for being patient and understanding. And keep it up, because from what I understand, academic life is still the same even after the PhD.

To Matt, my wonderful husband: it's impossible to write down all the reasons I am grateful for you. You are my biggest fan and cheerleader. Even when you're not quite sure what I'm doing, you still assure me that I'll be great at it. You're the Ben Wyatt to my Leslie Knope. If our friends often heard me having to bail on plans because of work, you heard it a million times more, but you never complained or questioned why I'd want to be in school. Even after 10 years together—including one full year of lockdown—I'm

somehow even *more* in love with you, which sounds like a thing people say but in my case it's actually true! I hope I make you proud.

And finally, to various SW/SE DC coffee shops and the Bravo network, for making a steady stream of cold brew coffee and reality television programming that sustained long analysis and writing sessions to get this dissertation written.

# Table of Contents

# List of Tables

# List of Figures

# Chapter 1: Introduction and Literature Review

As defined by the Joint United National Programme on AIDS, sex workers are individuals who "receive money or goods in exchange for sexual services, either regularly or occasionally."[1] A sex worker's experience can be shaped by several factors including: the location where transactions take place, such as street- or brothel-based; the autonomy in choosing clients and frequency of work (or, conversely, the control of these by a manager or pimp); the motivation for selling sex, including for economic survival, to obtain drugs, or for pleasure; and the legality and criminalization of sex work in a location.[1] This dissertation concerns the experiences of cisgender female sex workers (FSW) in Baltimore, MD. FSW in Baltimore are subject to state and federal laws criminalizing solicitation of clients; they are largely motivated to sell sex by deeply entrenched economic precarity and drug use but are not necessarily forced into sex work (e.g., coerced, trafficked, or controlled by a pimp).[2] This differs from the experience of transgender sex workers in Baltimore, who experience less (but still elevated) economic instability and substance use compared to cisgender FSW.[2]

**Epidemiology of Poor Mental Health Among Female Sex Workers**

Globally, FSW experience a higher burden of diagnosed mental illness and symptoms of mental distress compared to similar populations who do not sell sex. Yet the body of literature is small and most studies have been over 10 years ago. One of the earliest studies to report findings of FSW mental health was conducted in Harlem, New

York City.[3] The authors found that, among the 346 predominantly drug-using women enrolled in the study, women who had a history of trading or selling sex had significantly higher scores on nearly every domain of psychological distress including depression, anxiety, hostility, paranoid ideation, and phobic anxiety.[3] A 15-year longitudinal study of the physical and mental health outcomes of a cohort of London-based FSW (n=130) found that 40% reported some mental health problem during the course of the study [4] Two prior studies have compared mental health outcomes of women who are engaged in sex work to women who are not within the same sample, finding poorer mental health outcomes in women engaged in sex work. Romans *et al.* compared scores of domains of mental health functioning (e.g., somatic symptoms, social dysfunction, severe depression, anxiety, and insomnia) between FSW in Australia and age-matched controls.[5] Overall, the authors did not find significant differences between FSW and controls. However, when examining a subset of FSW who did not have regular clients or worked in a massage parlor, these women had significantly worse scores than controls, providing early insights into the personal, economic, and work contexts that can impact FSW mental health functioning.[5] In Sex workers And Police Promoting Health In the Risk Environment (SAPPHIRE) study, a prospective cohort study of 250 street-based FSW in Baltimore conducted between 2016-2017, 24% of participants said that mental health was their greatest health concern, more than drug use (16%), HIV/STI risk (19%) or chronic conditions (11%).[6]

While there are few studies that have directly compared FSW mental health to non-FSW, many studies have enumerated the scope of symptoms of mental distress—including depression and PTSD—of FSW globally. Prior literature has found prevalence

of clinical depression or depressive symptoms among FSW ranging from 29-86%.[7-17] Most studies of depression or depressive symptoms in FSW were conducted in East or Southeast Asia. For example, in a study of FSW across Southern India (n=2400), 29% screened for symptoms of major depression on the Patient Health Questionnaire.[15] In Chennai, India, however, 86% of FSW reported symptoms of clinical depression.[11] A study of 210 street- and bar/restaurant-based FSW in Nepal found similarly high prevalence of depression at 82.4% of the sample.[13] Two studies from across China found similar depression prevalence: 39% of FSW who also injected drugs had symptoms of severe or extremely severe depression, while 49% of a sample of FSW from nine venues throughout China (n=1022) reported clinically-significant depressive symptoms.[16,18] A recent meta-analysis of mental health conditions in low- and middle-income countries found a pooled prevalence of depression of 41.8% (95% CI 35.8%–48.0%).[17] Only one study of FSW mental health was conducted in Europe: in Zurich, Switzerland, 22.4% of 193 FSW had one-year prevalence of depression and 36% of the sample had ever been diagnosed with depression in their lifetime.[10]

Studies of FSW mental health conducted in North America found variable depression prevalence. Of FSW who also injected drugs (n=624) and worked at the U.S.-Mexico border, 86% reported symptoms at or above the cut-point for clinically significant depressive symptoms.[19] In Vancouver, however, 35% of FSW in the sample had a prior depression diagnosis and 48.8% were diagnosed with some mental illness.[14] There is little recent research into mental health among FSW in the United States. Alegria *et al.* surveyed FSW (n=127), about 60% of whom worked on the street and 40% in brothels. About 70% reported depressive symptoms, but when stratifying by HIV status

the authors found that 91% of HIV-positive FSW reported depressive symptoms and only 58% of those who were HIV-negative reported symptoms.[7] Surrat *et al.* conducted the most recent study of FSW mental health in in Miami, finding that, of the street-based FSW surveyed (n=278), 52.9% reported moderate or severe depressive symptoms.[9] Though these studies do not directly compare FSW samples to the general female population, depression among women in the United States is estimated at a prevalence of 8-16% demonstrating a clear discrepancy in symptoms of depression for the FSW population.[20-23] Further, these studies were conducted in 1994 and 2005, respectively, so more recent research is needed.

There are even fewer prior studies of PTSD in FSW compared to depression; nevertheless, these studies found the prevalence of PTSD or symptoms of trauma ranging from 13-68%.[9,10,17,24-27] The pooled prevalence of PTSD and its symptomatology in FSW from low- and middle-income countries is 19.7% (95% CI 3.2%–64.6%).[17] These percentages are notably higher than the current estimate of PTSD in the general US female population at about 10.4%.[28] The earliest of these studies was conducted in San Francisco with 130 FSW. Farley et al. found that 68% of the sample had clinically-significant symptoms of PTSD.[24] In a sample of 100 male, female, and transgender sex workers, Valera et al. found that 42% of the entire sample met criteria for PTSD though the authors did not report PTSD prevalence by gender so it is difficult to know the exact number of FSW who met PTSD criteria in their sample.[29] Finally, 13% of 130 FSW in Zurich, Switzerland had one-year prevalence of PTSD and 21% had been diagnosed with PTSD at some point in their lifetime.[10] In Baltimore, 61% of street-based FSW screened

positive for symptoms of PTSD, higher than PTSD levels seen in some samples of treatment-seeking combat veterans.[27]

**Theoretical Background and Key Concepts**

*Mental distress*

Very broadly, depression is defined in terms of five key characteristics: 1) a specific alternation in mood; 2) a negative self-concept and self-blame; 3) desire to punish oneself; 4) change in vegetative state; 5) change in activity level (either slowing or agitation).[30] The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V) outlines symptoms and clinical characteristics of three sub-types of depression: major depressive disorder (also known as unipolar depression), persistent depressive disorder (also known as dysthymic disorder), and bipolar depression I and II.[31] The DSM-V criteria for major depressive disorder (MDD) includes five or more symptoms that persist over at least two weeks including depressed mood most of the day, nearly every day; loss of interest; changes in weight, sleeping patterns, physical activity, or concentration and decision-making ability; feelings of guilt or worthlessness; thoughts of suicide or death.

The DSM-V describes several diagnostic criteria for post-traumatic stress disorder (PTSD): 1) Criteria A—exposure to a traumatic event or stressor, whether directly or indirectly witnessed or exposed; 2) Criteria B—experiencing intrusive thoughts and feeling about the traumatic even, such as flashbacks, nightmares, or strong physical or emotional reactions to reminders of the traumatic event; 3) Criterion C—avoiding reminders of the traumatic event, such as thoughts, emotions, or physical reminders; 4) Criterion D—negative alterations in cognitions and mood after the traumatic event; 5)

Criterion E—alterations in arousal and reactivity, like irritability, difficulty sleeping or concentrating, or risky behavior following the traumatic event.[31]

Diagnostic criteria for major depressive disorder and PTSD are important context as they give the reader a frame of reference for typical symptoms of each disorder. However, as the literature on FSW mental health is nascent—and most studies have not recently been conducted—exploring non-specific negative alterations in mood (rather than specific conditions) can provide insight into the mental health burden of FSW rather than limiting the research to symptomatology. When symptoms of a specific mental disorder are not the focus of the analysis and there is a strong correlation between depression and several criteria of PTSD, it may be preferable to combine measures of both disorders into one composite measure of a general mood disorder (i.e., mental distress), as I do throughout the dissertation.[32] As such, specific symptoms of depression or PTSD are not the focus of this research; rather, I am interested in the non-specific overall burden of general mental distress experienced by a marginalized population. In the ensuing literature review, however, I will review findings about specific symptoms of anxiety, depression, or PTSD to give the full scope of literature.

### Structural Vulnerability

This study uses the concept of structural vulnerability to understand the social, legal, and economic factors that may drive this mental health disparity for FSW. Structural vulnerability was born out of discourse on structural violence; sociologist Johan Galtung described structural violence as "the indirect violence built into repressive social orders creating enormous differences between potential and actual human self-realization."[33] Structural violence describes the oppression of individuals and

communities by largely political and economic forces. Structural vulnerability, however, extends the sources of structural violence to cultural, physical, or psychological forces of oppression and uses the more "neutral" term vulnerability to draw a distinction between the scope of structural violence and structural vulnerability.[33] According to the framework, structural vulnerabilities exist when an individual or group's position in society constrains behavior due to conflict with: existing hierarchies defined and ordered by perceived "worthiness"; historically defined norms and ethics; and the medicalization of individual characteristics or life circumstances (e.g., homelessness) that can produce social exclusion.[33] Structural vulnerability describes a much more complex process than just individual factors working in a vacuum to produce vulnerability that drives poor health outcomes.[33] Rather, it is a positionality whose relative disadvantage to existing power structures creates a prime environment for health disparities in vulnerable populations.

A vulnerable positionality as described above can result in elevated negative health outcomes and ensuing health disparities at a population level through the process of embodiment. Embodiment refers to "how we literally incorporate, biologically, the material and social world in which we live." [33,34] Embodiment is indeed a process and works reciprocally with the world in and outside of an individual's body and biology; pathways of embodiment are structured both by the social world and the power and hierarchies that exist within, and by an individual's physical and biological possibilities and limitations.[34] As Krieger describes it, embodiment can be a "reminder of entangled consequences of diverse forms of social inequality" that can reflect both biological susceptibility and the constraints on health behaviors that come from a disadvantages

social position.[34] Engagement in sex work does not inherently cause poor mental health or mental illness; rather, the social context of selling sex can create vulnerability to mental illness that becomes embodied. For example, after concluding that while there were few significant morbidity differences between FSW and controls, Romans *et al.* wrote: "No evidence was found that sex work and increased adult psychiatric morbidity are inevitably associated."[5] Rather, the authors concluded that there were labor and social contexts that did increase poor mental health outcomes for a sub-group of FSW, rather than an innate susceptibility based on occupation.[5]

### *Resilience*

Resilience is one potentially modifiable factor to serve as a buffer to SV and improve mental health outcomes, though experts have proposed slightly different definitions. Luthar *et al.* (2000) defined resilience as "the achievement of positive adaptation" in the face of "significant" threats or adversities that can avoid the "negative trajectories" associated with risks.[35] Similarly, Bonanno (2005) has defined resilience as maintaining a "stable trajectory of healthy functioning" after trauma or adverse events.[36] Both of these definitions conceptualize resilience as a characteristic or outcome that has been demonstrated or exhibited by an individual in the face of trauma. Other experts have conceptualized resilience as a dynamic process that can change over time and depends on the context, the risk factors, and the outcome.[37,38] Masten *et al.* (1994) classified the outcomes of resilient individuals as "better-than-expected," maintained over time, and "good recovery" from trauma.[37,39] However, she adds that resilience should be thought of as the capacity of individuals to present these positive outcomes, rather than maintaining them; individuals may have temporary setbacks related to their trauma but can still be

considered resilient because they still have that capacity.[36] Panter-Brick describes

resilience as "a process to harness resources in order to sustain well-being" which echoes

the emphasis on the capacity of individuals rather than on the outcomes they exhibit at a

moment in time.[36] Despite variations in the definitions of resilience, the scientific

consensus describes an intrapersonal process that is a response to difficult life events or

circumstances and is more complex and nuanced than just a personality trait.

Resilience has broadly been conceptualized by some scholars as a function of

allostasis. Allostasis is the process between a person and the environment to maintain

stability in the face of actual or anticipated stressors.[37] In the allostasis view of resilience,

there are two types of promotive factors in resilience: assets and resources.[37] Assets are

positive qualities that an individual possesses such as self-efficacy or coping skills.

Resources, however, are external to the individual but they are also positive sources of

resilience. Resources can refer to help or support from family or friends, or community

organizations that provide assistance or promote empowerment.[37] A review of existing

resilience scales found a similar dichotomy of internal and external dimensions of

resilience.[40] Internal resilience factors are qualities related to the person; prior measures

of resilience have used items that measure adaptability, self-efficacy, active coping,

positive emotions, mastery, and hardiness. External resilience factors are outside of the

individual and related to the situation; prior resilience measures have included items

about supportive relationships, planning and organizing abilities within the environment,

and accessing "external resources in the wider community."[40]

There are three proposed ways that the protective mechanisms of resilience work

to alter risk and psychological outcomes.[41] The compensatory model says that protective

and risk factors have an additive and direct effect on an outcome, and the final (positive or negative) outcome results from the overall balance of risk and protective factors.[41,42] The protective factor model says that protective factors buffer the negative effects of risk factors. Finally, the challenge model is similar to the mechanisms of inoculation: moderately stressful events earlier in life promote an active coping response in adults and, therefore, enhanced resilience in future situations. The level of stress required for successful resilience cannot exceed an individual's capacity to deal with the stress: if a stress level is severe (such as in the case of physical or sexual abuse as a child), this can diminish positive psychological functioning and hamper future opportunities to exhibit resilience. If the level of stress is too low, an adult may be unprepared for future stresses and respond poorly.[42] The Three-Hit Concept of Resilience and Vulnerability (described above) aligns with this model. In addition to the genetic predisposition to depression, there are also "reactive" alleles that can create a heightened vulnerability to environmental stressors and therefore create a genetic predisposition to the effects of stress. However, these "reactive" alleles have also been shown to have a heightened benefit in the biological reaction to stress when exposed to an environment that promotes resilience. The example of these "reactive" alleles shows the gene-environment interaction that are the first two "hits" of the Three-Hit Model.

### *Agency and Resilience*

The role of resilience in the face of structural difficulties or vulnerabilities raises the fundamental tension between structure and agency. Structure refers to the "recurrent organization and patterned arrangement" of social relationships and institutions.[43] Structure influences decisions and opportunity, while agency refers to the ability to act.[43]

10

Though structure and agency can be thought of as diametrically opposed, sociologist Anthony Giddens argues that it is necessary to consider agency and structure as part of a reflexive relationship, a phenomenon he calls the "duality of structure." [44] Structure, such as institutions, is comprised of and produced by individuals, whose actions are then influenced by structure. This process is recursive and is part of the reason why structures typically span across time and space, despite individuals being unaware of the role that play in the duality of structure.[44] Therefore, Giddens argues, neither agency nor structure should take precedence but should both be considered simultaneously because of their interdependent nature.[44] This does not mean that there is not still a tension between the two— agency necessitates some independence of an individual but structure naturally constrains or places boundaries on that independence. However, Giddens says that structure does not always need to be constraining and can be enabling as well, depending on an individual's relationship to structure and power.[44] Giddens argues that agency is about action and action is about power—the availability and use of resources is a medium by which individuals exhibit power on actions and thus exert agency.[44] The multi-faceted nature of resilience as both endogenous and exogenous considers both the individual-level qualities considered resilient and the relationship of the individual to community- and organizational-level factors that can foster resilience.

**Structural Vulnerabilities among Female Sex Workers**

FSW are characterized by a wide range of structural vulnerabilities including socio-economic and legal difficulties. There is a growing body of evidence that experiencing these difficulties can negatively impact mental health for FSW.

*Economic context*

Research has found that poverty can be both an entrée to and current reality for FSW globally. In qualitative interviews with 57 street-based Indian sex workers, all women reported that a lack of economic opportunity and education led them to begin selling sex.[11] Eighty-six percent of these FSW who felt forced into sex work because of lack of social or economic resources reported depressive symptoms.[11] Experiences of hunger and food insecurity were common in a sample of FSW ages 14-29 in Vancouver, Canada, with 62% reporting inability to find adequate sources of food and 61% said they were worried about their food supply running out.[45] Macroeconomic forces such as gentrification and housing costs, combined with cuts to welfare programs, have contributed to an increase in homelessness among FSW in Vancouver—and among the city's residents more broadly.[46] Though the effect of these forces on FSW living and working conditions have not been explicitly studied in US cities, prevalence of housing and economic insecurity among FSW in Baltimore is high.

FSW in Baltimore are similarly characterized by markers of low socioeconomic status. Of 117 exotic dancers in Baltimore clubs, 39% reported financial instability (e.g., borrowed money or was behind on rent in past 6 months), 39% reported housing instability (e.g., homeless, lived in temporary housing, or moved more than twice in the past 6 months), and 67% reported limited educational achievement (e.g., not graduating from high school or received a high school diploma or GED but was not enrolled in school/dropped out of college). In SAPPHIRE, 62% of street-based FSW were homeless in past 3 months, 90% reported no monthly savings, 92% were legally unemployed in past 3 months, 54% went to sleep hungry at least once a week, and 52% did not finish

high school.[47] In this sample, food insecurity has been associated with poor sleep, homelessness, and increased risk of intimate partner violence.[48,49]

*Experiences of violence*

Violence has been conceptualized as a structural vulnerability due to the inherent power imbalance of the relationship between the woman and the perpetrator.[47] In the context of sex work, there is a unique power imbalance between FSW and their clients, who have solicited women for sex in exchange for money thereby commoditizing the sex worker. Because of the illegality or criminalization of sex work in many countries, there is also a power imbalance between FSW and the police which can be exacerbated by the police's emphasis on the illegality of the sex worker and a lack of criminalization of perpetrators. If FSW and/or their partners use drugs and rely on the money from sex work to obtain drugs, there is a similar power imbalance between women and their partners. FSW who either turn to sex work due to poverty, or are currently living in poverty, may engage in sex work more frequently to make money thereby increasing the power imbalance between FSW and paying clients, on whom they rely for income.[46] This can also increase potential exposure to violence as FSW with fewer resources solicit more clients or engage in riskier behavior for money.[46]

An early study by Romans et al. found that, compared to age-matched controls, women in sex work were exposed to more physical and sexual abuse.[5] A systematic review of 41 studies of violence prevalence and correlates among FSW found lifetime prevalence of violence from any perpetrator ranging from 41-65%.[50] Lifetime prevalence of physical violence experienced in the context of sex work ranged from 19-67% and sexual violence from 14-54%. Prevalence of physical violence experienced during sex

work in the past year ranged from 19-44%; sexual violence during sex work ranged from 15-31%.[50] Recent data from the SAPPHIRE study in Baltimore shows 12-month prevalence of client-perpetrated violence at 42%.[51]

Any consideration of sex work in the U.S. is set against a backdrop of a punitive legal system which studies show drives violence against FSW from a variety of perpetrators. Arrest, or the threat of arrest, is a daily reality for FSW and the consequences of arrest are not just limited to the legal punishments of a conviction. Prior to—or in lieu of—arrest, police exert their power over sex workers in a variety of ways including sexual coercion, extortion or condom confiscation.[52-54] In the SAPPHIRE study, 70% of FSW in Baltimore said they were verbally or emotionally harassed by police in the past 3 months and 48% reported being sexually harassed or assaulted by police.[47] Twenty-three percent of women said they were pressured to have sex with a police officer in exchange for no arrest, a violation of police power that is aided by women's fear of the consequences of sex work criminalization. In the same sample, police-perpetrated violence against FSW was associated with increased odds of client-perpetrated violence, underscoring the entwined nature of violence in this population.[55] There is limited evidence available about the psychological impacts of arrest or police violence on FSW. Patel *et al.* found that violence from police yielded the highest odds of depression (OR=7.4) of all types of perpetrators in India, though this is the only study of the effect of policing or arrest on the mental illness of FSW published to date.[15] Arrest and incarceration can exacerbate homelessness, victimization from police and others, and consequently trauma for FSW.[50,56] Arrest in the past year was associated with a nearly two-fold increase in odds of physical or sexual violence during sex work in the past 6

months.[50] A lifetime history of arrest or incarceration was also associated with increased

odds of physical violence during sex work in the past year (OR=2.6).[57]

In addition to being highly prevalent among FSW, violent experiences also have

significant deleterious effects on mental health. There is clear evidence that FSW who

experience physical or sexual violence are more likely to report being depressed,

regardless of sex work venue or geographic location. Of 2400 FSWs in India, women

who experienced violence were three times more likely to report depressive symptoms.[15]

When these associations were stratified by perpetrator, violence from clients (OR=2.4)

and intimate partners (OR=2.2) yielded similar odds of depression, though violence from

pimps resulted in greater odds of depression (OR=5.0).[15]  Similarly, street-based and

venue-based FSW in Nepal were five times more likely to be depressed if they had

experienced any form of work-place violence in the past 6 months, ranging from

humiliation and intimidation to rape and physical assault.[13] A study of FSW in China

found significantly higher depressive symptoms in FSW who experienced physical

violence from partners (OR=2.00) or clients (OR=1.76).[18] Ulibarri et al. found that a

history of forced sex from any perpetrator (including clients, intimate partners, or other

sources) was associated with greater odds of depressive symptoms in FSW at the US-

Mexico border; these results were similarly significant when only considering a history of

forced sex with a client.[19]

Associations between violence and PTSD have not been studied as frequently as

depression in this population, but one early study found significantly higher PTSD scale

scores for women who were raped selling sex than FSW who had not been raped.[24,27] In

the SAPPHIRE study, found high levels of cumulative violence from a variety of

perpetrators including intimate partners, paying clients, and police officers. Of the FSW who reported adulthood sexual violence, 82% said they perpetrator was a paying client; 65% of those experiencing physical violence reported their perpetrator being a paying client.[27] Cumulative violence across the lifespan (i.e., childhood and adult victimization) and considering all perpetrators found a dose-response relationship with higher levels of cumulative violence associated with higher PTSD scores.[27]

Multivariable models have found important relationships between economic context and violence, suggesting an overlapping relationship between the two. FSW who were illiterate were more likely to experience sexual violence from clients (OR=1.44) than women who were literate.[58] Being in debt was associated with physical violence committed by any perpetrator (OR=2.4) and residential instability was associated with physical (OR=3.1) and sexual (OR=3.5) violence by any perpetrator.[59,60] These estimates are from violence by any perpetrator and not just clients, so it is not clear the extent to which client-perpetrated violence is associated with any of these economic exposures.

*Co-occurring Structural Vulnerabilities*

Few prior studies have considered the co-occurring nature or patterns of structural vulnerabilities for FSW. Structural vulnerability has recently been applied to FSW in exotic dance clubs, concluding that the HIV risk environment is impacted by women's structural vulnerability.[61,62] Compared to exotic dancers in the low structural vulnerability class, women in the high structural vulnerability class (i.e. higher probability of limited financial and housing stability, limited educational attainment, and history of arrest) were more likely to have multiple sex partners (15% vs. 52%, p=0.03), exchange sex (16% vs. 71%, p=0.02), and use illicit drugs including heroin, prescription opioids, crack or

cocaine (7% vs. 57%, p=0.04).[62] The current proposed study extends that prior work by considering the structural vulnerabilities of female sex workers who work outside exotic dance clubs, analyzes structural vulnerabilities as risk factors for health outcomes rather than mediators, and examines mental health outcomes of this population.

**Resilience**

To date, four studies have examined resilience among FSW in North America.[63-66] One study constructed focus groups with 35 male, female, and transgender sex workers in Mexico and the United States. All 35 participants described their feelings of resilience counterbalancing the discrimination and stigmatization they feel from others and several sex workers described resilience contributing to increased feelings of safety and agency over the services they would perform or clients they picked up.[64] However, results and quote attributions did not describe the participants' gender so it is not possible to understand the results of only FSW. The second study of resilience, of FSW in Miami, measures resilience with measures of personal mastery (i.e., the extent to which a person feels events in their life are under their control); though personal mastery has been described as a driver of resilience, the terms are not synonymous.[36,63] Nonetheless, the authors found that women with high levels of resilience were more likely to have a high school education or greater, high levels of social support, and were less likely to have signs of severe mental distress.[63] A recent study looked at resilience among cisgender and transgender sex workers in Baltimore found that structural vulnerabilities, such as housing and food insecurities and violence, play a central role in resilience for both cisgender and transgender FSW, though average resilience was lower for cis FSW.[65] A second study of FSW in Baltimore—this time Latina FSW—described several resilient

factors that emerged from in-depth interviews, including strategies to cognitively reframe engagement in sex work as a necessary act to support themselves and their families in the absence of higher-paying jobs or support networks.[66]

Despite these promising results, resilience has not been widely studied among FSW. Complicating the few findings available is the inconsistent discussion of outcomes in resilient individuals, as discussed briefly earlier. These slight variations can make comparing study results difficult. Further, studies of resilience and mental health outcomes in FSW have used coping styles, self-efficacy, and social support as measures of resilience and have used the terms synonymously.[67-71] However, these only capture dimensions of resilience and do not reflect the broader, multidimensional construct.[35] Self-efficacy, positive coping, and social support may aid in developing or exhibiting resiliency but these alone cannot suffice for the entire construct. Despite these varying definitions, positive coping styles, higher levels of self-efficacy, and social support have all been associated with better mental health outcomes for FSW which suggests the potential for a protective effect from resilience. [64,67-72]

Structural vulnerabilities have well-established associations with poor mental health, and some FSW experience a wide array of them. Yet no research has examined patterns of their co-occurrence and their longitudinal relationship to mental distress. FSW may be able to overcome these challenges with internal resilience, but it has been narrowly defined in research as it relates to marginalized populations such as FSW. To address these gaps in the research, the following aims are proposed:

**Specific Aims and Hypotheses**

**Aim 1:** To quantitatively identify patterns of experienced structural vulnerabilities among FSW in Baltimore, Maryland through latent class analysis (n=385)

> *Rationale: This aim uses the advanced quantitative method of latent class analysis as a person-centered approach to classify vulnerabilities experienced by female sex workers. A latent class approach better reflects real-world exposures by using data-driven methods to classify women according to their recently experienced vulnerabilities and not by examining each predictor in isolation.*

**Aim 2:** To examine how patterns of structural vulnerabilities predict mental distress between baseline and 12 months among FSW (n=385) in Baltimore, Maryland.

> *H2.1: Latent class(es) characterized by more markers of structural vulnerability will have significantly greater mental distress compared to class(es) with fewer markers.*

**Sub-Aim 2a:** To examine resilience as a moderator of patterns of structural vulnerabilities on symptoms of mental distress between baseline and 12 months among FSW workers (n=385) in Baltimore, Maryland.

> *H2a.1.: Resilience will modify the effect of the relationship between patterns of structural vulnerabilities at baseline and mental distress at 12 months.*

**Aim 3:** To qualitatively explore how FSW (N=20-25) in Baltimore, Maryland describe dimensions and experiences of resilience in their lives and how they acquire resources to strengthen resilience, including social support.

> *Rationale: This aim will use in-depth interviews to describe, in participants' own words, what resilience means and looks like for FSW. Interviews will also supplement the quantitative measure of resilience used in Aim 2 which does not adequately capture all theoretical dimensions of resilience. This includes the ability to harness resources, particularly social support.*

**Conceptual Model**

The following conceptual model is based on a review of the literature will be used to examine the proposed aims. Figure 1 shows the pathways between structural vulnerability, depressive symptoms, and resilience that address gaps in the literature. Based on the literature review, there are several important indicators that may comprise the latent concept of structural vulnerability; the model shows some key indicators of structural vulnerability that are pertinent to FSWs' lives. Prior studies have analyzed these as separate independent variables in statistical models. However, the proposed research will analyze the co-occurrence of these indicators in classes by which to group FSW. The conceptual model shows structural vulnerability predicting mental illness, a relationship that is moderated by resilience. In resilience theory, this moderation is a protective factor because resilience is theorized to lessen the effects of structural vulnerability on mental illness.[35] Specifically, resilience is a protective-reactive factor because there is still some hypothesized relationship between structural vulnerability and mental illness in the absence of resilience; it is not hypothesized that there will be no relationship between structural vulnerability class and mental illness in the presence of resilience, only that the effect sizes of the relationship may change.[35] It is important to distinguish between the various roles that resilience plays in the model because it enhances the precision of the definition of resilience.[35]

**Figure 1. Conceptual framework of the proposed dissertation among a sample of female sex workers in Baltimore, Maryland (n=385)**
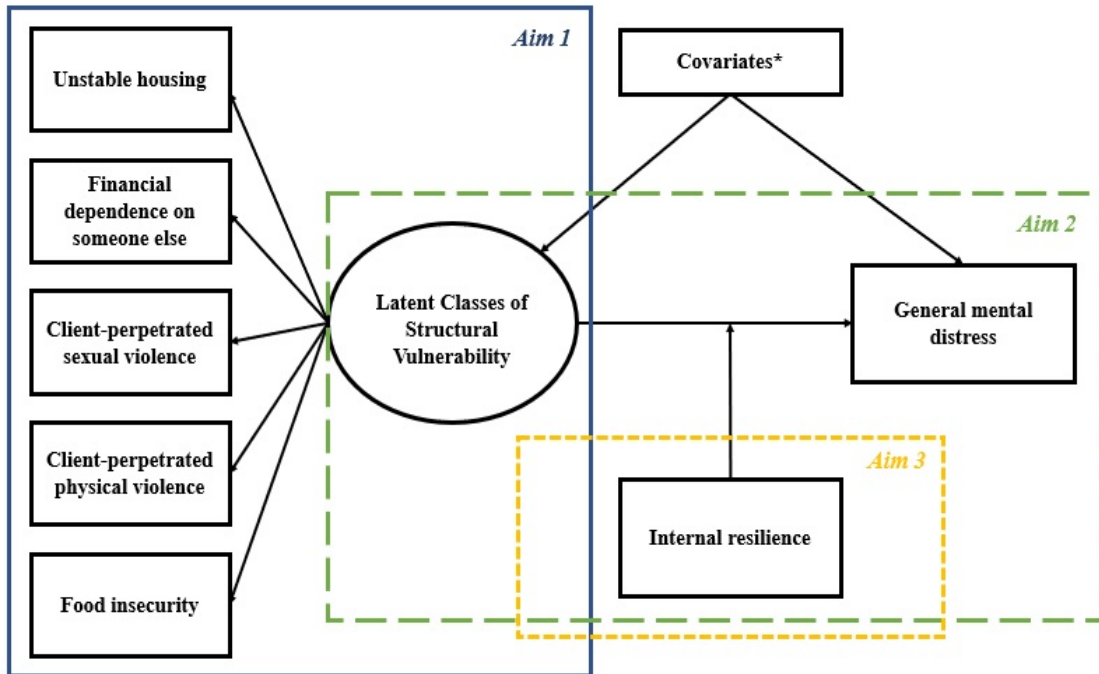


*age, race, crack cocaine use, injection drug use, internalized sex work stigma, study arm, condomless sex with clients, sex work entry as minor, baseline mental distress score

## References

1.  Joint United Nations Programme on HIV/AIDS. UNAIDS guidance note on HIV and sex work. *Geneva: UNAIDS.* 2012.

2.  Sherman SG, Park JN, Galai N, et al. Drivers of HIV infection among cisgender and transgender female sex worker populations in Baltimore city: Results from the SAPPHIRE study. *J Acquir Immune Defic Syndr.* 2019.

3.  el-Bassel N, Schilling RF, Irwin KL, et al. Sex trading and psychological distress among women recruited from the streets of Harlem. *Am J Public Health.* 1997;87(1):66-70.

4.  Ward H, Day S. What happens to women who sell sex? Report of a unique occupational cohort. *Sexually Transmitted Infections.* 2006;82(5):413-417.

5.  Romans SE, Potter K, Martin J, Herbison P. The mental and physical health of female sex workers: a comparative study. *Aust N Z J Psychiatry.* 2001;35(1):75-80.

6.  Sherman SG. The HIV Risk Environment OF High-Risk Women: Interaction With Public Safety. In: NIDA; 2014.

7.      Alegria M, Vera M, Freeman DH, Jr., Robles R, Santos MC, Rivera CL. HIV infection, risk behaviors, and depressive symptoms among Puerto Rican sex workers. *Am J Public Health.* 1994;84(12):2000-2002.

8.      Gunn JK, Roth AM, Center KE, Wiehe SE. The Unanticipated Benefits of Behavioral Assessments and Interviews on Anxiety, Self-Esteem and Depression Among Women Engaging in Transactional Sex. *Community Ment Health J.* 2016;52(8):1064-1069.

9.      Surratt HL, Kurtz SP, Weaver JC, Inciardi JA. The connections of mental health problems, violent life experiences, and the social milieu of the "stroll" with the HIV risk behaviors of female street sex workers. *Journal of Psychology & Human Sexuality.* 2005;17(1-2):23-44.

10.     Rossler W, Koch U, Lauber C, et al. The mental health of female sex workers. *Acta Psychiatr Scand.* 2010;122(2):143-152.

11.     Suresh G, Furr LA, Srikrishnan AK. An assessment of the mental health of street-based sex workers in Chennai, India. *Journal of Contemporary Criminal Justice.* 2009;25(2):186-201.

12.     Hong Y, Fang X, Li X, Liu Y, Li M, Tai-Seale T. Self-perceived stigma, depressive symptoms, and suicidal behaviors among female sex workers in China. *J Transcult Nurs.* 2010;21(1):29-34.

13.    Sagtani RA, Bhattarai S, Adhikari BR, Baral D, Yadav DK, Pokharel PK. Violence, HIV risk behaviour and depression among female sex workers of eastern Nepal. *BMJ Open.* 2013;3(6).

14.    Puri N, Shannon K, Nguyen P, Goldenberg SM. Burden and correlates of mental health diagnoses among sex workers in an urban setting. *BMC Womens Health.* 2017;17(1):133.

15.    Patel SK, Ganju D, Prabhakar P, Adhikary R. Relationship between mobility, violence and major depression among female sex workers: a cross-sectional study in southern India. *BMJ open.* 2016;6(9):e011439.

16.    Gu J, Lau JT, Li M, et al. Socio-ecological factors associated with depression, suicidal ideation and suicidal attempt among female injection drug users who are sex workers in China. *Drug Alcohol Depend.* 2014;144:102-110.

17.    Beattie TS, Smilenova B, Krishnaratne S, Mazzuca A. Mental health problems among female sex workers in low- and middle-income countries: A systematic review and meta-analysis. *PLoS Med.* 2020;17(9):e1003297.

18.    Hong Y, Zhang C, Li X, Liu W, Zhou Y. Partner violence and psychosocial distress among female sex workers in China. *PLoS One.* 2013;8(4):e62290.

19.     Ulibarri MD, Hiller SP, Lozada R, et al. Prevalence and characteristics of abuse experiences and depression symptoms among injection drug-using female sex workers in Mexico. *J Environ Public Health.* 2013;2013:631479.

20.     Kessler RC, McGonagle KA, Swartz M, Blazer DG, Nelson CB. Sex and depression in the National Comorbidity Survey. I: Lifetime prevalence, chronicity and recurrence. *J Affect Disord.* 1993;29(2-3):85-96.

21.     Vesga-Lopez O, Blanco C, Keyes K, Olfson M, Grant BF, Hasin DS. Psychiatric disorders in pregnant and postpartum women in the United States. *Arch Gen Psychiatry.* 2008;65(7):805-815.

22.     Farr SL, Bitsko RH, Hayes DK, Dietz PM. Mental health and access to services among US women of reproductive age. *Am J Obstet Gynecol.* 2010;203(6):542 e541-549.

23.     Melville JL, Gavin A, Guo Y, Fan MY, Katon WJ. Depressive disorders during pregnancy: prevalence and risk factors in a large urban sample. *Obstet Gynecol.* 2010;116(5):1064-1070.

24.     Farley M, Barkan H. Prostitution, violence, and posttraumatic stress disorder. *Women Health.* 1998;27(3):37-49.

25.    Farley M, Cotton A, Lynne J, et al. Prostitution and trafficking in nine countries: An update on violence and posttraumatic stress disorder. *Journal of trauma practice.* 2004;2(3-4):33-74.

26.    Roxburgh A, Degenhardt L, Copeland J. Posttraumatic stress disorder among female street-based sex workers in the greater Sydney area, Australia. *BMC Psychiatry.* 2006;6:24.

27.    Park JN, Decker MR, Bass JK, et al. Cumulative violence and PTSD symptom severity among urban street-based female sex workers. *Journal of interpersonal violence.* 2019:0886260519884694.

28.    Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry.* 1995;52(12):1048-1060.

29.    Valera RJ, Sawyer RG, Schiraldi GR. Perceived health needs of inner-city street prostitutes: a preliminary study. *Am J Health Behav.* 2001;25(1):50-59.

30.    Beck ATA, B.A. *Depression: Causes and Treatment.* 2nd ed. Philadelpha, PA: University of Pennsylvania Press; 2009.

31.    American Psychiatric Association., American Psychiatric Association. DSM-5 Task Force. *Diagnostic and statistical manual of mental disorders : DSM-5.* 5th ed. Washington, D.C.: American Psychiatric Association; 2013.

32. Watson D. Differentiating the mood and anxiety disorders: a quadripartite model. *Annu Rev Clin Psychol.* 2009;5:221-247.

33. Quesada J, Hart LK, Bourgois P. Structural vulnerability and health: Latino migrant laborers in the United States. *Med Anthropol.* 2011;30(4):339-362.

34. Krieger N. Embodiment: a conceptual glossary for epidemiology. *J Epidemiol Community Health.* 2005;59(5):350-355.

35. Luthar SS, Cicchetti D, Becker B. The construct of resilience: a critical evaluation and guidelines for future work. *Child Dev.* 2000;71(3):543-562.

36. Southwick SM, Bonanno GA, Masten AS, Panter-Brick C, Yehuda R. Resilience definitions, theory, and challenges: interdisciplinary perspectives. *Eur J Psychotraumatol.* 2014;5.

37. Fergus S, Zimmerman MA. Adolescent resilience: a framework for understanding healthy development in the face of risk. *Annu Rev Public Health.* 2005;26:399-419.

38. Bonanno GA. Resilience in the face of potential trauma. *Current directions in psychological science.* 2005;14(3):135-138.

39.     Masten AS. Resilience in individual development: Successful adaptation despite risk and adversity. 1994.

40.     Pangallo A, Zibarras L, Lewis R, Flaxman P. Resilience through the lens of interactionism: a systematic review. *Psychol Assess.* 2015;27(1):1-20.

41.     Schultze-Lutter F, Schimmelmann BG, Schmidt SJ. Resilience, risk, mental health and well-being: associations and conceptual differences. *Eur Child Adolesc Psychiatry.* 2016;25(5):459-466.

42.     Rutter M. Psychosocial resilience and protective mechanisms. *American journal of orthopsychiatry.* 1987;57(3):316-331.

43.     Barker C. *Cultural studies : theory and practice.* 5th edition. ed. London, CT: Sage Publications; 2016.

44.     Giddens A. *The constitution of society : outline of the theory of structuration.* Cambridge Cambridgeshire: Polity Press; 1984.

45.     Barreto D, Shannon K, Taylor C, et al. Food Insecurity Increases HIV Risk Among Young Sex Workers in Metro Vancouver, Canada. *AIDS and Behavior.* 2017;21(3):734-744.

46.	Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and structural violence and power relations in mitigating HIV risk of drug-using women in survival sex work. *Soc Sci Med.* 2008;66(4):911-921.

47.	Sherman S.G. P, J.N., Galai, N., Allen, S.T., Huettner, S.S., Silberzahn, B.E., Decker, M.R., Poteat, T.C., Footer K.H.A. Drivers of HIV infection among cisgender and transgender female sex workers. *Under review.*

48.	Lim S, Park JN, Kerrigan DL, Sherman SG. Severe Food Insecurity, Gender-Based Violence, Homelessness, and HIV Risk among Street-based Female Sex Workers in Baltimore, Maryland. *AIDS Behav.* 2019;23(11):3058-3063.

49.	Urquhart GJ, Sisson LN, Spira AP, et al. Associations of cumulative violence and structural vulnerability with restless sleep among female sex workers in Baltimore, Maryland. *Sleep Health.* 2020.

50.	Deering KN, Amin A, Shoveller J, et al. A systematic review of the correlates of violence against sex workers. *Am J Public Health.* 2014;104(5):e42-54.

51.	Decker M, Rouhani S, Park JN, et al. Incidence and predictors of violence from clients, intimate partners and police in a prospective US-based cohort of women in sex work. *Occup Environ Med.* 2020.

52.     Erausquin JT, Reed E, Blankenship KM. Police-related experiences and HIV
        risk among female sex workers in Andhra Pradesh, India. *J Infect Dis.* 2011;204
        Suppl 5:S1223-1228.

53.     Decker MR, Wirtz AL, Baral SD, et al. Injection drug use, sexual risk, violence
        and STI/HIV among Moscow female sex workers. *Sex Transm Infect.*
        2012;88(4):278-283.

54.     Decker MR, Wirtz AL, Moguilnyi V, et al. Female sex workers in three cities
        in Russia: HIV prevalence, risk factors and experience with targeted HIV
        prevention. *AIDS Behav.* 2014;18(3):562-572.

55.     Footer KHA, Park JN, Allen ST, et al. Police-Related Correlates of Client-
        Perpetrated Violence Among Female Sex Workers in Baltimore City,
        Maryland. *Am J Public Health.* 2019;109(2):289-295.

56.     Inciardi JA, Surratt HL. Drug use, street crime, and sex-trading among cocaine-
        dependent women: implications for public health and criminal justice policy. *J
        Psychoactive Drugs.* 2001;33(4):379-389.

57.     Platt L, Grenfell P, Bonell C, et al. Risk of sexually transmitted infections and
        violence among indoor-working female sex workers in London: the effect of
        migration from Eastern Europe. *Sex Transm Infect.* 2011;87(5):377-384.

58.    Blanchard AK, Mohan HL, Shahmanesh M, et al. Community mobilization, empowerment and HIV prevention among female sex workers in south India. *BMC Public Health.* 2013;13:234.

59.    Reed E, Gupta J, Biradavolu M, Devireddy V, Blankenship KM. The role of housing in determining HIV risk among female sex workers in Andhra Pradesh, India: considering women's life contexts. *Soc Sci Med.* 2011;72(5):710-716.

60.    Reed E, Gupta J, Biradavolu M, Devireddy V, Blankenship KM. The context of economic insecurity and its relation to violence and risk factors for HIV among female sex workers in Andhra Pradesh, India. *Public Health Rep.* 2010;125 Suppl 4:81-89.

61.    Brantley ML, Footer KHA, Lim S, Kerrigan D, Sherman SG. Experiences of structural vulnerability among exotic dancers in Baltimore, Maryland: Co-occurring social and economic antecedents of HIV/STI risk. *Int J Drug Policy.* 2017;50:74-81.

62.    Brantley ML, Kerrigan D, German D, Lim S, Sherman SG. Identifying Patterns of Social and Economic Hardship Among Structurally Vulnerable Women: A Latent Class Analysis of HIV/STI Risk. *AIDS Behav.* 2017;21(10):3047-3056.

63. Buttram ME, Surratt HL, Kurtz SP. Resilience and syndemic risk factors among African-American female sex workers. *Psychol Health Med.* 2014;19(4):442-452.

64. Burnes TR, Rojas EM, Delgado I, Watkins TE. "Wear Some Thick Socks If You Walk in My Shoes": Agency, Resilience, and Well-Being in Communities of North American Sex Workers. *Arch Sex Behav.* 2017.

65. Rouhani S, Decker MR, Tomko C, et al. Resilience among Cisgender and Transgender Women in Street-Based Sex Work in Baltimore, Maryland. *Women's Health Issues.* 2020.

66. Grieb SD, Flores-Miller A, Sherman SG, Page KR. Syndemic Factors and Resiliency Among Latina Immigrant Indirect Sex Workers in an Emergent Immigrant City. *J Immigr Minor Health.* 2018.

67. Eller LS, Mahat G. Psychological factors in Nepali former commercial sex workers with HIV. *J Nurs Scholarsh.* 2003;35(1):53-60.

68. Vanwesenbeeck I, De Graaf R, Van Zessen G, Straver CJ, Visser JH. [Risky life, risky business: AIDS risk of female prostitutes in the context of early abuse and well-being]. *Gedrag Gezond.* 1993;21(5):219-226.

69.    Ghimire L, Smith WC, van Teijlingen ER, Dahal R, Luitel NP. Reasons for non- use of condoms and self- efficacy among female sex workers: a qualitative study in Nepal. *BMC Womens Health.* 2011;11:42.

70.    Guha M, Baschieri A, Bharat S, et al. Risk reduction and perceived collective efficacy and community support among female sex workers in Tamil Nadu and Maharashtra, India: the importance of context. *J Epidemiol Community Health.* 2012;66 Suppl 2:ii55-61.

71.    Ulibarri MD, Semple SJ, Rao S, et al. History of abuse and psychological distress symptoms among female sex workers in two Mexico-U.S. border cities. *Violence Vict.* 2009;24(3):399-413.

72.    Scorgie F, Nakato D, Harper E, et al. 'We are despised in the hospitals': sex workers' experiences of accessing health care in four African countries. *Cult Health Sex.* 2013;15(4):450-465.

# Chapter 2: HIV and Mental Distress Risk Differs by Co-occurring Structural Vulnerabilities Among Cisgender Female Sex Workers in the United States

Manuscript 1[1]

**Abstract**

**Introduction:** Structural vulnerabilities (SV) help explain elevated risk for health disparities in marginalized populations owing to conflict with social and historical norms, values, and institutions. To date, no research has examined the co-occurrence of SV indicators (e.g., violence, economic strains) and their associated HIV and mental distress risk. Female sex workers (FSW) experience HIV and mental health disparities, yet are understudied, particularly in the U.S.

**Methods:** We recruited 385 FSW in Baltimore, Maryland via a mobile van. Participants completed a survey, HIV rapid test, and self-administered chlamydia and gonorrhea tests. Latent class analysis with distal outcomes was used to group FSW into classes using five SV indicators (unstable housing; financial dependence on someone else; client-perpetrated physical or sexual violence; food insecurity at least weekly) and to determine differences in HIV risk and mental health outcomes (e.g., depression, PTSD, mental distress).

---

[1] This manuscript is formatted to the specifications of the *Journal of the International AIDS Society.*

**Results:** The sample was on average 37 years old and 36% Black; 58% injected drugs in the past six months. HIV prevalence was 5%, with 16% and 18% testing positive for gonorrhea and chlamydia, respectively. A 3-class model fit the data best: *minimal SV* (i.e., low probabilities of all indicators); *material needs* (i.e., housing, food insecurity); and *high SV* (i.e., high probability of all indicators). Compared to *minimal SV*, *high SV* and *materials needs* had significantly greater adjusted probability of drug injection and heroin use, and higher adjusted mean mental distress scores; *high SV* and *material needs* classes did not significantly differ. The *high SV* class had a significantly higher proportion of FSW reporting condomless sex with clients compared to *material needs* and *minimal SV*.

**Conclusions**: Results show the deleterious effect of food and housing insecurities on mental health, substance use, and HIV risk. Urgent structural and policy interventions using a SV perspective are needed to reduce the burden of HIV risk and mental distress among FSW and other vulnerable women populations.

**Introduction**

Female sex workers (FSW) are a diverse population that can be characterized by venue or location of client solicitation (e.g., brothels, street-based, online), by gender that can shape the sex work experience (i.e., transwomen sex workers), motivations for selling sex (e.g., survival, pleasure, etc.), or many other characteristics. One such subgroup of FSW is characterized by a wide range of structural vulnerabilities (SV) including economic, social, and legal difficulties. SV exist when an individual or group's position in society constrains behavior due to conflict with: existing hierarchies defined and ordered by perceived "worthiness;" historically defined norms and ethics; and the medicalization of individual characteristics or life circumstances (i.e., homelessness) that can produce social exclusion and constrain opportunities for optimal health and security (1-6). Whereas structural violence describes the oppression of individuals and communities by largely political and economic forces, SV broadens the scope of structural violence to cultural, physical, or psychological forces of oppression (6).

The disparity between FSW and women who do not sell sex in terms of HIV diagnoses and associated risk has been well-documented, and sex workers remain a key population in HIV prevention (7). A range of SV have been shown to drive HIV risk among FSW. For example, over half of FSW surveyed in Baltimore and Vancouver reported frequent hunger, and a majority of FSW in Baltimore report housing and economic insecurity. In both cases, food and housing insecurities were associated with greater odds of HIV infection and risk behaviors (3, 8-10). In the context of sex work with structurally vulnerable FSW, a unique power imbalance exists between FSW and their clients, who have exchanged a needed resource they hold (e.g., money, drugs, or

secure housing) for sex (11). FSW constrained by lack of economic opportunity such as debt may engage in sex work more frequently to make money, thereby increasing the power imbalance between FSW and paying clients, on whom they rely for income (12). This can also increase potential exposure to violence, a crucial HIV risk for vulnerable FSW, as FSW with fewer resources tend to solicit more clients or are incentivized by clients seeking to engage in riskier behavior for more money (12). An early study by Romans *et al.* found that, compared to age-matched controls, women in sex work were exposed to more physical and sexual abuse from a variety of sources (13). A systematic review of violence among FSW found lifetime prevalence of violence from any perpetrator ranging from 41-65% (14). Because of the illegality or criminalization of sex work in many countries, a power imbalance also exists between FSW and the police; research in Baltimore has found an association between egregious policing practices and client-perpetrated violence (15, 16).

Limited economic opportunity can be both an entrée to and current reality for some FSW, negatively impacting their mental health (17). Depression, anxiety, and related symptoms of mental distress (even sub-clinical thresholds) have been consistently linked to greater HIV risk and HIV-related morbidity and mortality via sexual and parenteral pathways (18-20). Globally, prevalence of mental illness or symptoms of mental distress among FSW is substantially higher than the general female population, including depression (8-16% among U.S. women, 29-86% among FSW) and PTSD (9% among U.S. women, 47-69% among FSW) (17, 21-33). Strains on FSWs' mental health can be intensified by SV including client-perpetrated violence (27, 31, 33-35), police harassment (29), sex work stigma stemming from cultural norms about sexuality (26, 30),

and food insecurity (3, 8); arrest and incarceration can exacerbate homelessness, victimization from police and others, and consequently trauma for FSW (14, 36).

To the extent that they have been studied among FSW, most prior studies have analyzed SV separately rather than considering how they co-occur to impact HIV risk and mental health. A limited number of studies in similar populations have examined how SV or related constructs cluster together. These studies found that high vulnerability groups (compared to low) had greater odds of HIV risk such as sex exchange, drug use, and sexually transmitted infections (STI) (37-39). In the current study we analyze the co-occurrence of SV using latent class analysis (LCA) among an urban sample of FSW to both attempt to replicate these prior findings and extend findings to mental health outcomes. LCA is an analytical technique that uncovers patterns in participants' responses and places participants into mutually exclusive groups, called classes. The classes are said to reflect an unobserved latent construct such as SV. Finally, LCA may better reflect real-world patterns that can be missed when analyzing each variable alone (39). For example, it may be of limited utility to understand the independent effects of housing and food insecurities on health outcomes when, for a significant sub-group of a population, these two insecurities frequently co-occur and their co-occurrence is associated with poorer health outcomes.

We sought to examine meaningful differences between latent classes in terms of HIV risk, substance use and mental health measures. Based on earlier findings, sex exchange and vulnerability share an important relationship: focusing on FSW can identify nuances in structural vulnerability patterns for targeted interventions aimed at reducing salient health disparities in the population such as HIV and mental illness.

**Methods**

The Enabling Mobilization, Empowerment, Risk reduction, And Lasting Dignity
(EMERALD) study is a community-level structural intervention addressing HIV and STI
prevention among FSW (40, 41). Women were recruited via mobile van from 10 areas
throughout Baltimore, identified through geospatial analyses of several potential sex
work indicators such as 911 call data and prostitution/solicitation arrest data (42).
Recruitment areas were also identified in part through information on the sex work
economy gleaned from earlier work on a prospective cohort study of street-based FSW in
Baltimore (9, 40, 43). The structural intervention consists of a drop-in center, SPARC, for
non-male guests that provides services for a wide range of medical, legal, social,
physical, and structural health needs (e.g., case management, reproductive health care,
medication-assisted therapy, mental health care, laundry, showers, safe place to relax).
The intervention area was constituted of the six recruitment areas that bordered the drop-
in center's West Baltimore location; the four other recruitment areas comprised the
control area. A detailed account of the study protocol can be found in Silberzahn *et al*.
(40).

Eligibility criteria for EMERALD included: 1) aged 18 years or older; 2) cisgender
woman; 3) sold or traded oral, vaginal, or anal sex "for money or things like food, drugs,
or favors" at least three times in the past three months. If eligible, women completed an
Audio Computer-Assisted Self-Interview (ACASI) survey, an oral HIV rapid test, and
self-administered swab for gonorrhea and chlamydia. Swabs were sent to the Baltimore
City Health Department for testing. Women were paid a $70 VISA gift card for
completing the baseline visit.

Baseline data (analyzed here) were collected between September 2017 and February 2019. Eligible participants were provided a written copy of the consent form and orally explained the consent form by study staff; participants signed consent forms prior to all study activities. The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Structural Vulnerability Indicators. SV indicators were chosen a priori based on previous literature describing recent (past 6 months) vulnerabilities most salient to FSW: a) unstable housing (living in more than two locations in the past 6 months); b) food insecurity ("going to sleep at night hungry because there was not enough food" at least once per week); c) financial dependence on someone else (including food or housing); d) client-perpetrated physical violence; and e) client-perpetrated sexual violence (6, 37, 38). Violence items were adapted from the Revised Conflict Tactics Scale as adapted for FSWs (44).

Measures. The survey asked questions about personal background including age, race, education, sexual orientation, if women have children under 18 years old, and arrest history. Sex work history included time in sex work, locations where women found clients, if sex work is their only source of income, and condomless sex with clients in the past week (defined as any response other than "always" using condoms with paying clients). We also assessed recent (past 6 months) drug injection and any heroin and powdered or crack cocaine use. Symptoms of depression were assessed with the 9-item Patient Health Questionnaire-9 (alpha=0.90, range=0-27) and symptoms of post-traumatic stress disorder (PTSD) with the 20-item PTSD Patient Checklist (PCL-5) (alpha=0.97, range=0-80) with higher scores indicating greater severity of symptoms (45,

46). Given the high correlation between the PHQ-9 and PCL-5 in our data and between PTSD and depression in the larger literature, we added both scores to create a measure of general mental distress (range: 0-107), following Watson's suggestion when specific symptoms are not the focus of analysis (47). Participants also completed the 12-item Internalized Sex Work Stigma Scale (alpha=0.80, range=12-48), with greater scores indicating greater stigma (41). Social cohesion was measured with a validated 13-item scale with higher scores indicating greater social cohesion (alpha=0.88, range=13-52) (48-50).

Statistical Analysis. There are several benefits of LCA that make it a more appealing strategy than other techniques like higher-order interactions in regression models. With limited statistical power, LCA can produced more conceptually meaningful and less biased results in an efficient way (51). LCA uses a data-driven approach to guide the selection of the best-fitting and most meaningful subgroups, rather than conducting pairwise tests for all combinations of indicators (51). Prior to the LCA enumeration, we imputed scores for any participant missing fewer than 20% of items on the depression, PTSD, social cohesion, and Internalized Sex Work Stigma scales. Imputation was conducted by averaging the values of non-missing data and multiplying by the total number of items of each scale. The appropriate number of latent classes was determined by comparing fit statistics between models in addition to theory and interpretability of results. Model fit was assessed by standard measures, including the Bootstrap Likelihood Ratio Test (BLRT), Vuong-Lo-Mendell-Rubin test (VLMRT), Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), and relative entropy (52-55).

To understand the relationship between latent class and distal outcomes, we used the automatic Three-Step Method and retained BCH weights to account for potential misclassification of participants into latent classes; we used 500 randomly generated starting values to maximize the chance of reaching the global (rather than local) maximum (56). We first ran unadjusted models without covariates between class and outcome and used Wald tests to identify global differences in the outcomes. All variables that were significant in Wald tests (at alpha<0.10 level) were included as covariates in distal outcome models. Models adjusted for age, race, and entering sex work as a minor and exclusive street-based sex work because of their potential confounding with SV (57). We again used Wald tests to identify global differences between classes and model constraints to identify pairwise differences between classes. MPlus8 was used for all analyses.

**Results**

Participants (n=385) were on average 37 years old (standard deviation [SD] = 9.3), 57% White, and 46% had less than a high school education (Table 1). Nearly two-thirds (61%) had at least one child under 18 years old. About one-quarter (22%) entered sex work as a minor (<18 years old), 32% only found clients on the street, and for 26% sex work was their only income source. The sample was also characterized by a high prevalence of recent (past 6 months) substance use: 58% injected any drug; 80% used heroin; and 87% used powdered or crack cocaine. HIV prevalence was 5%, gonorrhea prevalence was 16%, and chlamydia prevalence was 18%.

Nearly three-quarters of the sample (74%) experienced unstable housing, about half (49%) reported financially depending on someone else, and nearly half (48%) reported

food insecurity (Table 1). Recent physical (32%) and sexual (26%) client-perpetrated violence was common.

Fit statistics showed that a three-class model best fit the data (Table 2). BIC and aBIC values were smallest for the three-class model; the BLRT showed that the four-class model did not fit the data any better than the three-class model. The VLMRT showed that a four-class model may have fit the data slightly better, but the smallest class was only 2% of the sample. Based on these fit statistics, as well as substantive interpretation, a three-class model was chosen.

The first latent class, *high structural vulnerability* (HSV), represented 28% of the sample (Figure 1). Women in the HSV class are characterized by high conditional probabilities of most indicators: unstable housing (0.92); physical violence (1.0); sexual violence (0.73); and food insecurity (0.68). The second latent class, *minimal structural vulnerability* (MSV), represented 43% of the sample. This class is characterized by very low conditional probabilities of physical violence (0.09), sexual violence (0.02), and food insecurity (0.0), and slightly higher probabilities of housing insecurity (0.54) and financial dependence (0.44), though these did not meet a threshold for defining the class. The last class, *material needs* (MN), represented 29% of the sample. High conditional probabilities are unstable housing (0.88) and food insecurity (1.00), but very low probabilities of either type of violence.

Wald tests showed unadjusted significant differences between latent classes (Table 3). Significant global differences between classes included: recent condomless sex with clients (p=0.02); injected any drug (p=0.002); used heroin (p=0.002); and powdered or crack cocaine (p=0.003), and greater scores on measures of depressive symptoms

(p<0.001), PTSD (p<0.001), and general mental distress (p<0.001). Wald tests of adjusted means showed significant differences between classes in terms of recent condomless sex with clients (p=0.004); drug injection (p=0.006); heroin use (p=0.002); powdered or crack cocaine use (p=0.02); depression (p<0.001), PTSD (p<0.001), and general mental distress scores (p<0.001) (table 4).

Table 4 shows the estimated probability or mean of each outcome by class, controlling for covariates. Pairwise comparisons showed significant differences between classes HSV and MSV, the classes with the most and fewest structural vulnerability indicators (Table 4). Compared to class MSV, class HSV had greater probability of class members having condomless sex with clients (difference: 0.18, 95% CI: 0.03, 0.32), drug injection (difference: 0.20, 95% CI: 0.07, 0.32), used heroin in the past 6 months (difference: 0.19, 95% CI: 0.08, 0.30), and used powdered or crack cocaine (difference: 0.13, 95% CI: 0.04, 0.22). Participants in class HSV had, on average, higher depression (difference: 3.42, 95% CI: 1.48, 5.35), PTSD (difference: 14.57, 95% CI: 8.97, 20.17), and general mental distress (difference: 18.12, 95% CI: 11.08, 25.16) scores than class MSV. There was only one significant difference between classes HSV and MN, the two classes differentiated by the presence of violent experiences: compared to class MN, class HSV had greater adjusted probability of class members having condomless sex with clients (difference: 0.23, 95% CI: 0.09, 0.36) but no other significant differences.

There were significant adjusted differences in substance use, STI, and mental health variables between class MN and MSV (Table 4). Compared to class MSV, class MN had a significantly greater probability of class members having recently injected any drug (difference: 0.14, 95% CI: 0.02, 0.25), used heroin (difference: 0.15, 95% 0.05, 0.25);

and greater mean depression (difference: 3.56, 95% CI: 1.78, 5.35), PTSD (difference: 10.23, 95% CI: 5.11, 15.35), and general mental distress (difference: 13.83, 95% CI: 7.40, 20.26) scores.

**Discussion**

In a sample of FSW, three distinct patterns of co-occurring structural vulnerabilities emerged, one characterized by high structural vulnerability, one characterized by material needs of food and housing insecurities, and one characterized by minimal structural vulnerability. The high vulnerability and material needs classes had significantly greater burden of mental distress, drug injection, and heroin use than the class with minimal structural vulnerability. These results corroborate prior findings about the association between co-occurring structural factors and HIV risk behaviors but is, to our knowledge, the first to explore the association with mental health outcomes. While there is growing documentation of the prevalence and salience of SV in the health of FSW, using LCA to uncover classes of co-occurring SV reveals heterogeneity within the population and better reflects real-world SV patterns and their health associations rather than attempting to isolate independent effects of each variable (39). Our novel findings are important steps in a line of research recognizing the complexity of structural drivers of mental illness and HIV risk behaviors in service of informing future targeted interventions that minimize both morbidities.

Compared to two prior latent class analyses of structural factors among women at risk of HIV, we found evidence of a third class beyond "high" and "low" structural risk (38, 39). We also found evidence of a third class characterized by only the material needs of food and housing insecurity. One possible reason for this difference is that our sample

size is larger than the others, giving us increased statistical power to detect this additional class. Further, this study is unique in its conceptualization of violence from paying clients as a structural factor and sheds light on further heterogeneity in the population compared to prior published studies. Research has also found that violence and material needs such as housing and food insecurity often co-occur, though the temporality of violence and poverty can be murky (i.e., there may be a bi-directional relationship between violence and economic precarity). Though we found few significant HIV risk behavior, substance use, or mental health differences between classes HSV and MN, fit statistics support these as two distinct classes and not an example of over-extracted classes.

Significant differences in condomless sex with clients, and drug injection reinforce prior findings about the relationship between SV and greater HIV risk (18-20). Our findings also quantify similar findings from people living with HIV in San Francisco, who qualitatively described living at the intersection of housing and food insecurity and its influence on transactional sex without a condom to address these structural needs (58). Living in poverty in resource-rich settings such as Baltimore or San Francisco— particularly as gentrification processes change the urban landscape and push these individuals further into the margins—produces a unique HIV risk environment that is worth further exploring and demands public health attention (59). One important caveat to our findings of HIV risk: while there are no differences between HSV and MN in chlamydia prevalence, there is over 20% greater probability of condomless sex with clients in HSV compared to MN. We believe this finding is likely due to the client-perpetrated violence that characterizes group HSV but is absent from MN; this finding underscores the role that violence plays in condomless sex, one of the most proximal HIV

risk factors. Condom promotion among FSW alone will likely not prevent HIV transmission unless interventions address violence toward FSW and the economic dynamics that co-occur with it.

However, our findings suggest that client-perpetrated violence may not contribute to general distress when combined with the likely presence of other structural factors. We only analyzed client-perpetrated violence, so we cannot draw conclusions about other types of violence FSW may face. Evidence shows that FSW who experience physical or sexual violence are more likely to report mental distress, regardless of sex work venue or geographic location (29, 30, 34, 60). These studies reported the independent main effects of client-perpetrated violence on measures of distress after controlling for covariates, while our results show the relationship of violence to mental health in combination with other structural vulnerabilities. Even so, further research is needed to replicate our findings.

We found differences in depression, PTSD, and mental distress scores, with classes with elevated SV having significantly higher scores compared to the class with minimal SV. However, there were no differences between classes HSV and MN. Taken together, these findings suggest that food and housing instabilities play unique roles in the presence of mental distress and lend support to prior findings showing the detrimental effects of precarious food, housing, and financial resources on mental health strain (61, 62). While there is evidence for an association between food insecurity and greater symptoms of PTSD among FSW, there is little evidence that food or housing insecurity drive unique symptoms of PTSD such as hyperarousal or flashbacks (61, 63). Depression and PTSD are often highly correlated (as they are in our sample) and our significant

48

findings are likely reflecting greater feelings of general mental distress (e.g., perceived helplessness, alienation, disempowerment) rather than specific symptoms of depression or PTSD (47, 64-69). Further, patterns of significant differences in terms of drug injection and heroin and crack cocaine use mirror those of mental health outcomes in adjusted analyses. These results may lend support to the multiple risk factor model of mental illness and substance use, which suggests that individuals use psychoactive substances to alleviate both symptoms of mental illness and general dysphoria, including depression, boredom, or loneliness (70). Improvements in SV for marginalized populations such as FSW may improve mental health, substance use, and HIV risk and their intersections, but future research should examine the long-term impact of SV on changes in general mental distress and substance use, including research on how SV and their co-occurrence may also serve as barriers to health care-seeking.

Policies and interventions aimed at improving mental health and HIV prevention must make addressing co-occurring structural factors an integral part of their design. Often interventions with FSW aimed at HIV prevention focus on individual-level behavior change such as condom use or syringe sharing (71). This is not unique to HIV prevention or work with FSW; public health policy broadly in the U.S. has focused on individualism, reflecting cultural and political values (72). However, our results (among others) show that individual-level behaviors are influenced by structural context; ignoring these structural factors in health promotion interventions risks overlooking the root causes of HIV and mental health inequities (71). Given the complex relationship between these factors and the breadth of their reach across many aspects of people's lives, public health solutions to improving mental health will require shifting thought from the top of

the Health Impact Pyramid (i.e., counseling and education) to the base (i.e., socioeconomic factors).

Legislation and policies in Baltimore and other (particularly urban) locations in the U.S. should increase access to housing, food, and safety in ways that acknowledge that structural harms do not exist in isolation. Given the co-occurring nature of housing and food insecurity, policies in the United States and beyond should address these in tandem for maximum benefit; interventions aimed at minimizing food insecurity are targeted and potentially effective primary and secondary prevention of mental illness and HIV in structurally vulnerable populations such as this sample of FSW, but may be limited in their effectiveness if secure housing and safety are not also addressed concurrently (73-75). More broadly, FSW may benefit in part from better access to licit sources of income via policies that can support funding for small businesses to support hiring or poverty alleviation programs in low-income areas. Sex work decriminalization is crucial to begin addressing the complex nature of co-occurring SV that we have shown FSW experience (15, 76, 77). Though decriminalizing sex work cannot fix all structural impediments FSW face, FSW in countries where sex work is legal or decriminalized have formed advocacy organizations and unions to demand more equitable treatment (78, 79).

Our findings should be understood in light of several limitations. First, our findings are not meant to represent all FSW, and they should not be read as such. Data were collected in the U.S., where sex work is illegal. Our sample was also recruited from street settings via a mobile van; though we accepted any FSW regardless of sex work venue, we had very few women (<10%) who did not find clients on the street, a type of FSW that has been shown to experience SV more commonly than FSW finding clients in

exotic dance clubs or online, for example. Second, data are cross-sectional, and we therefore cannot establish the directionality of findings. Third, data are all self-report including measures of depression and PTSD. However, we used the PHQ-9 and PCL-5, two measures well-validated measures used in clinical settings.

**Conclusions**

This study explores co-occurring structural vulnerabilities in a sample of FSW in Baltimore, Maryland that report experiencing many. Our findings provide nuance to the concept of SV in this population, showing the unique roles that food and housing insecurity and violence play in mental illness and HIV risk. These findings, while showing the complexity of co-occurring SV and their relationships to HIV risk and mental distress, also show the potential promise of HIV and mental illness prevention when employing a SV framework.

## References

1. Shannon K, Goldenberg SM, Deering KN, Strathdee SA. HIV infection among female sex workers in concentrated and high prevalence epidemics: why a structural determinants framework is needed. Curr Opin HIV AIDS. 2014;9(2):174-82.

2. Shannon K, Strathdee SA, Goldenberg SM, Duff P, Mwangi P, Rusakova M, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. Lancet. 2015;385(9962):55-71.

3. Lim S, Park JN, Kerrigan DL, Sherman SG. Severe Food Insecurity, Gender-Based Violence, Homelessness, and HIV Risk among Street-based Female Sex Workers in Baltimore, Maryland. AIDS Behav. 2019;23(11):3058-63.

4. Footer KH, Silberzahn BE, Tormohlen KN, Sherman SG. Policing practices as a structural determinant for HIV among sex workers: a systematic review of empirical findings. J Int AIDS Soc. 2016;19(4 Suppl 3):20883.

5. Footer KHA, Lim S, Brantley MR, Sherman SG. Structural risk and limits on agency among exotic dancers: HIV risk practices in the exotic dance club. Cult Health Sex. 2018;20(3):321-34.

6. Quesada J, Hart LK, Bourgois P. Structural vulnerability and health: Latino migrant laborers in the United States. Med Anthropol. 2011;30(4):339-62.

7. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. Lancet Infect Dis. 2012;12(7):538-49.

8. Barreto D, Shannon K, Taylor C, Dobrer S, Jean JS, Goldenberg SM, et al. Food Insecurity Increases HIV Risk Among Young Sex Workers in Metro Vancouver, Canada. AIDS and Behavior. 2017;21(3):734-44.

9. Sherman SG, Park JN, Galai N, Allen ST, Huettner SS, Silberzahn BE, et al. Drivers of HIV infection among cisgender and transgender female sex worker populations in Baltimore city: Results from the SAPPHIRE study. J Acquir Immune Defic Syndr. 2019.

10. Decker MR, Tomko C, Wingo E, Sawyer A, Peitzmeier S, Glass N, et al. A brief, trauma-informed intervention increases safety behavior and reduces HIV risk for drug-involved women who trade sex. BMC Public Health. 2017;18(1):75.

11. McGuffin P, Katz R, Bebbington P. Hazard, heredity and depression. A family study. J Psychiatr Res. 1987;21(4):365-75.

12. Shannon K, Kerr T, Allinott S, Chettiar J, Shoveller J, Tyndall MW. Social and structural violence and power relations in mitigating HIV risk of drug-using women in survival sex work. Soc Sci Med. 2008;66(4):911-21.

13.     Romans SE, Potter K, Martin J, Herbison P. The mental and physical health of female sex workers: a comparative study. Aust N Z J Psychiatry. 2001;35(1):75-80.

14. Deering KN, Amin A, Shoveller J, Nesbitt A, Garcia-Moreno C, Duff P, et al. A systematic review of the correlates of violence against sex workers. Am J Public Health. 2014;104(5):e42-54.

15. Footer KH, Silberzahn BE, Tormohlen KN, Sherman SG. Policing practices as a structural determinant for HIV among sex workers: a systematic review of empirical findings. Journal of the International AIDS Society. 2016;19:20883.

16. Footer KHA, Park JN, Allen ST, Decker MR, Silberzahn BE, Huettner S, et al. Police-Related Correlates of Client-Perpetrated Violence Among Female Sex Workers in Baltimore City, Maryland. Am J Public Health. 2019;109(2):289-95.

17. Suresh G, Furr LA, Srikrishnan AK. An assessment of the mental health of street-based sex workers in Chennai, India. Journal of Contemporary Criminal Justice. 2009;25(2):186-201.

18. Ickovics JR, Hamburger ME, Vlahov D, Schoenbaum EE, Schuman P, Boland RJ, et al. Mortality, CD4 cell count decline, and depressive symptoms among HIV-seropositive women: longitudinal analysis from the HIV Epidemiology Research Study. JAMA. 2001;285(11):1466-74.

19.     Springer SA, Dushaj A, Azar MM. The impact of DSM-IV mental disorders on adherence to combination antiretroviral therapy among adult persons living with HIV/AIDS: a systematic review. AIDS Behav. 2012;16(8):2119-43.

20. Williamson TJ, Mahmood Z, Kuhn TP, Thames AD. Differential relationships between social adversity and depressive symptoms by HIV status and racial/ethnic identity. Health Psychology. 2017;36(2):133.

21. Breslau N, Kessler RC, Chilcoat HD, Schultz LR, Davis GC, Andreski P. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. Arch Gen Psychiatry. 1998;55(7):626-32.

22. Alegria M, Vera M, Freeman DH, Jr., Robles R, Santos MC, Rivera CL. HIV infection, risk behaviors, and depressive symptoms among Puerto Rican sex workers. Am J Public Health. 1994;84(12):2000-2.

23. Gunn JK, Roth AM, Center KE, Wiehe SE. The Unanticipated Benefits of Behavioral Assessments and Interviews on Anxiety, Self-Esteem and Depression Among Women Engaging in Transactional Sex. Community Ment Health J. 2016;52(8):1064-9.

24. Surratt HL, Kurtz SP, Weaver JC, Inciardi JA. The connections of mental health problems, violent life experiences, and the social milieu of the "stroll" with the HIV risk

behaviors of female street sex workers. Journal of Psychology & Human Sexuality. 2005;17(1-2):23-44.

25.     Rossler W, Koch U, Lauber C, Hass AK, Altwegg M, Ajdacic-Gross V, et al. The mental health of female sex workers. Acta Psychiatr Scand. 2010;122(2):143-52.

26.     Hong Y, Fang X, Li X, Liu Y, Li M, Tai-Seale T. Self-perceived stigma, depressive symptoms, and suicidal behaviors among female sex workers in China. J Transcult Nurs. 2010;21(1):29-34.

27.     Sagtani RA, Bhattarai S, Adhikari BR, Baral D, Yadav DK, Pokharel PK. Violence, HIV risk behaviour and depression among female sex workers of eastern Nepal. BMJ Open. 2013;3(6).

28.     Puri N, Shannon K, Nguyen P, Goldenberg SM. Burden and correlates of mental health diagnoses among sex workers in an urban setting. BMC Womens Health. 2017;17(1):133.

29.     Patel SK, Ganju D, Prabhakar P, Adhikary R. Relationship between mobility, violence and major depression among female sex workers: a cross-sectional study in southern India. BMJ open. 2016;6(9):e011439.

30.     Gu J, Lau JT, Li M, Li H, Gao Q, Feng X, et al. Socio-ecological factors associated with depression, suicidal ideation and suicidal attempt among female injection drug users who are sex workers in China. Drug Alcohol Depend. 2014;144:102-10.

31.     Farley M, Cotton A, Lynne J, Zumbeck S, Spiwak F, Reyes ME, et al. Prostitution and trafficking in nine countries: An update on violence and posttraumatic stress disorder. Journal of trauma practice. 2004;2(3-4):33-74.

32.     Roxburgh A, Degenhardt L, Copeland J. Posttraumatic stress disorder among female street-based sex workers in the greater Sydney area, Australia. BMC Psychiatry. 2006;6:24.

33.     Park JN, Decker MR, Bass JK, Galai N, Tomko C, Jain KM, et al. Cumulative violence and PTSD symptom severity among urban street-based female sex workers. Journal of interpersonal violence. 2019:0886260519884694.

34.     Hong Y, Zhang C, Li X, Liu W, Zhou Y. Partner violence and psychosocial distress among female sex workers in China. PLoS One. 2013;8(4):e62290.

35.     Ulibarri MD, Semple SJ, Rao S, Strathdee SA, Fraga-Vallejo MA, Bucardo J, et al. History of abuse and psychological distress symptoms among female sex workers in two Mexico-U.S. border cities. Violence Vict. 2009;24(3):399-413.

36.     Inciardi JA, Surratt HL. Drug use, street crime, and sex-trading among cocaine-dependent women: implications for public health and criminal justice policy. J Psychoactive Drugs. 2001;33(4):379-89.

37.     Brantley ML, Footer KHA, Lim S, Kerrigan D, Sherman SG. Experiences of structural vulnerability among exotic dancers in Baltimore, Maryland: Co-occurring social and economic antecedents of HIV/STI risk. Int J Drug Policy. 2017;50:74-81.

38.     Brantley ML, Kerrigan D, German D, Lim S, Sherman SG. Identifying Patterns of Social and Economic Hardship Among Structurally Vulnerable Women: A Latent Class Analysis of HIV/STI Risk. AIDS Behav. 2017;21(10):3047-56.

39.     German D, Latkin CA. Social stability and HIV risk behavior: evaluating the role of accumulated vulnerability. AIDS Behav. 2012;16(1):168-78.

40.     Silberzahn BE, Tomko C, Clouse E, Haney K, Nestadt DF, Galai N, et al. An evaluation of a community-based combination HIV prevention intervention for female sex workers (FSW) in Baltimore, Maryland: The EMERALD study design and cohort description. Manuscript in preparation. 2020.

41.     Tomko C, Nestadt DF, Rouhani S, Silberzahn BE, Haney K, Park JN, et al. Confirmatory Factor Analysis and Construct Validity of the Internalized Sex Work Stigma

Scale among a Cohort of Cisgender Female Sex Workers in Baltimore, Maryland, United States. The Journal of Sex Research. 2020:1-11.

42.     Allen ST, Footer KHA, Galai N, Park JN, Silberzahn B, Sherman SG. Implementing Targeted Sampling: Lessons Learned from Recruiting Female Sex Workers in Baltimore, MD. J Urban Health. 2018.

43.     Silberzahn BE, Morris MB, Riegger KE, White RH, Tomko CA, Park JN, et al. Barriers and facilitators to retaining a cohort of street-based cisgender female sex workers recruited in Baltimore, Maryland, USA: results from the SAPPHIRE study. BMC Public Health. 2020;20:1-12.

44.     Straus MA, Douglas EM. A short form of the Revised Conflict Tactics Scales, and typologies for severity and mutuality. Violence Vict. 2004;19(5):507-20.

45.     Weathers FW LB, Herman D, Huska J, Keane T. The PTSD checklist-civilian version (PCL-C). Boston, MA: National Center for PTSD; 1994.

46.     Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606-13.

47.     Watson D. Differentiating the mood and anxiety disorders: a quadripartite model. Annu Rev Clin Psychol. 2009;5:221-47.

48.     Fonner VA, Kerrigan D, Mnisi Z, Ketende S, Kennedy CE, Baral S. Social cohesion, social participation, and HIV related risk among female sex workers in Swaziland. PloS one. 2014;9(1):e87527.

49.     Lippman SA, Donini A, Diaz J, Chinaglia M, Reingold A, Kerrigan D. Social-environmental factors and protective sexual behavior among sex workers: the Encontros intervention in Brazil. Am J Public Health. 2010;100 Suppl 1:S216-23.

50.     Kerrigan D, Telles P, Torres H, Overs C, Castle C. Community development and HIV/STI-related vulnerability among female sex workers in Rio de Janeiro, Brazil. Health education research. 2008;23(1):137-45.

51.     Lanza ST, Rhoades BL. Latent class analysis: an alternative perspective on subgroup analysis in prevention and treatment. Prev Sci. 2013;14(2):157-68.

52.     Akaike H. Factor analysis and AIC.  Selected Papers of Hirotugu Akaike: Springer; 1987. p. 371-86.

53.     Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. Structural equation modeling. 2007;14(4):535-69.

54.     Lo Y, Mendell NR, Rubin DB. Testing the number of components in a normal mixture. Biometrika. 2001;88(3):767-78.

55.     Schwartz S, Papworth E, Thiam-Niangoin M, Abo K, Drame F, Diouf D, et al. An urgent need for integration of family planning services into HIV care: the high burden of unplanned pregnancy, termination of pregnancy, and limited contraception use among female sex workers in Cote d'Ivoire. J Acquir Immune Defic Syndr. 2015;68 Suppl 2:S91-8.

56.     Asparouhov T, Muthén B. Auxiliary variables in mixture modeling: Using the BCH method in Mplus to estimate a distal outcome model and an arbitrary secondary model. Mplus Web Notes. 2014;21(2):1-22.

57.     Footer KH, White RH, Park JN, Decker MR, Lutnick A, Sherman SG. Entry to Sex Trade and Long-Term Vulnerabilities of Female Sex Workers Who Enter the Sex Trade Before the Age of Eighteen. Journal of Urban Health. 2020:1-12.

58.     Whittle HJ, Palar K, Napoles T, Hufstedler LL, Ching I, Hecht FM, et al. Experiences with food insecurity and risky sex among low-income people living with HIV/AIDS in a resource-rich setting. J Int AIDS Soc. 2015;18:20293.

59.     Whittle HJ, Palar K, Hufstedler LL, Seligman HK, Frongillo EA, Weiser SD. Food insecurity, chronic illness, and gentrification in the San Francisco Bay Area: An example of structural violence in United States public policy. Soc Sci Med. 2015;143:154-61.

60.     Ulibarri MD, Hiller SP, Lozada R, Rangel MG, Stockman JK, Silverman JG, et al. Prevalence and characteristics of abuse experiences and depression symptoms among injection drug-using female sex workers in Mexico. J Environ Public Health. 2013;2013:631479.

61.     Whittle HJ, Sheira LA, Wolfe WR, Frongillo EA, Palar K, Merenstein D, et al. Food insecurity is associated with anxiety, stress, and symptoms of posttraumatic stress disorder in a cohort of women with or at risk of HIV in the United States. J Nutr. 2019;149(8):1393-403.

62.     Nagata JM, Palar K, Gooding HC, Garber AK, Whittle HJ, Bibbins-Domingo K, et al. Food Insecurity Is Associated With Poorer Mental Health and Sleep Outcomes in Young Adults. J Adolesc Health. 2019;65(6):805-11.

63.     Golin CE, Haley DF, Wang J, Hughes JP, Kuo I, Justman J, et al. Post-traumatic Stress Disorder Symptoms and Mental Health over Time among Low-Income Women at Increased Risk of HIV in the U.S. J Health Care Poor Underserved. 2016;27(2):891-910.

64.     Heflin CM, Siefert K, Williams DR. Food insufficiency and women's mental health: findings from a 3-year panel of welfare recipients. Soc Sci Med. 2005;61(9):1971-82.

65.     Siefert K, Heflin CM, Corcoran ME, Williams DR. Food insufficiency and physical and mental health in a longitudinal survey of welfare recipients. J Health Soc Behav. 2004;45(2):171-86.

66.     Siefert K, Heflin CM, Corcoran ME, Williams DR. Food insufficiency and the physical and mental health of low-income women. Women Health. 2001;32(1-2):159-77.

67.     Palar K, Frongillo EA, Escobar J, Sheira LA, Wilson TE, Adedimeji A, et al. Food Insecurity, Internalized Stigma, and Depressive Symptoms Among Women Living with HIV in the United States. AIDS Behav. 2018;22(12):3869-78.

68.     Palar K, Kushel M, Frongillo EA, Riley ED, Grede N, Bangsberg D, et al. Food Insecurity is Longitudinally Associated with Depressive Symptoms Among Homeless and Marginally-Housed Individuals Living with HIV. AIDS Behav. 2015;19(8):1527-34.

69.     Whittle HJ, Leddy AM, Shieh J, Tien PC, Ofotokun I, Adimora AA, et al. Precarity and health: Theorizing the intersection of multiple material-need insecurities, stigma, and illness among women in the United States. Soc Sci Med. 2020;245:112683.

70.     Mueser KT, Drake RE, Wallach MA. Dual diagnosis: a review of etiological theories. Addictive behaviors. 1998;23(6):717-34.

71.     Blankenship KM, Friedman SR, Dworkin S, Mantell JE. Structural interventions: concepts, challenges and opportunities for research. Journal of Urban Health. 2006;83(1):59-72.

72.     Baum F, Fisher M. Why behavioural health promotion endures despite its failure to reduce health inequities. Sociol Health Illn. 2014;36(2):213-25.

73.     Mamlin J, Kimaiyo S, Lewis S, Tadayo H, Jerop FK, Gichunge C, et al. Integrating nutrition support for food-insecure patients and their dependents into an HIV care and treatment program in Western Kenya. American journal of public health. 2009;99(2):215-21.

74.     Cantrell RA, Sinkala M, Megazinni K, Lawson-Marriott S, Washington S, Chi BH, et al. A pilot study of food supplementation to improve adherence to antiretroviral therapy among food insecure adults in Lusaka, Zambia. Journal of acquired immune deficiency syndromes (1999). 2008;49(2).

75.     Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, et al. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. Am J Clin Nutr. 2011;94(6):1729S-39S.

76.     Decker MR, Crago AL, Chu SK, Sherman SG, Seshu MS, Buthelezi K, et al. Human rights violations against sex workers: burden and effect on HIV. Lancet. 2015;385(9963):186-99.

77.     Kaufman MR, Harman JJ, Menger LM, Shrestha DK. Understanding the experiences and needs of female commercial sex workers in Kathmandu, Nepal. Health Care Women Int. 2016;37(8):872-88.

78.     Weitzer R. Resistance to sex work stigma. Sexualities. 2018;21(5-6):717-29.

79.     Armstrong L. Stigma, decriminalisation, and violence against street-based sex workers: Changing the narrative. Sexualities. 2019;22(7-8):1288-308.

**Table 1**. Background characteristics and structural vulnerability indicators in a sample of female sex workers in Baltimore, Maryland (n=385)

| Variables | Total (n=385) |
|---|---|
| | N (%) |
| **Demographics** | |
| Age, years *(mean, SD)* | 37.0 (9.3) |
| Race | |
| *White* | 218 (56.6) |
| *Black* | 139 (36.1) |
| *Other race* | 28 (7.3) |
| Education | |
| *Less than high school graduate* | 177 (46.0) |
| *High school graduate or GED* | 96 (24.9) |
| *Some college or greater* | 112 (29.1) |
| Sexual orientation [‡] | |
| *Heterosexual/"straight"* | 260 (67.7) |
| *Lesbian/Queer/Same gender loving* | 24 (6.3) |
| *Bisexual* | 100 (26.0) |
| Has children under 18 | 233 (60.5) |
| Ever arrested | 314 (81.6) |
| **Sex work history and context** | |
| Time in sex work, years *(mean, SD)* [‡] | 13.2 (9.5) |
| Found clients[†]: | |
| *Street-based only* | 124 (32.2) |
| *Street and/or venue-based* | 261 (67.8) |
| Sex work only source of income[†] | 99 (25.7) |

| | |
|---|---|
| Condomless sex with clients, past week | 174 (45.2) |
| **Substance use[†]** | |
| Injected any drug | 223 (57.9) |
| Used heroin | 309 (80.3) |
| Used powdered or crack cocaine | 334 (86.8) |
| **Sexually transmitted infection results** | |
| Positive HIV rapid test | 20 (5.2) |
| Positive gonorrhea [§] | 59 (15.7) |
| Positive chlamydia [§] | 68 (18.1) |
| **Psychosocial characteristics** *(mean, SD)* | |
| Depression score[§] | 11.6 (7.3) |
| Post-traumatic stress score [§] | 33.2 (21.3) |
| General mental distress | 45.2 (26.6) |
| Social cohesion [§] | 29.0 (6.3) |
| Internalized sex work stigma [§] | 34.8 (5.8) |
| **Structural vulnerability indicators[†]** | |
| Unstable housing | 283 (74.3) |
| Financial dependence on someone else | 188 (48.8) |
| Client-perpetrated physical violence | 123 (31.9) |
| Client-perpetrated sexual violence | 99 (25.8) |
| Food insecurity | 183 (47.8) |

Note: [†]past 6 months; [‡] <1% missing data; [§] <5% data missing

**Table 2**. **Fit indices of number of structural vulnerability latent classes (k) in a sample of female sex workers in Baltimore, Maryland (n=385)**

| k | Log-likelihood | AIC | BIC | aBIC | VLMRT | BLRT | Entropy | Smallest class |
|---|---|---|---|---|---|---|---|---|
| 1 | -1209.4 | 2428.9 | 2448.6 | 2432.8 | n/a | n/a | n/a | n/a |
| 2 | -1115.6 | 2253.2 | 2296.7 | 2261.8 | <.0001 | <.0001 | 0.78 | 32% |
| 3 | -1091.3 | 2216.5 | *2283.7* | *2229.8* | <.0001 | *<.0001* | *0.96* | *28%* |
| 4 | *-1084.7* | *2215.4* | 2306.3 | 2233.3 | *0.02* | 0.27 | 0.95 | 2% |

Legend: K = no. of classes; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; aBIC= sample-size adjusted BIC; VLMRT = Vuong-Lo-Mendell-Rubin Test; BLRT = Bootstrap Likelihood Ratio Test

Note: italicized text indicates preferred values for each fit index.

**Table 3**. Unadjusted proportion of demographics and relevant variables stratified by latent class, in a sample of female sex workers in Baltimore, Maryland (n=385)

| | Latent Classes | | | Wald test |
|---|---|---|---|---|
| | **High Structural Vulnerability (n=107)** | **Minimal Structural Vulnerability (n=167)** | **Material Needs (n=111)** | ***p*** |
| | %‡ | %‡ | %‡ | |
| Age, years (*mean, standard error*) | 35.7 (0.9) | 38.1 (0.8) | 36.7 (0.9) | 0.12 |
| Race | | | | |
| *White* | 61.7 | 51.4 | 59.5 | 0.51 |
| *Black* | 31.3 | 42.3 | 31.5 | |
| *Other race* | 7.1 | 6.3 | 9.0 | |
| Education | | | | |
| *Less than high school graduate* | 47.4 | 46.8 | 43.2 | 0.82 |
| *High school graduate or GED* | 19.6 | 25.2 | 29.7 | |
| *Some college or greater* | 33.0 | 27.9 | 27.0 | |
| Has kids under 18 | 60.8 | 58.6 | 63.1 | 0.76 |
| **Sex work history and context** | | | | |
| Years in sex work (*mean, standard error*) | 13.4 (1.0) | 13.5 (0.7) | 12.6 (0.9) | 0.73 |

| | | | | |
|---|---|---|---|---|
| Found clients:[†] | | | | |
| *Street and/or venue-based* | 71.3 | 65.7 | 67.6 | 0.66 |
| *Street-based only* | 28.7 | 34.3 | 32.4 | |
| Sex work only source of income[†] | 28.3 | 20.7 | 30.6 | 0.15 |
| Condomless sex with clients, past week | 60.0 | 41.3 | 36.9 | **0.02** |
| **Substance use**[†] | | | | |
| Injected any drug | 71.1 | 45.9 | 63.1 | **0.002** |
| Used heroin | 89.6 | 70.0 | 86.5 | **0.002** |
| Used powdered or crack cocaine | 93.0 | 81.7 | 88.3 | **0.03** |
| **Sexually transmitted infections** | | | | |
| Positive chlamydia | 20.7 | 12.8 | 23.6 | 0.06 |
| Positive gonorrhea | 21.7 | 12.2 | 15.5 | 0.18 |
| **Psychosocial characteristics (*mean, standard error*)** | | | | |
| Depression score | 13.2 (0.7) | 9.6 (0.6) | 13.3 (0.7) | **<0.001** |
| Post-traumatic stress score | 41.6 (2.1) | 26.3 (1.7) | 36.8 (1.9) | **<0.001** |
| General mental distress score | 54.9 (2.6) | 35.8 (2.1) | 50.0 (2.3) | **<0.001** |
| Social cohesion | 29.0 (0.7) | 28.8 (0.5) | 29.2 (0.5) | 0.87 |
| Internalized sex work stigma | 35.2 (0.5) | 34.1 (0.5) | 35.3 (0.5) | 0.17 |

Note: [†]past 6 months; [‡] unless otherwise noted

**Table 4**. Adjusted global and pairwise differences of key HIV, substance use and mental health variables between latent classes in a sample of female sex workers in Baltimore, Maryland (n=385)

| | Adjusted probability | | | | Pairwise adjusted probability difference (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HSV | MSV | MN | *p* | HSV v. MSV | *p* | HSV v. MN | *p* | MN vs. MSV | *p* |
| Condomless sex with clients[a] | 0.60 | 0.42 | 0.37 | 0.004 | 0.18 (0.03, 0.32) | 0.015 | 0.23 (0.09, 0.36) | 0.001 | -0.05 (-0.18, 0.07) | 0.42 |
| Positive chlamydia test[a] | 0.20 | 0.13 | 0.23 | 0.12 | 0.07 (-0.04, 0.18) | 0.23 | -0.04 (-0.15, 0.07) | 0.52 | 0.10 (0.00, 0.20) | 0.04 |
| Injected any drug[b] | 0.71 | 0.47 | 0.64 | 0.006 | 0.20 (0.07, 0.32) | 0.002 | 0.06 (-0.06, 0.18) | 0.33 | 0.14 (0.02, 0.25) | 0.02 |
| Used heroin[b] | 0.90 | 0.69 | 0.88 | 0.002 | 0.19 (0.08, 0.30) | 0.001 | 0.04 (-0.05, 0.13) | 0.44 | 0.15 (0.05, 0.25) | 0.002 |
| Used powdered or crack cocaine[b] | 0.94 | 0.81 | 0.89 | 0.02 | 0.13 (0.04, 0.22) | 0.006 | 0.06 (-0.03, 0.14) | 0.18 | 0.08 (-0.02, 0.17) | 0.10 |
| | Adjusted mean | | | | Pairwise adjusted probability difference (95% CI) | | | | | |
| | HSV | MSV | MN | *p* | HSV v. MSV | *p* | HSV v. MN | *p* | MN vs. MSV | *p* |
| Depression score[c] | 13.22 | 9.55 | 13.25 | <0.001 | 3.42 (1.48, 5.35) | 0.001 | -0.15 (-2.14, 1.85) | 0.89 | 3.56 (1.78, 5.35) | <0.001 |
| Post-traumatic stress score[c] | 41.54 | 26.28 | 36.75 | <0.001 | 14.57 (8.97, 20.17) | <0.001 | 4.34 (-1.07, 9.75) | 0.12 | 10.23 (5.11, 15.35) | <0.001 |
| General mental distress score[c] | 54.81 | 35.78 | 49.96 | <0.001 | 18.12 (11.08, 25.16) | <0.001 | 4.29 (-2.54, 11.11) | 0.22 | 13.83 (7.40, 20.26) | <0.001 |

Note: All models adjusted for age, race, and entering sex work as a minor. HSV = high structural vulnerability; MSV = minimal structural vulnerability; MN = material needs

[a]Also adjusted for drug injection, crack cocaine use, and mental distress

[b]Also adjusted for mental distress

[c]Also adjusted for drug injection and crack cocaine use

**Figure 2**. **Conditional probabilities of structural vulnerability indicators in a sample of female sex workers in Baltimore, Maryland (n=385)**
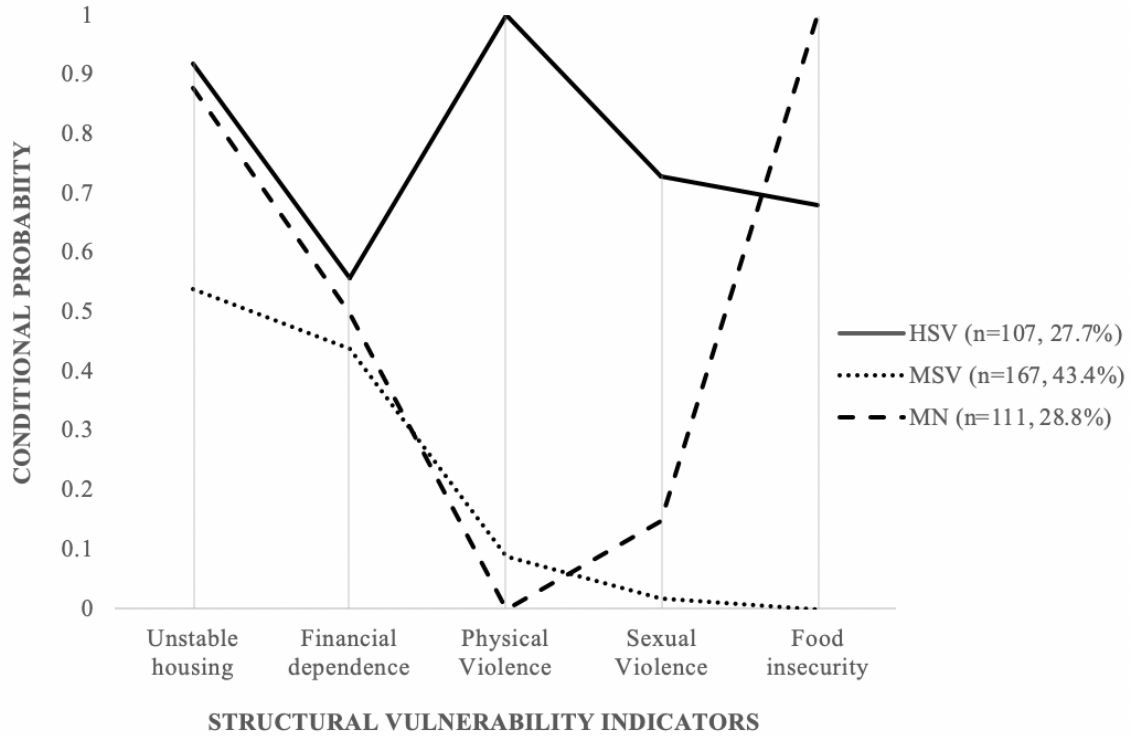


Note: HSV = high structural vulnerability; MSV = minimal structural

vulnerability; MN = material needs

# Chapter 3: Predicting 12-Month Mental Distress Among Female Sex Workers by Co-occurring Structural Vulnerabilities and Resilience: A Latent Class Analysis with Distal Outcome and Effect Modification

Manuscript 2

**Abstract**

**Introduction:** Female sex workers (FSW) experience significant mental distress. Structural vulnerabilities (SV) (i.e., structural factors that constrain marginalized populations' opportunity for optimal health) play important roles in the etiology of mental distress, but no research has examined the longitudinal relationship between co-occurring SV and mental distress. We also consider the potential moderating role of internal resilience in this relationship.

**Methods:** We recruited 385 FSW in Baltimore, Maryland via a mobile van and followed up with the cohort at 6- and 12-months post-baseline. The outcome of interest, mental distress, combines measures of depressive (PHQ-9) and post-traumatic stress (PCL-5) symptoms and was measured at baseline and 12-months. Using five latent class indicators (unstable housing; financial dependence on someone else; client-perpetrated physical, sexual violence; food insecurity at least weekly) we previously determined a 3-class model: *minimal SV* (i.e., low probabilities of all indicators); *material needs* (i.e., housing, food insecurity); and *high SV* (i.e., high probability of all indicators). To account for loss-to-follow-up, we then performed multiple imputation producing 10 datasets for an analytical sample of n=369. Using averaged data across these 10 datasets, latent class

analysis with distal outcomes was used to predict changes in mental distress over 12-months by latent class, controlling for covariates including baseline mental distress score. A second analysis tested whether the Connor-Davidson Resilience Scale (measured at 6-months) was an effect modifier on this relationship by allowing regression coefficients to vary between classes.

**Results:** At baseline, the sample was on average 37 years old and 43% Black or Person of Color; 59% injected drugs in the past six months. Unadjusted mental distress score (possible range: 0-60) was 38 at baseline and 34 at 12-months. In adjusted analyses, there were no significant global ($p$=0.53) or pairwise differences (*HSV vs. MSV*: $p$=0.26, *MN vs. MSV*: $p$=0.58) in changes to mental distress score by latent class. Baseline mental distress was the only significant predictor of 12-month mental distress ($\beta$ =0.39, 95% Confidence Interval= 0.27-0.51). The average resilience score was 22 (possible range: 0-40); we did not find evidence that resilience moderated the relationship between latent class and changes to mental distress.

**Conclusions**: Levels of mental distress in FSW were high at baseline and remained high 12 months later, suggesting significant need for interventions to improve FSW mental health. There was no indication that internal resilience can improve this relationship, as structural inequities are deeply entrenched and require structural solutions.

**Introduction**

Globally, female sex workers (FSW) bear a high burden of mental distress and poor mental health. The prevalence of depression and post-traumatic stress disorder (PTSD) in female sex workers is estimated at 29-82% and 21-68%, respectively.[1-11] For both of these disorders, these estimates are much higher than those of general female population in the United States (estimated at 8-16% for depression and 10% for post-traumatic stress).[12-16] Understanding mechanisms of mental distress and illness among FSW is critical to prevention and reduction of this disparity.

Nearly three decades of research shows that, for marginalized populations around the world such as FSW, exposure to structural vulnerabilities are implicated in the etiology of mental disorders.[17] Structural vulnerabilities exist when an individual or group's position in society constrains behavior due to conflict with: existing hierarchies defined and ordered by perceived "worthiness;" historically defined norms and ethics; and the medicalization of individual characteristics or life circumstances (i.e., homelessness) that can produce social exclusion and constrain opportunities for optimal health and security.[18-23] Two examples of structural vulnerabilities, food and housing insecurities, can increase anxiety, hopelessness, and erode physical health that can then exacerbate physical effects of mental disorders. Income insecurity (e.g., financial dependence, lack of regular income) is also associated with feelings of hopelessness, anxiety and fear, social marginalization because of poverty stigma and guilt.[17] In the case of FSW, violence from paying clients—already subject to a power imbalance given the transactional nature of the relationship partly reflected in gender dynamics with male clients— is associated with fear, loss of agency or sense of control, and helplessness.[17]

Relatedly, greater gender inequity as a social condition has also shown to manifest in elevated prevalence of depressive symptoms, with this relationship particularly pronounced for low-income women.[24,25] Specifically among FSW and other women at risk of HIV infection, lack of economic resources including food and housing insecurity, frequency and severity of violence, and arrest and criminalization of sex work have been associated with depression and PTSD. [4,5,9,26-30]

Many FSW experience high rates of these vulnerabilities, yet little data exists in this population about how these may co-exist and the attendant effect on FSW mental health. Prior research has largely concerned populations similar to FSW, including women living with or at risk of HIV infection and low-income women.[31,32] An early study of low-income women found that the presence of food insecurity and housing insecurity are both associated with greater risk of depressive symptoms compared to each insecurity alone.[33] In a longitudinal study of co-occurring food and housing insecurities, presence of food insecurity was associated with greater depressive symptoms and greater odds of probably clinically-significant depression compared to those who did not experience food insecurity in a sample of homeless individuals living with HIV.[34]

In a prior analysis of 385 FSW in Baltimore, we used five structural vulnerability indicators (housing insecurity, food insecurity, financial dependence on someone else, client-perpetrated physical or sexual violence) to understand how they may co-occur. Three distinct classes of structural vulnerability characterized the sample: *minimal SV* (i.e., low probabilities of all indicators); *material needs* (i.e., housing, food insecurity); and *high SV* (i.e., high probability of all indicators). Adjusted models showed significantly higher prevalence of heroin use and higher depression, PTSD, and mental

distress in the *material needs* and *high SV* classes compared to minimal SV, but there were no significant differences between *high SV* and *material needs*. In the only prior analysis of patterns of social and structural determinants of health specifically among FSW, Shokoohi *et al.* found evidence of similar subgroups including ones characterized by unemployment, co-occurring unemployment and low education, and unemployment and sexual violence.[35]

Despite mental health disparities between FSW and the general population, little research has focused on modifiable factors to improve mental health among FSW such as resilience. Resilience is "the achievement of positive adaptation" in the face of "significant" threats or adversities and is a process that can change and develop over time.[36,37] Resilience has not been widely studied among FSW. The few studies of resilience in this population have narrowly defined the topic but have nonetheless found that positive coping styles, higher levels of self-efficacy, and social support are associated with better mental health outcomes for FSW.[28,36,38-44] Further, in similar populations to FSW (e.g., women living with HIV, women at-risk of HIV, trauma-exposed women), resilience has been found to be a partial mediator or moderator in the relationship between childhood sexual abuse and depressive symptoms and perceived stress.[45-47]

This analysis aims to fill a number of gaps in the current literature. There is a dearth of longitudinal literature about mental health outcomes in marginalized populations, including FSW. Additionally, by using classes of co-occurring structural vulnerabilities in modeling mental health outcomes, this research can better reflect FSWs' lived experiences by embracing co-occurring vulnerabilities rather than attempting to isolate the effects of each alone. In this analysis, we aim to predict mental

distress over 12 months by structural vulnerability latent class among FSW in Baltimore. We hypothesize that *high SV* and *material needs* classes will show significantly greater mental distress scores than *minimal SV*. Finally, we also hypothesize that resilience will moderate the relationship between structural vulnerability latent class and mental distress.

**Methods**

The Enabling Mobilization, Empowerment, Risk reduction, And Lasting Dignity (EMERALD) study is a community-level structural intervention addressing HIV and STI prevention among FSW.[48,49] Women were recruited via mobile van from 10 areas throughout Baltimore. These areas were identified through geospatial analyses of several potential sex work indicators such as 911 call data and prostitution/solicitation arrest data.[50] Recruitment areas were also identified in part through information on the sex work economy gleaned from earlier work on a prospective cohort study of street-based FSW in Baltimore.[48,51,52] Analysis of 911 call and arrest data not only identified geographic areas throughout Baltimore from which to recruit but also identified times of the day with high sex work or drug use activity, thereby creating a sampling frame for baseline recruitment.

The structural intervention consists of a drop-in center, SPARC, for non-male guests, opened in November 2017. SPARC is located in a neighborhood in West Baltimore with a high concentration of sex work and drug use activity; the six recruitment zones that border SPARC's location were considered part of the intervention area and were also served by mobile outreach. The four other recruitment areas—mainly in East and South East Baltimore—comprised the control area. FSW recruited from intervention zones were explicitly encouraged to visit SPARC after their baseline study visit and given items (e.g., sanitizer, hygiene wipes, lip balm) with SPARC branding and

location. Control participants were given similar items with EMERALD branding rather than SPARC, and were given referrals to other local services but were not told about SPARC.

SPARC is guided by a harm reduction framework that provides services for a wide range of medical, legal, social, physical, and structural health needs (e.g., case management, reproductive health care, medication-assisted therapy, mental health care, laundry, showers, safe place to relax) with the goal of improving service acquisition in this underserved population and fostering community empowerment among FSW. Any non-male guest can use services free-of-charge and anonymously if so preferred; pseudonyms are permitted when using SPARC services that do not require verification of identity, such as prescribing medication-assisted therapy. SPARC services are provided by in-house staff and community partners. A mobile outreach program supplements the drop-in center services and provides harm reduction tools (e.g., syringes, naloxone) and micro-counseling to women on the street.

Eligibility criteria for EMERALD included: 1) aged 18 years or older; 2) cisgender woman; 3) sold or traded oral, vaginal, or anal sex "for money or things like food, drugs, or favors" at least three times in the past three months. If eligible, women completed an Audio Computer-Assisted Self-Interview (ACASI) survey, an oral HIV rapid test, and self-administered swab for gonorrhea and chlamydia. Swabs were sent to the Baltimore City Health Department for testing. Participants were also required to complete a tracking form that provided personal phone numbers, addresses, social media account names, and the name and contact information for two close contacts that we could reach if we were unable to locate the participant. Baseline data were collected

between September 2017 and February 2019. Eligible participants were provided a written copy of the consent form and orally explained the consent form by study staff; participants signed consent forms prior to all study activities.

Six- and 12-month follow-up visits were conducted between March 2018 and February 2020. Participants had a two-month eligibility window, one month before and after their eligibility date, during which they were able to complete their follow-up visit. Each follow-up visit included a 30-minute ACASI survey and the same HIV and STI testing protocols as at baseline. Prior to a visiting a study zone for follow-up data collection, study staff contacted eligible participants to notify them of their eligibility and where and when the van would park in their neighborhood. Study staff employed extensive methods to contact participants, including phone calls, text messages, emails, and social media private messages, if available; calling participants' close contacts (only disclosing they were part of a "women's health study") to help locate participants; searches on Maryland Judiciary Case Search for current incarceration status; and home visits. If after a month of eligibility women did not complete their survey, pairs of field trackers drove through areas participants are known to frequent in an attempt to locate those who have the most limited communication options.

Women were paid a $70 VISA gift card for completing the baseline visit and $45 for follow-up visits. The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board. A detailed account of the study protocol can be found in Silberzahn et al.[48]

*Outcome.* General mental distress was measured by adding the scores of depression and PTSD symptom measures into one score (possible range: 0-87). Symptoms of depression

were assessed with the 9-item Patient Health Questionnaire-9 (alpha=0.90, range=0-27). Symptoms of post-traumatic stress disorder (PTSD) were assessed with the PTSD Patient Checklist (PCL-5) with higher scores indicating greater severity of symptoms.[53,54] However, we did not hypothesize that criterion B items (e.g., intrusive thoughts, reexperiencing trauma triggered by reminders of the experience) would be associated with structural vulnerabilities so we removed these, resulting in a modified 15-item Checklist (alpha=0.97, range=0-60). Higher scores indicate greater mental distress.

*Moderator.* Resilience was only measured on the 6-month survey by the Connor-Davidson Resilience Scale (CDRS), a 10-item measure of internal resilience qualities with a 5-point Likert scale (possible range: 0-40, alpha=0.89) that has been widely used in adult samples with and without histories of trauma.[55] Higher scores indicate greater resilience.

*Covariates.* Survey items included questions about personal background (age, race, education, sexual orientation, if women have children under 18 years old, and arrest history), sex work history (time in sex work, locations where women found clients, if sex work is their only source of income) and condomless sex with clients in the past week (defined as any response other than "always" using condoms with paying clients), and recent (past 6 month) substance use (drug injection, heroin and powdered or crack cocaine use). HIV status was determined by rapid oral test and gonorrhea and chlamydia infection were determined by self-administered vaginal swab tested by the Baltimore City Health Department. Participants also completed the 12-item Internalized Sex Work Stigma Scale (alpha=0.80, range=12-48), with greater scores indicating greater stigma.[49]

Social cohesion was measured with a validated 13-item scale with higher scores indicating greater social cohesion (alpha=0.88, range=13-52).[56-58]

*Statistical Analysis*

In a previous analysis, we conducted a latent class analysis (LCA) on baseline data using five indicators of structural vulnerability (n=385). After determining the optimal three-class solution in our prior analysis, we retained the BCH weights as part of the manual three-step process to test for associations between latent classes and distal outcomes. We then determined differences in baseline characteristics between participants who completed the 12-month follow-up (n=235) and those lost to follow-up (LTFU) (n=150, data not shown). As there were many significant differences between completers and those LTFU, including on two latent class indicators (unstable housing and food insecurity), we performed multiple imputation using all covariates and outcome producing 10 multiply imputed datasets. We adjusted the association between SV latent class and mental distress for covariates specified in Figure 3 averaged across the 10 multiply imputed datasets. We then determined global (Wald test) and pairwise (model constraints) differences between average mental distress score and class. To see if internal resilience moderates the relationship between class and mental distress, we regressed resilience on all covariates and mental distress, allowing estimates to differ by latent class. Wald tests and model constraints showed any global or pairwise significant differences between regression coefficients by latent class, thereby signaling effect modification. All analyses were conducted with MPlus8.

**Results**

　　Multiple imputation produced a final sample of n=369. About one-third of data were imputed for resilience scores at 6 months (32%) and the outcome at 12-months (36%). At baseline, the final sample used in the present analysis (averaged across 10 multiply imputed datasets) was an average of 37 years old, 57% white race, and 59% from the control study arm (Table 5). Twenty-two percent entered sex work as a minor, 45% had recent condomless sex with a paying client. 59% injected any drug, and 87% used powdered or crack cocaine. Baseline mental distress score was 38 and baseline internalized sex work stigma score was 35.

　　Unadjusted scores were highest in class *HSV* (39.1), followed by class *MN* (36.2) and class *MSV* (29.9) last, and pairwise and Wald tests showed significantly higher scores in class *HSV* compared to *MSV* ($p$=0.004), class *MN* compared to class *MSV* ($p$=0.02), and global significant differences ($p$=0.01) (Figure 4). Adjusted scores were similar to unadjusted; however, after adjusting for baseline mental distress score and other covariates, the overall Wald test showed no significant difference in adjusted distress scores between classes ($p$=0.53) (Figure 4). Pairwise t-tests similarly showed no significant differences in mental distress scores between classes (*HSV vs. MSV*, $p$=0.36; *MN vs. MSV, p*=0.58). Table 6 shows covariates in the model: baseline mental distress scores were the only significant covariate, such that each one-point increase in baseline mental distress was associated with a 0.39 (95% CI: 0.27, 0.51) increase in 12-month mental distress score. Intervention study arm ($\beta$ =4.41, 95% CI =-0.06, 8.88) trended toward significance.

*Moderation analysis*

Resilience scores were similar between SV latent class, with the highest score (22.4) in *MSV* and the lowest (20.7) in *HSV* (Figure 5). Both the global Wald test and pairwise t-tests did not show statistically significant differences in resilience score. To assess the moderating effect of resilience, slopes were allowed to vary across latent class: resilience score was not significantly associated with mental distress score in any latent class (Table 7). Pairwise tests compared differences in resilience score coefficients between classes; there were no significant differences between classes, nor were there any significant covariates in the moderation model (Table 8).

**Discussion**

This is, to our knowledge, the first longitudinal analysis of mental health outcomes and structural vulnerabilities in a sample of FSW. While at baseline we found significant differences in mental distress between classes *HSV* and *MN* compared to *MSV*, we did not find significant differences between classes at 12-month follow-up after accounting for those baseline scores. Further, we did not find evidence that internal resilience moderated the relationship between structural vulnerability latent class and mental distress.

It is important to note, however, that mental distress scores were high at baseline and remained high at 12-month follow-up, even if severity of mental distress over time did not change significantly between classes. This finding was not expected, as we hypothesized that mental distress would be greatest for classes *MN* and *HSV*, the two classes characterized by co-occurring vulnerabilities. The indicators of structural vulnerability chosen for the latent class analysis reflect individual-level manifestations of structural policies around economic and social inequities that are a reality of daily life for

FSW in Baltimore. Greater socioeconomic disadvantage in part influences inequitable exposure to interpersonal violence, substance use, limited access to quality mental and physical healthcare—which all contribute to a cycle of further social exclusion. It is surprising, then, that classes characterized by greater housing and food insecurities and client-perpetrated violence did not show worsening mental health over time.

Baseline distress score was most predictive of 12-month distress score, emphasizing the sustained distress exhibited by FSW in this sample and showing critical need for mental health care in this population. We expected that the intervention, in part, may lead to decreased mental distress at 12 months, at least for class *MSV*, the least structurally vulnerable class. While it is promising that there were no significant increases in distress by class, it is still troubling that scores remained high over a year-long period. We combined PTSD and depression scores together to create a measure of mental distress, making comparison with previous research difficult. But when considering each measure separately, it is clear that our sample of FSW demonstrated high levels of PTSD and depressive symptoms. PCL-5 (PTSD) overall and sub-scale scores in this sample were similar or higher than treatment-seeking military veterans, while PHQ-9 (depression) scores were noticeably higher than other samples of people who use drugs.[59,60] FSW and people who use drugs experience a number of barriers to healthcare, particularly preventative care, including transportation, cost of care, anticipated or enacted stigma from providers, lack of knowledge about services, and competing priorities of income generation or substance use.[61] However, research with FSW has nearly exclusively focused on access to primary care, HIV/STI care, or drug treatment; there is a dearth of research illuminating mental health care access for FSW

and people who use drugs. Given the high (and sustained) levels of mental distress, this research is urgently needed.

We found that internal resilience did not moderate the relationship between structural vulnerability latent class and mental distress. As we will detail in Chapter 4, the Connor-Davidson Resilience Scale is individually-focused and does not fully capture the totality of resilience as a construct. Existing measures of internal resilience, like the Connor-Davidson Scale, also may not be appropriate for substance-using populations, as emotional numbing and perceived isolation can be misinterpreted as resilience as they are not nuanced enough to make these distinctions.

Additionally, policies and interventions aimed at improving mental health must make addressing co-occurring structural factors an integral part of their design. More broadly, public health needs to shift its thinking of mental health as an individual or interpersonal disease to thinking about policies and interventions targeting structural level factors to improve mental health. Though research with FSW is scarce, looking to research in other populations can show important pathways of co-occurring structural vulnerabilities to target. For example, qualitative research shows that stigma, discrimination, and prevailing negative stereotypes against low-income individuals are crucial mechanisms by which increasing markers of economic insecurity can increase risk of adverse mental health experiences.[62,63] Research has also found that violence and material needs such as housing and food insecurity often co-occur, though the temporality of violence and poverty can be murky (i.e., there may be a bi-directional relationship between violence and economic precarity). But these co-occurring vulnerabilities produce significant deficits in mental health including PTSD, anxiety, and

depression, with one literature review finding that this most often happens through stress, powerlessness, and isolation pathways.[64] Given the complex relationship between these factors and the breadth of their reach across many aspects of people's lives, public health solutions to improving mental health will require more equitable consideration of the base of the Health Impact Pyramid (i.e., socioeconomic factors) and the top (i.e., counseling and education).

There are several limitations to this analysis. First, we needed to impute resilience and mental distress data for approximately one-third of the sample because of LTFU. Imputation as we have conducted it has been found to result in data with minimal bias, but it is nonetheless not directly observed.[65] Second, all measures are self-report and therefore may be subject to desirability bias. Relatedly, if participants are self-medicating through drug use, it is possible that we may underestimate the scope of mental distress in this sample. Though we controlled for substance use in the latent class regression, future research is needed to better understand the extent of self-medication and how it may contribute to discrepancies on mental health measures. Third, we did not have thorough data on mental illness diagnosis and treatment history, including any treatment that may have taken place during the study period. Finally, this sample was recruited via a mobile van parked in locations throughout Baltimore; we therefore caution against drawing conclusions about all people who sell sex from these results. Our recruitment methods, coupled with the nature of sex work in Baltimore, yielded a sample that is highly structurally vulnerable and often solicits clients on the street. We also are likely missing FSW who solicit clients mostly online or through social media, or Black FSW who may avoid street solicitation because of police harassment.

There are some important benefits of this analysis, however. First, we used longitudinal data to understand the trajectory of mental distress among FSW, while most studies have previously been cross-sectional. Second, we did not limit the sample to FSW who were formally diagnosed with a mental illness or receiving clinical care. Though understanding symptom severity in this population is important, we would likely miss a wide swath of FSW who face barriers to receiving clinical mental health care but nonetheless still experience mental distress. Third, this is the largest cohort of FSW studied in the United States and provides a unique insight into structural vulnerabilities and mental health in the context of a high-income country.

Our results show that mental distress among FSW remained high over a 12-month period, though we did not find differential change in mental distress by latent class over this period. Further, internal resilience was not an effect modifier between latent class and mental distress in this population. These results suggest a critical need for improved access to mental health resources, including through policies and interventions that focus on co-occurring structural vulnerabilities.

**References**

1.      Alegria M, Vera M, Freeman DH, Jr., Robles R, Santos MC, Rivera CL. HIV infection, risk behaviors, and depressive symptoms among Puerto Rican sex workers. *Am J Public Health.* 1994;84(12):2000-2002.

2.      Gunn JK, Roth AM, Center KE, Wiehe SE. The Unanticipated Benefits of Behavioral Assessments and Interviews on Anxiety, Self-Esteem and Depression Among Women Engaging in Transactional Sex. *Community Ment Health J.* 2016;52(8):1064-1069.

3.      Surratt HL, Kurtz SP, Weaver JC, Inciardi JA. The connections of mental health problems, violent life experiences, and the social milieu of the "stroll" with the HIV risk behaviors of female street sex workers. *Journal of Psychology & Human Sexuality.* 2005;17(1-2):23-44.

4.      Rossler W, Koch U, Lauber C, et al. The mental health of female sex workers. *Acta Psychiatr Scand.* 2010;122(2):143-152.

5.      Suresh G, Furr LA, Srikrishnan AK. An assessment of the mental health of street-based sex workers in Chennai, India. *Journal of Contemporary Criminal Justice.* 2009;25(2):186-201.

6.      Hong Y, Fang X, Li X, Liu Y, Li M, Tai-Seale T. Self-perceived stigma, depressive symptoms, and suicidal behaviors among female sex workers in China. *J Transcult Nurs.* 2010;21(1):29-34.

7.      Sagtani RA, Bhattarai S, Adhikari BR, Baral D, Yadav DK, Pokharel PK. Violence, HIV risk behaviour and depression among female sex workers of eastern Nepal. *BMJ Open.* 2013;3(6).

8.      Puri N, Shannon K, Nguyen P, Goldenberg SM. Burden and correlates of mental health diagnoses among sex workers in an urban setting. *BMC Womens Health.* 2017;17(1):133.

9.      Farley M, Cotton A, Lynne J, et al. Prostitution and trafficking in nine countries: An update on violence and posttraumatic stress disorder. *Journal of trauma practice.* 2004;2(3-4):33-74.

10.     Roxburgh A, Degenhardt L, Copeland J. Posttraumatic stress disorder among female street-based sex workers in the greater Sydney area, Australia. *BMC Psychiatry.* 2006;6:24.

11.     Park JN, Decker MR, Bass JK, et al. Cumulative violence and PTSD symptom severity among urban street-based female sex workers. *Journal of interpersonal violence.* 2019:0886260519884694.

12.     Kessler RC, McGonagle KA, Swartz M, Blazer DG, Nelson CB. Sex and depression in the National Comorbidity Survey. I: Lifetime prevalence, chronicity and recurrence. *J Affect Disord.* 1993;29(2-3):85-96.

13.     Vesga-Lopez O, Blanco C, Keyes K, Olfson M, Grant BF, Hasin DS. Psychiatric disorders in pregnant and postpartum women in the United States. *Arch Gen Psychiatry.* 2008;65(7):805-815.

14.     Farr SL, Bitsko RH, Hayes DK, Dietz PM. Mental health and access to services among US women of reproductive age. *Am J Obstet Gynecol.* 2010;203(6):542 e541-549.

15.    Melville JL, Gavin A, Guo Y, Fan MY, Katon WJ. Depressive disorders during pregnancy: prevalence and risk factors in a large urban sample. *Obstet Gynecol.* 2010;116(5):1064-1070.

16.    Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry.* 1995;52(12):1048-1060.

17.    Patel V, Lund C, Hatherill S, et al. Mental disorders: equity and social determinants. *Equity, social determinants and public health programmes.* 2010;115:134.

18.    Shannon K, Goldenberg SM, Deering KN, Strathdee SA. HIV infection among female sex workers in concentrated and high prevalence epidemics: why a structural determinants framework is needed. *Curr Opin HIV AIDS.* 2014;9(2):174-182.

19.    Shannon K, Strathdee SA, Goldenberg SM, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet.* 2015;385(9962):55-71.

20.    Lim S, Park JN, Kerrigan DL, Sherman SG. Severe Food Insecurity, Gender-Based Violence, Homelessness, and HIV Risk among Street-based Female Sex Workers in Baltimore, Maryland. *AIDS Behav.* 2019;23(11):3058-3063.

21.    Footer KH, Silberzahn BE, Tormohlen KN, Sherman SG. Policing practices as a structural determinant for HIV among sex workers: a systematic review of empirical findings. *J Int AIDS Soc.* 2016;19(4 Suppl 3):20883.

22. Footer KHA, Lim S, Brantley MR, Sherman SG. Structural risk and limits on agency among exotic dancers: HIV risk practices in the exotic dance club. *Cult Health Sex.* 2018;20(3):321-334.

23. Quesada J, Hart LK, Bourgois P. Structural vulnerability and health: Latino migrant laborers in the United States. *Med Anthropol.* 2011;30(4):339-362.

24. Lorant V, Deliege D, Eaton W, Robert A, Philippot P, Ansseau M. Socioeconomic inequalities in depression: a meta-analysis. *Am J Epidemiol.* 2003;157(2):98-112.

25. Patel V, Kirkwood BR, Pednekar S, et al. Gender disadvantage and reproductive health risk factors for common mental disorders in women: a community survey in India. *Arch Gen Psychiatry.* 2006;63(4):404-413.

26. Whittle HJ, Sheira LA, Wolfe WR, et al. Food insecurity is associated with anxiety, stress, and symptoms of posttraumatic stress disorder in a cohort of women with or at risk of HIV in the United States. *J Nutr.* 2019;149(8):1393-1403.

27. Farley M, Barkan H. Prostitution, violence, and posttraumatic stress disorder. *Women Health.* 1998;27(3):37-49.

28. Vanwesenbeeck I, De Graaf R, Van Zessen G, Straver CJ, Visser JH. [Risky life, risky business: AIDS risk of female prostitutes in the context of early abuse and well-being]. *Gedrag Gezond.* 1993;21(5):219-226.

29. Inciardi JA, Surratt HL. Drug use, street crime, and sex-trading among cocaine-dependent women: implications for public health and criminal justice policy. *J Psychoactive Drugs.* 2001;33(4):379-389.

30. Deering KN, Amin A, Shoveller J, et al. A systematic review of the correlates of violence against sex workers. *Am J Public Health.* 2014;104(5):e42-54.

31. Logie CH, Wang Y, Marcus N, et al. Factors Associated with the Separate and Concurrent Experiences of Food and Housing Insecurity Among Women Living with HIV in Canada. *AIDS Behav.* 2018;22(9):3100-3110.

32. Shokoohi M, Bauer GR, Kaida A, et al. Patterns of social determinants of health associated with drug use among women living with HIV in Canada: a latent class analysis. *Addiction.* 2019;114(7):1214-1224.

33. Siefert K, Heflin CM, Corcoran ME, Williams DR. Food insufficiency and the physical and mental health of low-income women. *Women Health.* 2001;32(1-2):159-177.

34. Palar K, Kushel M, Frongillo EA, et al. Food Insecurity is Longitudinally Associated with Depressive Symptoms Among Homeless and Marginally-Housed Individuals Living with HIV. *AIDS Behav.* 2015;19(8):1527-1534.

35. Shokoohi M, Karamouzian M, Dolan K, Sharifi H, Mirzazadeh A. Social and structural determinants of health associated with drug use patterns among female sex workers in Iran: A latent class analysis. *Int J Drug Policy.* 2020:102798.

36. Luthar SS, Cicchetti D, Becker B. The construct of resilience: a critical evaluation and guidelines for future work. *Child Dev.* 2000;71(3):543-562.

37. Fergus S, Zimmerman MA. Adolescent resilience: a framework for understanding healthy development in the face of risk. *Annu Rev Public Health.* 2005;26:399-419.

38. Eller LS, Mahat G. Psychological factors in Nepali former commercial sex workers with HIV. *J Nurs Scholarsh.* 2003;35(1):53-60.

39. Ghimire L, Smith WC, van Teijlingen ER, Dahal R, Luitel NP. Reasons for non-use of condoms and self- efficacy among female sex workers: a qualitative study in Nepal. *BMC Womens Health.* 2011;11:42.

40. Guha M, Baschieri A, Bharat S, et al. Risk reduction and perceived collective efficacy and community support among female sex workers in Tamil Nadu and Maharashtra, India: the importance of context. *J Epidemiol Community Health.* 2012;66 Suppl 2:ii55-61.

41. Ulibarri MD, Semple SJ, Rao S, et al. History of abuse and psychological distress symptoms among female sex workers in two Mexico-U.S. border cities. *Violence Vict.* 2009;24(3):399-413.

42. Scorgie F, Nakato D, Harper E, et al. 'We are despised in the hospitals': sex workers' experiences of accessing health care in four African countries. *Cult Health Sex.* 2013;15(4):450-465.

43. Burnes TR, Rojas EM, Delgado I, Watkins TE. "Wear Some Thick Socks If You Walk in My Shoes": Agency, Resilience, and Well-Being in Communities of North American Sex Workers. *Arch Sex Behav.* 2017.

44. Buttram ME, Surratt HL, Kurtz SP. Resilience and syndemic risk factors among African-American female sex workers. *Psychol Health Med.* 2014;19(4):442-452.

45. Wingo AP, Wrenn G, Pelletier T, Gutman AR, Bradley B, Ressler KJ. Moderating effects of resilience on depression in individuals with a history of childhood abuse or trauma exposure. *J Affect Disord.* 2010;126(3):411-414.

46. Dale SK, Cohen MH, Kelso GA, et al. Resilience among women with HIV: Impact of silencing the self and socioeconomic factors. *Sex Roles.* 2014;70(5-6):221-231.

47.    Dale SK, Weber KM, Cohen MH, Kelso GA, Cruise RC, Brody LR. Resilience Moderates the Association Between Childhood Sexual Abuse and Depressive Symptoms Among Women with and At-Risk for HIV. *AIDS Behav.* 2015;19(8):1379-1387.

48.    Silberzahn BE, Tomko C, Clouse E, et al. An evaluation of a community-based combination HIV prevention intervention for female sex workers (FSW) in Baltimore, Maryland: The EMERALD study design and cohort description. *Manuscript in preparation.* 2020.

49.    Tomko C, Nestadt DF, Rouhani S, et al. Confirmatory Factor Analysis and Construct Validity of the Internalized Sex Work Stigma Scale among a Cohort of Cisgender Female Sex Workers in Baltimore, Maryland, United States. *The Journal of Sex Research.* 2020:1-11.

50.    Allen ST, Footer KHA, Galai N, Park JN, Silberzahn B, Sherman SG. Implementing Targeted Sampling: Lessons Learned from Recruiting Female Sex Workers in Baltimore, MD. *J Urban Health.* 2018.

51.    Sherman SG, Park JN, Galai N, et al. Drivers of HIV infection among cisgender and transgender female sex worker populations in Baltimore city: Results from the SAPPHIRE study. *J Acquir Immune Defic Syndr.* 2019.

52.    Silberzahn BE, Morris MB, Riegger KE, et al. Barriers and facilitators to retaining a cohort of street-based cisgender female sex workers recruited in Baltimore, Maryland, USA: results from the SAPPHIRE study. *BMC Public Health.* 2020;20:1-12.

53.     Weathers FW LB, Herman D, Huska J, Keane T. *The PTSD checklist-civilian version (PCL-C)*. Boston, MA: National Center for PTSD; 1994.

54.     Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606-613.

55.     Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety.* 2003;18(2):76-82.

56.     Fonner VA, Kerrigan D, Mnisi Z, Ketende S, Kennedy CE, Baral S. Social cohesion, social participation, and HIV related risk among female sex workers in Swaziland. *PloS one.* 2014;9(1):e87527.

57.     Lippman SA, Donini A, Diaz J, Chinaglia M, Reingold A, Kerrigan D. Social-environmental factors and protective sexual behavior among sex workers: the Encontros intervention in Brazil. *Am J Public Health.* 2010;100 Suppl 1:S216-223.

58.     Kerrigan D, Telles P, Torres H, Overs C, Castle C. Community development and HIV/STI-related vulnerability among female sex workers in Rio de Janeiro, Brazil. *Health education research.* 2008;23(1):137-145.

59.     Dum M, Pickren J, Sobell LC, Sobell MB. Comparing the BDI-II and the PHQ-9 with outpatient substance abusers. *Addict Behav.* 2008;33(2):381-387.

60.     Wortmann JH, Jordan AH, Weathers FW, et al. Psychometric analysis of the PTSD Checklist-5 (PCL-5) among treatment-seeking military service members. *Psychol Assess.* 2016;28(11):1392-1403.

61.     Ma PHX, Chan ZCY, Loke AY. The Socio-Ecological Model Approach to Understanding Barriers and Facilitators to the Accessing of Health Services by Sex Workers: A Systematic Review. *AIDS Behav.* 2017;21(8):2412-2438.

62.     Whittle HJ, Leddy AM, Shieh J, et al. Precarity and health: Theorizing the intersection of multiple material-need insecurities, stigma, and illness among women in the United States. *Soc Sci Med.* 2020;245:112683.

63.     Belle D, Doucet J. Poverty, inequality, and discrimination as sources of depression among US women. *Psychology of Women Quarterly.* 2003;27(2):101-113.

64.     Goodman LA, Smyth KF, Borges AM, Singer R. When crises collide: How intimate partner violence and poverty intersect to shape women's mental health and coping? *Trauma, Violence, & Abuse.* 2009;10(4):306-329.

65.     Sterne JA, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ.* 2009;338:b2393.

**Table 5**. Overall and class-specific characteristics of covariates averaged over ten imputed datasets among a sample of female sex workers in Baltimore, Maryland (n=369)

| | | Latent Class | | |
| | Total (n=369) | High Structural Vulnerability (n=101) | Minimal Structural Vulnerability (n=160) | Material Needs (n=108) |
|---|---|---|---|---|
| | *%* | *%* | *%* | *%* |
| Study arm | | | | |
| *Control* | 41.5 | 37.3 | 44.6 | 40.7 |
| *Intervention* | 58.5 | 62.7 | 55.4 | 59.3 |
| Age, years *(mean)* | 37.1 | 35.8 | 38.2 | 36.7 |
| Race | | | | |
| *White* | 56.6 | 61.2 | 51.6 | 59.3 |
| *Black or Person of Color* | 43.4 | 38.2 | 48.4 | 40.7 |
| Entered sex work as minor | 21.7 | 32.3 | 17.0 | 18.5 |
| Condomless sex with clients | 45.0 | 59.1 | 42.0 | 36.1 |
| Injected any drug | 58.5 | 70.3 | 47.4 | 63.9 |
| Used powdered or crack cocaine | 87.3 | 93.6 | 82.2 | 88.9 |
| | *Mean* | *Mean* | *Mean* | *Mean* |
| Baseline mental distress score | 37.9 | 44.8 | 30.6 | 42.1 |
| Internalized sex work stigma | 34.8 | 35.2 | 34.1 | 35.3 |

**Table 6**. **Bivariate linear regression of covariates on 12-month mental distress scores by latent classes of structural vulnerability among a sample of female sex workers in Baltimore, Maryland (n=369)**

|  | Total sample (n=369) | |
| --- | --- | --- |
| *Covariates* | *β (95% CI)* | *p* |
| Baseline distress score | 0.39 (0.27, 0.51) | <0.001 |
| Age | -0.16 (-0.38, 0.06) | 0.15 |
| White race | 2.38 (-3.05, 7.81) | 0.39 |
| Entered sex work as a minor | -3.09 (-8.28, 2.10) | 0.24 |
| Condomless sex with clients | -0.64 (-5.85, 4.57) | 0.81 |
| Injection drug use | -1.30 (-6.73, 4.13) | 0.64 |
| Crack cocaine use | 0.99 (-6.34, 8.32) | 0.79 |
| Internalized sex work stigma score | 0.06 (-039, 0.51) | 0.81 |
| Intervention study arm | 4.41 (-0.06, 8.88) | 0.05 |

**Table 7**. **Bivariate linear regression testing effect modification of resilience (and pairwise significance testing of coefficients) on 12-month mental distress score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=369)**

| | High Structural Vulnerability | | Minimal Structural Vulnerability | | Material Needs | |
|---|---|---|---|---|---|---|
| | *β (95% CI)* | *p* | *β (95% CI)* | *p* | *β (95% CI)* | *p* |
| Resilience score | 0.22 (-0.64, 1.08) | 0.61 | -0.05 (-0.48, 0.38) | 0.82 | -0.17 (-0.66, 0.32) | 0.51 |

| Pairwise differences in regression coefficients | | |
|---|---|---|
| Latent class comparisons | *β (95% CI)* | *p* |
| High Structural Vulnerability vs. Minimal Structural Vulnerability | 0.27 (-0.57, 1.11) | 0.53 |
| High Structural Vulnerability vs. Material Needs | 0.39 (-0.45, 1.23) | 0.37 |

**Table 8**. Bivariate linear regression of covariates on 12-month mental distress scores with resilience as a moderator by latent classes of structural vulnerability among a sample of female sex workers in Baltimore, Maryland (n=369)

| | Total sample (n=369) | |
| --- | --- | --- |
| *Covariates* | *β (95% CI)* | *p* |
| Baseline distress score | 0.40 (0.28, 0.52) | <0.001 |
| Age | -0.17 (-0.39, 0.05) | 0.13 |
| White race | 2.37 (-3.08, 7.82) | 0.39 |
| Entered sex work as a minor | -2.95 (-8.24, 2.34) | 0.27 |
| Condomless sex with clients | -0.70 (-6.42, 5.02) | 0.81 |
| Injection drug use | -1.35 (-6.68, 3.98) | 0.62 |
| Crack cocaine use | 0.77 (-6.66, 8.20) | 0.84 |
| Internalized sex work stigma score | 0.02 (-0.47, 0.51) | 0.92 |
| Intervention study arm | 4.56 (0.07, 9.05) | 0.05 |

**Figure 3**. Conceptual framework of the relationship between latent classes of structural vulnerability, general mental distress and internal resilience among a sample of female sex workers in Baltimore, Maryland (n=385)
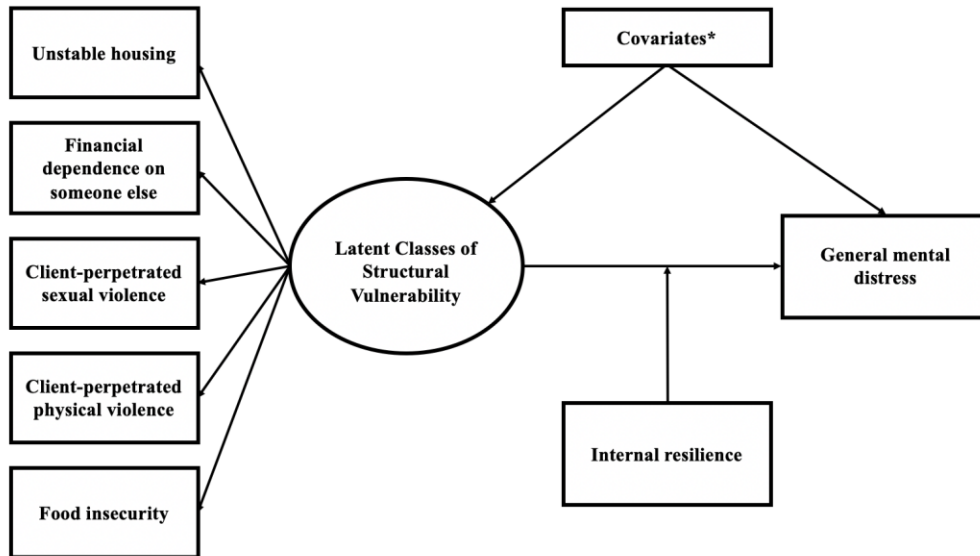


*age, race, crack cocaine use, injection drug use, internalized sex work stigma, study arm, condomless sex with clients, sex work entry as minor, baseline mental distress score

**Figure 4**. Average unadjusted and adjusted mental distress score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=369)
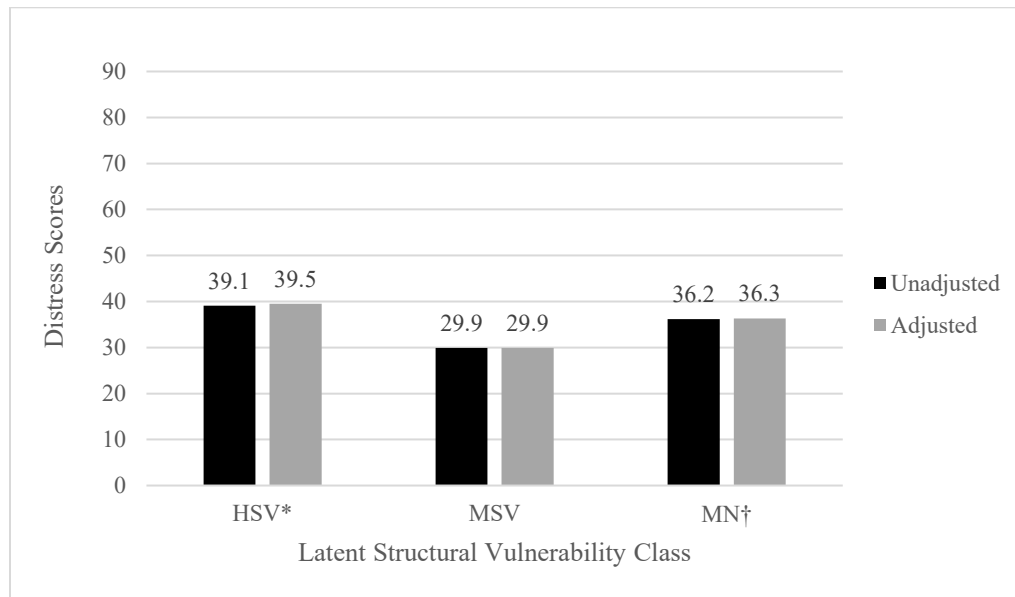


Note: HSV = high structural vulnerability; MSV = minimal structural vulnerability; MN = material needs

*Unadjusted*

*Overall significance*: *p*=0.01

*Pairwise significance: *HSV* vs. *MSV*, p=0.02

 †*MN* vs. *MSV*, p=0.004

*Adjusted*

*Overall significance*: *p*=0.53

*Pairwise significance: *HSV* vs. *MSV*, p=0.26

†*MN* vs. *MSV*, p=0.58

**Figure 5**. **Average resilience score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=369)**
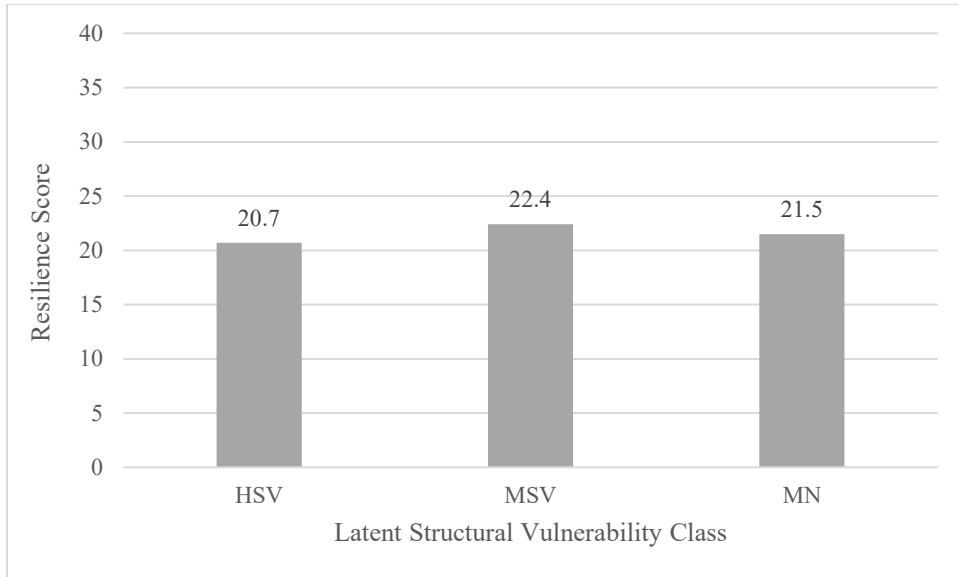


Note: HSV = high structural vulnerability; MSV = minimal structural vulnerability; MN = material needs

*Overall significance*: *p*=0.67

*Pairwise significance: HSV* vs. *MSV*, *p*=0.83

*HSV vs. MN, p*=0.54

# Chapter 4: Characterizing external resilience and the limitations of internal resilience in a sample of structurally vulnerable women who use drugs in Baltimore, Maryland

Manuscript 3

**Abstract**

**Introduction:** Female sex workers (FSW) experience significant mental distress but their mental health is understudied. Resilience is a popular target of mental health interventions, but the construct has been narrowly defined in research, particularly as it relates to marginalized populations such as FSW.

**Methods:** FSW (n=18) enrolled in an ongoing cohort study were purposively sampled for age, race, and recruitment location and participated in semi-structured in-depth interviews aimed to elucidate external resilience. Specifically, FSW were queried about recent difficult experiences with a focus on how they did or did not use social support or formal resources (e.g., social worker, health clinic, crisis hotline) in response to the difficulty. A mixed inductive/deductive coding approach was used to understand and develop themes. We then used participants' Connor-Davidson Resilience Scale (CDRS) score, a measure of internal resilience, to categorize participants into high or low internal resilience based on a median split. Themes were analysed within and across each high/low group.

**Results:** Participants were a median 37 years old (range: 19-62), 50% Black race, and 50% reported currently injecting drugs, with all having a history of substance use. Themes related to one facet of external resilience, social support, included: difficulty in

asking for support, perceived comparing sources of transactional versus genuine support. There were few differences between high and low internal resilience groups: one area of departure between FSW with low and high internal resilience was the availability of genuine, non-transactional relationships and maternal support. Community resource utilization was extremely rare and mainly involved drug treatment or emergency department use. "Self-medication" through substance use was a common practice in the face of adversity and in the absence of other perceived options for help.

**Conclusions**: External resilience—operationalized as social support and resource utilization—was limited among FSW. Reliance on internal resilience offers an incomplete picture of the construct in the population. Improving connections to community resources is a targeted and potentially impactful way to strengthen external resilience.

**Introduction**

Resilience is "the achievement of positive adaptation" in the face of "significant" threats or adversities and is a process that can change and develop over time.[1,2] Resilience has been broadly conceptualized as a function of allostasis, the process between a person and the environment to maintain stability in the face of actual or anticipated stressors.[2] In the allostasis view of resilience, there are two types of promotive factors: assets (positive qualities an individual possesses) and resources (external factors one can draw upon for assistance).[2]

A review of existing resilience scales found a similar dichotomy of internal and external dimensions of resilience.[3] Internal resilience factors are qualities related to the person; prior measures of resilience have used items that measure adaptability, self-efficacy, active coping, positive emotions, mastery, and hardiness. External resilience factors are outside of the individual and related to the situation; prior resilience measures have included items about supportive relationships, planning and organizing abilities within the environment, and accessing community-based organizations and resources.[3]

Globally, female sex workers (FSW) bear a high burden of depression (estimated at 29-82%), much higher than the general female population.[4-16] Lack of economic resources, frequency and severity of violence, stigma, and arrest and criminalization of sex work often co-exist among FSW and, independently and synergistically, heighten risk for developing depression.[7-9,17-23] In addition to its own morbidity, evidence suggests that depression can impact HIV, HIV risk behaviors, and poor HIV outcomes through a hopelessness pathway.[24,25] Preventing and treating depression and mental distress among FSW is critical to address mental illness and HIV-related disparities in a key population.

Despite the depression disparity between FSW and the general population, little research has focused on modifiable factors to improve mental health among FSW such as resilience. To date, few studies have examined resilience among FSW in North America.[26-29] One study conducted focus groups with 35 male, female, and transgender sex workers in Mexico and the U.S. All participants described their feelings of resilience counterbalancing the discrimination and stigmatization they feel from others, and several sex workers described resilience contributing to increased feelings of safety and agency over the services they would perform or clients they picked up.[27] However, results and quote attributions did not describe the participants' gender so it is not possible to understand the results of only FSW. A study examining resilience and its correlates among cisgender and transgender FSW in Baltimore found that structural vulnerabilities, such as housing and food insecurities and violence, play a central role in sustaining resilience for both cisgender and transgender FSW, though average resilience was lower for cis FSW.[29] A study of Latina FSW in Baltimore described several resilient factors that emerged from in-depth interviews, including strategies to cognitively reframe engagement in sex work as a necessary act to support themselves and their families in the absence of higher-paying jobs or support networks.[28] In these studies, however, resilience was conceptualized only as an internal quality and did not examine external resilience factors.

Social support, one dimension of external resilience, has shown positive associations with mental health outcomes in FSW.[26,27,30-33] Similarly, a small number of studies have examined FSWs' barriers to utilizing resources such as primary and emergency healthcare and HIV/STI testing and treatment.[34] None of these studies,

however, purported to study these domains specifically in the context of harnessing external resilience factors to overcome hardship. In this paper, we aim to present a more comprehensive picture of FSWs' external resilience by describing key themes related to social support and resource utilization after experiencing hardships and traumatic events. We will use quantitative data of a measure of internal resilience to show the limitation of not considering external and internal dimensions in understandings of resilience.

**Methods**

*Quantitative parent study*

<u>Recruitment and data collection.</u> The data for this study were collected as part of a larger parent study. The EMERALD study is the evaluation of a structural HIV/STI-reduction intervention targeting FSW in Baltimore, Maryland. intervention targeting FSW in Baltimore, Maryland. The intervention consists of a drop-in center providing resources aimed at the biological, behavioral, and social needs of FSW. The drop-in center is harm reduction-focused, low-barrier, and serves non-male guests. EMERALD participants were recruited from 10 "zones" throughout Baltimore that were identified through targeted sampling techniques used in a previous cohort study of FSW in Baltimore.[35] The six zones in closest proximity to the drop-in center's location on the west side of Baltimore constituted the intervention area; the other four zones in east, southeast, and northwest Baltimore served as the control areas.

Cohort (N=385) recruitment was conducted between September 2017 and February 2019 via a mobile van. Eligibility criteria included: 1) aged 18 or older; 2) cis-gender woman; 3) sold or traded oral, vaginal, or anal sex "for money or things like food, drugs, or favors in the past 3 months;" 4) picked up clients 3 or more times in the past

three months; and 5) willing to provide contact information for follow up visits. Follow-up surveys were completed every six months for 18 months. At baseline, EMERALD staff collected detailed contact and locator information for each participant, including personal cell phone numbers, social media accounts, and contact information of "stable" contacts (i.e., someone the participant sees or communicates with regularly).[36] When a participant was eligible for a follow-up visit, study staff used these methods to contact participants and tell them the day and time the mobile van would be in their zone. Additionally, participants often encountered the van organically while on the street and inquired about follow-up eligibility, at which time study staff verified eligibility and completed the survey. Participants were paid with a $70 VISA gift card at baseline and $45 VISA gift cards at follow-ups. All study activities were approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Quantitative measures. From the parent study, we had baseline demographic and other key background characteristics from participants including: age, race, sex work history (e.g., length of time in sex work) and substance use (e.g., injection drug use, types of drugs used). Previously, we identified latent classes of structural vulnerability for all participants using five indicators (unstable housing, food insecurity, financial dependence on someone else, experiencing client-perpetrated physical violence, experiencing client-perpetrated sexual violence) and classified participants according to these latent classes: minimal structural vulnerability (low probability of all indicators), material needs (high probability of unstable housing and food insecurity), and high structural vulnerability (high probability of all indicators). Resilience was measured on the 6-month survey by the Connor-Davidson Resilience Scale (CDRS), a 10-item measure of internal resilience

qualities with a 5-point Likert scale (possible range: 0-40) that has been widely used in adult samples with and without histories of trauma.[37] We used the median CDRS score (22) to classify participants into low (<22) and high (≥22) resilience score.

*Qualitative study*

<u>Recruitment and data collection.</u> We recruited qualitative sub-study participants from the EMERALD parent study in June 2019 specifically to explore resilience. An interviewer joined the EMERALD mobile van during scheduled shifts and parked next to the van. Prior to the start of data collection, the lead author and EMERALD field coordinator met to discuss the project and how to approach potential participants on the van. The field coordinator then briefed study staff about the project and recruitment. We used a purposive sampling strategy to select a subsample of participants for qualitative interviews. We aimed to sample evenly from intervention and control areas, and with a representative sample of ages, racial background, and structural vulnerability latent class. We recruited ten participants (half from intervention, half from control) from the first ten FSW who were interested in the study and recorded their age, race, and latent class. After this, we alternated recruitment from intervention and control areas and asked staff explaining the study to participants to first consider race and age range according to sampling needs. We initially attempted to sample the remaining participants evenly from structural vulnerability class, but because it was not always possible to know who was eligible for follow-up interviews, we could not reliably sample this way.

Prior to data collection, the lead author met with three experienced qualitative interviewers to discuss the project purpose, review the interview guide, and conduct brief mock interviews. Interviewers were all full- and part-time staff who had experience

interviewing FSW and people who use drugs; they themselves, however, do not identify as current or former FSW or people who use drugs. All interviewers were between 28-38 years old and white race. Participants were familiar and friendly with EMERALD staff—and by extension, interviewers—however it was well-known that the study was being conducted by researchers from Johns Hopkins University.

Interviewers used in-depth semi-structured interviews to engage participants in discussions about external dimensions of resilience. Interviewers were encouraged to probe where needed and to make the interview conversational. Broadly, the interview guide covered a brief participant background and their day-to-day life and then participants were encouraged to tell a story about a difficult time they recently experienced; there were no limitations on what participants defined as a "difficult experience." From there, questions related to social support (e.g., availability, source, perceived helpfulness) and formal resource use were asked using their story as a jumping-off point. Interviewers were trained on which part of the interview guides were essential to cover and which were less important, and interviewers were also reminded that interviews did not need to be linear in service of a conversational tone. Interviews were conducted in a private area of the mobile van (if space was available) or in the interviewer's car, in view of the EMERALD staff for safety. All interviews were audio-recorded and transcribed verbatim. Participants were given a $25 VISA gift card for remuneration.

Analysis. The target sample size (n=25) was determined by balancing code saturation (i.e., determining enough codes so that researchers have "heard it all") and meaning saturation (i.e., having enough data to "understand it all").[38] Earlier studies reached at

least 90% thematic saturation at 12-16 interviews;[39,40] one study found code saturation at 9 interviews and meaning saturation between 16-24 interviews.[38] Throughout sampling, the lead author listened to interviews and read transcripts to broadly understand emerging themes based largely on answers to questions in the interview guide. Specifically of interest to determining saturation were answers to use and availability of social support after experiencing difficulty, and (non-)use of formal resources for help. The lead author determined meaning and code saturation were both met at 18 interviews, at which time data collection ceased.

The lead author read through each transcript and developed the initial coding scheme based on a mixed inductive and deductive approach. Codes were partially generated from the interview guide, and the codebook also reflected emergent themes during the interviews. This coding structure was then applied to a set of two transcripts where two coders independently coded interviews and met to discuss code applications and any new codes that emerged. Both coders were cisgender women, one white race and another a non-Black woman of color, and between 25-35 years old. Both coders did not identify as former FSW or people who use drugs. Both coders received secondary and at least some level of post-secondary education.

The codebook was revised based on these discussions to add new codes and combine existing ones if needed. Inter-coder reliability was reached when both coders reached at least 75% consensus on the code applications after discussion. Codes were finalized, and two team members coded the remaining interviews. To begin analysis, we used the One Sheet of Paper (OSOP) technique for the broadest codes (e.g., social support) to reveal emergent patterns and themes.[41] OSOP involves reading through all

segments from a code and writing commonalities on a sheet of paper, grouped by narrower pattern and theme. Then, themes and codes were compared and discussed among the authors to reveal overarching themes in the data. MAXQDA (Berlin, VERBI Software) was used for all data management and analysis.

**Results**

Participants were a median of 37 years old (range: 19-62) and spent a median 13.5 years (range: 1-30) in sex exchange (Table 9). Eight participants were non-Hispanic White, nine were non-Hispanic Black, and one participant responded "other" race but did not clarify. Half of the participants currently injected drugs. Thirty-nine percent (7/18) score high on the CDRS indicating a high level of resilience.

Participants described a wide variety of traumas and hardships at the interview's onset. Some participants described difficulties related to sex work, drug use, or involvement in the drug trade such as sexual assault, overdose, struggles with withdrawal and sobriety, and robbery. Others described more universal difficulties, such as death of a loved one or breakup of an intimate relationship. However, participants described traumatic events throughout the course of the interview outside of explicit discussion of hardships, speaking to the ubiquity of trauma in many of their lives.

The following results describe actions and attitudes that, in part, stem from these acute traumatic experiences but participants also spoke about chronic difficult experiences and how they do or do not address them. Results will first describe how substance use serves as a form of self-medication and coping strategy in light of traumas; then results will describe themes related to social support including difficulty in asking for support, the dichotomy of transactional versus genuine support (including as this

115

pertains to peers, family, and maternal support in particular), and the unique role children play in resilience; finally, results will discuss limited formal resource utilization.

*Coping, self-medication, and substance use*

Substance use was often expressed as a distraction for FSW from traumatic experiences or the realities of a harsh environment, often one where social support and other external resources were perceived as unavailable: multiple participants used the term "self-medicate" to describe their relationship to drug use. Self-medication or other means of coping through substance use are rational choices considering the significant social and structural barriers FSW face. For example, when asked how she was currently feeling, Georgia (35 years old) responded:

> Lately, depressed. Very, very depressed. I feel like I just want to stay
> numbed. Yeah, just stay high. When I'm sober I'm freaking miserable.

Another example from Helen:

> I feel depressed when I'm sober. As soon as I get high, I'm happy. As soon
> as I'm sober, that's when everything gets me, which...I try not to let that
> happen, because I don't want to feel down.

This was not just true for FSW with low internal resilience scores; participants with high internal resilience scores similarly described using drugs to numb psychological pain or blot out memories of traumatic experiences, albeit temporarily:

> I just get high just to not think about it. To me, that's how I forget about
> stuff that's going in my life. That's the sad part about it. When I'm going

116

through something, to me to get high is to forget about it. [But] I still don't

forget about it after that happened. (Nia, 30 years old)

I'm tired. Mentally... I'm so over this lifestyle. I mean, I've been...I've been

over it. I started this shit to get my mind off of [her ex-girlfriend] but

smoking coke caused more problems than just, you know, trying to deal

with the breakup (Beth, 19 years old)

…You numb yourself out. That's what it does to me. If I feel like I'm

getting depressed, I'll do some dope and I'll be OK. It's self-medicating. It

works. The only time that I can honestly be like, "Yeah, I've gone through

it," is when I got locked up because I didn't have nothing to turn to.

(Marie, 32 years old)

These quotes raise potential drawbacks in limiting conceptualizations of resilience

to internal resilience measures with people who use drugs: attitudes expressed as internal

resilience on the Connor-Davidson scale (e.g., coping with stress, handling negative

feelings well, and "bouncing back" after hardship) may be complicated by the role that

substance use plays in masking psychological pain as an alternative to facing struggles.

Drug use in and of itself does not make an individual less resilient, but it does provide an

easily accessible coping mechanism for women facing extensive trauma and barriers to

other forms of support.

*Difficulty in asking for support*

For a variety of reasons, many participants said they did not want or need help

after experiencing trauma and therefore did not reach out to anyone for support. Most

117

women want support in the abstract but find it difficult to seek or accept help. Some participants discussed growing up with parents who abused substances, and so the women were forced to be self-sufficient early on:

> Interviewer: When you experience difficult things in your life, why do you not ask for help?
>
> Interviewee: Because I'm used to doing everything on my own.
>
> Interviewer: How long have you felt like you're doing everything on your own?
>
> Interviewee: Since I was 15. … When I was 12 and all that, I was raising my brothers. I'd never see her. My mother was doing drugs, and I just had to do everything in the home. (Jane, 31 years old)

Similarly, many women felt that asking for help was not an option because they were responsible for their own troubles, rooted in women's internalized stigma related to drug use or sex work. When asked what she did after being assaulted by several people for refusing to have sex with a man, Helen (20 years old) responded: "Nothin'. Just took it [laughs]. Just took the ass-beating…. I guess you could say that's what comes with this [life]."

For nearly every woman, sex work was either motivated by a current or former history of drug use and the associated economic insecurity. This meant that sex work and drug use stigmas were often intersecting and mutually reinforcing: if the participant did not need to buy drugs, she would not have had to sell sex, which meant that violence

perpetrated against her was of her own making and therefore not worthy of assistance from others.

*Transactional versus genuine support*

For women, not all forms of support presented equal availability or value. When asked to describe a typical day, women often described being surrounded by others: acquaintances, neighbors, family, other FSW on the stroll, people described as "friends." Yet when questioned about their recent history of social support, participants drew stark contrasts between people who provided transactional support (i.e., they want or expect something in return for their help) and people who provide genuine, non-transactional support.

Sources of transactional support were much more widely available, but women were hesitant to use these, if at all. People providing transactional support sometimes included family members or romantic partners, but those providing support were best characterized by Helen as "people out here," meaning other participants in the drug and sex work economies. Help was readily available from these sources for small amounts of money or food, tips about dangerous clients, or even drugs to stave off withdrawal. But receiving help from these people always came with explicit demands for something in return. When asked about approaching someone else to talk about a problem, Ann (38 years old) said: "If you have drugs, yeah, they'll listen. If not, they don't have time for you, basically."

After describing some positive events in her life, Marie (32 years old) reflected on how this transactional support undercuts the positive progress she is experiencing in other areas of her life:

> It's like, everything good is happening but then I'm just still stuck in this piece of shit area, where these girls out here act like they're your friend, but they're only your friend when you've got something.

Women are so used to transactional types of support, or questionable motivations from others when providing help, that Marie has learned self-reliance that is not so much resilience as resignation and cynicism. This was echoed to some extent by nearly all other participants, including participants with high internal resilience scores, and refers back to the reasons women feel they can't ask others for help.

Competition for money and drugs is often the factor undermining social cohesion and support between FSW: "Money, drugs, foods, and all that. They help each other, and they fight with each other, basically, [laughs] over money and drugs, too." (Nia, 30 years old) With both in scarce supply, many women feel as though anything another woman gets takes away from her own supply; this competition naturally fosters skepticism in motivations.

One important delineation between low and high internal resilience groups is the availability of support from people outside of the street economy, genuine support where nothing is expected in return. Almost no one in the low resilience group discussed having genuine sources of support, whereas this was described by a few participants in the high resilience group.

Some of them do [help others], like the black girl that was right there with

the dog. She used to be out here. She used to be out here like I'm out here

and everybody else was out here, but then she stopped. She still comes out

here to make sure all of us is OK, and that's what I like. If I'm calling you

my friend, don't only come around when it's beneficial to you. She's not

like that. She'll bring clothes out here for some of the girls that wear the

same clothes for days. She'll take them to her hotel or wherever she is, so

they can get in the shower. That's a true friend. (Marie, 32 years)

Family members were often cited as the most common source of genuine support.

This source of support did not differ much between participants with low and high

resilience scores. For example, one woman (Eve) with a low resilience score said she

leans on the support of her sister and partner to deal with the challenges of her drug

treatment program; though her sister sets firm boundaries with her (43 years old) because

of her history of stealing money to buy drugs, she nonetheless expressed a deep love and

sense of caring between herself and her sister. Familial relationships, however, were

complicated by trauma or histories of substance use that undermined the close bonds

participants desired.

The role of maternal support was not a theme that was anticipated or intended to

be explored in these interviews, yet mother-child relationships were central to nearly

every interview: unconditional love and support between participants and their mothers

was one of the strongest delineators between participants showing low and high internal

resilience. Two quotes demonstrate the contrast between low and high resilience and

maternal relationships. Irene (41 years old) has a tumultuous relationship with her

biological mother, who struggles with an addiction to crack cocaine and whose relationship more closely mirrors a transactional one, as described above, than non-transactional. Despite an older woman in the neighborhood serving as a caring, surrogate mother-figure to Irene, she still returned often to her biological mother and the support she desired from her:

> Just show me that you care. Show me that. You love me, you know because you are my strength to get myself together, just be there for me. You know just start coming to see me more tell me you love me, you know.

Kylie (26 years old) does not have a perfect relationship with her mother (she described arguments between the two) but she describes a close relationship rooted in unconditional support:

> My family is extremely supportive of me. I talk to my mom almost every day. Basically, my mom mainly, she just tells me...Every day she texts me and she says, "Whenever you're ready, just call me and you know, I'll get you."

*Children as motivation*

Nearly uniformly, women cited their own children as their motivation for weathering life's challenges. In some cases, their motivation was repairing broken relationships with their children or fostering fragile but in-tact ones. In other cases, children and grandchildren were a future-oriented lens through which women viewed their current difficulties. For example, Carly (44 years old) explained:

122

My motivation is watching my children grow into great mothers and

fathers, women and men, adults. And watching my grandbabies grow into

those great men and women. And I want to be there for every step because

that's the joy they give me. It's joy there when it comes to those babies.

One comment from Marie, who has young children, situated her needs with that

of her children when it came to asking her former partner for money:

That would be selfish for me to call him and say, "Can you come drop

$20 off because I don't feel good." Or, "Can you come and bring me

something to eat." No, because I look at my kids, they're the ones that

need him. I don't need him, I'm an adult. They cannot fend for

themselves. He's their provider right now. I feel as it's not really taken

from my kids, but it is taken from them because that $20 could go to

them, going swimming, or going out to a movie, or something like that. I

get out here and get it myself before I ask him for it.

It is important to note, however, that the importance of children for women did

not differ by internal resilience scores; though children were clearly important to women,

resilience is multi-faceted and influenced by a host of factors.

*Limited formal resource utilization*

Recent histories of formal resource utilization were nearly non-existent. In

general, FSW had little experience with or knowledge of local resources to assist with

physical or mental health issues outside of drug treatment or the emergency department.

Examples of participants visiting a physician's office, a shelter, or non-profit for social

services were infrequent and, when they occurred, had taken place months or years in the past; often participants could not remember the location or the name of the organization they visited (the exception was in the case of hospital or emergency department visits, as local hospitals are well-known in Baltimore).

Lack of transportation and other logistical difficulties were the most commonly cited barriers to seeking assistance from formal resources. Women were most aware of resources that were within a few-block radius of the places at which they lived, which alleviated the barrier of transportation but still did not guarantee use. These logistical barriers stemmed from structural inequities such as markers of economic marginalization including housing insecurity, lack of a reliable cell phone or internet connection to learn about resources or make appointments, and money for public transportation. One participant said the only reason she was able to seek out drug treatment was that they guaranteed her housing.

Processes of social marginalization included anticipated or enacted stigma from care providers that left some women feeling as though help was barely in reach. The way Ann describes interactions with hospital staff in the following exchange shows that judgement of drug use is common and front-and-center in the minds of FSW, and not just an issue she personally has experienced:

> Interviewer: You were in a ton of pain. Was there anything that made going to hospital difficult?
>
> Interviewee: Yeah, because they judge you when you go in there like, "Oh, she's an addict. We are not going to give her nothing for the pain,

> nothing for withdrawals. Let her suffer." They judge you terribly. That's
> why nobody goes to the hospital around here. They get tired because they
> judge you.
>
> Interviewer: When you go to a hospital, how do you know that they're
> judging you? What are they acting like or saying to you?
>
> Interviewee: They're just snooty. "You're a user. Put her in room three."
> You hit the bell for the nurse and they never come. …Even knowing that
> might happen, it still was like, "My leg was in so much pain. I need to go."

Ultimately Ann went to the hospital because of severe pain—but not without first second-guessing the potential helpfulness of going.

Many participants expressed a desire for mental health care, the majority of whom had received a formal mental illness diagnosis in the past and were keenly aware of their mental health needs. Often, participants had been diagnosed years prior as children or young adults but had engaged with mental health care intermittently as adults, if at all. Rarely did participants express a recent history of mental health care sought out independently of the justice system or drug treatment.

The justice system played a role in many women's past diagnosis of mental illness and history of engagement in mental health care. For example, Helen knew that her anxiety was debilitating ("I knew I had something wrong with me") but was not able to seek out professional care until she arrived in jail:

> When I got locked up, they sat down. They talked to me. I guess the way I
> talked and didn't look 'em in the eyes, they said... They said that they can

just tell just by lookin' at me and what I've been through and what I do and

stuff like that can increase it [anxiety].

In fact, drug treatment, mental health care, and involvement with the justice

system were often inextricably intertwined for women. Court-ordered counseling was a

typical route through which women received psychiatric or psychological care after their

own arrest—typically in the context of court-ordered drug treatment.

**Discussion**

This study is among the first to explore resilience in a sample of FSW and is, to

our knowledge, the first mixed-methods analysis of internal and external resilience in the

population. While qualities of internal resilience have heavily informed resilience

literature, interventions, and, consequently, the public's understanding of resilience, our

findings show that only measuring internal resilience can be misleading. Among a group

of FSW in Baltimore, external resilience—as expressed by resource utilization and social

support—was extremely limited, regardless of their stated level of internal resilience, and

often stifled by immediate survival needs and transactional relationships that left women

skeptical about the availability of genuine support available to them. Our findings show a

critical need for a more comprehensive understanding of resilience, particularly with

marginalized populations such as FSW and people who use drugs, as well as greater

precision in the language of resilience to better inform research and intervention.

Difficulties of life on the street and limited economic resources undercuts FSWs'

ability to foster social support and access external community-based resources when

needed. Many women said they did not want or need help—but this should not be

confused with resilience in the traditional sense: FSW often expressed resignation that

they had no other option but to tackle problems on their own. To be sure, FSWs' survival in the face of extreme difficulty is indeed a facet of resilience and speaks to participants' strength. However, qualities that have been conceptualized and measured as internally resilient are not necessarily applicable for substance-using populations such as this sample of FSW considering the stated reliance on emotional numbing and the difficulty of existing measures to distinguish between resilience and resignation to self-reliance. This is further underscored by similar findings between women with high internal resilience scores and those with lower scores. An important caveat to these findings is that, though we used the median CDRS score to classify high and low resilience scores, the median score in this sample (22) was lower than other similar populations (ranging from 29-34).[42-44] This particular sample, perhaps more than other similar marginalized samples, has significant hurdles to overcoming difficulties and fostering both internal and external resilience given the widely varied acute and chronic traumas they have experienced. Individual and community-level socioeconomic inequities in education, employment, and neighborhood development have all been associated with both lower exposure to trauma and diminished internal and external resilience.[45,46] Research and programmatic focus on internal resilience and its improvement in the absence of social justice considerations—including access to economic and health-related resources—will continue to show a misleading picture of resilience and may even be harmful to marginalized populations such as FSW who may be blamed for lacking resilience despite facing great structural hurdles to its improvement.

Yet FSW have employed logical and practical coping mechanisms in the face of these harsh realities including through drug use. This drug use is often a double-edged

sword for women: it provides relief in the face of struggles when faced with limited other options, but also creates a barrier to social and other sources of external support. FSW face a tension between drug use as a way to cope and substance use in part shaping the transactional relationships driven by competition for money and drugs when economic resources are thin. Empowerment interventions have shown promising results in building a sense of community cohesion and generating community mobilization for FSW around the world.[47] Empowerment interventions, however, do not fully address the complex role that drug use plays in creating competition for survival in the absence of other ways of making money beyond sex work. Economic interventions such as guaranteed basic income or microfinance are often not considered domains of public health, but our results show one pathway through which economic empowerment can potentially improve social support and, consequently, internal resilience. An emerging model of resilience attempts to incorporate economic and other structural factors into what the authors term a Multi-System Model of Resilience, where some of the external factors described in this manuscript are two levels of the model and socio-economic factors make up the outermost level.[48] This may prove to be a useful model in future research to further elucidate the role of structural factors in resilience.

Improving access to resources is a critical step in strengthening external resilience and ultimately improving physical and mental health. In this sample of FSW, perceived and actual access of local health and social service resources is extremely limited despite expressed need for these supportive services. Interviews with FSW corroborate many prior findings about cost and transportation, anticipated or enacted stigma, lack of knowledge of resources, and conflicting priorities with drug use being significant barriers

to accessing services.[34] These findings highlight the critical need for services that are welcoming, non-stigmatizing, flexible, and holistic. As we and others have written about previously, co-locating commonly needed services by FSW and PWUD (e.g., syringe services, trauma-informed counseling, and HIV testing and care) can alleviate some of these barriers to service use and empower these populations to access services in times of need. Additionally, peer mentoring or guidance on formal resources for health and social services can be a useful way to promote resilience and social support within the same intervention.

These findings should be considered in light of several limitations. First, the interviews are subject to potential social desirability bias and other limits of self-reporting. Second, we recruited the sample for this study (and the parent study, EMERALD) using street-based methods. Though the eligibility criteria did not specify street-only sex work, the recruitment method may have skewed the sample toward the most structurally vulnerable women. As such, these results should also not be considered representative of all FSW or of FSW outside of the context of Baltimore City, though our findings are similar to other published reports of FSW in other locations and provide a basis with which to conduct further research in other geographic settings. Additionally, qualitative data are not generalizable beyond the participants in the study.

It is important to reflect on interviewer and coder positionality, i.e., how one's social identities inform how they see the world and how the world sees them. There are several issues to raise with respect to this research and the researchers' positionality. First, there were no Black interviewers or coders despite half the participants identifying as Black. Second, no interviewer or coder had lived experience as either a sex worker, a

person who uses drugs, or were currently experiencing severe economic insecurity. As such, there are likely nuances in participants' narratives that interviewers and coders failed to grasp because of these differing backgrounds. And while the interviewers were all experienced in qualitative methods and developing rapport with participants, this lack of lived experience and affiliation with a powerful local institution may have undermined those efforts at building rapport, as participants may have been reticent to share details about their participation in illegal activities for fear of researchers' disclosure to police or poor treatment toward the participant. Further, participants' familiarity with the University and Johns Hopkins Hospital (JHH) may predispose participants to respond in ways that they believe are expected of them by the researchers, in particular pro-health or anti-substance use messages. For example, it is possible that participants mentioned their histories of drug treatment because they felt that was expected of them by the researchers. Another participant mentioned twice in her interview that she "loved" JHH; when asked about any drawbacks to seeking are at JHH she said she could not think of any. This may be true, but it is worth reflecting on the role that the researchers' affiliation may have had on her answer.

Resilience is an important construct in psychosocial research but not fully explicated in literature about marginalized populations such as FSW. This exploration of social support and resource utilization, two facets of external resilience, show the limitations of relying on measures of internal resilience. Interventions to strengthen FSW connectedness through social support and resource utilization may improve external resilience and FSW mental health.

**References**

1.      Luthar SS, Cicchetti D, Becker B. The construct of resilience: a critical evaluation and guidelines for future work. *Child Dev.* 2000;71(3):543-562.

2.      Fergus S, Zimmerman MA. Adolescent resilience: a framework for understanding healthy development in the face of risk. *Annu Rev Public Health.* 2005;26:399-419.

3.      Pangallo A, Zibarras L, Lewis R, Flaxman P. Resilience through the lens of interactionism: a systematic review. *Psychol Assess.* 2015;27(1):1-20.

4.      Alegria M, Vera M, Freeman DH, Jr., Robles R, Santos MC, Rivera CL. HIV infection, risk behaviors, and depressive symptoms among Puerto Rican sex workers. *Am J Public Health.* 1994;84(12):2000-2002.

5.      Gunn JK, Roth AM, Center KE, Wiehe SE. The Unanticipated Benefits of Behavioral Assessments and Interviews on Anxiety, Self-Esteem and Depression Among Women Engaging in Transactional Sex. *Community Ment Health J.* 2016;52(8):1064-1069.

6.      Surratt HL, Kurtz SP, Weaver JC, Inciardi JA. The connections of mental health problems, violent life experiences, and the social milieu of the "stroll" with the

HIV risk behaviors of female street sex workers. *Journal of Psychology &amp; Human Sexuality.* 2005;17(1-2):23-44.

7.  Rossler W, Koch U, Lauber C, et al. The mental health of female sex workers. *Acta Psychiatr Scand.* 2010;122(2):143-152.

8.  Suresh G, Furr LA, Srikrishnan AK. An assessment of the mental health of street-based sex workers in Chennai, India. *Journal of Contemporary Criminal Justice.* 2009;25(2):186-201.

9.  Hong Y, Fang X, Li X, Liu Y, Li M, Tai-Seale T. Self-perceived stigma, depressive symptoms, and suicidal behaviors among female sex workers in China. *J Transcult Nurs.* 2010;21(1):29-34.

10. Sagtani RA, Bhattarai S, Adhikari BR, Baral D, Yadav DK, Pokharel PK. Violence, HIV risk behaviour and depression among female sex workers of eastern Nepal. *BMJ Open.* 2013;3(6).

11. Puri N, Shannon K, Nguyen P, Goldenberg SM. Burden and correlates of mental health diagnoses among sex workers in an urban setting. *BMC Womens Health.* 2017;17(1):133.

12.    Kessler RC, McGonagle KA, Swartz M, Blazer DG, Nelson CB. Sex and depression in the National Comorbidity Survey. I: Lifetime prevalence, chronicity and recurrence. *J Affect Disord.* 1993;29(2-3):85-96.

13.    Vesga-Lopez O, Blanco C, Keyes K, Olfson M, Grant BF, Hasin DS. Psychiatric disorders in pregnant and postpartum women in the United States. *Arch Gen Psychiatry.* 2008;65(7):805-815.

14.    Farr SL, Bitsko RH, Hayes DK, Dietz PM. Mental health and access to services among US women of reproductive age. *Am J Obstet Gynecol.* 2010;203(6):542 e541-549.

15.    Melville JL, Gavin A, Guo Y, Fan MY, Katon WJ. Depressive disorders during pregnancy: prevalence and risk factors in a large urban sample. *Obstet Gynecol.* 2010;116(5):1064-1070.

16.    Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry.* 1995;52(12):1048-1060.

17.    Inciardi JA, Surratt HL. Drug use, street crime, and sex-trading among cocaine-dependent women: implications for public health and criminal justice policy. *J Psychoactive Drugs.* 2001;33(4):379-389.

18.    Deering KN, Amin A, Shoveller J, et al. A systematic review of the correlates of violence against sex workers. *Am J Public Health.* 2014;104(5):e42-54.

19.    Farley M, Barkan H. Prostitution, violence, and posttraumatic stress disorder. *Women Health.* 1998;27(3):37-49.

20.    Farley M, Cotton A, Lynne J, et al. Prostitution and trafficking in nine countries: An update on violence and posttraumatic stress disorder. *Journal of trauma practice.* 2004;2(3-4):33-74.

21.    Vanwesenbeeck I, De Graaf R, Van Zessen G, Straver CJ, Visser JH. [Risky life, risky business: AIDS risk of female prostitutes in the context of early abuse and well-being]. *Gedrag Gezond.* 1993;21(5):219-226.

22.    Ozer EJ, Best SR, Lipsey TL, Weiss DS. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychol Bull.* 2003;129(1):52-73.

23.    Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol.* 2000;68(5):748-766.

24.     Schuster R, Bornovalova M, Hunt E. The influence of depression on the progression of HIV: direct and indirect effects. *Behav Modif.* 2012;36(2):123-145.

25.     Gu J, Lau JT, Li M, et al. Socio-ecological factors associated with depression, suicidal ideation and suicidal attempt among female injection drug users who are sex workers in China. *Drug Alcohol Depend.* 2014;144:102-110.

26.     Buttram ME, Surratt HL, Kurtz SP. Resilience and syndemic risk factors among African-American female sex workers. *Psychol Health Med.* 2014;19(4):442-452.

27.     Burnes TR, Rojas EM, Delgado I, Watkins TE. "Wear Some Thick Socks If You Walk in My Shoes": Agency, Resilience, and Well-Being in Communities of North American Sex Workers. *Arch Sex Behav.* 2017.

28.     Grieb SD, Flores-Miller A, Sherman SG, Page KR. Syndemic Factors and Resiliency Among Latina Immigrant Indirect Sex Workers in an Emergent Immigrant City. *J Immigr Minor Health.* 2018.

29.     Rouhani S, Decker MR, Tomko C, et al. Resilience among Cisgender and Transgender Women in Street-Based Sex Work in Baltimore, Maryland. *Women's Health Issues.* 2020.

30.   Ulibarri MD, Semple SJ, Rao S, et al. History of abuse and psychological distress symptoms among female sex workers in two Mexico-U.S. border cities. *Violence Vict.* 2009;24(3):399-413.

31.   Scorgie F, Nakato D, Harper E, et al. 'We are despised in the hospitals': sex workers' experiences of accessing health care in four African countries. *Cult Health Sex.* 2013;15(4):450-465.

32.   Ghimire L, Smith WC, van Teijlingen ER, Dahal R, Luitel NP. Reasons for non- use of condoms and self- efficacy among female sex workers: a qualitative study in Nepal. *BMC Womens Health.* 2011;11:42.

33.   Guha M, Baschieri A, Bharat S, et al. Risk reduction and perceived collective efficacy and community support among female sex workers in Tamil Nadu and Maharashtra, India: the importance of context. *J Epidemiol Community Health.* 2012;66 Suppl 2:ii55-61.

34.   Ma PHX, Chan ZCY, Loke AY. The Socio-Ecological Model Approach to Understanding Barriers and Facilitators to the Accessing of Health Services by Sex Workers: A Systematic Review. *AIDS Behav.* 2017;21(8):2412-2438.

35. Allen ST, Footer KHA, Galai N, Park JN, Silberzahn B, Sherman SG. Implementing Targeted Sampling: Lessons Learned from Recruiting Female Sex Workers in Baltimore, MD. *J Urban Health.* 2018.

36. Silberzahn BE, Morris MB, Riegger KE, et al. Barriers and facilitators to retaining a cohort of street-based cisgender female sex workers recruited in Baltimore, Maryland, USA: results from the SAPPHIRE study. *BMC Public Health.* 2020;20:1-12.

37. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety.* 2003;18(2):76-82.

38. Hennink MM, Kaiser BN, Marconi VC. Code Saturation Versus Meaning Saturation: How Many Interviews Are Enough? *Qual Health Res.* 2017;27(4):591-608.

39. Namey E, Guest G, McKenna K, Chen M. Evaluating bang for the buck: A cost-effectiveness comparison between individual interviews and focus groups based on thematic saturation levels. *American Journal of Evaluation.* 2016;37(3):425-440.

40.     Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field methods.* 2006;18(1):59-82.

41.     Ziebland S, McPherson A. Making sense of qualitative data analysis: an introduction with illustrations from DIPEx (personal experiences of health and illness). *Medical education.* 2006;40(5):405-414.

42.     Dale SK, Cohen MH, Kelso GA, et al. Resilience among women with HIV: Impact of silencing the self and socioeconomic factors. *Sex Roles.* 2014;70(5-6):221-231.

43.     Dale SK, Weber KM, Cohen MH, Kelso GA, Cruise RC, Brody LR. Resilience Moderates the Association Between Childhood Sexual Abuse and Depressive Symptoms Among Women with and At-Risk for HIV. *AIDS Behav.* 2015;19(8):1379-1387.

44.     Wingo AP, Wrenn G, Pelletier T, Gutman AR, Bradley B, Ressler KJ. Moderating effects of resilience on depression in individuals with a history of childhood abuse or trauma exposure. *J Affect Disord.* 2010;126(3):411-414.

45. Morenoff JD, Sampson RJ, Raudenbush SW. Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence. *Criminology.* 2001;39(3):517-558.

46. Kjellstrand EK, Harper M. Yes, she can: An examination of resiliency factors in middle-and upper-income single mothers. *Journal of Divorce & Remarriage.* 2012;53(4):311-327.

47. Kerrigan DL, Fonner VA, Stromdahl S, Kennedy CE. Community empowerment among female sex workers is an effective HIV prevention intervention: a systematic review of the peer-reviewed evidence from low-and middle-income countries. *AIDS and Behavior.* 2013;17(6):1926-1940.

48. Liu JJ, Reed M, Girard TA. Advancing resilience: An integrative, multi-system model of resilience. *Personality and Individual Differences.* 2017;111:111-118.

**Table 9. Characteristics of qualitative interview participants, a sub-sample of the EMERALD cohort of female sex workers in Baltimore, Maryland (n=18)**

| "Name" | Age | Race | Time in sex work | Connor-Davidson Resilience Scale |
|---|---|---|---|---|
| Ann | 38 | NH White | 15 | 12 |
| Beth | 19 | NH Black | 5 | 33 (H) |
| Carly | 44 | NH Black | 26 | 30 (H) |
| Deborah | 59 | NH White | 34 | 10 |
| Eve | 43 | NH Black | 27 | 22 |
| Frida | 23 | NH White | 12 | 27 (H) |
| Georgia | 35 | NH White | 9 | 22 |
| Helen | 20 | NH White | <1 year | 22 |
| Irene | 41 | NH White | 24 | 18 |
| Jane | 31 | NH Black | 15 | 19 |
| Kylie | 26 | Other | 4 | 27 (H) |
| Lydia | 29 | NH White | 11 | 32 (H) |
| Marie | 32 | NH White | 6 | 28 (H) |
| Nia | 30 | NH Black | 2 | 24 (H) |
| Olivia | 43 | NH Black | 30 | 22 |
| Pearl | 46 | NH Black | 22 | 21 |
| Ruth | 62 | NH Black | 12 | 21 |
| Sarah | 48 | NH Black | 18 | 18 |

Note: All names are pseudonyms
NH=non-Hispanic, (H) refers to Connor-Davidson Resilience scores >22, the cohort median

# Chapter 5: Discussion, Conclusion, and Future Directions

Though the link between structural vulnerabilities and poor mental health has been understood for some time, there is a dearth of research exploring if and how they co-occur and the extent to which this may impact mental health. Female sex workers (FSW) in many settings, particularly in Baltimore, experience many of these structural vulnerabilities such as housing insecurity, food insecurity, stigmas from healthcare providers and others, and arrest and incarceration due to the illegal nature of their work. At the same time, FSW mental health is an underexplored topic despite estimates of mental distress or illness in this population nearly always eclipsing estimates from the general women population.

In Aim 1, we found evidence of three distinct latent classes of structural vulnerabilities: one characterized by minimal structural vulnerabilities, a second characterized by material needs like housing and food insecurities, and a third characterized by high conditional probabilities of all markers of structural vulnerability (including client-perpetrated physical and sexual violence, food and housing insecurities, and financial dependence on another person). In a cross-sectional analysis, adjusted models found greater mental distress among FSW in the high structural vulnerability and material needs classes compared to minimal structural vulnerability. We also found evidence of higher condomless sex with clients in the high structural vulnerability class

compared to the other two classes, demonstrating the role of structural precarity in the HIV risk environment of FSW.

At 12-month follow-up (Aim 2), levels of mental distress were nearly identical to baseline, though these were not significantly different by latent class as we hypothesized nor moderated by resilience (contrary to our hypothesis). This study is one of the first to examine mental health longitudinally among FSW and adds to the evidence of elevated mental distress in this population. A strength of this work is that we examined continuous mental health scores, irrespective of a clinical mental illness diagnosis or in the context of treatment-seeking. FSW often experience barriers to healthcare access, meaning access to clinical care for the purposes of a mental health diagnosis may not be feasible. Additionally, it allows us to explore sub-clinical levels of distress that contribute to a more complete picture of FSW mental health. However, we may also be underestimating levels of mental distress because of selection bias in the sample, i.e., we may miss those who are most distressed because they did not participate in the study. Overall, however, these results set up future research on structural vulnerabilities, their co-occurrence, and salient pathways to mental health.

Results from Aim 3 show the complexity of resilience as a construct, as well as limitations with the Connor-Davidson Resilience Scale and the associated focus on internal resilience in substance using populations. Aim 3 results showed that external resilience is limited in a sample of FSW who use drugs: the way that FSW live and interact within their communities is shaped in part by a resignation that quality sources of social support and community-based resources are not accessible, whether because of fear of stigma, structural barriers to access, or skepticism of others shaped by competition

143

for drugs and other scarce material resources. Aim 3 results also show that measures of internal resilience like the CDRS may not be accurately capturing the construct in a structurally vulnerable population who uses drugs. For example, FSW often spoke of "fixing" problems on their own because the problems are of their own making, or they have "always" only had themselves to rely upon. CDRS items such as "deal[ing] with whatever comes" or "think[ing] of self as a strong person" are complicated by the nuance with which FSW described their historical traumas, emotional resignation, and the complicated role substance use plays in coping.

But these results also show several actionable ways to address these limitations. First, research should include appropriate and relevant measures of external resilience when using the construct (or explicitly labeling the use as internal/external resilience as applicable). Second, measures of internal resilience should be adapted for substance-using populations to begin to unpack how internal resilience manifests in the presence or absence of substance use and structural vulnerability. Third, interventions to increase access to supportive resources or strengthening sources of social support among FSW may be important steps in improving external resilience. Qualitative results showed that community-based resources were not widely or routinely used, perhaps outside of emergency departments or drug treatment. Prior research has explored barriers and facilitators of healthcare utilization among FSW, but this largely covered only HIV-related care or primary care.[1] Mental health care and its provision is one area that is underexplored in FSW, despite our results and others showing that the sample has a high burden of mental distress that is unaddressed. Based on findings from qualitative

interviews, a peer support model may help other FSW to navigate mental health care and to develop a sense of social support.

Substance use is both a barrier to resource utilization and partially an effect of FSW having few perceived alternative options for coping with stressors and trauma. For FSW, meeting the demands of drug dependence is a top priority that can strain healthcare-seeking or other resource utilization; society's stigmatizing view of substance use can also create an unwelcoming environment for FSW, or there may be expectations of sobriety as a precondition of resource utilization, also serving as a barrier.[1] Yet substance use does not mean that FSW cannot solve problems or engage in health-promoting activities; these resources must meet people who use drugs where they are. Healthcare—including mental healthcare—that embraces harm reduction principles can offer new options through which FSW and people who use drugs can utilize supportive resources and improve their sense of external resilience. Expanding harm reduction in healthcare may be just one path forward: a greater exploration of policies or service-delivery models that can increase access to resources for FSW or people who use drugs is warranted.

Structural inequities require structural-level interventions to support sustainable health improvement. Often interventions with FSW focus on individual- or interpersonal-level behavior change, typically in the context of HIV or substance use, such as condom use or syringe sharing.[2] This is not unique to HIV prevention or work with FSW; public health policy broadly in the U.S. has focused on individualism, reflecting several cultural and political values, neoliberalism chief among them.[3] To our knowledge, there have not yet been any structural interventions with FSW targeted at mental health as the primary

outcome, though research has shown the importance of mental health and improved psychological outcomes as inextricably linked to HIV infection and related outcomes.[4] The results of this dissertation corroborate and extend prior research by showing the way structural vulnerabilities can manifest in individual-level behaviors. By ignoring these structural factors in health promotion, the field of public health risks overlooking the root causes of health inequities.[2] These results show patterns of co-occurring structural vulnerabilities that should be addressed in tandem. Blankenship *et al.* have argued for structural interventions that integrate other health and social services with existing HIV clinics.[2] Integrated health and social services that focus on the needs of FSW may be one way for clinicians and public health practitioners to address the complex intersection of structural vulnerabilities in this population.

Relatedly, housing policies in Baltimore and other (particularly urban) locations in the U.S. should increase access to stable, affordable housing. For example, Housing First is an innovative program that provides access to stable housing rented from community landlords without the expectation of sobriety; the program has shown better long-term substance use and psychiatric outcomes than community-supported housing (where sobriety may be a condition of housing) or continued housing instability.[5,6] In Baltimore, legislation that bans rejection of prospective renters because they use housing vouchers was only passed at the end of 2019, but landlords are still permitted to consider criminal history when rejecting tenants.[7] Almost three-quarters of the sample experienced housing insecurity, which, as previously discussed, confers its own health risks even if it is the only structural vulnerability one experiences.[8,9] More broadly, FSW may benefit in

part from better access to licit sources of income via policies that can support funding for small businesses to support hiring or poverty alleviation programs in low-income areas.

Interventions aimed at minimizing food insecurity are targeted but potentially extremely effective interventions for primary and secondary prevention of mental illness or HIV in structurally vulnerable populations such as this sample of FSW. A conceptual framework of food insecurity and HIV acquisition shows mental health as an important pathway moderating the relationship between structural drivers of hunger and HIV transmission.[10] Interventions that have provided macronutrient supplements to food insecure individuals have been associated with better HIV outcomes in people living with HIV, but these do not address the heart of food insecurity.[11,12] Cuts to public funding for food benefits such as Supplemental Nutrition Assistance Program (SNAP) put individuals at greater risk for a host of poor health outcomes, and efforts should be made to widen the safety net provided by SNAP and other similar programs.[13]

Given the co-occurring nature of housing and food insecurity found in these results, policies in the U.S. and beyond should address these in tandem for maximum benefit, and interventions may be limited in their effectiveness if secure housing and safety are not also addressed concurrently.[10-12] One suggestion may be removing requirements for identification (such as a birth certificate or driver's license) to begin enrollment in food or housing assistance programs, something that 29% of our sample reported not having. Another suggestion may be to begin enrollment in SNAP or other food security programs for anyone living in public housing. Policy changes to expand eligibility for housing and food assistance programs can begin to make access to these programs more equitable, but increased funding and political will are necessary

prerequisites. Decriminalizing sex work and drug use is one potential avenue to address co-occurring structural vulnerabilities and their impact on FSW mental health. Decriminalization can provide avenues for FSW experiencing violence from clients to pursue justice without fear of arrest; reduce potential exposure to police harassment, intimidation, or violence in the course of arrest; and break the cycle of further economic insecurity due to incarceration or a criminal record.

There are several broad limitations of this research that should be addressed. First, we caution against generalizing these findings to all FSW. Although participants did not need to only solicit clients from the street, our mobile recruitment strategy likely led to a sample where <10% did not at least occasionally find clients this way. Nearly three-quarters of our participants also reported being motivated to enter sex work to buy drugs, which does not necessarily reflect the motivations of all women who sell sex. Second, our data are self-reported and are subject to the social desirability or recall biases inherent in self-reported data. Third, the bi-directional relationship between mental health and drug use means that we cannot completely understand the temporality of their relationship in this research, i.e., we cannot know with this research whether mental distress is caused by drug use or drug use is caused by mental distress. For the purposes of understanding these research questions, we were able to use several measures of substance use as covariates in models to at least attempt to identify independent effects of mental distress. Relatedly, we hypothesized in Aim 1 that structural vulnerability latent classes are associated with substance use, mental distress, and sex work stigma cross-sectionally, for example, but it is possible that these measures may also predict structural vulnerability latent classes. We did not have historical data to fully understand this relationship, such as onset of

148

substance use, distress, housing or food insecurities, and future research may be able to better understand the timing of these relationships. Finally, we are limited by only having measures of depression and post-traumatic stress disorder (PTSD); Watson *et al.* suggests that depression and PTSD are both considered mood disorders and, as such, we are missing the distress associated with anxiety, personality, and psychotic disorders for example.[14] Future research would benefit from including additional measures of these disorders, including symptom-specific analyses.

This sample of FSW exhibit high levels of structural vulnerability, mental distress, and complex manifestations of internal and external resilience; this dissertation used multiple data collection and analysis methods to provide nuance to these concepts. In the last two decades, public health as a field has begun to embrace the role that structural factors have in creating health conditions, though this has largely been outside the realm of mental health. These results show that certain types of structural vulnerabilities co-exist in particular patterns for a highly marginalized population like FSW, and these patterns have differing levels of mental distress—distress which persists at a high level over time and requires urgent intervention at structural levels.

**References**

1. Ma PHX, Chan ZCY, Loke AY. The Socio-Ecological Model Approach to Understanding Barriers and Facilitators to the Accessing of Health Services by Sex Workers: A Systematic Review. *AIDS Behav.* 2017;21(8):2412-2438.

2. Blankenship KM, Friedman SR, Dworkin S, Mantell JE. Structural interventions: concepts, challenges and opportunities for research. *Journal of Urban Health.* 2006;83(1):59-72.

3. Baum F, Fisher M. Why behavioural health promotion endures despite its failure to reduce health inequities. *Sociol Health Illn.* 2014;36(2):213-225.

4. Rekart ML. Sex-work harm reduction. *Lancet.* 2005;366(9503):2123-2134.

5. Appel PW, Tsemberis S, Joseph H, Stefancic A, Lambert-Wacey D. Housing First for severely mentally ill homeless methadone patients. *J Addict Dis.* 2012;31(3):270-277.

6. Tsemberis S, Gulcur L, Nakae M. Housing First, consumer choice, and harm reduction for homeless individuals with a dual diagnosis. *Am J Public Health.* 2004;94(4):651-656.

7. Nobles WP. Baltimore County Council approves bill to protect renters using housing vouchers. *The Baltimore Sun*2019.

8. Shaw M. Housing and public health. *Annu Rev Public Health.* 2004;25:397-418.

9. Power R, French R, Connelly J, et al. Health, health promotion, and homelessness. *Bmj.* 1999;318(7183):590-592.

10. Weiser SD, Young SL, Cohen CR, et al. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *Am J Clin Nutr.* 2011;94(6):1729S-1739S.

11. Mamlin J, Kimaiyo S, Lewis S, et al. Integrating nutrition support for food-insecure patients and their dependents into an HIV care and treatment program in Western Kenya. *American journal of public health.* 2009;99(2):215-221.

12. Cantrell RA, Sinkala M, Megazinni K, et al. A pilot study of food supplementation to improve adherence to antiretroviral therapy among food insecure adults in Lusaka, Zambia. *Journal of acquired immune deficiency syndromes (1999).* 2008;49(2).

13. Fessler P, Treisman Rachel. Nearly 700,000 SNAP Recipients Could Lose Benefits Under New Trump Rule. 2019; https://www.npr.org/2019/12/04/784732180/nearly-700-000-snap-recipients-could-lose-benefits-under-new-trump-rule. Accessed February 26, 2020.

14. Watson D. Differentiating the mood and anxiety disorders: a quadripartite model. *Annu Rev Clin Psychol.* 2009;5:221-247.

# Appendix of Detailed Methods

**Chapter 2 Methods**

The following table shows how each variable in the latent class analysis was

operationally defined and the time frame of the recall period.

**Table 10. Definition of structural vulnerability indicators used in the latent class analysis**

| Structural Vulnerability Indicator | Time frame | Definition |
|---|---|---|
| Housing insecurity | 6 months | Living or staying in more than 2 places |
| Financially dependent | 6 months | Depending on someone else financially |
| Food insecurity | 6 months | "going to bed hungry" at least once per week |
| Sexual violence, client-perpetrated | 6 months | Being pressured for vaginal, anal, or oral sex; being made to have vaginal, anal, or oral sex through physical force; condom refusal or removal during sex by someone that paid or exchanged goods or services for sexual acts |
| Physical violence, client-perpetrated | 6 months | Being "hit, punched, slapped, or otherwise physically hurt" and/or have "a gun, knife, or other weapon used against you" by someone that paid or exchanged goods or services for sexual acts |

*Correlation between PHQ-9 and PCL-5*. We assessed the correlation between PHQ-9 and

PCL-5 prior to combining both into a measure of mental distress. The PCL-5 does not

include criterion B items.

**Table 11. Correlation coefficients between measures of depressive symptoms (PHQ-9) and PTSD (PCL-5—no criterion B) (n=235)**

|  | PHQ-9 *Baseline* | PHQ-9 *12 months* | PCL-5 *Baseline* |
|---|---|---|---|
| **PHQ-9** *12 months* | 0.39*** | | |
| **PCL-5** *Baseline* | 0.66*** | 0.31*** | |
| **PCL-5** *12 months* | 0.38*** | 0.62*** | 0.40*** |

**Figure 6. Scatterplot of correlation between baseline and 12-month measures of depressive symptoms (PHQ-9) and PTSD (PCL-5—no criterion B)**
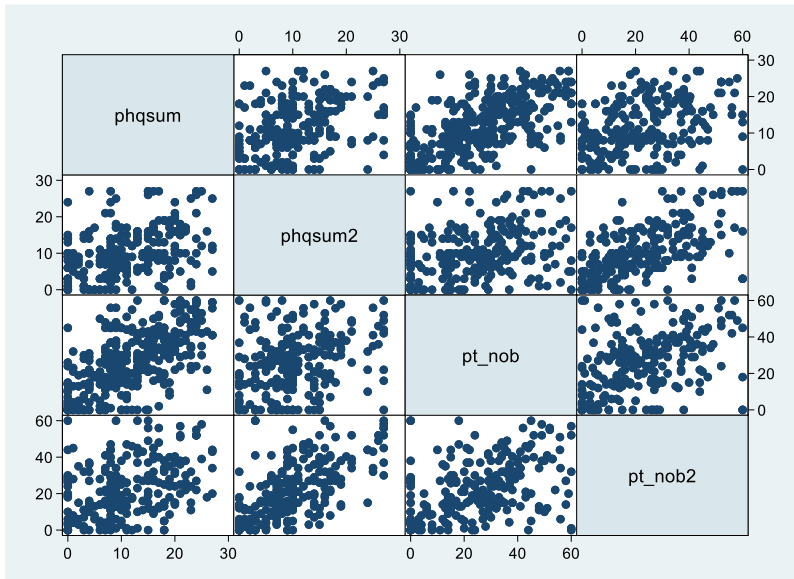


phqsum = baseline PHQ-9 score; phqsum2 = 12-month PHQ-9 score
pt_nob = baseline PCL-5 score without criterion B; pt_nob2 = 12-month PCL-5 score without criterion B

## Chapter 3 Methods

*Assessing loss to follow-up.* To begin Aim 2 analysis, we first compared sample

characteristics and latent class indicators at baseline between participants who completed

12-month follow-up and participants lost to follow-up. We did this using Chi-square and

t-tests. As the data showed a number of significant differences between completers and

LTFU, we decided to use multiple imputation of mental distress at 12-months to reduce

bias from LTFU.

**Table 12. Differences in sample characteristics between EMERALD participants lost to follow-up and those who completed 12-month follow-up (n=385)**

| | | Status of 12-month survey | | |
| | **Total (n=385)** | **Lost to follow-up (n=150)** | **Complete (n=235)** | |
| | *N (%) \** | *N (%)* | *N (%)* | *p* |
| **Background characteristics** | | | | |
| Study arm | | | | |
| *Control* | 161 (41.8) | 64 (42.7) | 97 (41.3) | 0.79 |
| *Intervention* | 224 (58.2) | 86 (57.3) | 138 (58.7) | |
| Age, years *(mean, SD)* | 37.0 (9.3) | 35.5 (8.9) | 38.0 (9.3) | 0.01 |
| Race | | | | |
| *White* | 218 (56.6) | 79 (52.7) | 139 (59.1) | 0.10 |
| *Black* | 139 (36.1) | 55 (36.7) | 84 (35.7) | |
| *Other race* | 28 (7.3) | 16 (10.7) | 12 (5.1) | |
| Education | | | | |
| *Less than high school graduate* | 177 (46.0) | 60 (40.0) | 117 (49.8) | 0.17 |
| *High school graduate or GED* | 96 (24.9) | 41 (27.3) | 55 (23.4) | |
| *Some college or greater* | 112 (29.1) | 49 (32.7) | 63 (26.8) | |
| Sexual orientation[a] | | | | |
| *Heterosexual/"straight"* | 260 (67.7) | 108 (72) | 152 (65) | 0.31 |
| *Lesbian/Queer/Same gender loving* | 24 (6.3) | 7 (4.7) | 17 (7.3) | |

| | | | | |
|---|---|---|---|---|
| *Bisexual* | 100 (26.0) | 35 (23.3) | 65 (27.8) | |
| Has kids under 18 years | 233 (60.5) | 89 (59.3) | 144 (61.3) | 0.70 |
| Ever arrested | 314 (81.6) | 110 (73.3) | 204 (86.8) | <0.001 |

**Sex work history and context**

| | | | | |
|---|---|---|---|---|
| Entered sex work as minor | 85 (22.1) | 28 (18.7) | 57 (24.3) | 0.20 |
| Coerced or tricked into sex work [a] | 19 (5.0) | 9 (6.0) | 10 (4.3) | 0.45 |
| Time in sex work, years *(mean, SD)* [b] | 13.2 (9.5) | 10.5 (9.3) | 15.0 (9.3) | <0.001 |
| Only street-based client solicitation[†] | 124 (32.2) | 52 (34.7) | 72 (30.6) | 0.41 |
| Sex work only source of income[†] | 99 (25.7) | 38 (25.3) | 61 (26) | 0.89 |
| Condomless sex with clients[†] | 174 (45.2) | 68 (45.3) | 106 (45.1) | 0.97 |

**Substance use[†]**

| | | | | |
|---|---|---|---|---|
| Injected any drug | 223 (57.9) | 98 (65.3) | 125 (53.2) | 0.02 |
| Used heroin | 309 (80.3) | 130 (86.7) | 179 (76.2) | 0.01 |
| Used powdered or crack cocaine | 334 (86.8) | 138 (92) | 196 (83.4) | 0.02 |

**HIV and sexually transmitted infection results**

| | | | | |
|---|---|---|---|---|
| Positive HIV rapid test | 20 (5.2) | 6 (4.0) | 14 (6.0) | 0.50 |
| Positive gonorrhea [c] | 59 (15.7) | 26 (17.5) | 33 (14.6) | 0.46 |
| Positive chlamydia [d] | 68 (18.1) | 35 (23.7) | 33 (14.5) | 0.02 |

**Psychosocial characteristics**

| | *Mean (SD)* | *Mean (SD)* | *Mean (SD)* | |
|---|---|---|---|---|
| Depressive symptoms [e] | 11.6 (7.3) | 12.1 (7.4) | 11.3 (7.2) | 0.30 |
| Post-traumatic stress symptoms [f] | 33.2 (21.3) | 35.2 (21.4) | 32.6 (21.2) | 0.26 |
| Distress score | 45.2 (26.6) | 47.3 (26.4) | 44.0 (26.7) | 0.24 |
| Social cohesion [d] | 29.0 (6.3) | 28.4 (6.3) | 29.3 (6.2) | 0.17 |
| Internalized sex work stigma [f] | 34.8 (5.8) | 34.5 (5.9) | 35.0 (5.8) | 0.40 |

**Latent class analysis indicators[†]**

| | | | | |
|---|---|---|---|---|
| Unstable housing | 283 (73.5) | 127 (84.7) | 156 (66.4) | <0.001 |
| Financial dependence on someone else | 188 (48.8) | 82 (54.7) | 106 (45.1) | 0.07 |
| Client-perpetrated physical violence | 123 (32.0) | 52 (34.7) | 71 (30.2) | 0.36 |
| Client-perpetrated sexual violence | 99 (25.8) | 44 (29.3) | 55 (23.5) | 0.20 |
| Food insecurity (weekly) | 183 (47.8) | 82 (55.0) | 101 (43.2) | 0.02 |

* Unless otherwise noted
[†]past 6 months
[a] n=384; [b] n=382; [c] n=375; [d] n=376; [e] n=380; [f] n=377

*Data imputation and resulting sample size*. At baseline, the small amount of missing data

(n=5) was imputed using full-information maximum likelihood, the default imputation

procedure in MPlus. Six-month (resilience) and 12-month (mental distress outcome) data

were imputed using multiple imputation methods in MPlus for about one-third of the

sample, resulting in an analytical sample of n=369. Multiple imputation was conducted

after latent class enumeration but before the performing the latent class regression with

distal outcome.

**Table 13. Complete, missing, and imputed data at each timepoint in the EMERALD study**

|  | Surveys completed | Non-missing data | Analytical sample | Data imputed ** | Data imputed*** |
|---|---|---|---|---|---|
|  | *N* | *N* | *N* | *N* | *%* |
| Baseline[†] | 385 | 380 | 385 | 5 | 1.3 |
| 6 Months | 251 | 251 | 369 | 118 | 32.0 |
| 12 Months | 235 | 235 | 369 | 134 | 36.3 |

** Data imputed (N) = Analytical sample - Non-missing data
***Data imputed (%) = Data imputed / Analytical sample
[†]at baseline, imputation was conducted with full-information maximum likelihood, a default imputation technique used by MPlus

*Individual PHQ-9 and PCL-5 item frequencies.* Frequencies of PHQ-9 and PCL-5 questions at baseline and 12-months show few significant differences in symptom endorsement between time points.

**Table 14. Distribution of Patient Health Questionnaire-9 questions at baseline and 12-months among a sample of female sex workers in Baltimore, Maryland**

| | Not at all | Several days | More than half the days | Nearly every day | |
|---|---|---|---|---|---|
| | N (%) | N (%) | N (%) | N (%) | p |
| Little interest or pleasure in doing things | | | | | 0.87 |
| *Baseline (n=381)* | 122 (32.0) | 115 (30.2) | 84 (22.1) | 60 (15.6) | |
| *12 months (n=235)* | 74 (31.5) | 76 (32.3) | 46 (19.6) | 39 (16.6) | |
| Feeling down, depressed, or hopeless | | | | | 0.33 |
| *Baseline (n=382)* | 85 (22.3) | 121 (31.7) | 90 (23.6) | 86 (22.5) | |
| *12 months (n=235)* | 63 (26.8) | 81 (34.5) | 46 (19.6) | 45 (19.2) | |
| Trouble falling or staying asleep, or sleeping too much | | | | | 0.31 |
| *Baseline (n=383)* | 98 (25.6) | 115 (30.0) | 75 (19.6) | 95 (24.8) | |
| *12 months (n=235)* | 63 (26.8) | 65 (27.7) | 59 (25.1) | 48 (20.4) | |
| Feeling tired or having little energy | | | | | 0.24 |
| *Baseline (n=382)* | 80 (20.9) | 120 (31.4) | 82 (21.5) | 100 (26.2) | |
| *12 months (n=234)* | 43 (18.4) | 86 (36.8) | 57 (24.4) | 48 (20.5) | |
| Poor appetite or overeating | | | | | 0.08 |
| *Baseline (n=384)* | 104 (27.1) | 108 (28.1) | 75 (19.5) | 97 (25.3) | |
| *12 months (n=234)* | 78 (33.3) | 65 (27.8) | 51 (21.8) | 40 (17.1) | |

| Feeling bad about yourself—or that you are a failure or have let yourself or your family down | | | | 0.05 |
|---|---|---|---|---|
| *Baseline (n=380)* | 86 (22.6) | 108 (28.4) | 79 (20.8) | 107 (28.2) |
| *12 months (n=235)* | 74 (31.5) | 68 (28.9) | 45 (19.2) | 48 (20.4) |
| Trouble concentrating on things, such as reading the newspaper or watching television | | | | 0.01 |
| *Baseline (n=379)* | 117 (30.9) | 92 (24.3) | 85 (22.4) | 85 (22.4) |
| *12 months (n=235)* | 91 (38.7) | 71 (30.2) | 34 (14.5) | 39 (16.6) |
| Moving or speaking so slowly that people could notice. Or the opposite—being so fidgety or restless that you have been moving around a lot more | | | | 0.002 |
| *Baseline (n=380)* | 157 (41.3) | 95 (25.0) | 75 (19.7) | 53 (14.0) |
| *12 months (n=234)* | 130 (55.6) | 55 (23.5) | 27 (11.5) | 22 (9.4) |
| Thoughts that you would be better off dead, or of hurting yourself | | | | 0.67 |
| *Baseline (n=380)* | 243 (64.0) | 67 (17.6) | 42 (11.1) | 28 (7.4) |
| *12 months (n=234)* | 156 (66.7) | 40 (17.1) | 19 (8.1) | 19 (8.1) |

**Table 15. Distribution of Patient Checklist for PTSD-5 questions at baseline and 12-months among a sample of female sex workers in Baltimore, Maryland (n=385)**

| | Not at all | A little bit | Moderately | Quite a bit | Extremely | p |
|---|---|---|---|---|---|---|
| | *N (%)* | *N (%)* | *N (%)* | *N (%)* | *N (%)* | |

**Criterion B**

| Repeated, disturbing, and unwanted memories of the stressful experience? | | | | | | 0.69 |
|---|---|---|---|---|---|---|
| *Baseline (n=380)* | 99 (26.1) | 100 (26.3) | 67 (17.6) | 69 (18.2) | 45 (11.8) | |
| *12 months (n=232)* | 52 (22.4) | 62 (26.7) | 50 (21.6) | 44 (19) | 24 (10.3) | |
| Repeated, disturbing dreams of the stressful experience? | | | | | | 0.99 |
| *Baseline (n=379)* | 120 (31.7) | 112 (29.6) | 57 (15) | 56 (14.8) | 34 (9) | |
| *12 months (n=234)* | 76 (32.5) | 69 (29.5) | 37 (15.8) | 33 (14.1) | 19 (8.1) | |
| Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)? | | | | | | 0.83 |
| *Baseline (n=378)* | 131 (34.7) | 104 (27.5) | 76 (20.1) | 41 (10.9) | 26 (6.9) | |
| *12 months (n=233)* | 86 (36.9) | 70 (30) | 40 (17.2) | 23 (9.9) | 14 (6) | |
| Feeling very upset when something reminded you of the stressful experience? | | | | | | 0.44 |
| *Baseline (n=379)* | 91 (24) | 107 (28.2) | 84 (22.1) | 59 (15.5) | 39 (10.3) | |
| *12 months (n=233)* | 55 (23.6) | 81 (34.8) | 41 (17.6) | 35 (15) | 21 (9) | |
| Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)? | | | | | | 0.04 |
| *Baseline (n=379)* | 103 (27.2) | 97 (25.6) | 85 (22.4) | 56 (14.8) | 38 (10) | |
| *12 months (n=233)* | 67 (28.8) | 79 (33.9) | 32 (13.7) | 37 (15.9) | 18 (7.7) | |

**Criterio**

| Avoiding memories, thoughts, or feelings related to the stressful experience? | | | | | | 0.45 |
|---|---|---|---|---|---|---|
| *Baseline (n=379)* | 85 (22.4) | 93 (24.5) | 74 (19.5) | 75 (19.8) | 52 (13.7) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *12 months (n=233)* | 50 (21.5) | 73 (31.3) | 41 (17.6) | 43 (18.5) | 26 (11.2) | |
| **Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?** | | | | | | 0.58 |
| *Baseline (n=380)* | 92 (24.2) | 85 (22.4) | 88 (23.2) | 67 (17.6) | 48 (12.6) | |
| *12 months (n=230)* | 54 (23.5) | 62 (27) | 43 (18.7) | 44 (19.1) | 27 (11.7) | |
| **Trouble remembering important parts of the stressful experience?** | | | | | | 0.15 |
| *Baseline (n=378)* | 114 (30.2) | 96 (25.4) | 80 (21.2) | 59 (15.6) | 29 (7.7) | |
| *12 months (n=233)* | 91 (39.1) | 59 (25.3) | 37 (15.9) | 28 (12) | 18 (7.7) | |
| **Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?** | | | | | | 0.21 |
| *Baseline (n=381)* | 109 (28.6) | 95 (24.9) | 77 (20.2) | 62 (16.3) | 38 (10) | |
| *12 months (n=234)* | 85 (36.3) | 59 (25.2) | 43 (18.4) | 26 (11.1) | 21 (9) | |
| **Blaming yourself or someone else for the stressful experience or what happened after it?** | | | | | | 0.21 |
| *Baseline (n=381)* | 104 (27.3) | 99 (26) | 77 (20.2) | 62 (16.3) | 39 (10.2) | |
| *12 months (n=233)* | 76 (32.6) | 70 (30) | 33 (14.2) | 34 (14.6) | 20 (8.6) | |
| **Having strong negative feelings such as fear, horror, anger, guilt, or shame?** | | | | | | 0.23 |
| *Baseline (n=380)* | 95 (25) | 100 (26.3) | 77 (20.3) | 54 (14.2) | 54 (14.2) | |
| *12 months (n=233)* | 75 (32.2) | 63 (27) | 37 (15.9) | 33 (14.2) | 25 (10.7) | |
| **Loss of interest in activities that you used to enjoy?** | | | | | | 0.16 |
| *Baseline (n=382)* | 77 (20.2) | 92 (24.1) | 74 (19.4) | 73 (19.1) | 66 (17.3) | |
| *12 months (n=233)* | 62 (26.6) | 63 (27) | 39 (16.7) | 41 (17.6) | 28 (12) | |
| **Feeling distant or cut off from other people?** | | | | | | 0.08 |
| *Baseline (n=382)* | 67 (17.5) | 97 (25.4) | 68 (17.8) | 82 (21.5) | 68 (17.8) | |
| *12 months (n=233)* | 62 (26.6) | 59 (25.3) | 39 (16.7) | 38 (16.3) | 35 (15) | |

160

| | | | | | | |
|---|---|---|---|---|---|---|
| | Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)? | | | | | 0.03 |
| Baseline (n=381) | 79 (20.7) | 95 (24.9) | 72 (18.9) | 66 (17.3) | 69 (18.1) | |
| 12 months (n=230) | 71 (30.9) | 62 (27) | 37 (16.1) | 30 (13) | 30 (13) | |
| | Irritable behavior, angry outbursts, or acting aggressively? | | | | | 0.05 |
| Baseline (n=380) | 93 (24.5) | 83 (21.8) | 82 (21.6) | 68 (17.9) | 54 (14.2) | |
| 12 months (n=231) | 66 (28.6) | 69 (29.9) | 35 (15.2) | 33 (14.3) | 28 (12.1) | |
| | Taking too many risks or doing things that could cause you harm? | | | | | 0.001 |
| Baseline (n=379) | 92 (24.3) | 86 (22.7) | 80 (21.1) | 57 (15) | 64 (16.9) | |
| 12 months (n=233) | 84 (36.1) | 62 (26.6) | 33 (14.2) | 34 (14.6) | 20 (8.6) | |
| | Being "superalert" or watchful or on guard? | | | | | 0.01 |
| Baseline (n=379) | 68 (17.9) | 88 (23.2) | 90 (23.8) | 72 (19) | 61 (16.1) | |
| 12 months (n=233) | 57 (24.5) | 66 (28.3) | 35 (15) | 49 (21) | 26 (11.2) | |
| | Feeling jumpy or easily startled? | | | | | 0.04 |
| Baseline (n=380) | 85 (22.4) | 96 (25.3) | 80 (21.1) | 71 (18.7) | 48 (12.6) | |
| 12 months (n=232) | 70 (30.2) | 66 (28.5) | 42 (18.1) | 39 (16.8) | 15 (6.5) | |
| | Having difficulty concentrating? | | | | | 0.30 |
| Baseline (n=379) | 76 (20.1) | 107 (28.2) | 70 (18.5) | 71 (18.7) | 55 (14.5) | |
| 12 months (n=232) | 59 (25.4) | 72 (31) | 38 (16.4) | 39 (16.8) | 24 (10.3) | |
| | Trouble falling or staying asleep? | | | | | 0.24 |
| Baseline (n=380) | 88 (23.2) | 92 (24.2) | 83 (21.8) | 48 (12.6) | 69 (18.2) | |
| 12 months (n=234) | 57 (24.4) | 64 (27.4) | 37 (15.8) | 39 (16.7) | 37 (15.8) | |

Criterion E

161

**Table 16. Distribution of Connor-Davidson Resilience Scale items measured at 6 months (n=251)**

|  | Not true at all | Rarely true | Sometimes true | Often true | True nearly all the time |
|---|---|---|---|---|---|
|  | N (%) | N (%) | N (%) | N (%) | N (%) |
| Able to adapt to change | 19 (7.7) | 36 (14.5) | 95 (38.3) | 53 (21.4) | 45 (18.2) |
| Can deal with whatever comes | 20 (8) | 30 (12.1) | 91 (36.6) | 64 (25.7) | 44 (17.7) |
| Tries to see humorous side of problems | 19 (7.7) | 36 (14.5) | 88 (35.5) | 60 (24.2) | 45 (18.2) |
| Coping with stress can strengthen me | 29 (11.7) | 33 (13.4) | 96 (38.9) | 45 (18.2) | 44 (17.8) |
| Tend to bounce back after illness or hardship | 25 (10.2) | 26 (10.6) | 82 (33.5) | 59 (24.1) | 53 (21.6) |
| Can achieve goals despite obstacles | 13 (5.3) | 29 (11.8) | 91 (37) | 61 (24.8) | 52 (21.1) |
| Can stay focused under pressure | 25 (10.2) | 46 (18.7) | 87 (35.4) | 50 (20.3) | 38 (15.5) |
| Not easily discouraged by failure | 27 (11.1) | 37 (15.2) | 95 (38.9) | 52 (21.3) | 33 (13.5) |
| Thinks of self as strong person | 22 (8.9) | 28 (11.3) | 94 (38.1) | 58 (23.5) | 45 (18.2) |
| Can handle unpleasant feelings | 27 (11) | 45 (18.3) | 94 (38.2) | 45 (18.3) | 35 (14.2) |

*Correlation between internal resilience and mental distress*. We assessed the correlation between the Connor-Davidson Resilience Scale and mental distress.

**Table 17. Correlation coefficients between Connor-Davidson Resilience Scale (CDRS) and mental distress at baseline and 12-month follow-up**

|  | CDRS | Mental Distress *Baseline* |
|---|---|---|
| **Mental Distress** *Baseline* | -0.09 | |
| **Mental Distress** *12 months* | -0.10 | 0.44*** |

**Figure 7. Scatterplot of correlation between resilience score and baseline and 12-month measures of mental distress (n=235)**
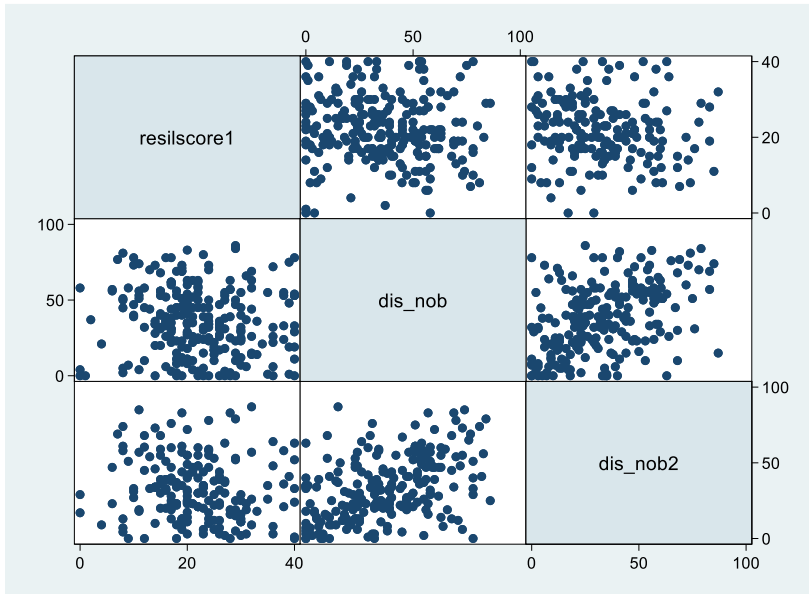


resilscore1 = Connor-Davidson Resilience Score measured at 6-month follow-up; dis_nob = baseline mental distress (without criterion B from PCL-5); dis_nob2 = 12-month mental distress (without criterion B from PCL-5)

*Sensitivity analyses without imputation.* As a sensitivity analysis, we analyzed non-missing data without any multiple imputation to assess whether a) multiple imputation was a necessary procedure; b) whether significance tests for differences in mental distress scores by structural vulnerability latent class were a function of differential loss-to-follow-up.

When analyzing non-imputed data, we saw meaningful differences in significance tests of mental distress scores by latent class: though p-values in adjusted Wald and pairwise tests did not meet the cut-off of $p<0.05$ for statistical significance, they nonetheless were much smaller than in the imputed analysis. Coupled with the significant differences in several key variables between completers and LTFU (Table 12) and much greater retention in the *minimal structural vulnerability* class (Table 18), we decided to proceed with imputed data to avoid potentially misleading conclusions. Tables 18-19 and Figure 8 show the results of these analyses.

**Table 18. A comparison of total and latent class-specific sample size at baseline and 12-months when imputing and not imputing missing data lost to follow-up**

| Latent Class | Baseline Sample Size | 12-month Imputed Sample Size | 12-month Non-imputed Sample Size | Percent of sample retained* |
|---|---|---|---|---|
| Total | 385 | 369 | 223 | |
| High Structural Vulnerability | 107 | 101 | 55 | 51.4 |
| Minimal Structural Vulnerability | 167 | 160 | 109 | 65.3 |
| Material Needs | 111 | 108 | 59 | 53.2 |

* Percent of sample retained = 12-month non-imputed sample size / baseline sample size

**Figure 8. Sensitivity analysis: Average unadjusted and adjusted mental distress score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=223), no multiple imputation**
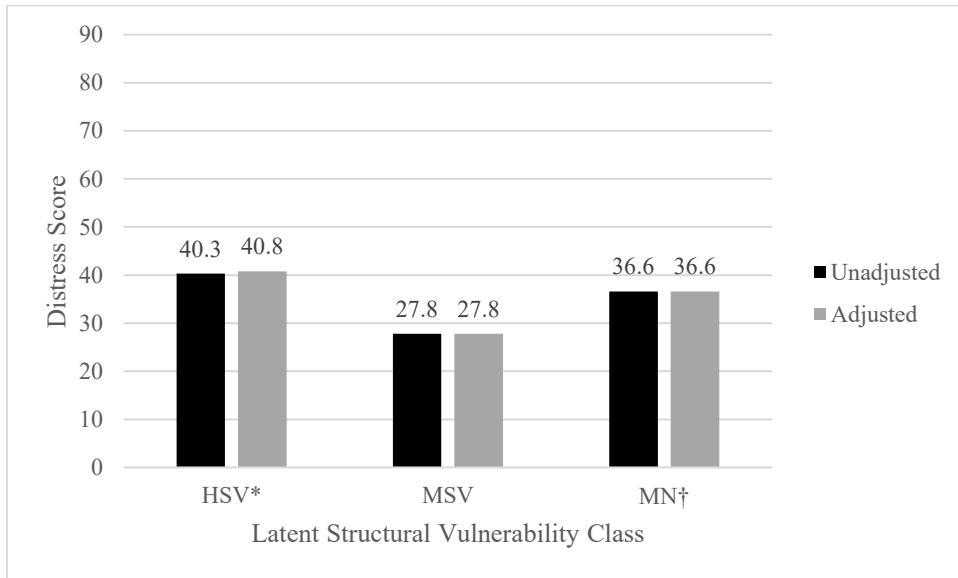


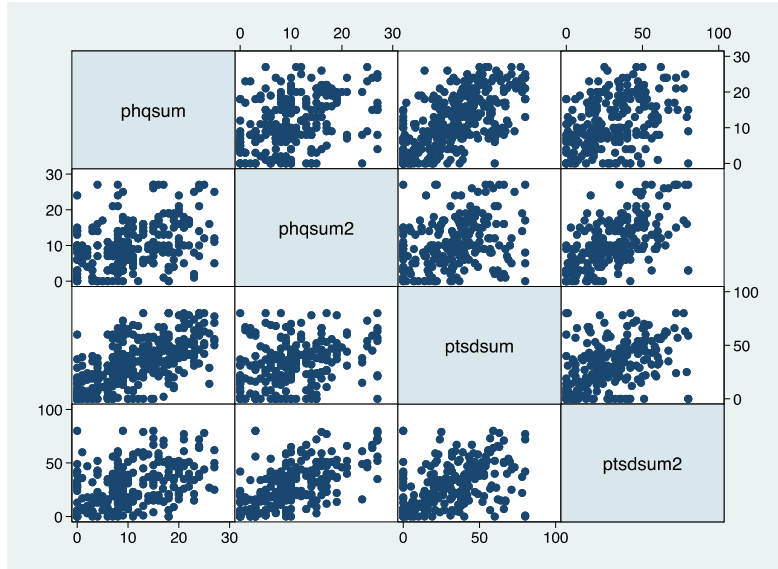Note: HSV = high structural vulnerability; MSV = minimal structural vulnerability; MN = material needs

*Unadjusted*
*Overall significance*: *p*<0.001
*Pairwise significance: *HSV* vs. *MSV*, p=0.003
　　　　　　　　　†*MN* vs. *MSV*, p=0.001

*Adjusted*
*Overall significance*: *p*=0.14
*Pairwise significance: *HSV* vs. *MSV*, p=0.07
　　　　　　　　　†*MN* vs. *MSV*, p=0.17

**Table 19. Sensitivity analysis: Bivariate linear regression of covariates on 12-month mental distress scores by latent classes of structural vulnerability among a sample of female sex workers in Baltimore, Maryland (n=223), no multiple imputation**

|  | Total sample (n=223) | |
| --- | --- | --- |
|  | *β (95% CI)* | *p* |
| Baseline distress score | 0.34 (0.18, 0.50) | <0.001 |
| Age | -0.13 (-0.39, 0.13) | 0.35 |
| White race | -5.33 (-10.07, -0.59) | 0.03 |
| Entered sex work as a minor | -1.25 (-7.19, 4.69) | 0.68 |
| Condomless sex with clients | -2.62 (-7.93, 2.69) | 0.33 |
| Injection drug use | -3.54 (-9.28, 2.20) | 0.23 |
| Crack cocaine use | 0.86 (-6.24, 7.96) | 0.81 |
| Internalized sex work stigma score | 0.08 (-0.43, 0.59) | 0.77 |
| Intervention study arm | 2.64 (-2.22, 7.50) | 0.29 |

*Sensitivity analyses with criterion B added.* To show that removing PCL-5 criterion B

questions from mental distress scores did not alter results, we re-ran the latent class

regression model with the mental distress outcome that includes these items. We used the

multiply imputed sample. The following tables and figures show that results were nearly

identical to the original analysis and that removing those items did not impact results.

Tables 20-23 and Figures 9-11 show the results of these analyses.

**Table 20. Sensitivity analysis: correlation coefficients between measures of depressive symptoms (PHQ-9) and PTSD (PCL-5— with criterion B) (n=235)**

|  | PHQ-9 *Baseline* | PHQ-9 *12 months* | PCL-5 *Baseline* |
|---|---|---|---|
| **PHQ-9** *12 months* | 0.39*** |  |  |
| **PCL-5** *Baseline* | 0.65*** | 0.31*** |  |
| **PCL-5** *12 months* | 0.39*** | 0.62*** | 0.39*** |

**Figure 9. Sensitivity analysis: scatterplot of correlation between baseline and 12-month measures of depressive symptoms (PHQ-9) and PTSD (PCL-5—with criterion B)**



phqsum = baseline PHQ-9 score; phqsum2 = 12-month PHQ-9 score
ptsdsum = baseline PCL-5 score with criterion B; ptsdsum2 = 12-month PCL-5 score
with criterion B

**Figure 10. Sensitivity analysis: average unadjusted and adjusted mental distress score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=371), with PCL-5 criterion B items**
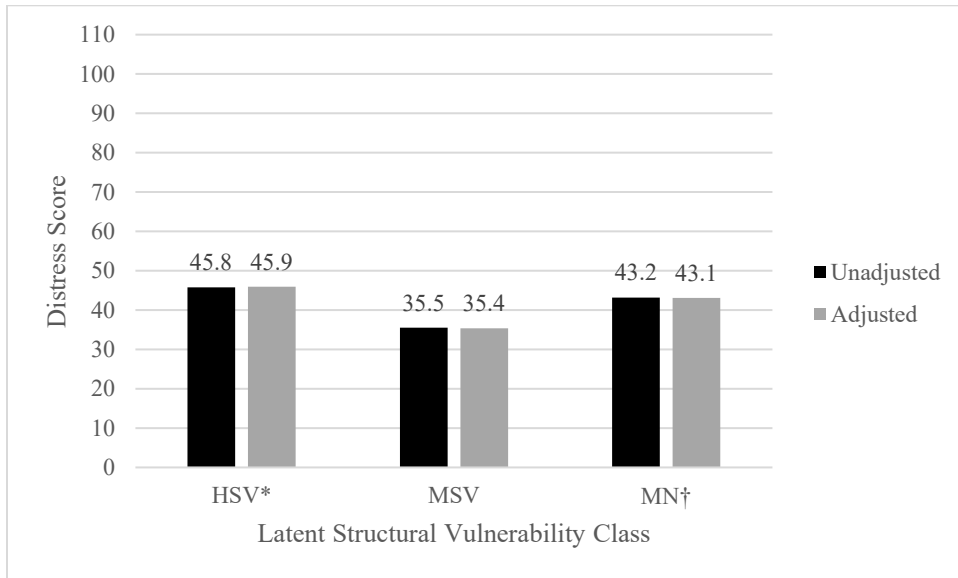


Note: HSV = high structural vulnerability; MSV = minimal structural vulnerability; MN = material needs

*Unadjusted*
*Overall significance*: *p*=0.006
*Pairwise significance: *HSV* vs. *MSV*, p=0.007*
              *†MN* vs. *MSV*, p=0.018*
*Adjusted*
*Overall significance*: *p*=0.67
*Pairwise significance: *HSV* vs. *MSV*, p=0.56*
              *†MN* vs. *MSV*, p=0.39*

**Table 21. Sensitivity analysis: bivariate linear regression of covariates on 12-month mental distress scores by latent classes of structural vulnerability among a sample of female sex workers in Baltimore, Maryland (n=371), with PCL-5 criterion B items**

|  | Total sample (n=371) | |
| --- | --- | --- |
|  | *β (95% CI)* | *p* |
| Baseline distress score | 0.36 (0.22, 0.50) | <0.001 |
| Age | -0.15 (-0.48, 0.18) | 0.38 |
| White race | -2.87 (-7.50, 1.76) | 0.22 |
| Entered sex work as a minor | -1.72 (-9.03, 5.59) | 0.39 |
| Condomless sex with clients | 1.25 (-5.32, 7.81) | 0.71 |
| Injection drug use | -2.79 (-10.63, 5.05) | 0.49 |
| Crack cocaine use | 2.26 (-6.85, 11.37) | 0.63 |
| Internalized sex work stigma score | 0.15 (-0.50, 0.80) | 0.66 |
| Intervention study arm | 3.22 (-3.48, 9.92) | 0.35 |

**Table 22. Sensitivity analysis: correlation coefficients between Connor-Davidson Resilience Scale (CDRS) and mental distress at baseline and 12-month follow-up (n=235), with PCL-5 criterion B items**

|  | CDRS | Mental Distress *Baseline* |
| --- | --- | --- |
| **Mental Distress** *Baseline* | -0.07 | |
| **Mental Distress** *12 months* | -0.08 | 0.43*** |

**Figure 11. Sensitivity analysis: scatterplot of correlation between resilience score and baseline and 12-month measures of mental distress (n=235), with PCL-5 criterion B items**
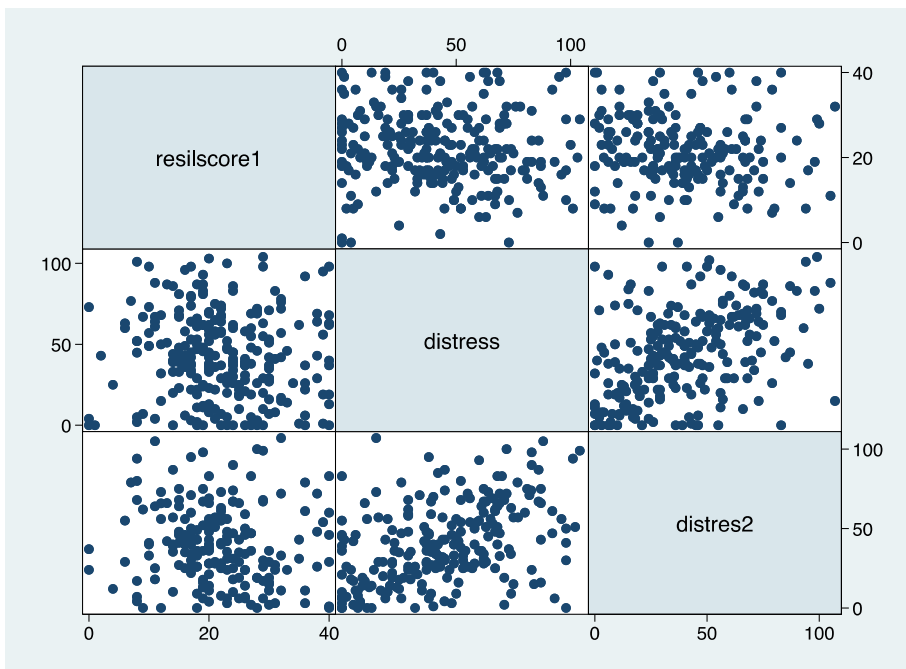


resilscore1 = Connor-Davidson Resilience Score measured at 6-month follow-up; distress = baseline mental distress (with criterion B from PCL-5); distres2 = 12-month mental distress (with criterion B from PCL-5)

**Table 23.** Bivariate linear regression showing effect modification of resilience (and pairwise significance testing of coefficients) on 12-month mental distress score by structural vulnerability latent class among a sample of female sex workers in Baltimore, Maryland (n=371), with PCL-5 criterion B items

| | High Structural Vulnerability | | Minimal Structural Vulnerability | | Material Needs | |
|---|---|---|---|---|---|---|
| | β (95% CI) | p | β (95% CI) | p | β (95% CI) | p |
| Resilience score | 0.27 (-0.63, 1.17) | 0.55 | -0.08 (-0.51, 0.35) | 0.72 | -0.30 (-0.97, 0.37) | 0.37 |

| Pairwise differences in regression coefficients | | |
|---|---|---|
| Latent class comparisons | β (95% CI) | p |
| High Structural Vulnerability vs. Minimal Structural Vulnerability | 0.35 (-0.55, 1.25) | 0.45 |
| High Structural Vulnerability vs. Material Needs | 0.57 (-0.51, 1.65) | 0.46 |

## Chapter 4 Methods

*The following is the interview guide used in Aim 3 data collection.*

## Background

*These first questions are about you and your background to help me get to know you better. Remember that everything you say is completely confidential and you don't have to answer any question that you feel uncomfortable with.*

1. Can you describe your typical day (i.e., where do you go, what do you do, who do you do it with)?
    *PROBES*:

    - What do you do with your free time?
    - How do you feel most days? (physically, mentally, emotionally)
    - Do you ever get bored? If yes, what do you do when you're bored?

## Experienced Difficulties & Overcoming Them: General

2. What are some things that are going well in your life?

    PROBES: family/kids, substance use or sobriety, secured housing, feeling happy or stable, etc.

*Now I'm going to ask you about difficulties you have experienced and how you dealt with them. I know this can be difficult to talk about so again, answer whatever you are comfortable with answering.*

## Experienced Difficulties & Overcoming Them: Story

1. Can you tell me a story about a specific hard time that you faced recently? What was it like and what did you do?

<table>
<tr>
<td>

**IF PARTICIPANT MENTIONED SOMEONE HELPED THEM/SOCIAL SUPPORT**

*You mentioned you got help from [person/persons]…*

a) How often do you seek [this person] out to help you?
b) What are other situations that you would call on this person to help you?
c) Is their support what you needed? If no, what would you need instead?
d) Is there anyone else? What did they do to help you?

</td>
<td>

**IF PARTICIPANT MENTIONED USING A SERVICE OR RESOURCE**

*You mentioned that you went to [organization name]. Tell me more about this.*

a) What made you decide to go?
b) How did you know where to go? / How did you hear about this resource?
c) What, if anything, made it difficult to access this resource?
d) What, if anything, made it easy to access this resource?
   a. PROBE for: *Logistics (transportation, cost), awareness of options, stigma*
e) How were you treated there? Why did you feel this way?
f) Did you disclose to them that you sold sex? Why or why not?
   a. *If disclosed: How did they react?*
   b. *What kind of reaction did you expect? / What kind of reaction would you expect if you disclosed?*

</td>
</tr>
</table>

**Mental Health History**

*Now I'm going to ask more specifically about mental health.*

2. How do you define mental health? What does it mean to you?

*Let's talk now about your own mental health.*

3. Have you ever been diagnosed with any mental health condition?
   a) *Could you tell me a story or describe being diagnosed? Probe for things like diagnosis, when or how they were diagnosed*
   b) *How did your diagnosis affect your everyday life?*
4. Have you ever felt like you had some sort of emotional or mental health concern, even if you weren't diagnosed? For example, you felt very depressed even though a doctor didn't tell you that you had depression.
   a) *What do you think it is?*
   b) *Why do you think that you have this condition?*
   c) *What is the reason you weren't diagnosed? (i.e. doctor said they didn't have it, or never went to doctor?)*
   d) *How did you work through those issues?*
5. How important are your emotions or your mental health for you? Why? What are things that are more important?

**Additional Questions about Resource Gathering: Social Support**

**IF PARTICIPANT <u>DID NOT MENTION</u> SOMEONE HELPED THEM/SOCIAL SUPPORT**

*In your story about a difficult experience, I noticed that you did not mention getting help from someone else during [difficult experience].*

8. Why did you not ask someone else for help?
9. Are there any situations where you would ask someone for help or support? What would that situation be?
    a. PROBE: Who would you ask? How would they show their support?
10. Do other women who [sell sex] provide support for you? How?
11. How easy or difficult is it for you to find someone to help you when you need it?

**IF PARTICIPANT <u>MENTIONED</u> SOMEONE HELPED THEM/SOCIAL SUPPORT**

*In your story about a difficult experience, I noticed that you mentioned getting help from someone else during [difficult experience].*

8. What are some other situations where you have asked for or gotten help from others?
    a. Who in your life gives you support?
    b. How do they show support? How do you know they're supportive?
10. Do other women who [sell sex] provide support for you? How?
11. How easy or difficult is it for you to find someone to help you when you need it?

**FREE LISTING.** *For this section, I am going to give you a piece of paper and pen and I want you to write down as many different organizations or places in Baltimore you can go if you were experiencing a mental or physical health problem. List all the things you can think of on this piece of paper.*

*FOR INTERVIEWER: if a participant is stuck, point to the first item listed and probe, "name some more places that are similar to X."*

176

## Resource Gathering: Mental Health Resource Use

12. Have you ever used any of the places you listed to address a physical or mental health need? NOTE TO INTERVIEWER: if the only resource they used was mentioned during their story, consider their answer NO

**IF PARTICIPANT SAYS NO**

**IF PARTICIPANT SAYS YES**

13. Why haven't you used any resources?
14. Is there a situation where you think you may need one in the future? If yes, what might it be?
15. Where would you go, and why?
16. What are some things that would make using resources easier?

15. Where did you go?
16. What made you decide to go?
    PROBE: *life circumstances at the time*, *severity of symptoms*, *influence of other people*

17. What, if anything, made it difficult to access this resource? What, if anything, made it easy to access this resource?
    PROBE for: *Logistics (transportation, cost), unaware of options/finding provider, treatment from providers, judgement from family/friends/community, stigma of sex work or drug use*

18. What was your experience with them? How were you treated there?
19. What made you feel comfortable or uncomfortable?
20. If you went to a resource in the future for your physical or mental health, would you disclose to them that you sell sex? Why or why not?

## Wrapping Up

21. Is there anything else you think we should know about the topics that we talked about today?

# Figure 12. Example of section of the finalized codebook

| Parent Code | Child Code | Grandchild code | Description | Inclusion Criteria | Exclusion Criteria | Examples: |
|---|---|---|---|---|---|---|
| trauma | | | description of traumatic events that happened to them | events that cause psychological, emotional, or physical harm<br>can be explicitly expressed as traumatic or interpreted by coder<br>can be discrete events or ongoing traumas<br>any time period | second-hand traumatic events | |
| | reaction to trauma | | behavioral, psychological, or emotional reaction to traumatic event or events | follows or is caused by traumatic event or events<br>caused by personal trauma<br>behavioral, psychological, or emotional reaction | feelings that precede traumatic event(s)<br>reactions to others' trauma | |
| | disclosing trauma | | process of deciding to share details of traumatic experience with others | describes action of telling another person about traumatic event(s)<br>regardless of whether or not they actually disclosed to someone | | |
| social support | experienced support | who supported | person(s) who provided social support | can be emotional, informational, or instrumental support<br>involves at least one other person | help or assistance from a formal organization/non-profit | |
| | | sought help | proactively seeking out help from others | involves another person or organization/entity that provides help<br>proactively sought out the help | passive help-seeking | |
| | | passive help | passively receiving help from others | involves another person or organization/entity that provides help<br>did not ask for help | sought out help from others | |
| | availability of help | | ability of women to find help if/when they need it | perceptions of level of support from people, organizations, etc. | description of help received | examples: "no one is around to help me"; "no one cares to help me"; "I don't even know where I'd go to get help with that" |
| | no support | | describes situations where women wanted/needed help but didn't receive it | no help available, no knowledge of help available, sentiments that are expressed to women from others about not helping | support that was given but not ultimately helpful (i.e. support was given, but women needed more) | |

| Parent Code | Child Code | Grandchild code | Description | Inclusion Criteria | Exclusion Criteria | Examples: |
|---|---|---|---|---|---|---|
| characterizing support | genuine support | | receiving help from someone without person expecting anything in return | woman's feeling that nothing is expected for help from any source | feeling of being used | |
| | transactional support | | receiving help from someone who wants something in return | can be an arrangement or woman's perception or expectation that she is being used<br>from any source | returning the support, "paying it forward," non-exploitative help | |

178

**Figure 13. Examples of One Sheet of Paper exercise for social support code in the low resilience group**

**Figure 14. Example of One Sheet of Paper exercise for social support code in the high resilience group**

# Appendix: Curriculum Vitae

## Catherine Tomko
### Curriculum Vitae

244 G St SW                                                                330-398-1933
Washington, DC 20024
   tomko.catherine@gmail.com

## EDUCATION

- **Ph.D., Public Health,** Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 2016 – present
  - **Dissertation:** *Mental Health of Female Sex Workers: The Role of Structural Vulnerabilities and Resilience in Mental Distress*
- **MHS, Social Factors in Health,** Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 2014-2016
- **BA, Psychology,** *magna cum laude.* The George Washington University, Washington, DC, 2007-2011. Minor in political science.

## RESEARCH EXPERIENCE

**Data Manager and Analyst.** Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, June 2017 – present

- Managed data for EMERALD (n=385), a non-randomized trial of a drop-in center for female sex workers in Baltimore. Regularly cleaned data and prepared weekly reports on enrollment progress. Created survey instruments for 6-, 12-, and 18-month follow-ups. Performed cross-sectional and longitudinal analyses. *Supervisor: Susan Sherman, PhD*

**Research Assistant and Analyst.** Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, October 2016- October 2017

- Conducting surveys in SAPPHIRE (n=250) study of the role that police play in the risk environment of cisgender and transgender female sex workers in Baltimore. Analyzed data and produced manuscripts using SAPPHIRE data. *Supervisor: Susan Sherman, PhD*

**Research Analyst.** Insight Policy Research, Rosslyn, VA, January 2016 – May 2017

- Manage and analyze large datasets of health care industry characteristics across the United States. Conduct qualitative interviews with key informants to assist with evaluations for government and non-profit clients. Code and analyze qualitative data. Draft final and interim reports. Clients include the Centers for Medicare and Medicaid (CMS), Department of Health and Human Services (HHS), the National Science

Foundation (NSF), and the Defense Advisory Council on Women in the Services (DACOWITS). *Supervisor: Meg Tucker, MHS*

**Research Assistant and Analyst.** Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, March 2015- June 2015

- Consent and conduct primary data collection with sex workers utilizing Baltimore City Health Department services. Conduct in-depth interviews with a sub-sample of participants. Analyze quantitative survey data and qualitative interview data. Tracked flow of participants throughout the study. Scheduled research assistants and participants for follow up survey and in-depth interview administration. *Supervisor: Michele Decker, PhD*

**Project Coordinator & Research Assistant,** Cancer Control Program, Lombardi Comprehensive Cancer Center, Washington, DC, July 2011- July 2014

- Assist with manuscript and grant writing. Review literature for manuscript and study questionnaire preparation. Clean and analyze large data sets of over 1000 participants using SPSS software. Assist in creation and editing of questionnaires for quality of life and decision-making studies of prostate and lung cancers. Conduct telephone survey interviews with study participants. Prepare submission documents to the Internal Review Board. *Supervisor: Kathryn L. Taylor, PhD*

## PUBLICATIONS (PEER-REVIEWED)

1. Taylor KL, Williams RM, Davis K, Luta G, Penek S, Barry S, Kelly S, **Tomko C**, Schwartz M…et al. (2013). Decision-making in prostate cancer screening using decision aids versus usual care: a randomized clinical trial. *JAMA Internal Medicine*. 173(18): 1704-1712.

2. Davis KM, Kelly SP, Luta G, Tomko C, Miller AB & Taylor KL (2014). The association of long-term treatment-related side effects with cancer-specific and general quality of life among prostate cancer survivors. Urology. *84(2), 300-306.*

3. **Tomko C**, Davis KM, Luta GL, Krist AH, Woolf SH & Taylor KL (2014).  A comparison of web- versus print-based decision aids for prostate cancer screening: participants' evaluation and utilization. *Journal of General Internal Medicine* 30 (1): 33-42

4. **Tomko C**, Davis KM, Ludin S, Kelly S, Stern A, Luta G, & Taylor KL (2015). Decisional outcomes following use of an interactive web-based decision aid for prostate cancer screening. *Translational Behavioral Medicine* 5(2): 189-97.

5. Starosta AJ, Luta G, **Tomko C,** Schwartz MD, Taylor KL (2015). Baseline attitudes about prostate cancer screening moderate the impact of decision aids on screening rates. *Annals of Behavioral Medicine* 49(5): 762-68.

6. Hagerman C, **Tomko C**, Stanton C, Kramer JA, Abrams DB, Anderson ED & Taylor KL (2015). Incorporating a smoking cessation intervention into lung cancer screening programs: preliminary studies. *Journal of Psychosocial Oncology* 33(6): 703-23.

7. Taylor KL, Hoffman RM, Davis KM, Luta G, Leimpeter A, Lobo T, Kelly SP, Aaronson D, **Tomko C**, Starosta A, Hagerman C, Van Den Eeden SK (2015). Treatment preferences for active surveillance versus active treatment among men with low-risk prostate cancer. *Cancer Epidemiology, Biomarkers, & Prevention*.

8. Peitzmeier S, **Tomko C**, Wingo E, Sawyer A, Sherman SG, Glass N, & Decker MR (2017). Acceptability of vaginal rings and pre-exposure prophylaxis for HIV prevention among female sex workers in a high-prevalence US city. *AIDS care, 29(11),* 1453-1457.

9. Decker MR, **Tomko C,** Wingo E, Peitzmeier S, Sawyer A, Glass N, & Sherman SG (2017). A brief, trauma-informed intervention increases safety behavior and reduces HIV risk among drug-involved women who trade sex. *BMC Public Health,* 18(1), 75.

10. **Tomko C,** Park JN, Allen ST, Glick J, Galai N, Decker MR, ... & Sherman SG (2019). Awareness and interest in HIV pre-exposure prophylaxis among street-based female sex workers: results from a US context. *AIDS patient care and STDs*, 33(2), 49-57.

11. Park JN, Footer KH, Decker MR, **Tomko C,** Allen ST, Galai N, & Sherman SG (2019). Interpersonal and structural factors associated with receptive syringe-sharing among a prospective cohort of female sex workers who inject drugs. *Addiction*, 114(7), 1204-1213.

12. Park JN, Decker MR, Bass JK, **Tomko** C, Jain KM, Footer K, & Sherman SG (2019). Cumulative violence and PTSD symptom severity among urban street-based female sex workers. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260519884694

13. Silberzahn BE, Riegger KE, Morris MM, White RH, **Tomko C,** Park JN & Sherman SG (2020). Barriers and facilitators to retention of a cohort of street-based cisgender female sex workers recruited in Baltimore, Maryland, USA: Results from the SAPPHIRE study. *BMC Public Health*, 20, 1-12.

14. **Tomko C,** Nestadt DF, Silberzahn BE, Rouhani S, Logie CH, Haney K, Galai N, & Sherman SG (2020). Confirmatory Factor Analysis and Construct Validity of an Internalized Sex Work Stigma Scale among a Cohort of Female Sex Workers in the United States. *The Journal of Sex Research*, 1-11.

15. Schneider KE, **Tomko C**, Nestadt DF, Silberzahn BE, White RH, & Sherman SG (2020). Conceptualizing Overdose Trauma: The Relationships between Experiencing and Witnessing Overdoses with PTSD Symptoms among Female Sex Workers in Baltimore, Maryland. *International Journal of Drug Policy*, 102859.

16. Glick JL, Lim S, Beckham SW, **Tomko C**, Park JN, & Sherman SG (2020). Structural vulnerabilities and HIV risk among sexual minority female sex workers (FSW) by identity and behavior in Baltimore, MD. *Harm reduction journal*, 17(1), 1-9.

17. Park JN, **Tomko C,** Silberzahn BE, Haney K, Marshall BDL & Sherman SG (2020). A fentanyl test strip intervention to reduce overdose risk among female sex workers who use drugs in Baltimore: Results from a pilot study. *Addictive Behaviors*, 110, 106529.

18. Logie CH, White RH, Galai N, **Tomko C**, & Sherman SG (2020). Longitudinal associations between place of sex work and client condom coercion among sex workers in Baltimore, Maryland. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. E-pub ahead of print. doi: 10.1097/QAI.0000000000002494

19. Nestadt DF, **Tomko C**, …Sherman SG (2020). Co-occurring threats to agency among female sex workers in Baltimore, Maryland. Accepted to *Journal of Interpersonal Violence.*

20. Rouhani S, Decker MR, **Tomko C,** Silberzahn BE, Allen ST, Park JN, Footer KFA, & Sherman SG (2020). Resilience among cis- and transgender women in street-based sex work in Baltimore, Maryland. Accepted to *Women's Health Reports.*

21. Sherman SG, **Tomko C**, White RH, Nestadt DF, Silberzahn BE, Clouse E, Haney K, & Galai N (2021). Structural and environmental influences increase risk of chlamydia and gonorrhea in a sample of female sex workers. Accepted to *STDs.*

22. **Tomko C**, Glick JL, Park JN, Galai N & Sherman SG (2021). Characterizing healthcare access among female sex workers with substance use histories in Baltimore, Maryland. Accepted to *Journal of Healthcare for the Poor and Underserved*.

23. Chien J, Schneider KE, **Tomko C,** Lim S, Galai N, & Sherman SG (2021). Patterns of sex work client solicitation and associations with HIV/STI risk among female sex workers in Baltimore, Maryland. Invited to revise and resubmit to *AIDS & Behavior.*

24. Silberzahn BE, **Tomko C**, Clouse E, Haney K, Allen ST, Galai N, & Sherman SG (2021). The EMERALD study: An evaluation of a community-based combination HIV prevention intervention for female sex workers in Baltimore, Maryland – design and cohort description. Invited to revise and resubmit to *JMIR Protocols.*


## BOOK CHAPTER

1. Davis KM, Kelly SP, Ludin S, **Tomko C,** & Taylor KL (2011). *Screening for chronic disease: The prostate cancer dilemma. 2011 Addendum.* Best Practices in the Behavioral Management of Chronic Disease. Menlo Park, CA: Institute for Disease Management.


## ONGOING RESEARCH/MANUSCRIPT PREPARATION

1. Sherman SG, **Tomko C,** Silberzahn BE, White RH, Nestadt DF, Clouse E, Haney K, & Galai N. The role of local business employees and community members in the HIV risk

environment of female sex workers in an urban setting: associations between negative interactions and inconsistent condom use. Under review.

2. **Tomko C**, Musci R, Kaufman M, Underwood C, Decker MR, & Sherman SG. HIV and Mental Distress Risk Differs By Co-occurring Structural Vulnerabilities Among Cisgender Female Sex Workers In the United States.

3. **Tomko C,** Schneider KE, Park JN, Urquhart GJ, & Sherman SG. Psychological pain, unmet mental health need, and overdose risk among people who use opioids non-medically: a path analysis.

4. **Tomko C,** Kaufman M, Underwood C & Sherman SG. Characterizing external resilience and the limitations of internal resilience in a sample of structurally vulnerable women who use drugs in Baltimore, MD.

5. Sherman SG, **Tomko C,** Nestadt DF, Silberzahn BE, Haney K, Allen ST, & Galai N. An evaluation of a community-based, multiservice drop-in center on cumulative sexually transmitted infections among female sex workers in Baltimore: the EMERALD study.

## PROFESSIONAL PRESENTATIONS

**Tomko C**, Schneider KE, & Sherman SG (19 June 2021). Post-Traumatic Stress Increases Risk of Concurrent Daily Non-Medical Opioid-Benzodiazepine Use in a Sample of Female Sex Workers. Submitted to The College of Problems of Drug Dependence Annual Scientific Meeting. Virtual format.

**Tomko C,** Schneider KE, Nestadt DF, White RH, Musci R, Kaufman M, & Sherman SG (6 July 2020). How Does HIV Risk Differ by Co-Occurring Structural Factors? A Latent Class Analysis of Structural Vulnerability Indicators Among Cisgender Female Sex Workers in Baltimore, Maryland. Oral presentation at the 23rd Annual International AIDS Conference. Virtual format.

Logie C, White RH, Galai N, **Tomko C** & Sherman SG (6 July 2020). Longitudinal associations between place of sex work, depression and HIV vulnerabilities among sex workers in Baltimore, Maryland: A social geography of sex work approach to guide HIV prevention cascade optimization. Oral presentation at the 23rd Annual International AIDS Conference. Virtual format.

Schneider KE, Park JN, **Tomko C,** Nestadt DF, Rouhani S, White RH, Allen ST, & Sherman SG (6 July 2020). Conceptualizing Drug-Related Trauma: The Relationships between Experiencing and Witnessing Overdoses with PTSD Symptoms among Women who Sell Sex. 13th National Harm Reduction Conference. Conference delayed due to COVID-19

**Tomko C,** Riegger KE, Clouse E, Nestadt DF, & Sherman SG (15 October 2020). Self-Reported Mental Health Need and Service Utilization Among Female Sex Workers in Baltimore, MD: Implications for Harm Reduction and Community Engagement. 13th National Harm Reduction Conference. Conference delayed due to COVID-19.

Park JN, **Tomko C**, Silberzahn B, Marshall BDL, Haney K, Sherman SG (19 June 2019). Short-term effectiveness of a brief fentanyl test strip intervention in reducing overdose risk among women who use street drugs. Oral Session: The College of Problems of Drug Dependence (CPDD), San Antonio, Texas.

Park JN, Allen ST, Decker MR, **Tomko C**, Footer K, Galai N, Sherman SG (July 2018). Dyad and structural determinants of HIV risk among a dual-risk population: receptive syringe sharing among female sex workers who inject drugs in Baltimore, MD. Presented at the 22nd International AIDS Conference, Amsterdam, The Netherlands.

**Tomko C** (28 Sept 2017). PrEP interest among high-risk women. Talk presented at the Women & PrEP Symposium, MidAtlantic AIDS Education and Training Center. Baltimore, MD.

Decker M, Sawyer A, **Tomko C**, Peitzmeier S, Wingo E, Glass N & Sherman S (2017). A brief, trauma-informed intervention to address safety and HIV risk among women who trade sex. Poster presented at the Futures without Violence 2017 National Conference on Health and Domestic Violence, San Francisco, CA.

Park JN, Raifman J, Footer K, **Tomko C**, Allen S, Decker MR, Galai N, & Sherman SG (2017). PrEP awareness, interest, and engagement among street-based female sex workers in Baltimore, Maryland. Poster presented at the 9th Annual IAS Conference on HIV Science, Paris, France.

Decker MR, **Tomko C,** Wingo E, Peitzmeier S, Sawyer A, Glass N, & Sherman SG (2015). A brief, trauma-informed intervention increases safety behavior and reduces HIV risk among drug-involved women who trade sex. Poster presented at the 21st Annual International AIDS Society Conference, Durban, South Africa.

De Leon E, **Tomko C**, Fuentes L, Kim J, Johnson M, Cohen J (2015). A novel approach to smoking cessation: "Quit and Stay Quit Mondays". Oral presentation presented at the 143rd Annual Meeting of the American Public Health Association, Chicago, IL.

Hagerman C, **Tomko C**, Stanton C, Kramer JA, Abrams DB, Anderson ED & Taylor KL (2015). *Incorporating a smoking cessation intervention into lung cancer screening programs: preliminary studies.* Poster presented at the 21st Annual Meeting of the Society for Research on Nicotine and Tobacco, Philadelphia, PA.

**Tomko C**, Davis KM & Taylor KL (2014). *Process evaluation of men's response to web- and print-based decision aids for prostate cancer screening.* Poster presented at the 35th Annual Meeting of the Society of Behavioral Medicine, Philadelphia, PA.

Taylor KL, Van den Eeden S, Hoffman R, Davis K, Leimpeter A, **Tomko C**, Starosta A & Kelly S (2014). *Treatment decision making processes among men with low risk*

*prostate cancer.* Poster presented at the 38th Annual Meeting of the American Society of Preventive Oncology, Washington DC

Taylor KL, Van den Eeden S, Hoffman R, Leimpeter A, **Tomko C**, Shan J, Davis K & Aaronson D (2013). *Treatment decisions among men with low-risk prostate cancer.* Paper presented at the 34th Annual Meeting of the Society of Behavioral Medicine, San Francisco, CA.

**Tomko C**, Ludin S, Stern A, Kelly SP & Taylor KL (2012). *Patterns of use of a web-based decision tool for prostate cancer screening: effects on decisional outcomes.* Poster presented at the 36th Annual Meeting of the American Society of Preventive Oncology, Washington, DC

## PEER REVIEW

*Ad hoc* reviewing for:

- *AIDS & Behavior (2019 - )*
- *International Journal of STDs & AIDS (2019 - )*
- *AIDS Care (2020)*
- *Journal of Sex Research (2020)*
- *International Perspectives on Sexual and Reproductive Health (2020)*
- *International Journal of Drug Policy (2020)*
- *Journal of Acquired Immune Deficiency Syndrome (2020)*

## RESEARCH SUPPORT

F31MH11881701A1                                           07/01/2019-06/31/2021

Mental Health of At-Risk Women: The Role of Structural Vulnerabilities and Resilience

The goal of this National Research Service Award project is to understand the grouping of structural vulnerabilities (e.g., financial dependence, hunger, violence) among a sample of female sex workers and to see if these groupings predict changes in depressive symptoms. This project also aims to conceptualize resilience using individual interviews with sex workers.
Role: PI

## AWARDS

| | |
|---|---|
| 2017 | Student Assembly Student Grant |
| 2017 | Gordis Teaching Fellowship |
| 2018 | HBS Distinguished Research Award |
| 2019 | HBS Distinguished Doctoral Research Award |

## TEACHING EXPERIENCE

| Fall 2016 | Graduate Teaching Assistant<br>Epidemiology of LGBT Health<br>Professor: Tonia Poteat, PhD<br>Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health |
|---|---|
| Summer 2017,<br>Spring 2018 | Graduate Teaching Assistant<br>Introduction to Campaigning & Organizing<br>Professor: David Jernigan, PhD<br>Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health |
| Summer 2017 | Graduate Teaching Assistant<br>Biology & Public Health<br>Professor: Katherine Henry, PhD<br>Public Health Studies, Krieger School of Arts & Sciences, Johns Hopkins University |
| Fall 2017-2020 | Graduate Teaching Assistant<br>Fundamentals of Health, Behavior, and Society<br>Professors: Jill Owczarzak, PhD (2017-18), Lauren J. Parker (2019), Rajiv N. Rimal (2020) & Susan Sherman, PhD (2017-2020)<br>Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health |
| Fall 2018 | Instructor<br>Introduction to Harm Reduction: Principles and Examples in Public Health (3 credits)<br>Public Health Studies, Krieger School of Arts & Sciences, Johns Hopkins University |
| Fall 2019 | Graduate Teaching Assistant<br>Harm Reduction: A Framework for Evidence-Based Policy and Practice<br>Professors: Carl Latkin, PhD, Karin Tobin, PhD, & Susan Sherman, PhD<br>Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health |

## SKILLS

Proficient in SPSS and STATA for quantitative data analysis
Proficient in MaxQDA for qualitative data analysis
Proficient in Questionnaire Design Studio (QDS)
Experienced in MapGIS
Rape Crisis Counseling Training