Karibu na sirenji (Near the Syringe):

Applying mixed methods to characterize the HIV risk environment and gender differences among persons who inject drugs in Nairobi, Kenya

Natasha T. Ludwig-Barron

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Reading Committee:

Brandon Guthrie (Chair)

Carey Farquhar

Judith Tsui

Program Authorized to Offer Degree:

Department of Epidemiology

University of Washington

Abstract

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Natasha T. Ludwig-Barron

Chair of the Supervisory Committee:

Brandon Guthrie

Departments of Global Health and Epidemiology

In Kenya, people who inject drugs (PWID) are considered a key population that are disproportionately affected by the HIV and hepatitis C (HCV) epidemics, with prevalence estimates reaching upwards of 19-25% and 11-36%, respectively. Kenya's national HIV program scale-up for key populations has resulted in significant reductions in HIV incidence among PWID, but service gaps remain with only 43% of PWID aware of their HIV status, 68% of PWID living with HIV (PWID-LH) taking antiretroviral treatment (ART), and 64% of those on ART are virally suppressed. HIV care outcomes improved with the introduction of opioid agonist therapy (OAT) clinics that provide integrated methadone and HIV treatment services; however, OAT service access among PWID remains low (26%). Ecological frameworks, like the Modified Social Ecological Model and HIV risk environment frameworks, provide a holistic approach to understanding HIV, HCV and drug-related outcomes by looking beyond individual-level factors to examine the surrounding structural factors (e.g., political, economic, community, social) that are largely outside of an individual's control, but often influence individual-level risk behaviors (e.g., syringe sharing, sexual risks, engagement in care). While ecological frameworks have been applied in other PWID-LH settings, their application has been limited in Kenya, yet, may be beneficial to current HIV strategies. To better understand environmental influences that affect HIV risk and service uptake, we applied a mixed methods design to (1) qualitatively characterize HIV and HCV barriers and facilitators to care among

PWID through the lens of peer educators, including resource recommendations to improve service uptake; (2) qualitatively describe the Nairobi-specific HIV risk environment surrounding PWID-LH; and (3a) quantitatively identify distinct subgroups of PWID-LH based on demographic and risk environment factors using cluster analysis techniques in order to (3b) assess whether empirically derived clusters are associated with suboptimal care (i.e., discontinued care or treatment, virally unsuppressed) among PWID-LH.

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Table of Contents

ABSTRACT **3**

ACKNOWLEDGEMENTS **5**

DEDICATION **8**

CHAPTER 1: INTRODUCTION **13**

CHAPTER 2: BARRIERS AND FACILITATORS OF HIV AND HEPATITIS C CARE AMONG PEOPLE WHO INJECT DRUGS IN NAIROBI, KENYA: A QUALITATIVE STUDY WITH PEER EDUCATORS **19**

ABSTRACT 19
BACKGROUND 20
METHODS 22
Setting *22*
Sampling & Recruitment *22*
Data Collection & Management *23*
Data Analysis *23*
Ethical approval *24*
RESULTS 24
Barriers to HIV and HCV Care *25*
Facilitators to HIV and HCV Care *32*
Recommended Services *35*
DISCUSSION 37
Limitations *39*
CONCLUSION 40

CHAPTER 3: CHARACTERIZING THE HIV RISK ENVIRONMENT FOR PERSONS WHO INJECT DRUGS LIVING WITH HIV IN NAIROBI, KENYA: A QUALITATIVE STUDY **41**

ABSTRACT 41
INTRODUCTION 42
METHODS 45
Parent Study *45*
Qualitative Study *45*
RESULTS 47
Overarching themes: Urbanization & Stigma *49*
Location matters: HIV risk within urban, peri-urban and incarceration faculties *51*
Urban cores and HIV risk: *52*
Peri-urban settings and HIV risk: *56*
Incarceration facilities and HIV risk *59*
DISCUSSION 60
Strengths and limitations *63*
CONCLUSION 64

CHAPTER 4: IDENTIFYING HETEROGENEITY AMONG PEOPLE WHO INJECT DRUGS LIVING WITH HIV IN KENYA: AN EXPLORATORY CLUSTER ANALYSIS **65**

INTRODUCTION 65
METHODS 67
Study settings and survey instrument *67*
Outcome: Suboptimal care *67*
Risk Prevalence and Correlates of suboptimal care *67*

Cluster analysis methods ... *68*
RESULTS ... 72
Baseline characteristics ... *72*
Univariate analysis: HIV risks associated with suboptimal care ... *76*
Cluster analysis ... *82*
Male clusters ... *83*
Female clusters ... *85*
DISCUSSION ... 87
Understanding women who inject drugs (WWID) ... *87*
Understanding men who inject drugs ... *88*
Cluster analysis vs. univariate logistic regression ... *89*
Limitations ... *89*
CONCLUSIONS ... 90
CHAPTER 5: CONCLUDING STATEMENTS ... 91
SUMMARY ... 91
RECOMMENDATIONS ... 93
FUTURE DIRECTIONS ... 94
REFERENCES ... 96
SUPPLEMENTAL MATERIALS ... 111

List of Figures

Figure 2.1: Summary of HIV/HCV care themes applied within the Modified Social Ecological Model (MSEM)

Figure 4.1: Complete cases of PWID-LH according to the HIV care continuum (n=646)

Figure 4.2: Dendrograms following hierarchical cluster analysis using Ward's Method (A) represents the SHARP male participants (n=402) and (B) represents the SHARP female participants (n=381)

Figure 4.3: Representative dendrograms following hierarchical cluster analysis shows (A) male participants (n=402) and (B) SHARP female participants (n=381)

Figure A: Depicting cluster analysis using Ward's Method with SHARP study participants (n=783)

Figure B: Dendrograms following hierarchical cluster analysis using Ward's Method with SHARP participants (n=783)

List of Tables

Table 1.1. Proposed HIV risk environment factors (Rhodes et al.)

Table 2.1: HHP Study participant characteristics

Table 3.1: Demographics, substance use, and HIV care among qualitative participants (n=28)

Table 3.2: Proposed HIV risk environment for PWID living in Nairobi, Kenya

Table 4.1: SHARP Study variables according the Rhodes risk environment domains

Table 4.2: Full sample characteristics of PWID-LH by male and female participants (n=783)

Table 4.3: Sociodemographic and HIV environmental risk factors associated with suboptimal care stratified by men (n=402) and women (n=381)

Table 4.4 Male cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Table 4.5 Male clusters associated with suboptimal care (k=4)

Table 4.6 Female cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Table 4.7 Female clusters associated with suboptimal care (k=4)Table A: SHARP participant baseline characteristics associated with suboptimal care (n=783)

Table B: SHARP participants cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Table C: SHARP participant clusters associated with suboptimal care (k=4)

CHAPTER 1: Introduction

In Kenya, key affected populations contribute disproportionately to the HIV/AIDS epidemic, and this is likely to increase as HIV prevention and treatment services penetrate the general population but fail to reach marginalized groups.[1,2] Among persons who inject drugs (PWID), HIV prevalence estimates reach 15-20% in men and >40% in women.[1,3,4] HIV/AIDS represents a large health burden with more than 1.4 million people infected and 28,200 annual deaths.[1] The 2018 Kenyan National Health Survey found that 11-20% of people living with HIV were unaware of their status and of those aware of their status, more than 30% were not on treatment, making them at high risk for disease progression and transmission.[2] Emphasis in Kenya and other parts of sub-Saharan Africa has been on testing the general population, with far less investment in HIV testing and engaging in care within key affected populations, which includes PWID, female sex workers, men who have sex with men and transgender persons.[2] The Kenyan National AIDS Strategic Framework highlights the need to provide evidence-based programs and services for key affected populations, which represents one-third of all newly diagnosed HIV infections.[2,5] The strategic framework was developed around the UNAIDS 95-95-95 Goals, whereby 95% of all people living with HIV will know their status, of those diagnosed 95% will be on antiretroviral therapy (ART), and of those on treatment 95% will be virally suppressed.[6] Progress has been made towards meeting these goals; however, five factors continue to influence new infections within the key affected populations including: 1) socio-cultural factors (e.g., stigma, discrimination, vulnerability among women); 2) high risk sexual behaviors (e.g., concurrent sexual partners, transactional sex); 3) biological factors (e.g., low prevalence of male circumcision); 4) economic factors (e.g., increased labor migration, poverty); 5) political factors (e.g., weak social and legal protection for key affected populations, high rates of criminalization, poor enforcement of anti-discrimination laws).[2,5-7]

Injection drug use is increasingly contributing to the HIV epidemic with the expansion of drug trafficking networks and an estimated 30,000 PWID in Kenya, 30-50% of whom are likely to be HIV-infected.[8-10] Of particular concern are national estimates suggesting > 50% of PWID were unaware of their HIV status.[2,11] The vast majority of PWID are concentrated in Nairobi and coastal Kenya (i.e., Mombasa and Kisumu County), which have all seen increases in their PWID communities.[10,12] As regional drug patterns fluctuate, so will the behaviors and patterns of injecting drugs among users, a

population known to engage in extremely high-risk HIV behaviors.[3,13] Recent evidence among PWID living with HIV in Nairobi suggests that more than half engage in high-risk injection behaviors like needle sharing, front or back-loading syringes and drawing drugs from a common container.[12,14] In addition, approximately 80% inject daily and 75% report injecting two or more times per day, with heroin being the most commonly injected illicit drug.[12,14] Current drug policies in Kenya are non-tolerant towards any amount of illicit substances, regardless of whether they are intended for personal use or for the intent to distribute, often making PWID communities targets for harassment based on their physical appearance and resulting track-marks.[15,16] Sexual risks compound the issue of HIV susceptibility and transmission among PWID living with HIV, particularly, unprotected sexual acts with concurrent sex partners, sex work, and transactional sex.[8,12] Women are a minority in the PWID community, but HIV prevalence is estimated to be >40% for this subpopulation in some settings.[14,17] In order to reach the UNAIDS 95-95-95 goals in Kenya, key populations should be tested frequently, linked to care at the point of diagnosis and be engaged in HIV care in order to achieve viral suppression. This research focuses on the emergent group of PWID living with HIV that may experience additional co-morbidities and drug-related harms.

PWID are also disproportionally affected by hepatitis C (HCV), with prevalence estimates reaching 20-70% depending on the county.[14,18,19] In addition, HIV/HCV co-infection is common (18-40%) among PWID due to coinciding transmission risks including unsafe injection practices (e.g., syringe sharing, using pre-filled syringes), sexual risks (e.g., unprotected sex, forced sexual encounters, sex work), low HIV viral suppression (<5% in one study), and limited HCV prevention and care resources.[2,3,14,18] Of particular concern, PWID living with HIV are more likely to experience HCV complications when left untreated, including reduced spontaneous HCV clearance, higher HCV viral loads, and rapid HCV disease progression.[18-20] While Kenya's MoH prioritizes HIV care for PWID, HCV testing and treatment has been cost-prohibitive and largely unsubsidized.[21,22] In addition, clinics that provide HCV services largely serve the general population and are not tailored to the specific needs of PWID communities, which may result in physical, social and political barriers to care. Very little is known about the current status of PWID knowledge, which could be beneficial for public health planning prior to the release of direct acting antiretrovirals (DAAs), which are >90% effective in other PWID settings and

are anticipated to be released by 2021. [23,24] Like ART for HIV, DAA's are also expected to be subsidized through the MoH; however, far less is known about DAA uptake in PWID communities.

Drug risk environments have played a critical role in preventing the forward transmission of HIV within other PWID settings; however, they have yet to be applied in Kenya to understand specific risk factors that could lead to improving programs and services.[25-30] Growing evidence highlights the aggregate effects that the surrounding environment has on shaping the HIV risk among PWID.[25-27,31] Moreover, interventions that target only individual-level factors may be limited in their effectiveness to achieve and sustain change. To address this, Rhodes and colleagues developed a 'risk environment' framework that posits the consequence of HIV among PWID is not solely derived from individual behavior, but is rather a by-product of the surrounding physical, social, political and economic environment (Table A). [25-27] The physical environment encompasses fixed features surrounding the PWID community including spaces where drug-use takes place, drug availability and quality, and spaces where the buying, selling or trading of sexual acts take place.[25] The social environment includes networks of peers, healthcare providers, figures of authority (e.g., law enforcement), gender inequalities and stigma surrounding the community which have a vital role in HIV risk reduction.[25] In comparison, the economic environment includes financial barriers associated with drug use and HIV risk including the cost of living, expenses tied to injection equipment and employment opportunities, including legal and illegal markets.[16] Finally, the political environment includes laws and policies that determine whether harm reduction strategies are legal, including needle exchange programs and safe haven facilities (i.e., areas where PWID can access healthcare services without harassment).[25,27] Considered together, the components of the drug risk environment as a unit of analysis will overcome the limits of individual behaviors, embedded within most HIV prevention interventions, and will convey how drug-related harms intersect with health and vulnerability more generally. [25,27,28] The risk environment framework serves as the theoretical basis of our investigation, which will qualitatively describe the surrounding HIV risk environment for PWID living with HIV in Kenya.

Table 1.1 Proposed HIV risk environment factors (Rhodes et al.) [11,16,18]	
Categories	Examples of variables
Physical	- Drug-using practices, injecting and commercial sex work locations - Injecting drugs in public spaces - Drug availability and purity
Social	- Social and peer group 'risk' norms (e.g., sharing injection equipment) - Local policing practices (e.g., following formal laws, bribery, discrimination) - Community healthcare (e.g., HIV care), social services and HIV ancillary services - Gender inequities and gender-based violence - Stigmatization and marginalization of PWID
Economic	- Cost of living - Cost of healthcare services (e.g., HIV services, drug treatment, etc.) - Cost of prevention materials (e.g., clean injection equipment, condoms, etc.) - Employment opportunities (both formal and informal)
Policy	- Availability and coverage of clean injection equipment (e.g., needles, cooker, water, etc.) - Harm reduction policies (e.g., needle exchange programs, opioid agonist treatment) - Criminalization of substance use possession, paraphernalia possession and affiliation with drug settings

In 2011, Nairobi established its first needle-syringe program (NSP) to curb HIV transmission and provide ancillary medical services (e.g., HIV testing and treatment) to this marginalized group.[21] Traditionally, NSP's fall within one of many harm reduction strategies that aim to prevent new HIV infections, but many are now leveraging their position within the PWID community to provide additional services to address the HIV and HCV epidemics.[32-34] Assisted partner notification services (APS), which exists within needle-syringe programs, helps to identify PWID living with HIV and their partners, many of whom may not know their status and face unique barriers to accessing and remaining in care.[35-37] Within the general population, APS is considered an evidence-based program used to find, test and link thousands of HIV-positive individuals to care in Kenya, Mozambique, Cameroon and the United States.[35,36] Within PWID communities, APS involves collecting injecting and sexual partner contact information from persons testing positive for HIV, and using health advisors as mediators to offer testing and referrals after notification of exposure.[35,36] Communication and disclosure of HIV risk behaviors represents a key area of epidemiologic importance in terms of prevention, treatment and the potential for tailored interventions.[38,39] Previous studies demonstrate that shame and stigma surrounding HIV are associated with non-disclosure (i.e., purposely not discussing drug use and HIV status) and failure to seek care and treatment, which further isolates community members and perpetuates the epidemic.[39] In

addition to identifying HIV and HCV infections among those unaware of their status, a critical part of APS is linking newly diagnosed individuals and re-engaging those who are not engaged in care and/or nonadherent to treatment, to care and support services.[38,39] APS strategies have the unique ability to locate individuals who have a greater chance of transmitting HIV, and potentially HCV, but have yet to be applied with PWID communities in Kenya.[40] The current investigation is nested within an APS parent study that began in 2017 and aims to assess HIV outcomes among PWID living with HIV and their sexual and/or injecting partners. Using this sampling frame, we aim to highlight factors associated with engagement in HIV care, treatment adherence and viral load suppression, in order to improve current programs and services.

The HIV care continuum provides an underlying framework to track the progress of PWID living with HIV and their sexual and/or injecting partners through APS.[41,42] The HIV care continuum is a widely-accepted framework that outlines the sequential stages of HIV care that persons living with HIV experience. [41,42] This includes testing persons who are unaware of their HIV status, linking those diagnosed to HIV care, retaining HIV-positive individuals in care, ensuring ART adherence, and achieving viral load suppression. [41,42] Loss to follow-up is a significant disruption to this pathway and a common outcome among PWID living with HIV who face several barriers to accessing HIV care and treatment.[43,44] Challenges to HIV testing and engagement in care include locating 'hidden' or hard-to-reach populations, addressing HIV-related medical expenses, overcoming mistrust of medical professionals, and discrimination and/or stigma towards PWID living with HIV.[43,45] Competing needs (i.e., housing, employment, safety) and co-morbidities, mainly mental health issues, sexually transmitted infections, and dual chemical dependencies are all barriers to HIV care in PWID communities.[43,45] In addition, adherence to ART medication can be a challenge for individuals with substance use disorders due to housing insecurity, violence, symptoms of drug withdrawal, and side effects resulting from multiple substances.[44,46] HIV testing is a critical entry point for HIV prevention and treatment, and has been the fucus of several investigations, but there is limited knowledge on the barriers and facilitators to HIV care post-diagnosis and how to achieve the ultimate goal of HIV viral suppression.[47-50] Maximizing retention throughout the HIV care continuum benefits both individuals and community members by improving health outcomes and reducing HIV transmission risks.[41,42] Using the HIV care continuum framework can

be a useful tool in evaluating the progress made towards the UNAIDS 95-95-95 Goal to diagnose 95% of all people living with HIV; treat 95% of people who know their HIV status; and suppress the virus in 95% of people on treatment.[46] This framework can be particularly useful in determining the unmet needs of a marginalized community and will serve as a framework in understanding suboptimal care, defined as the disruption of HIV care or treatment, or being virally unsuppressed.

We apply a mixed methods study design, to qualitatively characterize HIV and HCV barriers and facilitators to care among PWID through the lens of peer educators, including resource recommendations to improve service uptake (Chapter 2); qualitatively describe the Nairobi-specific HIV risk environment of PWID living with HIV (Chapter 3); and quantitatively identify distinct subgroups of PWID living with HIV based on sociodemographic and risk environment factors using cluster analysis techniques in order to assess whether empirically derived clusters are associated with suboptimal care (i.e., discontinued care or treatment) (Chapter 4). We conclude with policy and service recommendations aiming to improve PWID care, with the ultimate goal of working towards community-level HIV viral suppression and HCV viral clearance (Chapter 5).

Chapter 2: Barriers and facilitators of HIV and hepatitis C care among people who inject drugs in Nairobi, Kenya: A qualitative study with peer educators

Abstract

Background: In Kenya, people who inject drugs (PWID) are disproportionately affected by HIV and hepatitis C (HCV) epidemics, including HIV-HCV coinfections; however, few have assessed factors affecting their access to and engagement in care through the lens of harm reduction specialists. This qualitative study leverages the personal and professional experiences of peer educators to help identify HIV and HCV barriers and facilitators to care among PWID in Nairobi, including resource recommendations to improve service uptake. **Methods:** We recruited peer educators from two harm reduction facilities in Nairobi, Kenya, using random and purposive sampling techniques. Semi-structured interviews explored circumstances surrounding HIV and HCV service access, prevention education and resource recommendations. A thematic analysis was conducted using the Modified Social Ecological Model (MSEM) as an underlying framework, with illustrative quotes highlighting emergent themes. **Results:** Twenty peer educators participated, including six women, with 2 months to 6 years of harm reduction service. Barriers to HIV and HCV care were organized by (a) individual-level themes including competing needs of addiction and misinterpreted symptoms; (b) network-level themes including social isolation and drug pusher interactions; (c) community-level themes including transportation, mental and rural healthcare services, and limited HCV resources; and (d) policy-level themes including nonintegrated services, clinical administration, and law enforcement. Stigma, an overarching barrier, was highlighted throughout the MSEM. Facilitators to HIV and HCV care were comprised of (a) individual-level themes including concurrent care, personal reflections, and religious beliefs; (b) network-level themes including community recommendations, navigation services, family commitment, and employer support; (c) community-level themes including quality services, peer support, and outreach; and (d) policy-level themes including integrated services and medicalized approaches within law enforcement. Participant resource recommendations include (i) additional medical, social and ancillary support services, (ii) national strategies to address stigma and violence and (iii) HCV prevention education. **Conclusions**: Peer educators provided intimate knowledge of PWID barriers and facilitators to HIV and HCV care that were described at each level of the MSEM, and should be given careful consideration when developing

future initiatives. Recommendations emphasized policy and community-level interventions including educational campaigns and program suggestions to supplement existing HIV and HCV services.

Background

In Kenya, people who inject drugs (PWID) are considered a key population that are disproportionately affected by the HIV and hepatitis C (HCV) epidemics, with prevalence estimates reaching upwards of 19-25% and 11-36%, respectively.[2,3,14,18,51,52] Within PWID communities HIV-HCV co-infection is common, prevalence estimates ranging 18-40%, due to the coinciding transmission risks including unsafe injection practices (e.g., syringe sharing, injecting blood or "flashblood"), sexual risks (e.g., unprotected sex, sexual violence, sex work), low HIV viral suppression (28-40%), and limited HCV prevention and care resources.[14,18,19] Moreover, PWID living with HIV are more susceptible to acquiring HCV and experiencing HCV-related morbidity and mortality.[20] Kenya's national HIV program scale-up for key populations has resulted in significant reductions in HIV incidence among PWID, but service gaps remain with 57% of PWID unaware of their HIV status, 68% of PWID living with HIV are on antiretroviral treatment (ART), and 64% of those on ART are virally suppressed.[21,52] With the release of direct acting antiretrovirals (DAAs), which are over 90% effective in treating HCV within other PWID settings, HCV elimination is achievable and has shown promising, cost-effective results when incorporated in to existing harm reduction and HIV programs for PWID.[21,22,24] Within Kenya, DAA access has been largely cost-prohibitive and HCV prevention resources are limited, with little information on current PWID knowledge and perceptions of HCV, which can contribute to future HCV programs and services.[18,53] As such, characterizing the circumstances surrounding PWID experiences of HIV and HCV care and access to prevention resources, will provide opportunities to improve services uptake.

Kenya's Ministry of Health supports the collaboration of healthcare providers and harm reduction organizations that have established rapport with PWID communities in order to address the HIV and HCV epidemics.[15,54] Harm reduction programs are largely credited with reducing HIV and HCV incidence among PWID through needle syringes programs (NSPs), HIV counseling and testing services, social services (e.g., meals, shower facilities) and healthcare referrals.[21,55] Common healthcare referrals include HIV and HCV care, wound care and opioid agonist therapy (OAT), with several OAT clinics providing more comprehensive healthcare services by offering both methadone and HIV treatment to PWID.[56]

Despite the success of harm reduction programs, NSP and OAT service coverage remains low with approximately 54% of PWID accessing to NSPs and 4% accessing to OAT.[57] In Nairobi, Support for Addictions Prevention and Treatment in Africa (SAPTA) is a non-profit organization that implements an evidence-based Peer Educator (PE) Program that trains former PWID to conduct outreach in PWID communities, offering grassroots harm reduction services that aim to reduce HIV and HCV incidence.[58] PEs serve as trusted community liaisons, often bridging the gap between PWID and healthcare providers, who largely serve the general public. Until recently, most studies have highlighted the experiences and perspectives of PWID, healthcare service provides and key stakeholders, but rarely consider the unique vantage-point of PEs, who offer both personal and professional perspectives on dynamics surrounding addiction, HIV and HCV care, and recommendations for improving service uptake.[53,59]

The Modified Social Ecological Model (MSEM) is often applied to understand the multiple contributors to infectious disease risk within specific communities, but it has yet to be applied to PWID communities within Kenya.[60] The MSEM suggests that individual behaviors are not solely derived from individual decisions, but rather influenced by external factors outside of an individual's control.[60,61] Specifically, the MSEM explains the complex relationships between the stage of an epidemic, including HIV and HCV epidemics, and the surrounding risks that fall within political, community, network and individual domains.[60,61] Policy-level risks include laws and policies that promote or prohibit access to care; whereas, community-level risks include organizational structures, social cohesion, and socio-cultural norms that may affect a PWID's ability to engage in HIV and HCV care.[60] At the network-level, risks may be influenced by family, friends, sexual and/or injecting partnerships, while individual-level risks include personal knowledge, attitudes, and behaviors that influence the health and wellbeing of PWID.[60] Describing risk through an ecological lens, applying the MSEM, will provide a holistic view of how the surrounding environment impacts PWID behaviors, particularly the uptake of HIV and HCV services.

Using the MSEM as an underlying framework, we aim to characterize barriers and facilitators of HIV and HCV care through the perspective of community-embedded PEs in Nairobi, Kenya. Until recently, several studies have highlighted the roles and perspectives of clinicians, policy makers and current PWID, but rarely seek input from PEs who offer intimate knowledge of PWID experiences. In addition, we ask PEs for suggestions on resources and services that may support current PWID and aide

their work as harm reduction specialists in improving HIV and HCV care uptake, with the ultimate goal of achieving community-level HIV viral suppression and HCV viral clearance.

Methods

Setting

Our qualitative study takes place within Nairobi's urban core with two SAPTA facilities where PEs provide outreach and harm reduction services to surrounding PWID communities. The SAPTA service region caters to more than 21,000 PWID, most of which buy, sell and trade drugs within "dens" that are located in outdoor public spaces. To avoid contributing to community stigma, location names will not be provided. PEs are trained harm reduction specialists, who are former PWID. They undergo instructional and field training in order to provide a range of harm reduction services, including distributing injection kits; connecting PWID to HIV/HCV counseling and testing services; educating on HIV, HCV and overdose prevention; providing opioid-receptor agonist treatment (i.e., naloxone); promoting OAT clinical referrals; providing medical navigation assistance (e.g., appointment setting and reminders, transportation); and social services offered through SAPTA facilities (e.g., meals, groceries, shower and laundry facilities, etc.) At the time of this study, HIV treatment and care was subsidized throughout Nairobi; however, HCV treatment was limited to interferon-based regimes, that were largely cost prohibitive and <50% ineffective.[18] Until recently, DAA treatment was limited to research studies and pilot programs, with a national HCV treatment rollout anticipated in 2021. Strategic planning around HCV services and DAA dissemination are expected to evolve in order to meet community needs.

Sampling & Recruitment

We established a sampling frame of PEs working at two SAPTA facilities in Nairobi, Kenya. Study eligibility included: 1) adults 18 years or older; 2) employed as a PE from November to December 2017; 3) English or Swahili-speaking; and 4) willing and able to provide informed consent. All SAPTA PEs are former PWID, with established PWID relationships. Random and purposive sampling techniques were applied, whereby we randomly selected PEs from a SAPTA roster and oversampled female PEs in order to increase the robustness of participant experiences. A standard script was used to explain the study purpose and procedures, and in total, 20 participants were selected and agreed to participate.

Data Collection & Management

Prior to conducing in-depth interviews with PEs, key informant interviews were completed by the senior author (AMW), who met with SAPTA leadership, HIV and HCV clinicians, mental health experts and government officials. The interview guide was developed through an iterative process with key informants and translated into Swahili by the study coordinator (LM), which was later piloted with two PEs prior to the start of data collection.

Semi-structured, in-depth interviews were used to elicit PEs personal and professional experiences surrounding (1) job responsibilities; (2) PWID access and utilization of HIV, HCV and addiction care services; (3) treatment by law enforcement and medical providers; and (4) suggested resources for PWID and to aide PEs in providing harm reduction services. One female, bilingual (English/Swahili) interviewer, with graduate-level qualitative training and extensive experience working with local PWID communities, received training on study procedures and conducted all interviews. Interviews were audio recorded and ranged from 45-90 minutes, with the interviewer taking detailed field notes post-interview to summarize content and the physical and mental condition of each participant. Weekly study team discussions were used to (a) refine interview guides, (b) explore emergent topics (i.e., reciprocation), and (c) initiate analysis discussions.[62-64] Through study discussions, research team members concluded conceptual saturation had been reached, whereby additional interviews would not elicit new information.[62,63] All transcripts were transcribed verbatim, with all but four transcripts undergoing translation from Swahili to English. ATLAS.ti, v8 (Berlin, Germany), was used to manage and analyze all transcripts, field notes, and memos into one integrated system.

Data Analysis

We conducted a thematic analysis using similar methods to those described by Braun and Clark (2006).[62] Codebook development involved three study team members (NLB, AMW and LM) independently reading and open-coding select transcript excerpts in order to generate an initial list of codes based on *a priori* topics (i.e., deductive) and emergent themes (i.e., inductive).[62,64] Similar themes were merged together as common or recurring concepts, which were organized into typologies and later into classification schemes. Weekly coding schedules consisted of coding, reviewing field notes, and writing detailed memos, which was followed by team discussions of major themes and code definitions as

an iterative process.[64] Isolated coding concerns were resolved through team discussions and further refinement of codebook parameters. Higher-level code classifications included (a) drug use and addiction, (b) social support systems, (c) politics and law enforcement, (d) infectious diseases, and (e) peer educator employment. Guided by the MSEM, PWID experiences of HIV/HCV barriers and facilitators to care, as described by PEs, are presented alongside representative quotes using pseudonyms to protect anonymity.

Ethical approval

All study procedures and materials were approved by the University of Washington Institutional Review Board (Seattle, WA, USA) and the Kenyatta National Hospital/University of Nairobi Ethical Review Committee (Nairobi, Kenya). Participants provided written informed consent in Swahili or English. Careful consideration was given to SAPTA employment contracts that outline grounds for probation or dismissal, whereby if a PE disclosed current substance use, particularly the combination of methadone and substance use, they were encouraged to speak with an addiction counsellor. To our knowledge, no PEs were engaging in poly-substance use at the time of their interview. PEs were reimbursed 400 Ksh ($4 USD) for their time and transportation.

Results

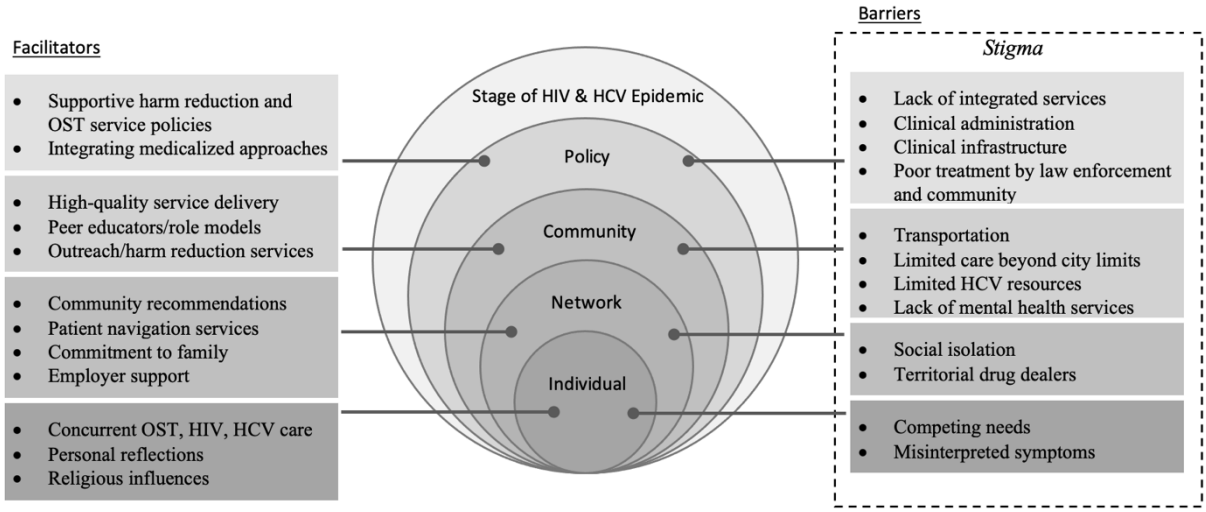
Twenty participants completed in-depth interviews, of which 30% were women. PE mean age was 37 years, half completed their secondary education (55%), and more than half were married or had partners (65%). Participant average years of service was 3 years (range: 2 months-6 years) (Table 2.1). PEs referred to actively injecting PWID living with HIV/HCV as their “clients,” which is how they will be referred to throughout.

Table 2.1: HHP Study participant characteristics

Characteristics	**Peer Educators (n=20)**
Sex	
Female	6 (30%)
Male	14 (70%)
Mean age (range)	37 years (25-50 years)
Level of Education	
Primary	9 (45%)
Secondary	10 (50%)
Some College	1 (5%)
Married or Partnered	13 (65%)
PE average years of service (range)	3 years (2 months – 6 years)

Themes relevant to HIV/HCV barriers and facilitators to care were adapted to the MSEM framework including individual, network, community and policy-level risks that are centered around Kenya's HIV and HCV epidemics (Figure 2.1), with suggested service recommendations that included medical, social and ancillary support services, provided at the end.

Figure 2.1: Summary of HIV/HCV care themes applied within the Modified Social Ecological Model (MSEM)



Barriers to HIV and HCV Care

Individual-level themes

Participants described two individual-level barriers: the competing needs of addiction and misinterpreted HIV/HCV symptoms. PEs characterized periods of addiction, from both personal and professional perspectives, as constantly having to "hustle" to earn an income to acquire drugs, food and shelter, with main objective to avoid their withdrawal symptoms. As a consequence, HIV/HCV treatment and care was often neglected. Kizito, a PE for over 2 years, described the effort he dedicates to escorting clients to HIV/HCV testing and treatment facilities, but struggles keep his clients engaged in care when clients anticipate their withdrawal symptoms in-transit or waiting in queue to see a provider at the clinic. He described one client with HCV complications, who voluntarily discharged against medical advice:

"I lost one guy with Hepatitis C and the problem is that they [PWID clients] cannot be contained. They don't stay in the hospital. If they are admitted, when they feel a little bit okay, they run away because of the craving." Kizito, M, age 44 years, PE for 2 years

Kizito's day is often consumed by transporting clients to harm reduction facilities and medical appointments, or following-up with clients to ensure they adhere to treatment regimens. Kizito concluded that without PE follow-up, clients will delay their HIV/HCV medical care until they are extremely sick and treatment options are limited.

In other cases, PEs describe their clients' hesitation in receiving an HIV/HCV test due to their misinterpretation of *rosto*, or withdrawal symptoms, which can be difficult to discern from symptoms of advanced HIV/HCV infection (e.g., headaches, body chills, stomach aches, diarrhea, etc.) Below Murwa, a newly trained PE, explains that some of his clients have mistaken HIV/HCV-related health issues as withdrawal symptoms, causing them to consume additional drugs rather than seek care:

"You might find that someone has stayed with the HIV virus for almost one-year and they don't know [their serostatus], and the body continues to wither down.. . .they feel the stomach or somewhere else aching, and they will just say it is rosto [withdrawal symptoms]." Murwa, M, 37 years, PE for 7 months

Experiences of HIV/HCV-related health issues could be the result of high viral loads stemming from non-adherence to treatment. When paired with sharing injection equipment or unprotected sexual activities, PWID may continue to transmit HIV/HCV to sexual and injecting partners.

Network-level barriers

PEs highlighted two network-level themes: social isolation and territorial drug dealers. For many clients, stealing from family and friends is a common occurrence, with all but two PE's recalling personal and professional accounts of theft that resulted in dissolved relationships. Otieno (M, 36 years), a PE who injected heroin for 15 years, recalled experiencing social isolation from family and friends that impacted his mental health. He relates to clients' poor mental health and fatalistic thoughts where, *"they don't see the meaning of life,"* which ultimately affects their willingness to engage in HIV/HCV care. In addition, PEs described limited family counselling services that are tailored to injecting communities and their families.

More than half of the PEs described the benefits of addressing clients' mental health and supporting family reunification, which would increase client engagement in HIV/HCV services.

Territorial "drug lords" and "pushers," whose main objective of selling drugs, interfered with PEs' ability to provide harm reduction services in local dens, or outdoor areas where drugs are bought, sold and consumed. Moha describes acts of physical violence and threats from drug suppliers, who blame PEs for impinging on their revenue:

> *"Sometimes you have to hide, so that you can talk with people [clients] at the den, or when distributing the [needle-syringe] kits, sometimes we hide because the drug lords see us as blocks to their business. . . . we [PEs] are people who have been marked. There was a time a peer educator from here, they were beaten." Moha, M, 34 years, PE for 2 years*

PEs provide essential harm reduction and HIV/HCV services, which is obstructed when drug suppliers threaten or carry out acts of violence. As a result, clients will avoid PEs, fearing retaliation by drug suppliers, which limits their access to harm reduction services.

Community-level barriers

Four community-level themes emerged during PE discussions including: (a) transportation, (b) limited care beyond city limits, (c) limited HCV resources, and (d) lack of mental health services. PEs described transportation cost as common barrier, especially when clients lived or spent time outside of city limits. Three PE's, including Wangai, described instances where they felt obligated to fund transportation costs to medical facilities when their client's health was at stake:

> *"If the person is very sick, they will have to use transport and you find that we don't have money in the DIC [SAPTA drop-in centre] to support such things. We contribute money amongst ourselves [between several PEs] and take him to the hospital." Wangai, M, 42 years, PE for 5 years*

Wangai and Muniu (M, age 39) explained that their personal experience with addiction motivates them to support clients who are *"still our brothers and sisters,"* regardless of the financial cost. On several occasions, PEs described selfless acts to overcome community-level barriers, which highlights their dedication to client's healthcare needs goes beyond financial incentives.

In addition, PEs described several scenarios where clients with HIV/HCV-related complications returned to their home villages to receive family support. However, with limited medical facilities in the villages, family members will often transport clients back to Nairobi when a client health conditions are severe. To complicate matters, clients often do not disclose their HIV/HCV-status or substance use to family members, due to stigma and fear of discrimination. Rita and her sister moved into a Nairobi slum in search of work, where they both developed a heroin addiction. Rita received her HIV diagnosis shortly after her sister passed away, and although her sister was never tested, Rita assumes her death was related to HIV complications. Rita summarizes her sister's final days alive:

> *"She [Rita's sister]got pneumonia. . . I took her home [to our village] when I saw things are bad and by that time she was really in a bad condition. My mother took her to the hospital, and the following day when my mother went to visit her, found that she had died. You know when you are at the base. . . you don't think that this thing is serious." Rita, F, 38 years, PE for 3 years*

Rita was one of two PEs that described returning home to their village for family support and finding limited medical resources. In addition, many clients underestimate the severity of their illness and re-engage in care when they are severely immunocompromised, which limits their treatment options and increases the risk of mortality.

Several PEs cited an abundance of HIV-related health education and awareness, but limited community awareness on HCV testing, treatment and care. Muniu (M, 39 years) a PE for more than 4 years, describes his clients' limited awareness of HCV prevention and requested national HCV educational campaigns to educate communities on transmission routes, affected sub-groups, and locations for low-cost testing services. While harm reduction agencies provide consistent HIV prevention messaging and promote the use of clean injection equipment, clients often lack information on primary and secondary HCV prevention services.

Nearly all PEs described personal and/or professional experiences of poor mental health that impacted daily activities, drug use, and ultimately, HIV/HCV care. Descriptions of violence, trauma, stress, isolation and experiences of forced migration to major cities in order to support family members, all contributed to poor mental health. Seventeen PEs described experiences of trauma, stress, depression and anxiety after witnessing a peer overdose. Muniu (M, age 39 years) recalled a traumatic event where

he and his peers attended a demonstration event that turned violent and his close friend was killed, citing, *"Nothing like that has ever happened to me. Losing someone that you were with five minutes ago, I think it took a toll on me."* Following the event, Muniu's addiction to heroin and benzodiazepines increased and he neglected his HIV care for more than a year. While PEs draw on personal experiences to counsel clients, they recognize their limitations in providing professional mental health services. Furthermore, PEs conveyed that most mental health services do not treat co-occurring disorders or severe mental health conditions (e.g., suicidal ideation, depression, psychosis), but highlighted the importance of mental health services and improved HIV/HCV care.

Policy-level barriers

PEs described four policy-level themes: integrated and tailored services, clinical administration (e.g., long wait queues, ambiguous financial obligations), clinical infrastructure (e.g., confidentiality concerns), and poor treatment by law enforcement and community members. PEs consistently cited the lack of integrated, tailored services as challenges as reasons for discontinued HIV/HCV care among their clients. Many endorsed a *"one-stop"* facility where clients could access harm reduction, HIV/HCV care, OAT, wound care, mental health and ancillary services from providers who understood the specific needs of their clients. Harm reduction sites are limited to basic first aid, HIV counseling and testing, peer support groups and social services, with all other medical services provided via referrals. As a result, clients that attend multiple clinics face additional time and financial burdens associated with lost income, transportation costs and household obligations. Nearly all PEs advocated for integrated medical services provided within harm reduction facilities, which have established positive report with injecting communities.

Administrative barriers included crowded medical facilities, long wait-queues and ambiguity around the financial obligations for medical services. In several cases, PEs felt obligated to accompany their clients to medical visits in order to provide coping strategies for withdrawal symptoms and to assist in navigating complex administrative processes. In addition, ambiguous financial obligations leave PWID unsure about whether medical expenses are subsidized or unsubsidized, creating unnecessary barriers to HIV/HCV and ancillary health services. Kizito described accompanying his clients to medical appointments and being solicited for payment:

"Once we take the client to the hospital, we take the client to the Social Department where they [apply for a subsidization] waiver. It is a challenge because if they [medical staff] refuse, you keep on telling them that they are street people and they are junkies and we usually have letters with our [SAPTA] letterhead, used for referrals. And then, at long last, they agree to waiver. That is why you have to follow up with them . . because if you leave them [a client] there, they will just die." Kizito, M, age 44 years, PE for 2 years

While HIV medical services are subsidized, clinical administrators will often seek payment for ancillary medical services that can delay PWID from seeing a provider, which increases the possibility of withdrawal symptoms and creates undue stress. Like Kizito, many PEs feel obligated to assist clients in navigating through administrative and clinical barriers, fearing clients will become overwhelmed and neglect their medical care.

Several PEs highlighted concerns surrounding confidentiality breaches due to lack of privacy with the clinical infrastructure. Often small building spaces and the use of curtains as temporary walls impacted privacy, so that patients in the waiting areas could decipher patient-provider conversations. Kiplimo understands the advantages of providing ART within OAT clinics, but described his clients confidentiality concerns:

"You will be given your medicine [ART] and then you are given your methadone through the window and you know there is no curtain. . . . Or even there are two windows, and you open the other one and you find someone receiving the medicine and then that person will start talking." Kiplimo, M, 35 years, PE for 6 years

Kiplimo and two other PEs described the benefits and convenience of integrating ART and methadone services; however, breaches in confidentiality have led to the unintended disclosure of clients' HIV status, which later induced social discrimination. The fear surrounding confidentiality breaches causes clients to avoid OAT clinics or to enroll in separate facilities. Notably, clients that attend separate medical facilities face both time and financial constraints, which can increase suboptimal care through miss appointments and treatment regimens.

Nineteen PEs described first- and second-hand accounts of poor treatment, harassment, and violent acts that were carried out by local businesses, police and community members. Fifteen PEs

described experiences of physical violence perpetrated by community members, referred to as “mob justice,” with at least three instances resulting in mortality. Mob justice was described as a spontaneous assembly of community vigilantes delivering justice through physical beatings, typically following theft or the destruction of property; however, the notion that all community members are empowered to punish marginalized clients. In total, 13 PEs characterized scare tactics, threats and acts of physical violence carried out by law enforcement. Kizito (M, 44 years) described one law officer who consistently carried out lethal force within the dens, which resulted in more than a half-dozen deaths. According to Muniu (M, age 39 years), law enforcement agents arbitrarily apply physical violence towards injecting communities, explaining, *“. . .there [are] good days and bad days for a cop,”* which causes clients to avoid areas associated with law enforcement and government entities, including medical facilities that provide HIV/HCV services. Law enforcement mistrust was rooted in corruption, with three PEs describing personal bribe solicitations by officers in order to mitigate jail sentences. This was coupled with recent government sanctioned den raids carried out by law enforcement, where surrounding homes were demolished within hours and physical violence targeted known PWID. Raids caused displacement, stress, and trauma amongst clients, with several PEs unable to locate clients for medical appointments. Considered together, displacement, corruption and violence perpetrated by law enforcement and supported by government officials, further marginalize PWID and limited their access to HIV/HCV healthcare services.

Overarching barrier: Stigma

Discussions around stigma-related barriers to HIV/HCV care were described at each level of the MSEM. PEs described intrapersonal stigma as clients’ acceptance of discriminatory beliefs about themself that were rooted in living with HIV/HCV, using drugs, and/or illegal income sources (e.g., “hustling”, stealing, sex work). At the network-level, PEs frequently described experiences of stigma, isolation and being outcasted from friends, family and community members based on one’s addiction, illegal income sources, and/or HIV/HCV serostatus status. Cherono (F, 33 years) still faces the consequences of her heroin addiction, as her siblings are unwilling to communicate. As a PE, Cherono witnesses similar patterns of family isolation stating, *“They [family] count a junky as dead, they don’t count them as a person anymore.”* At the community-level, PEs highlighted experiences of discrimination by

uninformed medical providers and law enforcement, which further isolates PWID communities. Rita (F, 38 years) and two other female PEs explained that doctors that serve *raiya*, or the general public, *"look at you like you are not human,"* which further marginalizes injecting communities. Often PEs characterized societal beliefs associated with substance use and HIV/HCV as lapses in judgement or poor morality, which caused clients to avoid medical assistance. Experiences of clinical stigma and discrimination, caused several clients to go without screenings, care, and treatment. Particularly, six PEs described medical conditions (e.g., abscesses, broken bones and high fevers) that were left unattended and increased in severity, which complicated treatment options. At the policy-level, PEs discussed historically unsupported harm reduction programs from government officials that marginalized clients, which was compared with the current lack of government support for HCV services. In general, PEs perceived policy-makers, government officials, medical providers, and community members as being uninformed and intolerant towards their clients' needs.

Facilitators to HIV and HCV Care

Individual-level facilitators

PEs characterized three individual-level themes, including: concurrent engagement in OAT, personal reflections and religious influences that motivated clients to remain engaged or re-engage in HIV/HCV medical care. Almost all PEs described improvements in physical and mental health outcomes when HIV, HCV and substance use disorders were addressed in parallel. Particularly, OAT clinics provide daily directly-observed methadone and HIV treatment, with infrastructure to accommodate HCV testing and DAA distribution in the future. In addition, several PEs discussed personal reflections following severe health complications or the death of a peer, as a motivating factor for returning to HIV care, but left many unaware of HCV service options. The fear of death, particularly not wanting to abandon family or children, prompted several PEs to prioritize their health, re-engage in care and reduce their substance use. PEs credit their lived experiences and personal reflections as impactful tools in encouraging clients to engage in care. Furthermore, 10 PEs credited their faith and religious beliefs for improvements in treatment adherence and overall health, especially following extended periods of suboptimal care. Cherono (F, age 33 years) described her disbelief of surviving a 9-year heroin addiction and being orphaned, surviving physical violence, and living in unsafe environments stating, *"I don't have parents, no*

one else to take care of me, only God." Cherono shares with clients that her strength and survival is a combination of religious faith and following medical advice, which has allowed her to a better mother. Several PEs described the benefits of faith-based organizations that provide social services (e.g., food, shelter, clothing) and host events to build community, which increases social inclusion and improves mental health. As such, PEs found it easier to motivate clients with religious beliefs to re-engage in care.

Network-level facilitators

Emergent network-level themes included trusted community recommendations, patient navigation services, commitment to family and children, and employer support. Trusted community recommendations and positive clinic reputations were seen as essential to promoting healthcare services to clients, including HIV, HCV and OAT services. PEs characterized communication networks within injecting communities that shared both positive and negative clinical experiences, which often impacted client engagement or re-engagement in care. When discussing HCV services, PEs stressed the importance of considering community perceptions and clinic reputations when developing HCV care delivery strategies.

At the center of client care was the unanticipated theme of patent navigation services carried out by PEs providing the highest level of healthcare support and coordination, which often fall outside of the PE job description and without additional compensation. Specifically, PEs described (a) tracking and reminding clients of medical appointments, (2) absorbing clients' medical transportation costs, (3) navigating administrative processes, (4) mediating patient-provider discussions and (5) providing treatment adherence reminders. Hawi recalls neglecting her medical appointment at the height of her addiction, which motivates her persistent follow-up with clients:

> *"I go with them to the hospital and when they have been given medication, I ensure they get them [medication], and if they are given a follow-up [appointment] I accompany them to the hospital again until they are done." Hawi, F, Age 34 yrs, PE for 3 years*

Ultimately, PEs described additional hours in providing ancillary services to clients that are integral to HIV/HCV care and achieving viral suppression; however, these services remain largely uncompensated and unrecognized by the medical community.

In addition, men and women discussed slightly different motivations for engaging or re-engaging in care. For women, commitment to family and children often motivates PEs and their female clients to follow medical recommendations. For men, influential community members like religious figures, PE colleagues and supportive employers provided motivation to remain or re-engage in HIV/HCV services. Moha (M, age 34 years) described the positive impact his former employer had on returning to care. Moha's employer permitted him to take time-off to attend medical appointments and encouraged him to take medical leave to address his substance use disorder, while maintaining job security. Both social networks (i.e., PWID, family, children, and employers) and patient navigation services provided by PEs were instrumental facilitating clients' engagement in care.

Community-level facilitators

High-quality service delivery, harm reduction services, and peer educator programs emerged as community-level themes and promoters of HIV/HCV care. All PEs credited access to harm reduction organizations, like SAPTA, for their improved physical and mental health. PEs relate to clients' skepticism of harm reduction agencies, but share their positive experiences with non-judgmental staff, access to social services (e.g., laundry, two meals per day, and shower facilities) and quality healthcare services within harm reduction facilities. Wairimu (F, age 27 years) described her initial motivation for visiting SAPTA in order to access social services, which created a level of trust and later transitioned into HIV, HCV and OAT services. More often than not, PEs credited harm reduction facilities as mediators or "bridges" between clients and high-quality HIV/HCV care.

Harm reduction programs apply grassroots service delivery principles through the PE program, training PEs to, *"meet people where they are,"* and provide harm reduction services in dens where clients reside. These activities establish rapport between PEs and clients, with PEs drawing on their lived experiences and serving as positive role models. Eventually, PEs are able to broach the topic of HIV/HCV prevention, testing and care. Martin (M, age 50 years) explains that several of his clients *"feeling like it's the end of the world. . . but when they look at people like us [PEs], they get hope."* Employing PEs is a critical step in accessing and bridging the gap between PWID and medical communities, that ultimately, improve access to HIV, HCV and ancillary medical services.

Policy-level facilitators

PEs described two overarching policy-level themes, which included: supportive harm reduction and OAT service policies and integrating medicalized approaches within law enforcement agencies. Three PEs provided historical context prior to the advent of harm reduction programs. Martin (M, age 50 years) shared injection equipment and engaged in "flashblood," where he would inject another peer's blood to avoid withdrawal symptoms, which is how he believes he contracted HIV and HCV. Following national support on harm reduction and OAT programs, PEs noted the subsequent uptake of HIV/HCV prevention and care. Muniu (M, age 39 years) engaged in heroin and benzodiazepine use for more than 10-years and posits when *"methadone came [to Kenya], life began.*" Until harm reduction and OAT programs were nationally recognized public health strategies, PEs found it extremely difficult to assist clients in accessing HIV/HCV services.

Until recently, PEs noted that punitive punishments for drug possession were the standard practice; however, more recently harm reduction programs have partnered with law enforcement agencies to provide education around medicalized approaches to assist PWID. PEs described three accounts of law enforcement agents taking a medicalized approach by encouraging clients to pursue methadone when they were found in possession of opioids and/or drug equipment. In these instances, law enforcement agents provided clients with two options: jail or OAT enrolment. While PEs felt medicalized approaches were inconsistently implemented by law enforcement agencies, they highlighted the promising effects of being a gateway to OAT, HIV, HCV and harm reduction services.

Recommended Services

PEs recommended HIV/HCV resources and services, that would assist them in providing outreach and harm reduction services, which were categorized by: social, medical and ancillary services. Within the requested the social services, PEs advocated for occupational and vocational training programs for clients that provide pathways towards financial independence and stable housing options, which would allow them to prioritize their health. Vocational training spanned basket weaving, cosmetology, and typing classes. Four PEs suggested evaluating a client's education and skill-level to offer opportunities for re-certification or occupational re-integration where appropriate. PEs noted clients with small businesses, mainly shoe-shining and car washing, and could benefit from small business loan

programs to purchase supplies. Nearly all PEs advocated for occupational programs for clients to increase their financial independence and change their living conditions to be away from drug environments, so that their role of delivering harm reduction and assisting with HIV/HCV services would be more impactful.

Nearly all PEs requested integrated medical services, which included HIV, HCV, OAT and ancillary services within established harm reduction organizations. PEs described the time, effort and cost of escorting clients to multiple clinics that serve the general population, which produced lapses in care and less time spent conducting outreach. Two PEs suggested that providers and clinical frontline workers should be cross-trained on substance use disorders to reduce stigma and discrimination. PEs that have clients who frequently travel back to their villages, advocated for harm reduction mobile units that can provide HIV/HCV services in the villages. Additionally, six PEs requested training in first aid, resuscitation, and basic wound care that they can apply while conducting outreach. PEs are an integral part of the HIV/HCV care, yet their training is limited to outreach, harm reduction education and informal patient navigation services, with several PEs requesting additional responsibilities to better serve clients.

Recommendations for ancillary resources included mental health services, family counseling and re-unification services, national HCV educational campaigns, and non-traditional services like physical activity space to improve *kujithamini*, or self-esteem, and mental health. Twelve PEs stressed the importance of addressing clients' mental and physical health in parallel to increase the overall. Specifically, PEs recommended mental health and counseling services equipped to deal with co-occurring disorders (e.g., trauma, depression, schizophrenia), as well as, family counseling and reunification services. Nearly all PEs described their client's as having a basic understanding of HIV prevention, but lacked awareness around HCV prevention. PEs advocated for national HCV campaigns to educate community members and low literacy campaigns tailored towards PWID communities. Finally, two PEs suggested providing physical activity space and workout equipment in harm reduction facilities, explaining that improved physical appearance increases a client's confidence and ultimately keeps them engaged in HIV/HCV care. While non-traditional, ancillary programs are not widely promoted, they may offer unique solutions in addressing HIV/HCV care barriers.

Discussion

This qualitative analysis applies the MSEM as an underlying framework to better understand HIV/HCV barriers and facilitators to care through the unique lens of PEs who offer both lived-experiences as former PWID, and professional experiences of providing outreach services to hidden PWID communities in Nairobi, Kenya. Barriers and facilitators to HIV/HCV care were identified within each level of the MSEM, including individual, network, community and policy-levels, and were specific to Kenya's HIV and HCV epidemics among PWID, a group previously identified as a key population.[15] Notably, stigma was an overarching theme that touched all levels of the MSEM and greatly impacted HIV/HCV care. Additional resources and service recommendations to aid PEs, included additional medical, social and ancillary support services. Leveraging the unique perspectives of PEs through an ecological framework, posits intervention strategies that address one level of the MSEM may have limited effectiveness in improving HIV/HCV care. Moreover, HIV/HCV interventions should be developed by multiple stakeholders including current PWID, PEs, medical professionals, harm reduction specialists, law enforcement agents, and policy-makers.

Addressing policy-level barriers through a top-down approach, may address multiple HIV/HCV-related barriers at various levels of the MSEM with suggestions to (a) expand integrated services beyond the current OAT, HIV, and HCV services; (b) increase OAT capacity and treatment options; and (c) advocate for drug policies that emphasize medicalized, rather than punitive approaches. Several studies point to the benefits of patient-centered, integrated care models that provide HIV, HCV, OAT and ancillary services within trusted harm reduction organizations and employ medical staff trained on the specific needs of PWID.[65,66] Globally, integrated approaches have effectively improved health outcomes among PWID, including reduced community viral suppression, and were cost-effective compared to decentralized care models.[66-68] However, PEs and PWID have expressed confidentiality concerns attributed to clinical infrastructure, in our study and elsewhere, which should be addressed.[69] More recently, harm reduction facilities have incorporated additional medical services (e.g., ART, physical exams, tuberculous testing), which may provide a foundation for integrating HCV care in the near future. As such, integrated services within trusted harm reduction facilities offer a high level of patient-centered care and the potential to increase HIV/HCV service uptake among PWID.

To address logistical and financial barriers, including mobility to and from villages, OAT services should expand to include more convenient treatment options like take-home buprenorphine, which has been associated with improved HIV/HCV care outcomes.[70,71] Currently, methadone is Kenya's standard of care for OAT; however, service coverage is limited and requires patients to attend daily clinic appointments which presents time, financial and logistic barriers for PWID.[54,55] Early concerns pointed to the effectiveness, misuse and increased overdose risks associated with take-home buprenorphine treatment; however, new evidence highlights the multiple benefits, including increased HIV/HCV treatment initiation and adherence, negative opioid urinalysis, HIV viral suppression and HCV viral clearance among PWID.[70-72] Currently, Kenya's Essential Medicines List (2019) includes methadone and buprenorphine as approved OAT; however, funding constraints limit methadone service access and buprenorphine access is scarce.[73] Thus, efforts to prioritize OAT options and increase availability may address opioid use disorders and multiple HIV/HCV barriers.

Outside of healthcare services, punitive drug laws and harm reduction policies further marginalize PWID communities and often disrupted HIV, HCV and OAT care. Recent OAT service modifications include less punitive, and more strengths-based approaches following a positive urinalysis for opioids (e.g., counselling, goal setting) to meet PWID where they are in their addiction.[15,74] Following study enrolment, SAPTA and other harm reduction facilities partnered with local law enforcement agencies to provide education on medicalized approaches when working with PWID. Currently, a few local police jurisdictions offer PWID the option of drug treatment or a jail sentence upon being arrested; however, constraints exist on OAT capacity and law enforcement agents that physically harm on PWID, with the perception that substance use is affiliated with moral choice, rather than mental health. Global funding agencies and policy makers should prioritize (a) integrating OAT, HIV, and HCV services within trusted harm reduction facilities, (b) increasing capacity and disseminating OAT options, including buprenorphine, and (c) advocating for local and national policies that adapt medicalized approaches when working with PWID.

With the release of DAAs in 2021, HCV prevention, testing and care services were not well understood by the general public or PWID communities, supporting the need for educational campaigns. Until recently, HCV treatment in Kenya was limited to interferon-based options, which are cost prohibitive,

produced multiple side effects and were largely ineffective (<50% viral clearance).[18] According to the WHO, DAAs are the standard of care for HCV due to their shorter treatment duration, limited side effects, fewer clinic visits and increased effectiveness (>90% viral clearance), eliminating several financial and logistic barriers.[75,76] Thus, targeted HCV educational campaigns for medical providers, harm reduction specialists and PWID are fundamental to HCV elimination, which is largely achievable in the DAA era.

Finally, addressing the mutually reinforcing effects of intra- and interpersonal stigma (e.g., network, community and policy level) at multiple levels of the MSEM, can greatly improve the physical and mental wellbeing of PWID communities. Policy-level recommendations include broad communication efforts enforcing Kenya's National AIDS and STI Control Programme Guidelines that condemn community and network-level violence as a form of retaliation and moral cleansing, paired with healthcare provider trainings emphasizing harm reduction approaches.[77] Alternatively, political ambivalence towards community violence, will continue to reinforce issues of stigma towards PWID. At the network-level, cognitive behavioral interventions coupled with family and couple counselling have noted promising results in reducing stigma.[78] Intrapersonal interventions are personalized counseling sessions on "coping" with experienced stigma or changing personal environments, which when well-timed and supported by sufficient resources have been effective.[79] Stigma against injection drug use carries important implications for PWID health, and currently, there are limited evidence-based interventions that reduce HIV/HCV and/or substance use-related stigma in Kenya, highlighting opportunities to adapt, develop and evaluate strategies in the future.[79,80]

Limitations

These findings reflect the personal and professional experiences of PEs from two harm reduction facilities in Nairobi, Kenya, and may not be representative of all PE or actively injecting PWID experiences. Additional insight may be gained through the experiences of providers, local policy makers, and persons who are actively injecting drugs at the time of the interview. Second, the interview setting included PEs' place of employment, which may have induced socially desirable bias. However, this was felt to be minimal as several PEs were comfortable discussing sensitive topics like illegal activities, instances of relapse, and negative employment experiences, including low salaries, having to take multiple jobs, low transportation reimbursement, and having use personal cell phones. Thirdly, this study

took place prior to the release of DAAs, with the anticipation that information gained from this work could inform HCV program planning.

Conclusion

Applying the MSEM as a guiding framework and drawing upon the experiences of PEs to discuss personal and professional HIV/HCV barriers and facilitators to care within Nairobi, Kenya, offers a grassroots perspective to improving HIV/HCV care among PWID that should be considered when designing future initiatives. Moreover, addressing barriers and supporting existing facilitators at multiple levels of the MSEM, may offer more effective approaches to increasing HIV/HCV care uptake. Recommendations largely focused on policy and community-level interventions to supplement existing services and provided awareness around issues that affect PWID, with the ultimate goal of achieving community HIV viral suppression and HCV viral clearance among PWID in Kenya.

Chapter 3: Characterizing the HIV risk environment for persons who inject drugs living with HIV in Nairobi, Kenya: A qualitative study

Abstract

Background: In Kenya, persons who inject drugs (PWID) are disproportionately affected by the HIV/AIDS epidemic, yet few studies have described the surrounding risk environment that shapes individual HIV risk behaviors. Applying a risk environment framework, this qualitative study characterizes Nairobi-specific, HIV transmission risks among PWID living with HIV (PWID-LH). **Methods:** Participants were recruited from an HIV service intervention conducted at three clinical and harm reduction facilities in Nairobi from September to December 2018. Eligibility criteria included being ≥18 years, having injected drugs within the last year, and being HIV-positive. Semi-structured interviews explored (a) local injection settings and practices, (b) engagement in HIV and harm reduction services, (c) economic opportunities and challenges, (d) support systems, and (e) harmful experiences. Thematic analysis was conducted to characterize HIV risks using an HIV risk environment framework. **Results:** Participants (n=28) were on average 37.5 years (range 18-56 years), over half were women (57%), and 32% reported missing an HIV medical appointment in the last year. Participants described several types of injection settings within three locations: (a) urban, (b) peri-urban, and (c) incarceration facilities. Urban settings provided greater access to HIV and harm reduction services, while violence, displacement, and reuse/sharing of injection equipment were common HIV risks. Peri-urban settings offered greater protection from violence and displacement, while HIV risks included less access to HIV and harm reduction services, which promoted reuse/sharing of injection equipment and non-adherence to antiretroviral treatment. Incarceration settings offered few harm reduction services and HIV disclosure was contingent on inmates disclosing their HIV status. **Conclusion:** In Nairobi, the risk of HIV transmission among PWID-LH varies by injection location, with contributing risk factors that often fall beyond an individual's control. HIV risk reduction strategies should incorporate multitiered approaches that address the physical, social, economic and political risks to prevent HIV transmission.

Introduction

In Kenya, HIV is a leading cause of mortality (104 deaths per 100,000 persons) and over 30% of incident infections are attributed to key populations, which includes persons who inject drugs (PWID).[2] Among the estimated 30,000 PWID in Kenya, regional differences exist in PWID community density, with 85% of PWID located in 4 out of 47 counties.[81] HIV prevalence among PWID also varies, with 14% of PWID living with HIV (PWID-LH) located in Nairobi County compared to 20% in Coastal Kenya, and several HIV risk behaviors that vary by region, including syringe sharing and condom use.[12,14,81] Over the last decade, Kenya's Ministry of Health (MoH) and local harm reduction programs, which are located in 16 out of 47 counties, have been credited with reducing HIV incidence among PWID through behavioral interventions.[21] Condom use increased from 25% in 2012 to 75% in 2018, and syringe sharing decreased from 23% in 2012 to 88% in 2018.[21] In addition, HIV care outcomes improved with the introduction of opioid agonist treatment (OAT) clinics in 2014 that provide integrated methadone and HIV treatment services; however, service uptake remains low with 26% of PWID accessing OAT services.[21] National HIV programing for PWID-LH aims to improve HIV health outcomes and prevent transmission by (a) increasing the number of PWID who know their status from 43% to 90%, (b) increasing antiretroviral treatment (ART) among PWID who know their status from 68% to 90% and (c) increasing viral suppression among PWID who are on ART from 64% to 90%.[10,21] While there has been success with individual-level HIV-risk reduction interventions and recent structural interventions offering integrated harm reduction and HIV services, these interventions effects may be limited without the consideration of complex environments in which PWID-LH exist.[26-28]

Risk environments have played a critical role in understanding the aggregate effects the surrounding environment has on shaping HIV risk among PWID-LH and their sexual and/or injecting partners.[16,27,82,83] HIV-related risks can be linked to needle-sharing, unprotected sex and discontinuation of HIV care services, with elevated viral loads often serving as a proxy for increased HIV transmission risk.[3,14] Rhodes and colleagues developed a 'risk environment framework' that posits PWID experience health consequences and inadequate care that are not solely derived from individual behaviors, but are rather a by-product of the surrounding physical, social, political and economic risk environments.[25,26,28] The physical environment encompasses fixed features surrounding PWID-LH including spaces where

drug-use takes place, drug availability and quality, and community mobility patterns.[25,28] Social environments include networks of peers, healthcare providers, law enforcement agents, and gender dynamics surrounding PWID communities that contribute to or mitigate HIV risk.[25,27,28] The economic environment highlights the cost of daily necessities (e.g., food, shelter), healthcare subsidies (e.g., syringes, condoms, HIV services, transportation) and employment opportunities, including legal and illegal economic markets.[25,28] At the highest level, the political environment includes laws and policies that support harm reduction and HIV services, decriminalize drug use, and protect against human rights abuse. [25,28]

Globally, risk environment frameworks have been useful in providing a comprehensive understanding of how broader HIV risks impact PWID communities and their sexual and/or injecting partners, with implications towards multilevel intervention strategies that offer more effective HIV risk reduction strategies that improve community health. Moreover, ecological approaches that apply risk environment frameworks shift the focus from the individual, which leads to blame and stigma, to environmental impacts and structural realities that either promote health and well-being or further exacerbate risk and harm. While the HIV risk environment framework has been applied to multiple PWID settings, few have focused on Kenya. [28,29,82,84,85]

Initially developed within high-income countries, the risk environment framework has been adapted to low- and middle-income settings to provide a comprehensive understanding of how drug-related harms translate into HIV incidence and risk.[26,28,29,82,86] While previous work has expanded our understanding of risk environments, findings may not be generalizable to Kenyan settings. Still ecological studies provide a foundation to understanding Kenya's dynamic risk environment, suggesting geographical differences in assessing local HIV programs, OAT services, drug markets and communities of women who inject drugs.[13,17,31,69,87] For instance, Kenya's physical environment shifted 30-40 years ago from selling predominately 'brown heroin' products that were typically smoked or inhaled, to selling 'white heroin' products that were typically smoked or injected, which increased HIV risk through shared injection equipment.[88] Other dynamic shift processes occur within the physical and political environments include the migration of PWID through wars, trauma, and urbanization, which often promotes sharing injection equipment and disrupts HIV care.[13] Similarly, physical and social environments intersect when PWID

inject drugs within public areas (e.g., park, alley, bathrooms), which often exposes PWID to discrimination and violence perpetrated by law enforcement, community members and PWID peers that are associated with HIV risks.[16,89,90] Furthermore, physical and social environments where multiple PWID inject drugs and injection equipment is either discarded or stored for re-use, have been associated syringe sharing and increased HIV transmission.[28,29,89,90] Thus, knowing how environmental influences impact and shape HIV risk, can offer insight in the development of HIV risk reduction strategies.

In Kenya, the broader political risk environment includes policies that criminalize drug use and fail to protect PWID from physical violence perpetrated by police and community members, which increases the likelihood of unsafe injections and limits access to healthcare services.[16] Guise et al. characterizes the surrounding economic and physical environment as influencing PWID to transition from smoking to injecting heroin to reduce personal cost, increasing HIV risk.[87] In addition, HIV care barriers among PWID-LH have been attributed to economic and social environments, mainly the cost of services, community stigma and discrimination within healthcare settings.[59] In Coastal Kenya, descriptions HIV risks among women who inject drugs were attributed to the criminalization of sex work and drug use, violence, gender inequities, economic hardships, and barriers to HIV prevention methods.[17,59] Considered together, previous work provides a foundation for characterizing the HIV risk environment, which may not be specific to PWID-LH living in Nairobi, Kenya.

In order to access PWID communities and deliver HIV services, Kenya's Ministry of Health supports the collaboration of healthcare providers and trusted harm reduction organizations that have established rapport with PWID communities.[11,56] Support for Addictions Prevention and Treatment in Africa (SAPTA) a Nairobi-based, harm reduction agency distributes safe-injection equipment and condoms within high-density drug settings, provides HIV counseling testing services, coordinates clinical referrals (e.g., OAT clinics) and offers social services (e.g., meals, clothing, washing facilities).[56] While harm reduction facilities have been vital in reducing HIV transmission among PWID-LH, their effects may be limited without understanding the broader context of the political, economic, social and physical environments that reinforce HIV risks and produce (a) unsafe sexual practices, (b) needle-sharing and (c) non-adherence to ART, which increases the likelihood of HIV transmission through elevated viral loads. This qualitative study contributes to a growing body literature on HIV risk environments through the lens

of PWID-LH in Nairobi, Kenya, with implications for interdisciplinary HIV risk reduction strategies. Specifically, we apply the Rhodes et al. risk environment framework to (1) characterize PWID-LH injecting settings, (2) describe participant experiences within the surrounding physical, social, economic and political HIV risk environments, and (3) highlight potential HIV risk reduction strategies.

Methods

This qualitative sub-study is nested within a larger parent study, which evaluates a health service intervention among PWID and their sexual and/or injecting partners. The qualitative study applies the risk environment framework to describe the Nairobi-specific HIV risks among PWID-LH, highlighting effects of the physical, social, political and economic environments.

Parent Study

The SHARP Study uses a prospective cohort design to assess assisted-partner notification services (APS) and conduct phylogenetic analysis of HIV and HCV viral sequences on PWID-LH in Kenya. The SHARP Study protocol has been described elsewhere.[91] Briefly, peer educators, who are former PWID, are trained to provide grassroots harm reductions services and invite potential participants to enroll at any of 11 study sites located in local harm reduction organizations or OAT clinics throughout Nairobi and Coastal Kenya. Trained health advisors screen and enroll potential participants who meet the following eligibility criteria: at least 18 years of age, HIV-positive (confirmed via OraSure Quick test), injected drugs within the last year, willing and able to provide locator information on sexual and/or needle sharing partners, and speak English or Swahili. Exclusion criteria includes scoring as high-risk for intimate partner violence. Participants complete bloodwork and a baseline and 6-month follow-up questionnaire.

Qualitative Study

Sampling and Recruitment

The qualitative study applied random and purposive sampling techniques to SHARP Study participants who completed 6-month follow-up interviews between June-December 2018, in order to limit potential interference with the parent study outcomes. Our sampling frame included Nairobi-based participants, stratified according to participant a) sex (male or female), b) study site location, and c) HIV care status, which was categorized as either optimal or suboptimal care. Suboptimal HIV care was

defined using the parent study baseline survey questions of (a) no self-reported HIV clinical visit within the last 6-months and/or (b) self-reporting not currently taking ART, which increased the probably of having discussions around community-level barriers. We applied an R Studio randomization feature to our three groups in order to capture a wide range of experiences, with the goal of interviewing 10 women, 10 individuals with optimal HIV care, and 10 individuals with suboptimal HIV care. Participants were approached through peer educators and health advisors, who explained study procedures using a summary script and invited participants to participate in an in-depth interview at their preferred study location. Two bilingual (Swahili/English) female interviewers, one bachelor's level and one Master's level, with extensive experience working with PWID-LH communities were trained on study protocols and were responsible for conducting informed consent procedures, completed semi-structured in-depth interviews and provided post-interview dictation notes.

Data collection & management

Part I of the interview guide provided close-ended questions to assess demographics (e.g., age, gender, education, residence location), drugs use characteristics (e.g., route of administration, drug use history), HIV care and OAT enrollment. Part II included as series of open-ended questions to elicit descriptions of participant experiences related to injection settings, environmental risks, HIV care and overdose experiences. All interviews were audio-recorded and were roughly 40-75 minutes in length. Audio recordings were transcribed and translated into English, and were later evaluated for accuracy by another study team member (LM) who read through the transcripts and listened to audio files to check for inconsistencies.[92] Interviewers completed post-interview note in the form of audio dictations to summarize the main study topics and to capture the physical and mental condition of participants, which were also transcribed. The post-interview notes were discussed at weekly team meetings and integrated into our data management system. Data collection and analysis were conducted in parallel, whereby research team members met to discuss the main interview topics each week to refine our interview guide. Through weekly discussions and ongoing analysis of the transcripts, we determined that we had reached conceptual saturation, whereby additional interviews would not elicit new information on the topics of interest.[93] ATLAS.ti Version 8 (Berlin, Germany) was used to manage, merge, and analyze the transcript data and post-interview notes into one integrated database.

Data Analysis

Thematic analysis was conducted by the lead author (NLB) who independently read through transcript passages to generate preliminary themes based on the *a priori* research aims using the Rhodes risk environment as an underlying framework (i.e., deductive), and relevant themes that emerged in the transcripts (i.e., inductive).[94] Similar themes were merged together as common or recurring concepts, which were organized into typologies and classification schemes and later assigned to risk domains through team member consensus.[95] Research team members (NLB, LM, AMW) met weekly to discuss major themes, code definitions, and developed a codebook to address the primary research questions. Each week, team members read and discussed one transcript in-depth to assess code applications, with coding concerns were resolved through team member discussion and further refinement of code parameters. Guided by the Rhodes risk environment framework, PWID experiences within injecting locations are presented alongside representative quotes, using pseudonyms to protect participant identities and location names were avoided to prevent further stigmatization of specific communities.

Ethical approval

All study procedures and materials were approved by the University of Washington Institutional Review Board (Seattle, WA, USA) and the Kenyatta National Hospital/University of Nairobi Ethical Review Committee (Nairobi, Kenya). Participants provided written informed consent in Swahili or English, and received a list of local health resources. Provided that some of the interview topics could potentially trigger methadone patients to relapse, additional support services were arranged, offering counseling and peer support services post-interview. All participants were reimbursed 400 Ksh ($4 USD) for their time and transportation.

Results

In total, 28 participants were enrolled in the qualitative study, with more than half being women (57%), 32% self-reporting suboptimal HIV care (i.e., >6-months since last clinic visit and not on ART) and 50% currently on methadone. Participant demographic characteristics are presented in Table 3.1.

Table 3.1: Demographics, substance use, and HIV care among qualitative participants (n=28)

Characteristics	**Total Sample (n=28)** n (%) or mean (range)
Sex	
Male	12 (42.9%)
Female	16 (57.1%)
Average age in yrs (range)	37.1 (18-56)
Birth location	
Urban	14 (50%)
Peri-urban	6 (21%)
Village/rural	7 (25%)
Outside of Kenya	1 (4%)
Current residence location	
Urban	20 (71%)
Peri-urban	8 (29%)
Ever incarcerated	17 (61%)
Alcohol use (weekly)	
Consumes ≥2 drinks	7 (25%)
Excessive drinking[1]	4 (14%)
Drug use (pervious year)	
Any drug use[2]	23 (82%)
Injection drug use (IDU)	19 (68%)
Common drugs reported[3]	
Heroin	22 (79%)
Cannabis/Bhang	18 (64%)
Cocaine	6 (21%)
Prescription drug misuse	10 (36%)
Poly drug use	22 (79%)
HIV Care (last 12 months)	
Missed any appointments	10 (36%)
≥6-months between appts	8 (29%)
Currently not on ART	5 (18%)
OAT services (i.e., current methadone use)	14 (50%)

[1]Consumed 6 or more alcoholic drinks on one occasion weekly
[2]Smoked, snorted, inhaled or ingested any drugs in the previous year
[3]Any drugs consumed in the previous year

A priori, we intended to present results according to the Rhodes et al. risk environment domains (e.g., physical, social, economic and politcal); however, through research team discussions there was consensus that HIV risk environments largely varied according to the type of physical environment within and around Nairobi. As such, risk environment themes are presented according to the three emergent and Nairobi-specific settings: urban, peri-urban, or incarceration facilities. Overarching themes of urbanization and stigma were described within each of the three physical environments. In sections that follow, we describe (a) participant experiences with urbanization and stigma and (b) experiences within three drug use setting (i.e., urban, peri-urban, and incarceration facilities) that promoted perceived or

actual HIV transmission risk through sharing injection equipment, unprotected sex, and/or non-adherence to ART.

Overarching themes: Urbanization & Stigma

Urbanization and stigma were two overarching themes described by participants, with half of the participants discussing experiences of urbanization and nearly all participants discussing intra- and interpersonal stigma, which contributed to HIV risk. Urbanization dynamics included relocating to urban cores for economic opportunities, which included housekeeping, hawking (i.e., trading or bartering used goods), tout and matatu services (i.e., local mini-bus transport industry), carrying luggage, sex work, or stealing as a means to afford daily necessities and drugs. Four participants described providing remittances or monetary support to family members residing in villages and two participants described living in Nairobi, but regularly traveling back to home villages where their spouse and children reside, which largely interfered with their safe injection practices, HIV treatment, and OAT services. Mainly, harm reduction, HIV services, and OAT were limited outside of city limits, with participants having to choose between traveling home and momentarily discontinuing their healthcare. Within the economic environment, urbanization dynamics within Kenya may impact HIV risk and transmission through social networks and limited medical service access within rural village settings.

Secondly, nearly all participants experienced at least one out of three types of stigma including internalized, social, and/or structural stigma, which affected their mental health and HIV care experience. Internalized stigma emerged on 14 different occasions where participants adopted negative stereotypes towards themselves based on their HIV status and/or drug use, which were adapted from the surrounding environment. Participants described themselves as “spoilt,” “hopeless,” “damaged,” “addicts” and felt at times they were “not meant to live,” conveying internalized stigma that affected their mental health and produced HIV risk behaviors including inconsistent ART use, sexual risk taking (i.e., multiple sexual partners, unprotected sex) and sharing equipment with other PWID-LH. In comparison, social stigma included negative thoughts or acts carried out by family or community members following the disclosure of someone’s HIV status or drug use. Several participants described experiencing or fearing rejection by family and/or community members, which impacted their decision to disclose their HIV status, drug use and methadone use. In order to avoid involuntary disclosure, participants rush their injections, re-used

injection equipment, neglected their HIV treatment and missed OAT appointments, which resulted in at least one relapse. Naserian (F, 42 years) currently lives in Nairobi, but travels to her home village to support her family, who suspected her drug use based on her physical appearance. Naserian described experiences of intra- and community stigma, which she highlighted during an incident of involuntarily disclosure, when community members from her village lectured her for attending an OAT-HIV clinic in front of family members:

> *I see myself as low in society. I used to go home once in a month and that changed. Now I can stay even for 5 months without even thinking of going home. I used to send money home, which I no longer do. . . It went on like that, until one day my people [from the village] took me and started lecturing me because I used to come take the [OAT and HIV] drugs and go home . . . Naserian (F, 42 years)*

Similar to Naserian, several participants described having to hide their HIV medication, injection equipment and methadone, citing fear of family and community rejection as reasons. Rehema (F, 35 years) has not seen her family in nearly 10-years due to experiences of poor verbal and physical treatment following her HIV-diagnosis, which included being denied access to her father's funeral. Following her diagnosis, Rehema describes feeling excluded from family events, experiencing depressive symptoms and having fatalistic thoughts, which largely contributed to her discontinuing HIV medication for four-years. For Naserian, Rehema and several other participants, social stigma largely affects their mental health and produced feelings of isolation. Both intra- and community stigma within the social risk environment may contribute to sexual and injection risk-taking, and disruptions in HIV and OAT treatment, which is associated with HIV transmission.

Systemic stigma was described as rules, laws, policies or healthcare systems within society that overtly or indirectly discriminate towards PWID-LH. Eight participants described experiencing stigma within healthcare facilities that resulted in mistrust towards medical staff and providers, which contributed to their avoidance of healthcare facilities for several years. Feruzi (M, 42 years) describes not taking HIV medication for more than 5 years after experiencing unnecessarily long wait-queues within HIV clinics, and having a provider who dismissed his concerns around treatment side effects and lectured his inconsistent ART use. Feruzi re-engaged in HIV services after being introduced to harm reduction

facilities that provided a non-judgement setting for PWID-LH. Farashuu (F, 36 years) describes her first provider as having a poor attitude towards her sex work, drug use and HIV-positive status, and the clinic staff branded her a "defaulter," for not taking ART medication. Farashuu requested a clinic transfer that took over three-months, and in the interim, she stopped attending clinic and taking ART. Both Feruzi and Farashuu's experienced forms of systemic stigmatization including administrative barriers (e.g., long wait cues and transfer periods) and poor treatment within the clinical settings, which contributes to PWID-LH discontinuing ART and HIV care. Several participants described re-engaging in HIV care through trusted harm reduction and OAT facilities that provide tailored services to PWID-LH; however, during periods of suboptimal care, PWID-LH run the risk of transmitting HIV to clients and partners.

Location matters: HIV risk within urban, peri-urban and incarceration faculties

Participants described multiple injection settings, which were inductively grouped by experiences leading to actual or potential HIV risks. These settings were further categorized into broader geographic locations: a) *urban settings* that included dens, rental rooms, group homes, shanty towns, and dumpsites; b) *peri-urban settings,* located on the periphery of urban cores, included housing units and illicit breweries; and c) *incarceration facilities*. Participant descriptions of HIV risk themes across geographic locations (i.e., urban, peri-urban and incarceration facilities) follow and are summarized in Table 3.2.

Table 3.2: Proposed HIV risk environment for PWID living in Nairobi, Kenya

	Urban cores	Peri-urban settings	Incarceration facilities
Physical	• Dens (open fields) • Dumpsites • Group homes • Rental rooms	• Houses • Illicit breweries	• Jails • Prisons
Social	• Stigma • Violence/social harms • Reuse and shared injection equipment	• Stigma • Reuse of injection equipment • Use of pre-filled syringes	• Stigma • Violence/social harms • Reuse and shared injection equipment
Economic	• Urbanization • High cost of living • Sex work and transactional sex • Cost of healthcare services	• Urbanization • Sex work and transactional sex • Cost of healthcare services • Ancillary healthcare costs: transport and time-off from work	

Political	• Citywide clean-up efforts cause displacement	• Limited access to HIV, harm reduction and OAT services	• Limited access to harm reduction and OAT services • Required to self-disclose HIV status to access HIV care

Urban cores and HIV risk:

Within urban settings, dens were the most frequently referenced injection location, which were also referred to as “bases,” “fields,” and “hideouts.” Similarly, construction dumping grounds or “dumpsites,” were described as public fields filled with debris and discarded surplus materials, where people look for scrap metal and other materials to recycle. Mainly, dens and dumpsites were described as public, densely packed areas with 50-200 people who were purchasing, selling or consuming drugs. Most dens and dumpsites were referred to as multipurpose sites with non-drug related activities including recreational sports, recycling and pedestrian traffic. While their physical appearance differed, dens and dumpsites offered similar risks related to injecting in public, exposing PWID-LH to community stigma, violence, law enforcement, and rushed injections. However, PWID-LH within dens and dumpsites described the benefits of accessing grassroots harm reduction specialists that provide prevention education, safe injection equipment and link PWID-LH to healthcare services. In comparison, group homes and shanty towns were described as shared housing units with two to eight residents, often with common occupations (e.g., sex workers, touts and matatu industry workers), similar village-origins or intimate partners. Both group homes and go-downs offered PWID-LH with low-cost housing options within urban cores and provided privacy within injection settings, which reduced HIV risks related to rushed injections, violence and community stigma. However, participants discussed notable HIV risks within group settings that promoted the re-use and sharing of inject equipment. Within urban cores, emergent HIV risk themes included a) violence, b) citywide clean-up efforts, and c) reuse and sharing of injection equipment; whereas, themes that reduced HIV risks included d) supportive social networks and e) access to harm reduction and HIV care.

The overarching theme of violence was described by 21 participants who described being the target of theft, harassment and violent acts perpetrated by PWID peers, *raiya* (non-PWID community

members), drug pushers, gangs and police. Kerubo (F, 28 years), a female sex worker who injects heroin up to 6-times per day, describes multiple attacks by police, PWID peers, drug sellers and community members that have never been reported due to the illegal nature of her drug use and sex work:

> *The sellers can also take advantage and do something like belittling you and beating you up because they know you are a junkie and there is no where you can report them to. (Kerubo, F, 28 years)*

Kerubo and other participants described the experiences of arrest and mistreatment for being associated with drug areas or other crimes, with all but one violent act going unreported to law enforcement. In addition, participants rarely sought care for injuries or illness due to the fear of being reported to law enforcement and the high cost of medical services, which Eucabeth (F, 28 years) described "everything in the hospital is money." Several participants associated law enforcement with medical facilities, and worried they would be recognized within clinics and arrested for prior accusations of theft, drug possession or sex work. In addition, participants described experiences of mob justice, whereby community vigilantes enact physical violence on individuals as a form of punishment, generally following theft or destruction of property. Participants described lacerations, swollen faces and broken bones as consequences of mob justice, with at least one incident resulting in the death of a PWID-LH. These spontaneous assemblies of community members, were portrayed as a form of empowerment in the absence of law enforcement; however, this further marginalizes PWID-LH by promoting social isolation and reluctance to engage in HIV care.

Within recent political environments, government citywide clean-up efforts have targeted dens producing abrupt displacement, violence and a pronounced disruption in the drug market, which causes PWID-LH to rush their injections, carry drugs to unfamiliar areas (e.g., public toilets, homes) exposing them to community harassment, which disrupts harm reduction efforts, HIV and OAT services. Absko (M, 50 years) explains, *"They [police] have turned the place into a running field*," since the initiation of citywide clean-up efforts, which he denotes is a government "war" on PWID. Kioko (M, 54 years) has been using heroin for over 20-years and offered his historical perspective on one of Nairobi's largest dens, noting the recent government clean-up efforts:

It is just a field. That's where they sell it [heroin], but recently, they [PWID peers] were beaten up and houses demolished and then they were chased out of the place. Even now things are very tight [unsafe] there. If you are found in that area by the police, they beat you up . . . They don't want anyone sitting there, in that area. Earlier on people used to sit there and take their drugs, even when the police were passing, but nowadays it is risky. (Kioko, M, 54 years)

During the government clean-up efforts, PWID are not able to access public health and harm reduction specialists that provide safe injecting equipment and vital health services directly to PWID, which may promote HIV transmission. For two participants, this meant having to seek out additional income in order to use within the surrounding area's rental rooms, or "guest houses", which provides privacy and safety. Gathii (M, 56 years), who injects heroin up to four-times per day, avoids dens and seeks the same guest house so that he can store his injection equipment within the room's interior:

I used to pay for a short-time guest house, which I used to inject the drugs [inside]. . . I inject myself and then relax a little, then inject again a second time, and then stay for one-hour before I leave. (Gathii, M, 56 years)

While rental spaces offer safety and privacy compared to public injection locations, they do not provide access to harm reduction specialists that provide safe injection equipment, which may encourage syringe re-use and sharing. Like Gathii, other PWID-LH may store their used syringes within the room's interior (e.g., under mats, between walls) for re-use at a later time, which may increase HIV risk for other PWID patrons that find themselves in need of a syringe during withdrawal symptoms and opt to use any syringe they find.

Group homes were described as living quarters with several PWID under one roof to augment the high living expenses within urban cores. Participants described economic and security benefits to living in group homes; however, this promoted needle-sharing in situations of extreme withdrawal. For a short period, Durah (F, 30 years) a sex worker who lived with other sex workers in a group home, could not work due to an unknown illness. Durah's house-mate supported her by purchasing, preparing and administering their drugs through shared injection equipment, so that Durah did not experience withdrawals symptoms:

We put the drugs into the needle, measure and put two or three depending on how much your body could take and because we were sharing, me with my friend. We were using the needles so much. After she injected herself, she then gave me [the syringe] to inject myself. If she tied her arm, I also tied my arm, and we both injected it together. (Durah, F, 30 years)

Ultimately, Durah was engaging in two HIV high-risk behaviors (i.e., sharing injection equipment and unprotected sex with clients), but is also describing community support that could be leveraged through public health interventions.

In addition, four participants characterized the physical environment within group homes as promoting HIV risks, whereby living in close proximity to other PWID reinforced their substance use and several housemates were unsupportive of quitting or reducing drug use. Alternatively, two participants described HIV risks reduction characteristics within group homes as encouraging HIV treatment adherence through reminders to take ART and attend scheduled clinic appointments. Chepkirui (F, 32 years), who lives in a group home, was encouraged to take her ART describing:

After sometime I made a resolution, if my counterparts are under [HIV] medication, I can also use it. But now the badness with this medication is that after taking it you feel like vomiting. (Chepkirui, F, 32 years)

Chepkirui and others living in group homes described the benefits of having housemates that provided meals, home remedies to reduced HIV treatment side effects, and assisted with medical expenses. Thus, groups homes provide economic and security benefits, community support, and supportive environments for HIV care, but promoted HIV risks through shared injection equipment and reinforcing substance use.

Most notably, participants described urban cores as providing PWID-LH with access to harm reduction and HIV services, though services were not available on weekends or holidays. Jimiya (M, 41 years) has used heroin for 20-years and earns his living recycling goods at a dumpsite, where he purchases and injects his drugs. He describes the benefits of having harm reduction services brought to the dumpsite:

Whenever we are at the dumpsite, they [injection equipment] are brought to us by the peer educators. We are shown how to use it [injection equipment] and how to discard it. Especially for

those of us who already know their HIV status. If I don't discard it, well, I will be transmitting it. (Jimiyu, M, 41 years)

Nearly all participants injecting drug within urban cores described the ease of accessing harm reduction, HIV care, and social services (i.e., meals, laundry and bathing facilities), which reduces community-level HIV risks. In summary, participants living in urban cores highlighted HIV risks within the physical, social, economic and political environments, including themes that increased HIV risk through a) theft and violence, b) citywide clean-up efforts, and c) reuse and sharing of injection equipment, with HIV risk reduction themes demonstrating d) increased access to harm reduction and HIV care, and e) supportive social networks.

Peri-urban settings and HIV risk:

In contrast, peri-urban areas are located along the periphery of Nairobi's urban cores, but closer in proximity than rural villages. Peri-urban areas offer more affordable housing and are less densely populated, but offer fewer economic opportunities and healthcare options compared to urban cores. Drugs are often purchased out of houses and back alleyways with participants describing injection settings as private homes, streets or alcoves within alleyways and illicit breweries. Twelve participants described recent experiences of living in peri-urban areas and using drugs, which offered privacy while injecting and safety from violence, theft and law enforcement activities. In comparison to urban settings, peri-urban areas offered less access to harm reduction, HIV, and OAT services, which often contributed to HIV risks.

Participants living in peri-urban areas attributed the lower cost of living, slower pace and safety as reasons for relocating from urban cores. Darweshi (M, 41 years) has used heroin for over 20 years, in both urban and peri-urban settings. He cites the lack of privacy and high cost of living as reasons for relocating to his current peri-urban community, which offers the same access to heroin and better security from violence perpetrated by community members, PWID peers, and police compared to the urban dens. He describes the area he visits daily:

There are houses on both sides and the street in between them. Now people sit on the sides. You can find the lady is selling food there daily. And also, she is the one selling the syringes, the 'c'

[prescription drugs] and tea. She sells a lot of things . . .it's a hidden street that you cannot go through with a vehicle. (Darweshi, M, 41 years)

While peri-urban areas offer several benefits, access to harm reduction services is limited so that PWID-LH, like Darweshi, often purchase their injection equipment rather than receive them for free at needle and syringe programs. For Darweshi and others who inject multiple times per day, limited access to safe injection equipment and clean water promotes syringe reuse and sharing equipment among PWID-LH, increasing the risk of HIV transmission. While harm reduction specialists conduct daily outreach visits to dens within urban cores; outreach efforts to peri-urban communities are infrequent due to transportation costs limiting PWID-LH access to safe injection equipment, HIV care and general healthcare services.

Harm reduction services, particularly syringe access, had been problematic in peri-urban areas until national policies recognized injection drug use as a public health concern and allowed pharmacists to sell syringes without questioning the purpose of their use. Three participants, including Zawadi (F, 47 years), provided a historical perspective of living in a peri-urban community for the last 20 years with limited access to injection equipment:

[Previously]You had your drugs in powder form in your bag and you got a syringe anywhere. You just use it as long as it serves the purpose [to inject drugs]. You don't even know who had that syringe. . . . Nowadays buying a syringe is common. (Zawadi, F, 47 years)

A decade ago, Zawadi admits to sharing injection equipment due to her limited awareness of HIV prevention, limited access to harm reduction services, and pharmacists' unwillingness to sell syringes; however, today PWID-LH living in peri-urban settings have been educated on HIV risks and recent policy reforms ensure pharmacists are able to sell syringes without harassment. While being able to purchase syringes through pharmacists was highlighted as a benefit, the cost of syringes may discourage PWID with few financial means and promote the re-use or sharing of injection equipment, which increases the potential of HIV transmission.

Within peri-urban areas, illicit breweries provide *chang'aa,* or homemade spirits, and are located near the areas known to sell drugs. Although violence, theft and police were not commonly described by participants living in peri-urban settings, illicit breweries were the exception. Participants cited two

incidents of violence between patrons and two incidents of arrest for serving illicit spirits, which were prompted by political agendas aiming to close illicit breweries. In all four incidents, PWID-LH were jailed for 2 months to 2 years, which disrupted their HIV treatment adherence. Although not common, at least one participant purchases pre-filled syringes from a brewery patron. Hanuni (F, 45 years) lives and works at a local illicit brewery where she was introduced to injecting heroin by a female "associate" who lives in the region and is a regular customer at the brewery. Within the peri-urban community there are few harm reduction services, which means Hanuni and her associate have to purchase syringes from a pharmacist. After Hanuni finishes her shift at the brewery, her associate brings her two pre-filled syringes stating, "*I always have someone to prepare it for me*," because she is unfamiliar with the preparation process. Notably, PWID-LH who are unfamiliar with drug preparation processes and lack access to harm reduction services, are at risk of administering unsafe injections.

In addition to lacking access to harm reduction services, participants cited a lack of access to HIV services, OAT services, or both. Two participants, Gathii (M, 56 years) and Jimiyu (M, 41 years) received their HIV diagnosis in peri-urban and rural settings referred to as "medical camps," or temporary tents that served as clinical units. After participants depleted their initial two-month supply of ART, they discontinued their treatment for several years without communication from the rural medical centers. Following a relocation to urban core, they were both connected to harm reduction facilities that linked them to care services and peer support to ensure they stayed engaged in HIV care. Other reasons for discontinuing HIV care and treatment included having to stay in peri-urban communities and villages to support family for extended periods. Makena (F, 44 years) lives within Nairobi's urban core, where she receives HIV services, but discontinued taking ART for several months following the death of a family member, which required her to return home to support her family. Although her family knew her HIV status, the transportation costs to the nearest clinic were high, so Makena had to save money in order to return to Nairobi.

For peri-urban residents, transportation costs are a major barrier to accessing OAT services, which offer daily observed methadone treatment and integrated HIV treatment. For several participants, integrated OAT and HIV treatment alleviates the stress of having to re-fill medication, remembering to take ART at consistent times, and ensuring medication is stored at the correct temperature. For Okeyo

(M, 36 years) who is trying to reduce his heroin use, which includes injecting at least three times per day, transportation costs are barrier to continuing OAT and HIV services:

> "*I use 250 shillings per day [$2.50 USD] to get from [town name] to [OAT clinic name]. This is both ways. . . . So that is why it is expensive. Because I come here every day for methadone and then decided that when I come to take my dose, I should just come for both [methadone and ART] at the same time." Okeyo (M, 36 years)*

Over the course of a month, Okeyo spends roughly 5,000-6,250 KSh ($50-62 USD) for round-trip fare to his local OAT clinic, which may not be sustainable. Okeyo and others aiming to quit their heroin use with the help of OAT may struggle to overcome the stress of high transportation costs to treatment facilities, which also offer ART. Similarly, Wawira (F, 42 years) injects heroin at least once per day and works as a housekeeper. She attributes discontinuing her ART for more than a year to transportation costs and having to request time-off from work. She recently re-engaged in HIV care after locating a clinic within walking distance of her work, but was not able to commit to daily methadone treatment:

> *I had stopped going to [clinic name], because at times I was lacking fare and I was going to [town name] so I stopped, but later on I changed to [clinic name] because here I could even walk… the kind of work that I do is casual work so they [OAT clinic staff] kept telling me to come today, and then they tell me tomorrow. I got bored and gave up because if am told to come [last minute], I might lose my job. (Wawira, F, 42 years)*

While Wawira was able to re-engage in HIV care, she was not able to enroll in OAT services due to administrative barriers and daily clinic attendance that would interfere with her livelihood. Most OAT clinics are located within the urban cores and cater to the large number of PWID-LH that reside in the city, which limits opportunities for PWID-LH to access OAT and HIV integrated services. As such, peri-urban areas offer private and safe injecting settings, with trade-offs of reduced access to harm reduction, HIV, and OAT services, which perpetuate HIV risks.

Incarceration facilities and HIV risk

Emergent themes related to the physical environment included discussion of HIV risks within prisons and incarceration facilities. Seventeen participants shared their experience within incarceration facilities, with sentences that ranged from 2 weeks to 2 years, and one participant serving approximately

20 jail and prison sentences. Within incarceration facilities, drug access was not always consistent, but present, and access to safe injection equipment was extremely limited and came at a high cost. Three participants described defaulting on their HIV medication while incarcerated, mainly due to the fear of stigmatization and poor treatment by inmates and guards. Nekesa (F, 30 years) served a 6-month prison sentence for stealing and harming an elderly man. She describes her fear of telling prison personnel and physicians that she was HIV-positive during her sentence:

> *When I was arrested, I was afraid of telling them that I have been using the medication. I stayed there for those 6 months. . . . I was hurting but now there was nothing I could have done. I stayed there until the woman came and withdrew the case and I was set free. That is when I started using them [ART] again. (Nekesa, F, 30 years)*

Like Nekesa, several participants described their decision to not disclose their HIV status upon arriving at an incarceration facility, anticipating the social stigma and poor treatment that would follow. Similarly, Wawuda (F, 23 years) was sentenced to two months in prison for loitering. She did not to disclose her HIV status to prison personnel and following her release from prison, she did not return to care. Ultimately, Wawuda returned to care after several months of not taking treatment, when she was too sick to work due to HIV-related complications, including severe headaches and stomach pains. Alternatively, Chepkirui (F, 32 years) who served four jail sentences, was tested for HIV and other communicable diseases within the first few weeks, where she received her HIV-positive diagnosis; however, this was followed by a passive referral to receive HIV services post-release and without any support or assistance. With limited resources and support, Chepkirui and other PWID-LH are not likely to engage in care following their release from jail or prison. Several PWID-LH experience recidivism, passing through detention centers multiple times, which may provide opportunities to test, engage or re-engage PWID in HIV care.

Discussion

Our analysis uses qualitative inquiry to explore the HIV risk environment through the lens of PWID-LH living within urban cores, peri-urban communities, and incarceration facilities in Nairobi, Kenya. PWID-LH characterized overarching themes of (a) intra- and interpersonal stigma and (b) urbanization that was largely driven by the economic environment, both of which translated into HIV risks via needle-

sharing, sexual risks and suboptimal HIV care. Urban cores offer potential protective factors through economic opportunities, health and harm reduction resources, while experiences of violence and the high cost of living combined to increase risk of HIV transmission. In comparison, peri-urban settings offered safety from violence and lower cost of living, yet provided limited access to health and harm reduction resources and few economic opportunities. Incarceration facilities offer few harm reduction resources and HIV service access was contingent on self-disclosure of someone's HIV status, which should be framed as opportunities to capture PWID-LH that are unaware of their HIV status or experiencing suboptimal care.

Within Nairobi's urban cores HIV, harm reduction and OAT services were abundant; however, government-initiated clean-up efforts that displace PWID-LH, punitive policies that criminalize drug use and possession, and violent acts towards PWID by law enforcement agents and community members often obstruct access to vital healthcare services. In addition, our findings contribute to existing evidence that citywide clean-up efforts, violence and punitive polices are mutually reinforcing factors that further marginalize PWID-LH and create barriers to HIV care.[16,82] Mainly, punitive polices contribute to the stigmatization and violence towards PWID-LH, which is perpetrated by law enforcement and community members, and government sanctioned clean-up efforts carried out by law enforcement results in the displacement of PWID-LH, which creates additional barriers to accessing HIV care and grassroots harm reduction services that deliver services to high density drug areas. In addition, findings support new policy agendas, which promote less punitive and more medicalized approaches for PWID-LH, providing options for drug treatment or jail sentences, and non-tolerance of harassment, violence, or stigmatization of PWID-LH. [5,77] Policing practices that cause fear and physical harm, undermine access to essential harm reduction and health services for PWID-LH, which has been addressed through recurrent police trainings, which are regularly monitored to ensure that "written laws" are upheld in communities.[16]

Several PWID-LH discussed barriers within medical systems and unsupportive policies. Mainly, HIV services are currently subsidized; however, several ancillary healthcare services that are specific to PWID-LH (e.g., wound care, mental health services) remained unsubsidized. As the National AIDS Strategy calls for increased political support and the prioritization of PWID, ancillary health services should be considered as they provide additional "reachable moments" for patient-provider interactions

and opportunities to discuss HIV care. [5] For PWID who use opioids, accessing OAT increases the likelihood of engagement in HIV care and ART adherence; however, funding and service access for OAT remains low among PWID. [21] Several policy evaluations have highlighted the cost and health benefits of implementing alcohol and tobacco taxes to fund substance use and OAT services, which could assist in subsidizing OAT services. [96,97] However, tax increases should be preceded with caution as international reviews have indicated alcohol taxation may increase illegal, informal alcohol markets. [98] Notably, within Nairobi's urban cores several HIV risks are bound to economic and political environments, which should be addressed by interdisciplinary teams of policymakers, law enforcement, harm reduction specialists and public health professionals.

Alternatively, peri-urban settings offered several protective influences, including affordable housing, privacy and protection from violence, and dependence on policies that allow PWID to purchase clean injection equipment from pharmacies; however, these settings have limited access to economic opportunities, harm reeducation services, HIV programs and OAT services, which largely shaped the HIV risk environment through sharing of injection equipment and discontinued HIV care. Currently, HIV programs and harm reduction services for PWID are being implemented in 16 out 47 counties in Kenya with an estimated 26% of PWID accessing OAT services[21]; however, county jurisdiction boundaries may not be appropriate units of analysis for decisions around HIV and OAT resource allocations. Recent key population surveillance efforts, conducted by the MoH and international partners, identified PWID "hot spots" or physical locations where PWID buy, sell and use drugs (e.g., dens) that provided information on where harm reduction resources should be distributed.[81] Incorporating HIV risk assessments into existing harm reduction surveillance efforts and creating smaller community-level boundaries that indicate urban, peri-urban and rural settings, could provide valuable information on specific community-level risks and service needs. Notably, Kenya is addressing the needs of low access service areas, mainly rural communities, through mobile clinics that provide HIV testing and care services, which could be used as a model to offer services within peri-urban areas. Furthermore, OAT services could be expanded to offer more flexible treatment options for PWID-LH who frequently travel outside of urban core or reside in peri-urban communities.[99,100] Buprenorphine, which has been successful in reducing opioid use and supporting HIV care outcomes, may increase OAT enrollment and HIV care outcomes.[72] [51] New evidence

indicates that scale up of HIV services, harm reduction, and OAT among PWID-LH could avert 58-62% of incident HIV infections, but these reductions cannot be achieved without the consideration of peri-urban communities.[55] Moreover, interventions that do not consider economic and political factors affecting PWID-LH living outside of the urban cores, may be limited in their ability to reduce HIV risk and achieve community-level viral suppression.

Within incarceration facilities, there are several opportunities to provide HIV testing and treatment services. Although most facilities offer HIV testing upon booking these services are not offered consistently across facilities, which could identify new HIV incident cases. In addition, recidivism or the re-incarceration of individuals, is a reality for many PWID-LH and may provide a "reachable moment" for HIV test, engagement and re-engagement in care.[101] Furthermore, HIV sexual and injection risks are prevalent within incarceration facilities, increasing the potential for HIV transmission, as such, it may be beneficial to offer HIV testing to inmates at multiple timepoints. Globally, there has been a push to implement programs that link inmates to HIV care post-release; however, these have yet to be implemented in Kenya and are largely dependent on international funding mechanisms.[102,103] As such, the focus of HIV and harm reduction services within incarceration facilities should be a priority to reach Kenya's HIV elimination goals.

Strengths and limitations

To strengthen the study's validity, we applied Maxwell's framework which aims to improve descriptive validity (i.e., the extent to which we captured what was said) by conducting two rounds of translation and transcription between four study staff, with one staff member [LM] comparing audio files to transcripts.[104] Interpretative validity (i.e., the extent to which the researchers captured participants' intended meaning) was enhanced through extensive review of coding, particularly when questions surfaced around colloquialisms and street terms, reviewing post-interview summaries and through community partner collaboration [WS, EG].

These findings reflect the experiences of PWID-LH recruited from two harm reduction facilities and one OAT clinic based in Nairobi, Kenya, and may not be representative of all PWID communities. Future studies should consider the experiences of clinicians, local policy makers, and law enforcement to triangulate study findings. The unanticipated theme of incarceration settings as a physical environment

was identified through team member discussions after the first ten interviews were completed and resulted in the modification of our interview guide to further explore this topic. This warrants additional investigations to establish a better understanding how HIV risks are shaped within incarceration settings, including short-term and long-term, male and female facilities.

Conclusion

While risk environment frameworks have provided strategic planning opportunities for HIV and associated co-morbidity care and prevention in other PWID settings, few have highlighted the Nairobi-specific risk environment in order to shift public health discussions from individual-level interventions (e.g., condom use, clean injection equipment) to broad-level intervention strategies that aim to reduce HIV community transmission rate among PWID-LH. Physical environments include injection locations, mainly, urban, peri-urban and incarceration faculties, which provide opportunities to tailor HIV risk reduction strategies. By applying a risk environment framework, we were able to identify HIV risks with urban, peri-urban and incarceration facilities in order to provide tailored intervention suggestions. Moreover, addressing HIV risks within one environment may provide limited effectiveness and sustainability. Intra- and interpersonal stigma was an overarching HIV risk produced within each environment and should be addressed within multiple sectors including healthcare, law enforcement, community, family, etc. Thus, HIV risk reduction strategies may benefit from incorporating multi-tiered approaches that address the physical, social, economic and political risks to prevent HIV transmission.

Chapter 4: Identifying heterogeneity among people who inject drugs living with HIV in Kenya: An exploratory cluster analysis

Introduction

In Kenya, people who inject drugs (PWID) contribute disproportionately to the HIV/AIDS epidemic, which may increase as HIV prevention and treatment services penetrate the general population but fail to reach marginalized groups.[5] In addition, injection drug use continues to increase with the expansion of drug trafficking networks.[105,106] There is an estimated 30,000 PWID in Kenya, 30-50% of whom are likely to be HIV-infected and upwards of 40% are likely unaware of their HIV status, providing an opportunity for HIV forward transmission.[3,8,14,21,81] Moreover, PWID living with HIV (PWID-LH) communities that experience suboptimal care, including individuals that are a) not engaged in care for > 6 months per self-report, b) not currently on antiretroviral treatment (ART) per self-report or c) not virally suppressed (>1000 copies/ml), are more likely to experience health complications and are at risk of transmitting HIV to sexual and/or needle-sharing partners. [41,42]

Recently, ecological frameworks have played a critical role in providing a holistic understanding of HIV forward transmission within PWID settings by highlighting the aggregate effects that the surrounding environment has on shaping HIV risks.[60,61,107] Rhodes et al. developed a 'risk environment' framework that posits the consequence of HIV among PWID is not solely derived from individual behaviors, but is largely a by-product of the surrounding physical, social, political and economic environments.[25-28] Moreover, HIV interventions that target only individual-level factors may be limited in their effectiveness to achieve and sustain change.[25,27] Disaggregating factors that make-up the risk environment alongside individual-level behaviors may convey how drug-related harms intersect with health and vulnerability more generally, and could offer suggestions on how to better tailor HIV programs and services to the needs of PWID-LH communities. Currently, there is limited evidence on which environmental factors effect HIV care outcomes, including suboptimal care, among PWID-LH communities within Kenya.

Within the medical and public health community, PWID-LH are often referenced as a monolithic group, which may overshadow characteristic behavioral and environmental factors that could serve as a cautionary indicator for suboptimal care.[2,5,51] Several studies have highlighted the benefits of understanding between and within group differences to aid the development of public health

interventions, particularly within communities living with HIV.[108-111] For instance, women represent a small sub-group with PWID communities, yet make-up >40% of PWID living with HIV compared to 15-20% of PWID men living with HIV.[81,112] Understanding the unique needs of women, and more broadly, the heterogeneity within and between PWID-LH sub-groups, may provide greater insight for healthcare organizations aiming to support PWID-LH experiencing suboptimal HIV care, with the ultimate goal of reducing HIV disease progression and transmission to sexual and/or needle-sharing partners.[108-111,113,114]

More recently, cluster analysis methods have been leveraged in HIV and substance use research as an exploratory technique to reveal differences between underlying community sub-groups or clusters, so that there is a strong degree of association within clusters and a weaker degree of association between clusters.[108-111,113-115] Compared to factor analysis, which aims to reveal variable dimensions and structures within a set of variables, cluster analysis enables researchers and practitioners to disaggregate community characteristics in order to tailor healthcare services and resources to underlying subgroups.[108-111,115,116] More commonly applied within marketing and psychological research, cluster analysis has been gaining favor within HIV and substance use research as an informative tool to understand challenges in HIV service uptake.[108,109,115] While cluster analysis has been applied to other PWID community settings,[115] it has not been applied to PWID-LH in Kenya, and may provide new insight to HIV and substance use providers, public health practitioners and policy makers that aim to tailor programs and services to the needs of PWID-LH subgroups experiencing suboptimal HIV care.

Using cluster analysis techniques, we conducted a secondary data analysis on a sample of PWID-LH enrolled in an HIV service study in Kenya, conducted between January 2017 and June 2021. Applying a risk environment framework[25], we (a) describe statistically significant differences in risk environment factors between men and women, (b) conduct a stratified logistic regression analysis to determine individual factors associated with suboptimal care, (c) conduct a stratified hierarchical cluster analysis using 57 variables including sociodemographic, substance use, and HIV risk environment variables that represent potentially important characteristics in relation to suboptimal HIV care, and (d) derived clusters will serve as predictors in order to determine associations between higher-risk clusters and suboptimal care. Findings will contribute to the growing body of evidence aiming to describe the

surrounding risk environment and it's impacts on HIV and substance use among PWID-LH, while also providing insight to practical intervention strategies.

Methods

Study settings and survey instrument

This analysis uses a subset of participants from the SHARP Study, which aims to evaluate an HIV service program within PWID communities in Nairobi and Coastal Kenya, which has been previous described.[91] A total of 11 recruitment sites located are within harm reduction and OAT clinics in Nairobi (N=5), Mombasa (n=3) and Kilifi (n=3) counties. The current project includes participants that are 1) HIV-positive (confirmed via testing), 2) current or recently injecting PWID (i.e., injected within the last year), 3) ≥18 years and 4) willing and able to provide informed consent. Exclusion criteria includes screening for high to moderate risk of partner violence within the last month. Study participants complete a baseline questionnaire that collects basic sociodemographic information, HIV history, violence and instability, hepatitis care, sexual behaviors, and drug use history, with a blood draw to determine HIV viral load.

The current analysis uses the full study sample to (a) determine statistically significant differences between men and women PWID-LH, (b) highlight independent characteristics associated with suboptimal care, and (c) derive clusters based on sociodemographic and HIV risk environment factors; however, a complete case analysis is conducted to (d) determine associations between clusters experiencing suboptimal care.

Outcome: Suboptimal care

Using HIV care continuum stages, we define "suboptimal care" as 1) self-reporting not engaged in HIV care, defined as not attending an HIV clinic in the last 6 months; 2) self-reporting currently not taking ART; and 3) laboratory confirmation of non-viral suppression (>1000 copies/ml).

Risk prevalence and correlates of suboptimal care

Descriptive statistics were calculated for demographics, income sources, housing and mobility, sexual behaviors, HIV care, violence, drug use, and injection drug use, which were stratified by men and women. Statistically significant differences between the men and women, were assessed via T-tests for continuous variables and chi-squared or Fisher's exact tests for categorical variables, using a <0.05

significance threshold. Stratified by men and women, a logistic regression analysis assessed factors associated with suboptimal care, controlling for recruitment region (Nairobi/Coastal Kenya), with both crude and adjusted odds ratios presented.

Cluster analysis methods

We conducted an agglomerative hierarchical cluster analysis, using Ward's method with the matching coefficient specified as the similarity measure, which has multiple benefits when using binary and categorical data.[117-119] Ward's method uses a minimum variance approach and operates under the basic notion that if two clusters are similar then the between cluster sum of squares should be small. In addition, this approach is more likely to produce approximately equal group sizes, which is favorable when conducting statistical comparisons, and aims to minimize within-group variance and maximize between-group variance.[120,121] We will apply Finch et al. recommendations for stopping rules, which uses Duda's pseudo T^2 statistic and Calinski's pseudo F-statistic to determine ideal cluster sizes.[122] We will present a stratified results of men and women participants, with results of the full sample cluster analysis provided within the supplemental materials. We considered 66 demographic and HIV risk environment variables described within the Rhodes framework, which includes physical, social, political and economic environment variables, as suggested in Table 4.1.

Table 4.1: SHARP Study variables according the Rhodes risk environment domains.

Individual Characteristics	Risk Environment		
	Physical	Social	Political/Economic

• Age
• Sex
• Marital Status
• Number of children <18 yrs
• Years of injecting drugs
• Types of drugs used
• Alcohol use
• Overdose (lifetime)
	• Housing/living situation
	  ○ Years living in Nairobi or coast
	• Location of drug use[2]
	  ○ Den
	  ○ Street or public area
	  ○ Home
	  ○ Uninhabited space
	• Drug quality[3]
	• Drug access[4]
	• Rushed injection
	  ○ Police
	  ○ People
	  ○ Withdrawal
		• Poor interactions with clinicians
		• Fear of disclosing HIV status
		• Sexual behaviors
		  ○ Sex w/ men, women, or both[1]
		  ○ Sex partners (qty)[5]
		  ○ Sex with person(s) HIV-positive[6]
		• Types of violence[6]
		  ○ Physical
		  ○ Sexual
		  ○ Threatened with a weapon
		  ○ Fear for safety
		• Injecting social network[7]
		  ○ Peer/PWID
		  ○ Sex partner/PWID
		  ○ Stranger/PWID
		• Injecting practices
		  ○ Injects drugs alone[7]
			• Income source[9]
			• Cost of care
			• Transportation
			• Clinic wait-times
			• Sex work or transactional sex[1]
			• Mobility/Migration[10]
			• Access to clean injection equipment[7]
			• Methadone use[11]

		○ First person to inject[7] ○ Second person to inject[7] ○ Flashblood[1,8]	

[1]Lifetime experiences; [2]Most common or frequent; [3]Rarely vs less, more than half of the time or always concerned about drug quality; [4]Always or rarely vs. sometimes or usually difficulty finding drugs; [5]Past 3-months; [6]Previous year; [7]Previous month; [8]Injected someone else's blood most commonly to avoid withdrawal symptoms; [9]Typicaly income sources last year; [10]Spent >7 consecutive nights away from city in the past 6-months; [11]Currently taking methadone

Demographic characteristics

Descriptions of the study sample includes age, marital status, number of childing living in the household and recruitment region. Age was categorized into quartiles: 18 – 30, 31-40, 40-50, and >50 years. Marital status categories included single, married, partnered, divorced or separated, and widowed. Number of children <18 years living in the household include options for 0, 1 or ≥2 children, and enrollment sites were collapsed into recruitment regions, Nairobi and Coastal Kenya.

Income sources

Participants provided the number of incomes sources within the last month, which was summed across all categories into 0, 1 or ≥2 income sources. Types of income sources included five broad categories: formal employment, formal self-employment, informal employment, informal illegal employment and other employment. Formal employment included working in the transportation industry (e.g., matatus, boda-bodas), tourist industry (e.g., carrying luggage, hotel service), commercial food industry (e.g., fishing, farming), restaurant industry (e.g., wait-staff, bar service), hair dresser, massage therapist, community health worker and administrative worker. Formal self-employment included small business owners (e.g., trading, selling goods), housekeeping, and artists/musicians. Informal work included day laborers, recycling (e.g., metal scraps, plastics, other goods), seeking charity (e.g., street peddlers), construction, beach boys, and gardeners/landscapers. Informal illegal employment included sex work or transactional sex, theft of money or goods, and selling drugs. Other employment included having no income or receiving money from partners, family or friends.

Housing and mobility

Participants were asked to report whether or not they currently had stable housing and to describe the place they slept most frequently in the last month: personal, friend or family member's house or apartment, temporary housing (e.g., hotel, nightly rental, impoverish shelter), outside in the open, or

another location. To assess mobility, participants were asked whether they had spent more than seven consecutive nights away from the city they live in within the last six-months.

Sexual behaviors

Participants were asked a series of questions on partners, sexual acts, and sexual risks (e.g., condom use and transactional sex.) Sexual partners were assessed over the previous 3-months, with options for 0, 1-2 and ≥3 sexual partners. Types of sexual partners were assessed over participant's lifetime including options for opposite, same or both male and family sexual partners. Quantity of sex acts within the past month, included 0, 1-10, ≥10 sexual encounters. Condom use was assessed during the last sex act and included options for condom use, no condom use and unsure. Transactional sex included both receiving and giving money or goods in exchange sexual acts. Finally, participants asked whether or not they had sex with a person living with HIV in the last year.

HIV Care

Descriptive statistics included number of newly diagnosed, participants currently enrolled in HIV care, number of years living with HIV, and having >6-months since their last clinical appointment. ART was assessed by asking if someone has ever taken ART, if they are currently taking ART, number of years they have been taking ART, and whether they have missed >7-days taking ART. Viral suppression was determined via laboratory confirmation using a cut-point of ≤1000 copies/ml, with greater quantities indicating not virally suppressed. All HIV variables were excluded from the cluster analysis as they were associated with the outcome of interest.

Number of HIV care barriers were assessed, with participants describing 0, 1, 2, ≥3 barriers. The top five types of barriers were included in the cluster analysis, including cost, transportation, administrative (wait queues, paperwork), stigma (discrimination and non-disclosure of HIV status), and clinical discrimination (providers, staff). Other barriers included competing needs, drug side effects, denial of HIV status, addiction, illness, lack of storage for ART and lifetime commitment to taking treatment (intrapersonal stigma).

Violence

Violence was assessed over the last year, including experiences of physical violence (hit, slapped, kicked, punched), sexual violence and threaten with a weapon. Participants were also asked if they were currently worried about their safety.

Drug use

Types of drugs consumed were assessed over the last month, including heroin, methamphetamine, cocaine, marijuana, benzodiazepines (valium, Rohypnol), artane, khat, and alcohol. Poly substance use was defined as two or more substances used in the past month, and excluded alcohol use. Difficulty locating drugs was defined as usually or sometimes has difficulty finding drugs, compared to always/never has difficulty finding drugs. Drug quality was assessed as never concerned about drug quality, compared to always, more than half the time and less than half the time concerned about drug quality. Two questions assessed overdose including whether someone experienced a personal overdose or whether they witnessed a fatal overdose. Also, several participants were recruited from OAT clinics, which was assessed within one question on current methadone use.

Injection drug use

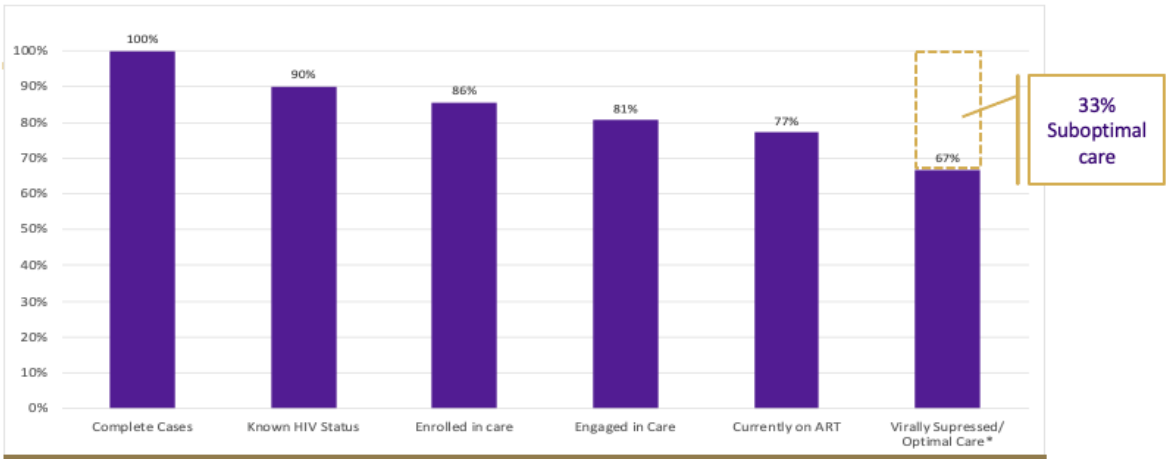
Injection drug use was assessed by years engaged in injecting and injections per day (0, 1, >1 injection). Participants were asked to describe a common location for injecting drugs, including within a personal home, den, street or public, and uninhabited house or building. Injecting alone in the past month, as well as frequency of injecting alone (e.g., less than or more than half of the time) was assessed. Within the past month, participants were asked to describe who they injected with and included options for (a) non-injecting friend, (b) injecting friend, (c) non-injecting sexual partner, (d) injecting sexual partner, (e) stranger and/or (f) family member. Rushed injections were assessed and who caused the rushed injection included options for people, withdrawal symptoms, concerns about law enforcement and other. Sharing needles was assessed, specifically who was first on the needle and second on the needle. Similarly, sharing equipment was assessed and experiences injecting someone else's blood, known as "flashblood" a practice that coincides with extreme withdrawals and limited resources to purchase drugs.

Results

Baseline characteristics

Study sample included 783 participants, with characteristics described in Table 4.2, which were stratified by men and women. Median age was 36 years (IQR 31-42 years), 51.3% were male, 49.1% had children, and 57.7% were recruited from Nairobi. Most participants (95.1%) claimed at least one income source and the most common income source(s) were informal illegal work (34.4%), which included sex work, selling drugs and theft/stealing, followed by informal work (30.1%), which included day laborers, recycling goods, charity, construction, beach boys and gardeners. Several participants experienced unstable housing (13.8%) and recent mobility or relocation (18.9%). In the previous year, physical violence was the most commonly reported type of violence (35%). Under sexual behaviors, several participants reported 3 or more new sexual partners over the last 3-months (21.5%), the majority reported opposite sex partners (93.4%), and nearly half reported not using or were uncertain of condom use during the last sex encounter (42.7%). High risk sexual behaviors included transactional sex, where people received goods or money in exchange for sex (52.1% overall, 80.6% among women and 25.1% among men) and sex with a person living with HIV in the past year (33.3%). The most commonly used drug was heroin (91.4%), with more than half of the participants engaging in poly substance use (64%). Over a third of participants experienced a personal overdose (39.6%) and nearly a quarter were using methadone (22.5%). Median years injecting was 4 years (IQR 2.0-8.0 years), with most participants injecting more than once per day (79.7%) and dens served as the most common injection location (60.3%). More than half of the participants injected with someone in the previous month (62.2%), with few sharing injection equipment (6.0%). For HIV care, most reported experiencing at least one HIV care barrier (62.6%), with the most commonly reported barriers including transportation (41.5%), disclosure, discrimination or stigma (26.4%) and administrative issues (24.6%). Conducting a complete case analysis of participants with viral load data (n=646) using the stages of the HIV care continuum, 10% of participants were unaware of their HIV status, 14% were not enrolled in care, 19% were not engage in care (i.e., no clinical visit in the past 6-months), 23% were not currently taking ART, 33% were not virally suppressed or experienced suboptimal care (Figure 4.1).

Figure 4.1: Complete cases of PWID-LH according to the HIV care continuum (n=646)



	Complete Cases	Known HIV Status	Enrolled in care	Engaged in Care	Currently on ART	Virally Suppressed	Optimal Care	Suboptimal Care*
n/646	646	581	553	521	499	431	431	215
%	100%	91%	86%	81%	77%	67%	67%	33%

**Suboptimal care defined as (1)not currently on ART (self-report); or (2) no clinical visit in past 6 months (self-report); or (3) Not virally suppressed (lab data)*

Comparing characteristics of PWID-LH men (51.3%) and women (48.7%), there were several statistically significant differences including age, marital status, number of children, number of income sources and types of income, housing type, new sexual partners (previous 3 months), sexual acts (past month), transactional sex (lifetime), years living with HIV, ART use, 3 or more HIV care barriers (e.g., transportation, disclosure/discrimination/stigma, clinicians), sexual violence (previous year) and being threatened with a weapon. Additional differences in drug use between men and women in the previous month included methamphetamine, benzodiazepine, alcohol and concerns regarding drug quality. Injection-related risk differences between men and women were seen in personal overdoes, methadone use, years injecting drugs, injections administered per day, location for injecting drugs (i.e., uninhabited house or building), injecting alone and in the presence of someone, rushed injections and sharing needles. Men and women PWID-LH are different on a variety of factors (Table 4.2), thus we decided to carry out a gender-specific univariate and cluster analysis to explore differences within each sub-group.

Table 4.2: Sociodemographic and behavioral characteristics of PWID-LH by male and female participants (n=783)

	Total n=783 n(%)	**Male n=402 n(%)**	**Female n=381 n(%)**	**p-value**
Median Age [IQR]	36.0 [31.0, 42.0]	38.0 [33.0, 44.0]	35.0 [30.0, 40.0]	**<0.001**
Age Categories*				
18-30 yrs	181 (23.1)	70 (17.4)	111 (29.1)	**<0.001**
31-40 yrs	355 (45.3)	179 (44.5)	176 (46.2)	0.692
41-50 yrs	207 (26.4)	124 (30.8)	83 (21.8)	**0.005**
>50 yrs	40 (5.1)	29 (7.2)	11 (2.9)	**0.010**
Marital status*				
Single	287 (36.7)	126 (31.3)	161 (42.3)	**0.002**
Married	189 (24.1)	113 (28.1)	76 (19.9)	**0.010**
Partnered	48 (6.1)	17 (4.2)	31 (8.1)	**0.033**
Divorced/separated	184 (23.5)	104 (25.9)	80 (21.0)	0.128
Widowed	75 (9.6)	42 (10.4)	33 (8.7)	0.467
Children ≤18 yrs living with participant*				
0 children	398 (50.8)	245 (60.9)	153 (40.2)	**<0.001**
1 child	185 (23.6)	79 (19.7)	106 (27.8)	**0.009**
≥2 children	200 (25.5)	78 (19.4)	122 (32.0)	**<0.001**
Recruitment region*				**<0.001**
Nairobi	452 (57.7)	189 (47.0)	263 (69.0)	
Coast	331 (42.3)	213 (53.0)	118 (31.0)	
Income Source(s)				
*Number of income sources**				
0	38 (4.9)	9 (2.2)	29 (7.6)	**<0.001**
1	596 (76.1)	336 (83.6)	260 (68.2)	**<0.001**
≥2	149 (19.0)	57 (14.2)	92 (24.1)	**<0.001**
*Formal Employment**	171 (21.8)	145 (36.1)	26 (6.8)	**<0.001**
Transportation	107 (13.7)	106 (26.4)	1 (0.3)	**<0.001**
Tourist industry	10 (1.3)	8 (2.0)	2 (0.5)	0.108
(Commercial) Food industry	19 (2.4)	19 (4.7)	0 (0)	**<0.001**
Restaurant	7 (0.9)	2 (0.5)	5 (1.3)	0.275
Hairdresser/Massage Therapist	15 (1.9)	1 (0.2)	14 (3.7)	**<0.001**
Community Health Worker	9 (1.1)	6 (1.5)	3 (0.8)	0.507
Office/Clerical Work	4 (0.5)	3 (0.7)	1 (0.3)	0.625
*Formal Self-employment**	168 (21.5)	77 (19.2)	91 (23.9)	**<0.001**
Small business	116 (14.8)	68 (16.9)	48 (12.6)	0.127
Housekeeping	47 (6.0)	4 (1.0)	43 (11.3)	**<0.001**
Artist	5 (0.6)	5 (1.2)	0 (0)	0.062
*Informal Work**	236 (30.1)	147 (36.6)	89 (23.4)	**<0.001**
Day laborer	132 (16.9)	59 (14.7)	73 (19.2)	0.114
Recycling	63 (8.0)	58 (14.4)	5 (1.3)	**<0.001**
Charity	28 (3.6)	20 (5.0)	8 (2.1)	**0.048**
Construction	13 (1.7)	12 (3.0)	1 (0.3)	**0.007**
Beach boy	10 (1.3)	10 (2.5)	0 (0)	**0.002**
Gardening	2 (0.3)	0 (0)	2 (0.5)	0.236
*Informal (Illegal) Work**	269 (34.4)	59 (14.7)	210 (55.1)	**<0.001**
Sex work	244 (31.2)	38 (9.5)	206 (54.1)	**<0.001**
Stealing	20 (2.6)	17 (4.2)	3 (0.8)	**0.005**
Selling drugs	17 (2.2)	11 (2.7)	6 (1.6)	0.385
*Other**	92 (11.7)	17 (4.2)	75 (19.7)	**<0.001**

No income	57 (7.3)	9 (2.2)	48 (12.6)	**<0.001**
Partner	20 (2.6)	1 (0.2)	19 (5.0)	**<0.001**
Family/Friends	16 (2.0)	7 (1.7)	9 (2.4)	0.718
Housing & Mobility				
Unstable housing*	108 (13.8)	63 (15.7%)	45 (11.8%)	0.143
Housing type (past month)*				
Personal/friends/relatives	683 (87.2)	341 (84.8)	342 (89.8)	**0.050**
Temporary housing	52 (6.6)	32 (8.0)	20 (5.2)	0.168
Outside in the open	47 (6.0)	28 (7.0)	19 (5.0)	0.310
Relocation/Mobility[1*]	148 (18.9)	84 (20.9)	64 (16.8)	0.170
Sexual Behaviors*				
New sex partners (last 3 months)*				
0 partner	366 (46.7)	197 (49.0)	169 (44.4)	0.218
1-2 partners	249 (31.8)	156 (38.8)	93 (24.4)	**<0.001**
≥3 partners	168 (21.5)	49 (12.2)	119 (31.2)	**<0.001**
Partner Types*				
Opposite sex partner	731 (93.4)	373 (92.8)	358 (94.0)	0.605
Same sex partner	12 (1.5)	7 (1.7)	5 (1.3)	0.774
Male/Female sex partners	40 (5.1)	22 (5.5)	18 (4.7)	0.746
Sex acts (past month)*				
0 times	222 (28.4)	156 (38.6)	66 (17.3)	**<0.001**
1-10 times	353 (45.1)	201 (50.0)	152 (39.9)	**0.006**
>10 times	207 (26.4)	45 (11.2)	162 (42.5)	**<0.001**
Condom use (last sex act)*				
Yes	449 (57.3)	225 (56.0)	224 (58.8)	0.468
No	321 (41.0)	168 (41.8)	153 (40.2)	0.695
Unknown/unsure	13 (1.7)	9 (2.2)	4 (1.0)	0.265
Transactional sex				
Rec'd money/goods for sex*	408 (52.1)	101 (25.1)	307 (80.6)	**<0.001**
Gave money/goods for sex*	283 (36.1)	262 (65.2)	21 (5.5)	**<0.001**
Sex w/ person living w/ HIV (past year)*	261 (33.3)	130 (32.3)	131 (34.4)	0.613
HIV Care				
Years living with HIV	5.0 [2.0, 10.0]	6.0 [2.0, 11.0]	4.0 [2.0, 9.0]	**<0.001**
Number of barriers to HIV care*				
0 barriers	293 (37.4)	145 (36.1)	148 (38.8)	0.466
1 barrier	193 (24.6)	94 (23.4)	99 (26.0)	0.447
2 barriers	167 (21.3)	84 (20.9)	83 (21.8)	0.829
3 or more barriers	130 (16.6)	79 (19.7)	51 (13.4)	**0.024**
Types of HIV care barriers				
Cost*	77 (9.8)	46 (11.4)	31 (8.1)	0.152
Transportation*	325 (41.5)	197 (49.0)	128 (33.6)	**<0.001**
Administrative*	193 (24.6)	104 (25.9)	89 (23.4)	0.536
Disclosure, Discrimination, or stigma*	207 (26.4)	86 (21.4)	121 (31.8)	**0.001**
Clinicians*	133 (17.0)	83 (20.6)	50 (13.1)	**0.007**
Violence (past year)				
Physical violence*	274 (35.0)	151 (37.6)	123 (32.3)	0.141
Sexual violence*	67 (8.6)	23 (5.7)	44 (11.5)	**0.005**
Threat w/ a weapon*	135 (17.2)	99 (24.6)	36 (9.4)	**<0.001**
Fear for safety*	55 (7.0)	29 (7.2)	26 (6.8)	0.941
Drug use				
Drugs used (past month)				
Heroin*	716 (91.4)	366 (91.0)	350 (91.9)	0.778

Methamphetamine*	71 (9.1)	45 (11.2)	26 (6.8)	**0.045**
Cocaine*	55 (7.0)	30 (7.5)	25 (6.6)	0.724
Marijuana*	414 (52.9)	218 (54.2)	196 (51.4)	0.478
Benzodiazepines*	55 (7.0)	40 (10.0)	15 (3.9)	**0.002**
Artane*	40 (5.1)	18 (4.5)	22 (5.8)	0.508
Khat*	104 (13.3)	48 (11.9)	56 (14.7)	0.302
Alcohol*	265 (33.8)	105 (26.1)	160 (42.0)	**<0.001**
Poly substance use (2+ drugs)*	495 (63.2)	245 (60.9)	250 (65.6)	0.200
Difficulty locating drugs*	221 (28.2)	121 (30.1)	100 (26.2)	0.264
Concerned about drug quality*	501 (64.0)	305 (75.9)	196 (51.4)	**<0.001**
Overdose (lifetime)				
Personal overdose*	310 (39.6)	192 (47.8)	118 (31.0)	**<0.001**
Witnessed fatal overdose*	512 (65.4)	287 (71.4)	225 (59.1)	**<0.001**
Methadone use (current)*	176 (22.5)	112 (27.9)	64 (16.8)	**<0.001**
Injection Drug Use				
Median yrs injecting [IQR]	4.00 [2.0, 8.0]	5.00 [3.0, 10.0]	3.00 [1.5, 5.0]	**<0.001**
Years injecting drugs ≥4 years*	408 (52.1)	259 (64.4)	149 (39.1)	**<0.001**
Injections per day*				
None	42 (5.4)	16 (4.0)	26 (6.8)	0.108
1x	117 (14.9)	52 (12.9)	65 (17.1)	0.192
>1x per day	624 (79.7)	334 (83.1)	290 (76.1)	**0.020**
Common location for IDU*				
Home	117 (14.9)	51 (12.7)	66 (17.3)	0.085
Den	472 (60.3)	232 (57.7)	240 (63.0)	0.151
Street or public	24 (3.1)	15 (3.7)	9 (2.4)	0.366
Uninhabited house/building	148 (18.9)	96 (23.9)	52 (13.6)	**<0.001**
Other	22 (2.8)	8 (2.0)	14 (3.7)	0.227
Injected alone (past month)*	296 (37.8)	180 (44.8)	116 (30.4)	**<0.001**
Injected with someone (past month)				
Non-injecting friend*	189 (24.1)	118 (29.4)	71 (18.6)	**<0.001**
Injecting friend*	636 (81.2)	317 (78.9)	319 (83.7)	0.098
Non-injecting sex partner*	60 (7.7)	28 (7.0)	32 (8.4)	0.536
Injecting sex partner*	108 (13.8)	42 (10.4)	66 (17.3)	**0.007**
Stranger*	21 (2.7)	14 (3.5)	7 (1.8)	0.229
Family member*	4 (0.5)	3 (0.7)	1 (0.3)	0.625
Rushed injection (lifetime)*	451 (57.6)	241 (60.0)	210 (55.1)	0.195
Due to people*	35 (4.5)	27 (6.7)	8 (2.1)	**0.003**
Due to withdrawal symptoms*	424 (54.2)	222 (55.2)	202 (53.0)	0.584
Due to concerns about police*	69 (8.8)	43 (10.7)	26 (6.8)	0.074
IDU practices (past month)				
Shared needles*	47 (6.0)	14 (3.5)	33 (8.7)	**0.004**
First on the needle*	27 (3.4)	6 (1.5)	21 (5.5)	**0.004**
Second on the needle*	39 (5.0)	12 (3.0)	27 (7.1)	**0.013**
Shared equipment*	94 (12.0)	42 (10.4)	52 (13.6)	0.205
Ever injected blood ("flashblood")*	24 (3.1)	12 (3.0)	12 (3.1)	0.999

[1]Past six months, participant spent more than 7 consecutive nights away from (recruitment) city
* Indicates variable that is included in the cluster analysis

Univariate analysis: HIV risks associated with suboptimal care

For comparison, we conducted a gender-stratified univariate analysis using the same demographic and risk environment variables incorporated in the cluster analysis, and adjusted for study

recruitment location (i.e., Nairobi vs. Coastal Kenya), which is presented in Table 4.3. (While not discussed, the full sample univariate analysis is presented in supplemental Table A.) Among men, six variables were associated with suboptimal care, with two out of the six variables associated with an increase in suboptimal care. Men who engaged in informal employment experienced 56% higher odds of experiencing suboptimal care compared to those who were not engage in informal employment (AOR: 1.56; 95% CI: 1.00-2.43) and those reporting one HIV care barrier were twice as likely to experience suboptimal care compared to those experiencing no HIV care barriers (AOR=2.04; 95% CI: 1.15-3.63). Whereas, men living with at least one child (AOR: 0.42; 95% CI: 0.22-0.81), engaged in informal illegal employment (AOR: 0.42; 95% CI: 0.20 – 0.91) and living with HIV for more than 7-years (AOR: 0.58; 95% CI: 0.33-0.99) were all associated with lower odds of experiencing suboptimal care.

For women, 14 variables were associated with suboptimal care, with eight out of the 14 variables associated with an increased odds of experiencing suboptimal care. Living in unstable housing was associated with a 3-fold increase in experiencing suboptimal care compared to women with stable housing (AOR: 3.22; 95% CI: 1.70-6.10), which was similar for those living in temporary housing (AOR: 2.88; 95% CI 1.15-7.17) or slept outdoors (AOR: 3.93; 95% CI: 1.50-10.3) compared to those who slept within a home. Women reporting experiences of stigma as an HIV care barrier (AOR: 2.08; 95% CI: 1.30-3.31), having one barrier (AOR: 1.99; 95% CI: 1.16-3.44) and having three or more HIV care barriers (AOR: 2.33; 95% CI: 1.19-4.56) were twice as likely to experience suboptimal care as women with no experiences of stigma or no HIV care barriers. In addition, women with safety concerns more than 3.5 times more likely to experience suboptimal care (AOR: 3.58, 95% CI: 1.57-8.17) compared to those without safety concerns. Women reporting one to two new sexual partners over the previous 3-months were nearly twice as likely to experience suboptimal care (AOR: 1.91; 95% CI: 1.10-3.34) compared to those without any new sexual partners. Additionally, women between the ages of 41-50 years (AOR: 0.31; 95% CI: 0.16-0.61), living with one child (AOR: 0.58, 95% CI: 0.34-1.00), engaged in informal work (AOR: 0.57, 95% CI: 0.33-0.98), living with HIV for more than 7-years (AOR: 0.52; 95% CI: 0.30-0.89), and having sex with a PLWH in the previous year (AOR: 0.62: 95% CI: 0.39-1.00) were all associated with the decreased odds of experiencing suboptimal care.

Table 4.3: Social demographic and HIV environmental risk factors associated with suboptimal care stratified by men (n=402) and women (n=381)

	MEN (n=402)						WOMEN (N=381)					
	OR	95% CI	p-value	AOR[1]	95% CI	p-value	OR	95% CI	p-value	AOR[1]	95% CI	p-value
Demographics												
Age: 18-30 yrs	1	ref		1	ref		1	ref		1	ref	
Age: 31-40 yrs	1.08	0.59-1.99	0.80	1.08	0.59-1.99	0.80	0.75	0.46-1.22	0.25	0.76	0.46-1.24	0.27
Age: 41-50 yrs	0.73	0.37-1.42	0.35	0.75	0.38-1.46	0.39	0.34	0.17-0.66	**0.001**	0.31	0.16-0.61	**<0.001**
Age: >50 yrs	1.12	0.44-2.89	0.81	1.15	0.45-2.98	0.76	0.31	0.06-1.52	0.15	0.28	0.06-1.37	0.12
Rel Status: Single	1	ref		1	ref		1	ref		1	ref	
Rel Status: Married	0.56	0.31-0.99	**0.04**	0.58	0.32-1.02	0.06	0.79	0.44-1.42	0.44	0.82	0.45-1.49	0.52
Rel Status: Partnered	0.57	0.18-1.86	0.36	0.64	0.19-2.09	0.46	0.44	0.17-1.13	0.09	0.49	0.18-1.31	0.15
Rel Status: Divorced/Separated	0.69	0.39-1.21	0.19	0.73	0.41-1.31	0.29	0.88	0.50-1.55	0.66	0.88	0.50-1.55	0.66
Rel Status: Widowed	0.51	0.22-1.16	0.11	0.52	0.23-1.19	0.12	1.19	0.55-2.56	0.66	1.18	0.55-2.54	0.68
Children <18 yrs: 0	1	ref		1	ref		1	ref		1	ref	
Children <18 yrs: 1	0.41	0.21-0.78	**0.006**	0.42	0.22-0.81	**0.01**	0.57	0.33-0.97	**0.04**	0.58	0.34-1.00	**0.05**
Children <18 yrs: 2 or more	0.62	0.34-1.12	0.11	0.64	0.35-1.17	0.15	0.61	0.36-1.00	**0.05**	0.63	0.38-1.05	0.07
Income cat: Formal employment	0.68	0.42-1.08	010	0.70	0.43-1.12	0.13	0.59	0.23-1.52	0.28	0.63	0.25-1.62	0.34
Income cat: Formal Self-employment	0.90	0.51-1.59	0.72	0.86	0.49-1.52	0.60	1.30	0.80-2.13	0.29	1.27	0.77-2.08	0.35
Income cat: Informal illegal work	0.43	0.20-0.90	**0.02**	0.42	0.20-0.91	**0.03**	1.11	0.72-1.70	0.64	1.12	0.73-1.72	0.61
Income cat: Informal work	1.56	1.00-2.43	**0.05**	1.56	1.00-2.44	**0.05**	0.65	0.38-1.11	0.11	0.57	0.33-0.98	**0.04**
Income cat: Other	1.10	0.38-3.19	0.87	1.20	0.41-3.51	0.74	1.03	0.60-1.76	0.91	1.06	0.62-1.82	0.82
Num incomes: 0	1	ref		1	ref		1	ref		1	ref	
Num incomes: 1	0.81	0.20-3.31	0.77	0.71	0.17-2.95	0.64	0.79	0.36-1.76	0.57	0.77	0.35-1.72	0.53
Num incomes: >1	0.48	0.10-2.22	0.34	0.43	0.09-2.04	0.29	0.75	0.32-1.80	0.52	0.70	0.29-1.67	0.42
Stable housing: Yes	1	ref		1	ref		1	ref		1	ref	
Stable housing: No	1.51	0.85-2.67	0.16	1.46	0.82-2.60	0.19	3.27	1.73-6.19	**<0.001**	3.22	1.70-6.10	**<0.001**
Slept past month: Home (personal, friends, relatives)	1	ref		1	ref		1	ref		1	ref	
Slept past month: Temporary housing	1.48	0.69-3.20	0.31	1.47	0.68-3.18	0.32	2.88	1.15-7.15	**0.02**	2.88	1.15-7.17	**0.02**
Slept past month: Outside in the open	1.83	0.83-4.06	0.14	1.64	0.72-3.70	0.24	4.03	1.54-10.5	**0.004**	3.93	1.50-10.3	**0.005**
Seven nights away from area: No	1	ref		1	ref		1	ref		1	ref	
Seven nights away from area: Yes	1.23	0.72-2.08	0.44	1.37	0.80-2.36	0.26	0.77	0.42-1.39	0.38	0.86	0.46-1.59	0.62
HIV diagnosis, year positive, barriers												
Yrs HIV positive: <3	1	ref		1	ref		1	ref		1	ref	
Yrs HIV positive: 3-7	0.88	0.52-1.49	0.63	0.90	0.53-1.54	0.71	0.68	0.41-1.12	0.13	0.70	0.42-1.16	0.17
Yrs HIV positive: >7	0.54	0.32-0.93	**0.02**	0.58	0.33-0.99	**0.05**	0.51	0.30-0.89	**0.02**	0.52	0.30-0.89	**0.02**
Barrier to care: not cost	1	ref		1	ref		1	ref		1	ref	
Barrier to care: cost	1.46	0.76-2.81	0.25	1.60	0.82-3.09	0.17	1.53	0.73-3.24	0.26	1.79	0.82-3.88	0.14
Barrier to care: not transportation	1	ref		1	ref		1	ref		1	ref	
Barrier to care: transportation	0.98	0.63-1.52	0.93	1.05	0.67-1.64	0.84	1.00	0.64-1.57	1.00	1.10	0.69-1.77	0.69
Barrier to care: not clinicians	1	ref		1	ref		1	ref		1	ref	
Barrier to care: clinicians	1.00	0.59-1.73	0.98	0.96	0.55-1.65	0.87	1.43	0.78-2.64	0.25	1.49	0.81-2.76	0.20
Barrier to care: not stigma	1	ref		1	ref		1	ref		1	ref	
Barrier to care: stigma	1.26	0.75-2.12	0.38	1.16	0.68-1.98	0.59	2.15	1.37-3.37	**<0.001**	2.08	1.30-3.31	**0.002**
Barrier to care: not administrative	1	ref		1	ref		1	ref		1	ref	
Barrier to care: Administrative	1.09	0.75-2.12	0.74	1.12	0.68-1.98	0.65	1.13	0.68-1.86	0.64	1.18	0.71-1.96	0.52
Number of barriers: 0	1	ref		1	ref		1	ref		1	ref	
Number of barriers: 1	1.94	1.10-3.42	**0.02**	2.04	1.15-3.63	**0.01**	2.05	1.19-3.53	**0.01**	1.99	1.16-3.44	**0.01**
Number of barriers: 2	1.02	0.54-1.92	0.95	1.02	0.54-1.93	0.94	1.18	0.65-2.15	0.59	1.22	0.66-2.22	0.53

Number of barriers: 3 or more	1.26	0.68-2.35	0.47	1.29	0.69-2.42	0.43	2.20	1.13-4.27	**0.02**	2.33	1.19-4.56	**0.01**
Violence												
Violence physical: no	1	ref		1	ref		1	ref		1	ref	
Violence physical: yes	1.07	0.68-1.68	0.76	1.10	0.70-1.72	0.69	0.66	0.41-1.06	0.09	0.71	0.43-1.16	0.17
Violence sexual: no	1	ref		1	ref		1	ref		1	ref	
Violence sexual: yes	0.54	0.18-1.61	0.27	0.57	0.19-1.74	0.33	0.65	0.32-1.34	0.24	0.77	0.37-1.62	0.49
Threaten violence: no	1	ref		1	ref		1	ref		1	ref	
Threaten violence: yes	0.64	0.37-1.09	0.10	0.68	0.39-1.18	0.17	1.53	0.76-3.07	0.24	1.93	0.91-4.08	0.09
Worried about safety: no	1	ref		1	ref		1	ref		1	ref	
Worried about safety: yes	1.20	0.53-2.71	0.67	1.15	0.50-2.61	0.74	3.61	1.59-8.21	**0.002**	3.58	1.57-8.17	**0.002**
Sexual Behaviors												
Number of sex partner (past 3 month): 0 partners	1	ref		1	ref		1	ref		1	ref	
Number of sex partner (past 3 month): 1-2 partners	0.67	0.42-1.07	0.10	0.71	0.43-1.19	0.19	1.67	0.98-2.83	0.06	1.91	1.10-3.34	**0.02**
Number of sex partner (past 3 month): 3 or more partners	0.47	0.21-1.02	0.06	0.50	0.22-1.14	0.10	1.28	0.77-2.12	0.34	1.36	0.81-2.28	0.24
Partner types: opposite sex	1	ref		1	ref		1	ref		1	ref	
Partner types: both sexes	0.24	0.06-1.05	0.06	0.26	0.06-1.12	0.07	0.57	0.18-1.76	0.33	0.62	0.20-1.95	0.41
Partner types: same sex	<0.01	<0.01-Inf	0.98	<0.01	<0.01-Inf	0.98	0.50	0.05-4.49	0.53	0.54	0.06-4.93	0.59
Number times sex (past month): 0 times	1	ref		1	ref		1	ref		1	ref	
Number times sex (past month): 1-10	0.95	0.60-1.51	0.84	0.97	0.61-1.55	0.91	0.66	0.36-1.22	0.19	0.67	0.36-1.23	0.20
Number times sex (past month): >10 times	0.70	0.32-1.54	0.38	0.66	0.30-1.46	0.31	1.05	0.58-1.91	0.86	1.02	0.56-1.86	0.94
Condom use (last sex act): no	1	ref		1	ref		1	ref		1	ref	
Condom use (last sex act): yes	1.06	0.68-1.66	0.79	1.06	0.68-1.67	0.79	0.68	0.44-1.06	0.09	0.67	0.43-1.04	0.07
Condom use (last sex act): not sure	1.37	0.33-5.70	0.67	1.50	0.36-6.30	0.58	0.55	0.06-5.37	0.60	0.53	0.05-5.22	0.58
Ever received money or goods for sex: no	1	ref		1	ref		1	ref		1	ref	
Ever received money or goods for sex: yes	0.71	0.42-1.21	0.21	0.73	0.43-1.23	0.24	0.95	0.55-1.63	0.84	0.98	0.57-1.70	0.95
Ever given money or goods for sex: no	1	ref		1	ref		1	ref		1	ref	
Ever given money or goods for sex: yes	0.75	0.48-1.18	0.21	0.79	0.50-1.24	0.30	0.81	0.31-2.14	0.67	0.86	0.32-2.27	0.75
Sex w/ PLWH (last year): no	1	ref		1	ref		1	ref		1	ref	
Sex w/ PLWH (last year): yes	0.90	0.56-1.44	0.65	0.91	0.57-1.46	0.69	0.61	0.38-0.98	**0.04**	0.62	0.39-1.00	**0.05**
Substance Use												
Heroin: no	1	ref		1	ref		1	ref		1	ref	
Heroin: yes	1.37	0.60-3.11	0.45	1.28	0.56-2.92	0.56	1.44	0.63-3.33	0.39	1.32	0.56-3.07	0.53
Methamphetamine: no	1	ref		1	ref		1	ref		1	ref	
Methamphetamine: yes	1.07	0.54-2.13	0.84	1.00	0.50-1.99	0.99	0.59	0.23-1.52	0.28	0.57	0.22-1.46	0.24
Cocaine: no	1	ref		1	ref		1	ref		1	ref	
Cocaine: yes	0.95	0.41-2.20	0.90	0.97	0.42-2.27	0.95	1.40	0.61-3.21	0.43	1.54	0.66-3.59	0.31
Benzodiazepines: no	1	ref		1	ref		1	ref		1	ref	
Benzodiazepines: yes	0.74	0.34-1.61	0.45	0.77	0.35-1.67	0.50	0.74	0.23-2.36	0.61	0.77	0.24-2.49	0.67
Khat: no	1	ref		1	ref		1	ref		1	ref	
Khat: yes	1.36	0.72-2.60	0.35	1.46	0.76-2.81	0.25	0.51	0.26-1.01	**0.05**	0.54	0.27-1.08	0.08
Alcohol: no	1	ref		1	ref		1	ref		1	ref	
Alcohol: yes	0.77	0.46-1.28	0.31	0.77	0.46-1.29	0.32	0.88	0.57-1.37	0.58	0.89	0.57-1.37	0.59
Other: no	1	ref		1	ref		1	ref		1	ref	
Other: yes	1.24	0.67-2.31	0.49	1.11	0.58-2.11	0.75	0.62	0.33-1.19	0.15	0.57	0.30-1.10	0.10

Poly-substance use: no	1	ref		1	ref		1	ref		1	ref	
Poly-substance use: yes	1.13	0.72-1.78	0.59	1.13	0.72-1.77	0.61	1.00	0.64-1.57	1.00	0.98	0.62-1.54	0.93
Difficulty locating drugs: no	1	ref		1	ref		1	ref		1	ref	
Difficulty location drugs: yes	1.23	0.77-1.97	0.38	1.38	0.85-2.24	0.20	0.52	0.31-0.89	**0.02**	0.54	0.32-0.91	**0.02**
Concerned about drug quality: no	1	ref		1	ref		1	ref		1	ref	
Concerned about drug quality: yes	0.86	0.52-1.43	0.56	1.04	0.59-1.83	0.89	1.19	0.78-1.83	0.42	1.53	0.94-2.51	0.09
Ever overdose: no	1	ref		1	ref		1	ref		1	ref	
Ever overdose: yes	0.86	0.55-1.33	0.50	0.91	0.58-1.43	0.69	0.81	0.51-1.30	0.38	0.86	0.53-1.39	0.55
Ever witness fatal overdose: no	1	ref		1	ref		1	ref		1	ref	
Ever witness fatal overdose: yes	1.05	0.64-1.70	0.85	0.98	0.59-1.61	0.93	1.36	0.88-2.12	0.17	1.34	0.86-2.08	0.20
Currently on methadone: no	1	ref		1	ref		1	ref		1	ref	
Current on methadone: yes	0.63	0.38-1.07	0.09	0.67	0.40-1.25	0.13	0.70	0.38-1.28	0.24	0.81	0.41-1.59	0.54
Injection Drug Use												
Years injecting drugs: <4 yrs	1	ref		1	ref		1	ref		1	ref	
Years injecting drugs: ≥4 yrs	0.92	0.58-1.45	0.72	0.92	0.58-1.45	0.71	1.01	0.65-1.56	0.98	1.01	0.65-1.57	0.96
Injections per day: 0 times	1	ref		1	ref		1	ref		1	ref	
Injections per day: 1 time	0.73	0.21-2.51	0.62	0.85	0.25-2.95	0.80	0.66	0.25-1.72	0.39	0.68	0.26-1.78	0.44
Injections per day: 2 or more	0.84	0.29-2.51	0.77	1.03	0.34-3.13	0.96	0.79	0.35-1.81	0.58	0.80	0.35-1.83	0.59
Injection location: home	1	ref		1	ref		1	ref		1	ref	
Injection location: den	1.43	0.71-2.90	0.32	1.33	0.65-2.72	0.43	0.70	0.40-1.22	0.20	0.63	0.35-1.13	0.12
Injection location: street/public	1.18	0.32-4.40	0.80	1.05	0.28-3.96	0.94	1.81	0.44-7.35	0.41	1.61	0.39-6.67	0.51
Injection location: uninhabited structure	1.08	0.49-2.40	0.84	1.21	0.54-2.72	0.65	0.48	0.22-1.07	0.07	0.54	0.24-1.24	0.15
Injection location: other	<0.001	0-Inf	0.99	<0.001	0-Inf	0.99	0.24	0.05-1.16	0.07	0.23	0.05-1.12	0.07
Inject alone (past month): no	1	ref		1	ref		1	ref		1	ref	
Inject alone (past month): yes	1.12	0.72-1.74	0.61	1.14	0.73-1.77	0.56	0.94	0.59-1.50	0.80	1.02	0.63-1.65	0.93
Injected w/ non-IDU friend (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ non-IDU friend (past month): yes	1.30	0.81-2.08	0.28	1.51	0.91-2.48	0.11	0.70	0.40-1.25	0.23	0.79	0.42-1.44	0.43
Injected w/ IDU friend (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ IDU friend (past month): yes	1.31	0.75-2.28	0.34	1.23	0.70-2.17	0.47	0.80	0.45-1.40	0.43	0.74	0.41-1.31	0.30
Injected w/ non-IDU sex partner (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ non-IDU sex partner (past month): yes	1.05	0.45-2.46	0.91	1.13	0.48-2.66	0.78	0.66	0.29-1.52	0.33	0.76	0.32-1.82	0.54
Injected w/ IDU sex partner (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ IDU sex partner (past month): yes	0.92	0.45-1.91	0.83	0.94	0.45-1.94	0.86	1.03	0.59-1.81	0.92	1.12	0.63-2.00	0.70
Injected w/ stranger (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ stranger (past month): yes	2.02	0.69-5.96	0.20	2.12	0.71-6.29	0.18	0.82	0.16-4.27	0.81	0.98	0.18-5.25	0.98
Injected w/ family (past month): no	1	ref		1	ref		1	ref		1	ref	
Injected w/ family (past month): yes	1.31	0.12-14.6	0.82	1.23	0.11-13.8	0.87	NA	NA	NA	NA	NA	NA
Rushed injection: no	1	ref		1	ref		1	ref		1	ref	
Rushed injection: yes	1.02	0.66-1.60	0.92	0.95	0.60-1.51	0.84	1.05	0.65-1.54	0.98	0.94	0.61-1.46	0.79
Reason rushed injection: People: no	1	ref		1	ref		1	ref		1	ref	
Reason rushed injection: People: yes	0.73	0.29-1.87	0.52	0.83	0.32-2.16	0.71	NA	NA	NA	NA	NA	NA
Reason rushed injection: Withdrawal: no	1	ref		1	ref		1	ref		1	ref	
Reason rushed injection: Withdrawal: yes	1.27	0.81-1.98	0.29	1.19	0.75-1.87	0.46	0.99	0.64-1.51	0.95	0.92	0.60-1.43	0.72
Reason rushed injection: Police: no	1	ref		1	ref		1	ref		1	ref	

Reason rushed injection: Police: yes	1.02	0.50-2.06	0.96	1.06	0.52-2.15	0.88	1.55	0.69-3.48	0.29	1.49	0.66-3.37	0.33
Ever shared needles: no	1	ref		1	ref		1	ref		1	ref	
Ever shared needles: yes	0.43	0.09-1.94	0.27	0.39	0.08-1.77	0.22	1.19	0.56-2.50	0.65	1.12	0.53-2.36	0.78
First on needle: no	1	ref		1	ref		1	ref		1	ref	
First on needle: yes	0.52	0.06-4.50	0.55	0.51	0.06-4.46	0.55	1.28	0.52-3.17	0.60	1.21	0.49-3.02	0.68
Second on needle: no	1	ref		1	ref		1	ref		1	ref	
Second on needle: yes	0.52	0.11-2.39	0.40	0.48	0.10-2.23	0.35	1.45	0.65-3.22	0.36	1.34	0.60-3.02	0.47
Ever inject another's blood "flashblood": no	1	ref		1	ref		1	ref		1	ref	
Ever inject another's blood "flashblood": yes	0.52	0.11-2.39	0.40	0.49	0.11-2.30	0.37	0.18	0.02-1.41	0.10	0.17	0.02-1.33	0.09

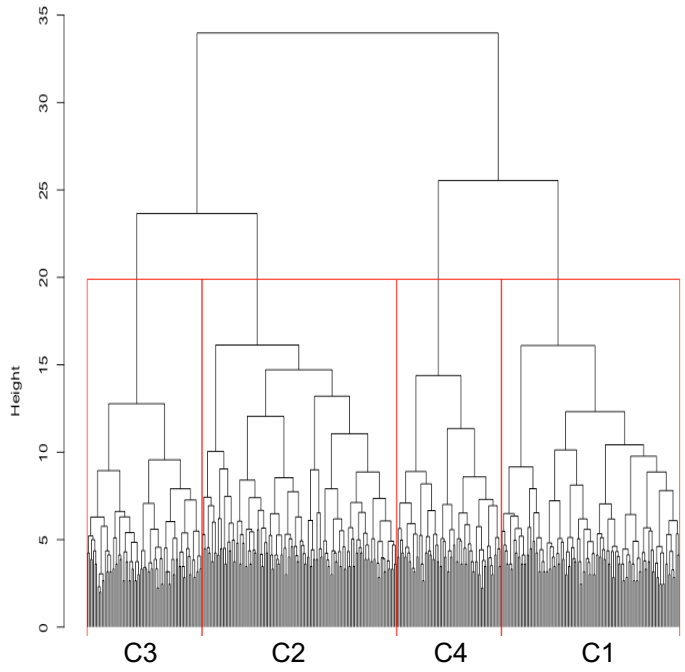
OR: odds ratio; CI: confidence interval: AOR: Adjusted odds ratio; [1]Ajusted by recruitment region (Nairobi vs. Coastal Kenya)

Cluster analysis

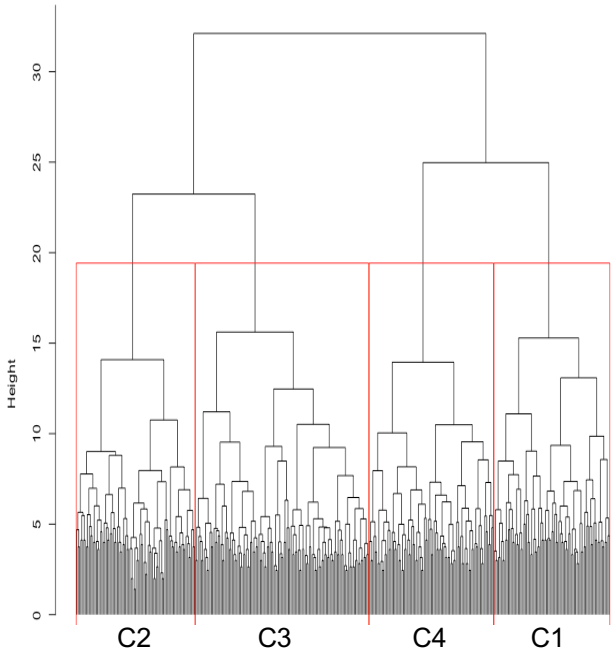
Hierarchical cluster analyses using Ward's linkage method and stopping methods outlined by Finch and colleagues,[122] were conducted three times using (a) the full sample of 783 participants, (b) the male participant sample (n=402) and (c) the female participant sample (n=381). In total, 66 sociodemographic and HIV risk environment variables were included in the analysis. Stopping rules for all three analyses indicated that four clusters were ideal for both male and female clusters, with the full sample ideal cluster size between four or eight clusters. Though not presented here, Figure A provides a schematic of the agglomerative hierarchical cluster analysis using the full study sample; with Figure B highlighting clusters breaks that indicate internal cohesion and external isolation. Similarly, our *a priori* stopping rules indicated four male (k_{male}=4) and female (k_{female}=4) clusters provide optimal within cluster cohesion and between cluster isolation, with Figure 4.3 highlighting natural breaks between (A) male and (B) female clusters.

Figure 4.3: Representative dendrograms following hierarchical cluster analysis shows (A) male participants (n=402) and (B) SHARP female participants (n=381).

A) Male Clusters



B) Female Clusters



Male clusters

Table 4.4 provides an overview of male cluster characteristics (n=402), based on HIV risk variables including demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence. For ease, we arranged clusters by median age so that cluster 1 represents our youngest cluster, with a median age of 36 years, and cluster 4 represents our oldest cluster, with a median age of 41 years. In addition, we highlighted in red the variables with the highest prevalence across all four clusters. By applying Ward's method, clusters 1 through 4 have relatively similar sizes, with 132 (32.8%), 78 (19.4%), 121 (30.1%) and 71 (17.7%) participants, respectively. Cluster 1 contains the most HIV risks with the highest proportions of HIV barriers (i.e., ≥3 HIV care barriers, specific HIV care barriers include cost, transportation, administration and stigma), injection drug use factors (i.e., rushed injections and shared injection equipment in the past month), sexual behaviors (i.e., ≥3 new sexual partners and ≥10 sexual acts over the last 3-months, having male and female sex partners, no condom use during the last sexual act, ever received money/goods in exchange for sex, sex with a PWIH in the last year) and violence (i.e., experienced sexual and physical violence in the last year, and feared for safety). In comparison, cluster 3 has the least amount of high HIV risk prevalence (i.e., living outside and injecting alone in the past month). With cluster 4 possessing a higher proportion of poly substance use, concerns for drug quality, personal overdose and current methadone use.

We conducted a logistic regression using complete case analysis of male participants with viral load data (n=305) in order to assess associations between suboptimal care and derived clusters (Table 4.5). We hypothesized cluster 4, our oldest cluster, would have the fewest HIV risks and served as our reference group. There were no statistically significant associations found between suboptimal care and male clusters.

Table 4.4 Male cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Variables	1 n=132 (32.8%)	2 n=78 (19.4%)	3 n=121 (30.1%)	4 n=71 (17.7%)
Demographics	Median age: 36 yrs Marital status: Single (55%) Marital status: Married (40%) Living w/ children (38%) Informal employment (37%) informal illegal employment (21%) Unstable housing (17%) Temporary housing (9%) Living outside in open (7%) Relocation/mobility (27%)	Median age: 39 yrs Marital status: Single (51%) Marital status: Married (47%) Living w/ children (46%) Informal employment (41%) informal illegal employment (14%) Unstable housing (14%) Temporary housing (5%) Living outside in open (8%) Relocation/mobility (13%)	Median Age: 40 yrs Marital status: Single (0%) Marital status: Married (1%) Living w/ children (36%) Informal employment (36%) informal illegal employment (11%) Unstable housing (16%) Temporary housing (7%) Living outside in open (10%) Relocation/mobility (17%)	Median age: 41 yrs Marital status: Single (20%) Marital status: Married (30%) Living w/ children (39%) Informal employment (31%) informal illegal employment (11%) Unstable housing (16%) Temporary housing (11%) Living outside in open (1%) Relocation/mobility (24%)
HIV	>7 yrs living w/ HIV (33%) 3+ HIV barriers to care (42%) Barrier to care: Cost (20%) Barrier to care: Transport (77%) Barrier to care: Admin (47%) Barrier to care: Stigma (38%)	>7 yrs living w/ HIV (33%) 3+ HIV barriers to care (0%) Barrier to care: Cost (3%) Barrier to care: Transport (14%) Barrier to care: Admin (3%) Barrier to care: Stigma (8%)	>7 yrs living w/ HIV (38%) 3+ HIV barriers to care (17%) Barrier to care: Cost (13%) Barrier to care: Transport (46%) Barrier to care: Admin (26%) Barrier to care: Stigma (23%)	>7 yrs living w/ HIV (45%) 3+ HIV barriers to care (6%) Barrier to care: Cost (3%) Barrier to care: Transport (39%) Barrier to care: Admin (11%) Barrier to care: Stigma (3%)
Drug use (past month)	Poly substance use (66%) Concern for drug quality (73%) Personal OD (53%) Current methadone use (35%)	Poly substance use (45%) Concern for drug quality (67%) Personal OD (36%) Current methadone use (22%)	Poly substance use (58%) Concern for drug quality (78%) Personal OD (45%) Current methadone use (18%)	Poly substance use (75%) Concern for drug quality (89%) Personal OD (56%) Current methadone use (38%)
Injection drug use	>= 4 years IDU (61%) IDU Location: Uninhab building (20%) Injected alone (43%) Rushed injection (71%) Shared needles (6%)	>= 4 years IDU (74%) IDU Location: Uninhab building (0%) Injected alone (44%) Rushed injection (69%) Shared needles (1%)	>= 4 years IDU (63%) IDU Location: Uninhab building (3%) Injected alone (50%) Rushed injection (43%) Shared needles (3%)	>= 4 years IDU (63%) IDU Location: Uninhab building (93%) Injected alone (41%) Rushed injection (59%) Shared needles (1%)
Sexual Behaviors	3+ new sex partners (17%) M/F sex partners (14%) >10 sex acts (17%) No condom use during last sex (52%) Received goods/money for sex (33%) Sex w/ PLWH (44%)	3+ new sex partners (5%) M/F sex partners (3%) >10 sex acts (13%) No condom use during last sex (30%) Received goods/money for sex (18%) Sex w/ PLWH 24%)	3+ new sex partners (10%) M/F sex partners (0%) >10 sex acts (6%) No condom use during last sex (38%) Received goods/money for sex (18%) Sex w/ PLWH (26%)	3+ new sex partners (14%) M/F sex partners (3%) >10 sex acts (7%) No condom use during last sex (42%) Received goods/money for sex (31%) Sex w/ PLWH (31%)
Violence (past year)	Physical violence (48%) Sexual violence (11%) Fear for safety (11%)	Physical violence (23%) Sexual violence (0%) Fear for safety (8%)	Physical violence (36%) Sexual violence (2%) Fear for safety (6%)	Physical violence (37%) Sexual violence (9%) Fear for safety (3%)

Note: Characteristics with the highest proportion highlighted in red

Table 4.5 Male clusters associated with suboptimal care (k=4)

	Proportion Suboptimal Care	OR	95% CI	p-value	AOR	95% CI	p-value
Cluster 1	32 of 94 (34.0%)	1.03	(0.48-2.23)	0.94	1.02	(0.47-2.23	0.96
Cluster 2	25 of 68 (36.8%)	1.23	(0.55-2.77)	0.60	1.22	(0.53-2.79)	0.64
Cluster 3	29 of 101 (28.7%)	0.88	(0.41-1.91)	0.76	0.88	(0.41-1.91)	0.74
Cluster 4	13 of 42 (31.0%)	1.00	ref				

OR: odds ratio: AOR: Adjusted odds ratio; CI: confidence interval
[1]Adjusted for recruitment region (i.e., Nairobi, Coastal Kenya)

Female clusters

Similarly, the formation of female cluster characteristics (n=381) was based on demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence, with clusters arranged by median age so that cluster 1 represents our youngest cluster, with a median age of 32 years, and cluster 4 represents our oldest cluster, with a median age of 39 years. Variables with the highest prevalence across all four clusters are highlighted in red (Table 4.6). Clusters 1 through 4 have relatively similar sizes, with 83 (21.8%), 85 (22.3%), 124 (32.5%) and 89 (23.4%) participants, respectively. Notably, clusters 1 and 2, the younger clusters, contain a higher prevalence of HIV risk factors. Cluster 1 contains participants with risk profiles that include a high proportion of women who are married, experiencing housing instability and mobility (i.e., unstable and temporary housing, living outside and recently spent more than 7 nights away from home), drug use risks (i.e., concern about drug quality over the last month, ever experienced a personal overdose, currently enrolled in methadone), injection drug use risks (i.e., typically injects in an abandoned building), sexual risk behaviors (i.e., having male and female sex partners over one's lifetime, no condom use during the last sexual act), and violence (i.e., experienced sexual and physical violence in the last year). Whereas, cluster 2 represents participants with risk profiles that include a higher proportion of women who are single, living with children, engaged in informal illegal employment (i.e., sex work, theft, or selling drugs), live in temporary housing, experience HIV care barriers (i.e., ≥3 HIV care barriers, specific HIV care barriers include cost, transportation, administration and stigma), engage in polysubstance use, injection drug risks (i.e., injected drugs for ≥4 years, injects alone, rush injections and shared injection equipment in the past month), sexual risk behaviors (i.e., ≥3 new sexual partner and ≥10 sexual act carried out over the last 3-months, having male and female sex partners over one's lifetime, ever received money or goods in exchange for sex) and feared for safety over the last year.

We conducted a logistic regression using complete case analysis of female participants with viral load data (n=276) to determine associations between suboptimal care and the derived clusters, with cluster 4, our oldest cluster, serving as our reference group (Table 4.7). Results indicate that cluster 2 was nearly 2.5 times more likely to experience suboptimal care compared with cluster 4 (AOR: 2.49; 95% CI: 1.21-5.13), with no other clusters being associated with suboptimal care.

Table 4.6 Female cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Variables	1 n=83 (21.8%)	2 n=85 (22.3%)	3 n=124 (32.5%)	4 n=89 (23.4%)
Demographics	Median age: 32 yrs Marital status: Single (24%) Marital status: Married (30%) Living w/ children (61%) Informal employment (12%) Informal illegal employment (55%) Unstable housing (16%) Temporary housing (6%) Living outside in open (11%) Relocation/mobility (30%)	Median age: 33 yrs Marital status: Single (74%) Marital status: Married (15%) Living w/ children (66%) Informal employment (21%) Informal illegal employment (75%) Unstable housing (13%) Temporary housing (6%) Living outside in open (2%) Relocation/mobility (13%)	Median age: 35 yrs Marital status: Single (63%) Marital status: Married (30%) Living w/ children (63%) Informal employment (29%) Informal illegal employment (45%) Unstable housing (11%) Temporary housing (5%) Living outside in open (6%) Relocation/mobility (12%)	Median Age: 39 yrs Marital status: Single (0%) Marital status: Married (1%) Living w/ children (48%) Informal employment (28%) Informal illegal employment (49%) Unstable housing (8%) Temporary housing (5%) Living outside in open (1%) Relocation/mobility (15%)
HIV	>7 yrs living w/ HIV (23%) 3+ HIV barriers to care (15%) Barrier to care: Cost (13%) Barrier to care: Transport (51%) Barrier to care: Admin (27%) Barrier to care: Stigma (16%)	>7 yrs living w/ HIV (19%) 3+ HIV barriers to care (44%) Barrier to care: Cost (21%) Barrier to care: Transport (53%) Barrier to care: Admin (51%) Barrier to care: Stigma (65%)	>7 yrs living w/ HIV (24%) 3+ HIV barriers to care (0%) Barrier to care: Cost (1%) Barrier to care: Transport (11%) Barrier to care: Admin (3%) Barrier to care: Stigma (17%)	>7 yrs living w/ HIV (40%) 3+ HIV barriers to care (2%) Barrier to care: Cost (1%) Barrier to care: Transport (32%) Barrier to care: Admin (23%) Barrier to care: Stigma (36%)
Drug use (past month)	Poly substance use (64%) Concern for drug quality (66%) Personal OD (46%) Current methadone use (39%)	Poly substance use (82%) Concern for drug quality (48%) Personal OD (37%) Current methadone use (12%)	Poly substance use (54%) Concern for drug quality (61%) Personal OD (19%) Current methadone use (11%)	Poly substance use (67%) Concern for drug quality (27%) Personal OD (29%) Current methadone use (9%)
Injection drug use	>= 4 years IDU (39%) IDU Location: Uninhab building (57%) Injected alone (25%) Rushed injection (40%) Shared needles (6%)	>= 4 years IDU (42%) IDU Location: Uninhab building (0%) Injected alone (40%) Rushed injection (78%) Shared needles (13%)	>= 4 years IDU (36%) IDU Location: Uninhab building (2%) Injected alone (39%) Rushed injection (54%) Shared needles (7%)	>= 4 years IDU (42%) IDU Location: Uninhab building (3%) Injected alone (15%) Rushed injection (49%) Shared needles (9%)
Sexual Behaviors	3+ new sex partners (35%) M/F sex partners (6%) >10 sex acts (33%) No condom use during last sex (48%) Received goods/money for sex (82%) Sex w/ PLWH (46%)	3+ new sex partners (40%) M/F sex partners (6%) >10 sex acts (62%) No condom use during last sex (40%) Received goods/money for sex (94%) Sex w/ PLWH (21%)	3+ new sex partners (19%) M/F sex partners (5%) >10 sex acts (40%) No condom use during last sex (40%) Received goods/money for sex (72%) Sex w/ PLWH (30%)	3+ new sex partners (36%) M/F sex partners (2%) >10 sex acts (37%) No condom use during last sex (33%) Received goods/money for sex (82%) Sex w/ PLWH (43%)
Violence (past year)	Physical violence (52%) Sexual violence (25%) Fear for safety (6%)	Physical violence (32%) Sexual violence (8%) Fear for safety (12%)	Physical violence (24%) Sexual violence (7%) Fear for safety (4%)	Physical violence (26%) Sexual violence (8%) Fear for safety (7%)

Note: Characteristics with the highest proportion highlighted in red

Table 4.7 Female clusters associated with suboptimal care (k=4)

	Proportion Suboptimal Care	OR	95% CI	p-value	AOR[1]	95% CI	p-value
Cluster 1	23 of 51 (45.1%)	1.64	(0.79-3.41)	0.18	1.88	(0.85-4.16)	0.12
Cluster 2	29 of 55 (52.7%)	2.40	(1.17-4.90)	0.02	2.49	(1.21-5.13)	0.02
Cluster 3	30 of 95 (31.6%)	1.11	(0.59-2.11)	0.74	1.15	(0.60-2.18)	0.67
Cluster 4	25 of 75 (33.1%)	1.00	ref				

OR: odds ratio: AOR: Adjusted odds ratio; CI: confidence interval
[1]Adjusted for recruitment region (i.e., Nairobi, Coastal Kenya)

Discussion

In summary, this study stems from a pragmatic research question aiming to identify PWID-LH sub-groups and assessing which groups are more likely to experience suboptimal care. In addition, we conducted conventional univariate analyses to determine whether results from the cluster analysis would provide us with additional information on PWID-LH experiencing suboptimal, with the goal of using analyses results to help foster discussions around HIV program and service recommendations. Prior qualitative research (Chapter 3) and bivariate comparisons of male and female participants, indicated these groups are distinctly different in terms of environmental risks, which informed our univariate and cluster analyses that were stratified by sex. Univariate analyses indicated that men have fewer HIV environmental risks associated with suboptimal care (i.e., conducting informal work and having one HIV care barrier), whereas women had eight environmental risks associated with suboptimal care (i.e., unstable housing features, experiencing multiple HIV care barriers, including stigma, safety concerns, and having up to two new sexual partners). Cluster analyses yielded additional information on HIV risk profiles, with four underlying clusters identified for men and women. While none of the male clusters were associated with suboptimal care, one female cluster was 2.5 times more likely to experience suboptimal care and possessed a higher proportion of women who were single, living with children, engaged in informal illegal employment (i.e., sex work, theft, or selling drugs), living in temporary housing, experiencing multiple HIV care barriers (i.e., cost, transportation, administration and stigma), engaged in polysubstance use and injection drug use, engaged in sexual risk behaviors and reported safety concerns. The clustering of these variables indicates that among women who inject drugs (WWID) in Kenya, there may be a distinct subset of women with a set of behavioral and sociodemographic characteristics that combine to create barriers to HIV care engagement. Findings point to increasing HIV programs and services that address the needs of WWID, with careful consideration given to women that possess similar risk profiles as the cluster identified as most likely to experience suboptimal care.

Understanding women who inject drugs (WWID)

We identified several co-occurring risks that affected HIV care outcomes for women who inject drugs living with HIV (WWID-LH) including a high prevalence of being single, living with children, engaging in informal illegal employment (i.e., sex work, theft, selling drugs), currently living in temporary

housing, experiencing multiple HIV barriers (i.e., cost, transportation, administration, stigma), engaging in injection risks (i.e., injecting alone, rushed injections, or shared needles), engaging in sexual behaviors (i.e., 3 or more new sexual partners in the previous 3-months, engaging in 10 or more sex acts, or ever having male and/or female partners) and fearing for one's safety. Several of the cluster profile characteristics overlapped with findings in the univariate analysis (e.g., single, living with children, housing instability, safety concerns) with the exception that several drug use, injection drug use and sexual risks were not significant in the univariate analysis, but had a high prevalence in the cluster associated with suboptimal care. In addition, there were several notable differences between men and women, with WWID-LH indicating a higher prevalence of stigma as a barrier to care and lower prevalence of methadone use, which supports prior evidence that women often have the time and transportation to access HIV and harm reduction services, but are hindered by the physical environments where HIV and harm reduction services are delivered, which are often male-dominate, unwelcoming and unsafe. [114,122] Several countries are calling for a shift from generic PWID programs and services, to tailored services that meet the unique needs of women including women only facilities that offer reproductive health services, intimate partner violence (IPV) programs, childcare services, group housing and food access. [114,123-125] Our findings, support such global efforts that advocate for tailored research, treatment and services for WWID-LH in Kenya. [114]

Understanding men who inject drugs

While conducting a cluster analysis was particularly useful in identifying profiles of WWID-LH with experiences of suboptimal HIV care, this method did not prove to be useful for men who inject drugs living with HIV. Univariate analysis provided information on individual characteristics associated with an increased likelihood of experiencing suboptimal care, which included experiencing one HIV care barrier and informal employment that largely consisted of day laborers, recycling goods, construction and beach boys, with the later based in Coastal Kenya. Future interventions that address the needs of men, may consider places of employment (e.g., dumping yards, open-air markets, construction sites, and beach towns) for targeted HIV campaigns. To better understand the needs of men who inject drugs, additional qualitative research may be applied to understand unmeasured HIV risks (e.g., incarceration) and how established environmental risks (i.e., employment barriers and service design) can affect HIV care

outcomes. Though clusters were not associated with suboptimal HIV care, they can be used to assess other outcomes of interest (e.g., co-infection with COVID-19, hepatitis, tuberculosis) when the underlying assumptions align including, the theoretical underpinnings of the risk environment framework, outcome measure was not included in the cluster analysis, and underlying PWID sub-groups exist.

Cluster analysis vs. univariate logistic regression

We leveraged two analysis techniques, which assessed suboptimal care through a) univariate logistic regression analysis and b) exploratory hierarchical cluster analysis, applying Wards method to asses cluster linkage. The cluster analysis was useful in identifying underlying subgroups of PWID-LH, which provided a different understanding of how individual risks come together to shape suboptimal HIV care compared with the univariate analyses that highlighted associations between individual risks and suboptimal care. Cluster analysis allows us to consider multiple variables simultaneously to uncover underlying similarities and differences within the data, where univariate and multivariate analyses require moderate or no multicollinearity between independent variables, which limits our variable selection and can complicate the interpretation of results.[117,126] Mainly, cluster analysis provides a more realistic overview of who may be affected by an outcome and moves us closer to understanding mechanistically, which risks come together to effect HIV care. Applied together, cluster and univariate analyses offered different perspectives and opportunities to identify individuals experiencing suboptimal care. Still questions remain on (a) identifying PWID-LH at higher risk of experiencing suboptimal care, in order to design more tailored prevention interventions, and (b) understand mechanistically, which risk factors, services or programs may be causing suboptimal care. Where possible, we should be moving towards processes and tools, like intake forms, that identify individuals who are more likely to experience suboptimal care than others, so that we can provide better support and wraparound services like mental health counseling, patient navigation and peer support.

Limitations

There were several limitations within our study, including enrolled participants were already more apt to seeking harm reduction and HIV care services, which limits the generalizability to more difficult to reach, non-service seeking PWID-LH. Second, most information was self-reported, including parts of our derived outcome variable of suboptimal care (i.e., discontinued ART and HIV care), and therefore subject

to recall and social desirability biases. Third, the cross-sectional design limited our ability to provide causal inference, but did allow us to uncover underlying subgroups of PWID-LH, which may or may not change overtime. Fourth, one of the parent study's exclusion criteria included experiences of moderate to severe partner violence, which is likely to be more prevalent in WWID-LH than men, and could affected cluster development and predictions of clusters more likely to experience suboptimal care. Finally, prevalence of suboptimal HIV care was similar between men and women; however, neither cluster nor univariate analysis highlighted as many characteristics associated with suboptimal HIV care in men compared with women, which suggests additional qualitative inquiries are needed to assess unmeasured variables like incarceration, mental health, employment influences, etc.

Conclusions

Our exploratory hierarchical cluster analysis was useful in identifying subgroups of PWID-LH, which provided a better understanding of how individual risks come together to shape suboptimal HIV care compared with the conventional univariate analyses that highlighted associations between individual risks and suboptimal care. This was particularly useful in revealing risk characteristics for WWID-LH with experiences of suboptimal HIV care, but did not prove to be useful for men who inject drugs. Future studies should continue to focus on groups of PWID-LH that struggle to maintain their HIV care, including how current HIV services may cause people to fall out of care. Findings can be used to advocate for women-specific HIV programs and services, and interventions should focus on women with risk profiles that are more likely to experience suboptimal care.

Chapter 5: Concluding statements

Summary

The three studies presented leveraged the strengths of both qualitative and quantitative methods to better understand pragmatic research questions related to HIV environmental risks and their influences on suboptimal HIV care among persons who inject drugs living with HIV (PWID-LH) in Kenya. Applying the Rhodes risk environment framework [25,26] and the Modified Social Ecological Model (MSEM), [60] we were able to map HIV risks and barriers that largely fall outside of an individual's control, and descriptively, these figures can be used to guide practical intervention recommendations. Peer educators offered unique perspectives, providing both lived and professional experiences on barriers and facilitators to HIV and HCV care, and resource recommendations to improve service uptake. Recently injecting PWID-LH, qualitatively characterized the HIV risk environment, which provided insight as to how the environment may affect HIV treatment, engagement in care and viral suppression. Coupled with an exploratory quantitative data analysis that applied hierarchical clustering techniques, we were able to characterize underlying subgroups within PWID-LH communities, which were stratified by gender, and highlighted the degree to which specific subgroups experienced suboptimal care. Data triangulation, the process of using a variety of data sources and informants, provided a more robust understanding of how HIV barriers and risks translate into suboptimal care. [127,128] Considered together, our novel approach leverages the strengths of both qualitative and quantitative methods and findings can be used to modify HIV programing and services that aim to improve the health and wellbeing of PWID-LH.

Peer educators highlighted barriers and facilitators to HIV and HCV care within each level of the MSEM which considers individuals, social networks, communities and policies, with stigma identified as an overarching theme that impacted each level of the MSEM. We add to the current literature on stigma, discrimination, violence, transport barriers, and limited access to OAT services, which penetrated each ecological level from individuals to public policies. Many of the themes were consistent with recently injecting PWID-LH, with several barriers falling outside of an individual's control, highlighting the need for more structural and community-based interventions. In anticipation of the national release of DAA's, peer educators brought an awareness to the limited HCV prevention and service knowledge that should be addressed with PWID communities. In addition, peer educators advocated for providing integrated

medical, social and support services (e.g., HIV, OAT, HCV, mental health, wound care) tailored to the needs of PWID-LH, but with careful consideration given to confidentiality concerns. Mainly, clinical facilities are often limited in terms of space and privacy, which could discourage PWID-LH from accessing integrated services. Finally, peer educators and recently injecting PWID-LH highlighted community and politically derived violence, which largely impacted HIV service uptake and engagement. Moreover, both peer educators and recently injecting PWID-LH described unique factors within the physical, social, economic and political environments that impact HIV and HCV care, that may not affect the general population, which should be given careful consideration when designing and implementing HIV and HCV policies and services within Kenya.

In addition, recently injecting PWID-LH described three non-traditional physical environments that contribute to and support HIV risks in Kenya: urban settings, peri-urban settings and incarceration facilities. Most research and government evaluations look to county-jurisdictions as units of analysis [5,81]; however, our findings suggest that smaller geographical units may offer better spatial precision and clarity around HIV service needs. Urban settings offered more heath and harm reduction services, but were associated with violence, displacement and high cost of living. Additionally, group homes possess both risks, in the form of needle-sharing, and protective factors, in the form of supportive networks that could be leveraged in future intervention development. Alternatively, peri-urban areas lacked access to health and harm reduction services, with transportation identified as a major barrier to accessing care; however, these areas offered affordable housing, as well as, safety and protection from violence. We encountered the unanticipated theme that incarceration facilities present very different HIV environmental risks due to their limited HIV and harm reduction services, despite having access to illicit substances within facilities. Recidivism, or the process of re-incarceration among PWID-LH, is often a reality among criminalized groups, and may offer “reachable moments” to engage with PWID-LH who may not be aware of their HIV status or have discontinued their treatment or care.[101,129] Tailoring HIV programs and services to the three physical environments within and around Kenya, may reduce HIV risks and support HIV care outcomes.

The exploratory hierarchical cluster analysis was useful in identifying subgroups of PWID-LH, which provided a different understanding of how individual risks come together to shape suboptimal HIV care compared with the conventional univariate analyses that highlighted associations between individual

risks and suboptimal care. This was particularly useful for women who inject drugs living with HIV (WWID-LH) with experiences of suboptimal HIV care, but did not prove to be useful in predicting suboptimal care outcomes for men who inject drugs. Mainly, we identified several risks that affected HIV care outcomes for WWID-LH including a high prevalence of being single, living with children, engaging in informal illegal employment (i.e., sex work, theft, selling drugs), currently living in temporary housing, experiencing multiple HIV barriers (i.e., cost, transportation, administration, stigma), engaging in injection risks (i.e., injecting alone, rushed injections, or shared needles in the previous month), engaging in higher-risk sexual behaviors (i.e., 3 or more new sexual partners in the previous 3-months, engaging in 10 or more sex acts in the previous 3-months, or ever having sex with both male and female partners) and fearing for one's safety over the last year. Moreover, findings from both qualitative and quantitative studies suggest that WWID have different risk profiles and experience greater magnitudes of risk compared to men, which should be considered by HIV funding and service organizations.

Recommendations

Our HIV service recommendations include partnering with harm reduction facilities and drawing upon the untapped perspectives of peer educators who understand the unique needs of PWID, in order to improve HIV service uptake and engagement. While highly educated healthcare professionals like clinicians, nursing staff and administrators offer insight into HIV service delivery, the value and experience of para-professionals like peer educators should not be overlooked. Peer educators who provide grassroots harm reduction services have the responsibility of connecting service provider to service user, and their expertise can be incorporated at each stage of HIV service and program development.

In addition, our findings support the implementation of multi-leveled interventions that go beyond changing individual-level behaviors. Distal interventions that work towards structural and policy-level changes, should not be discounted as unachievable, resource intense solutions, but should draw from the momentum of recent harm reduction policies and coalitions. This momentum should be applied to policies that decriminalize personal substance use and incorporate medicalized approaches that offer OAT or incarceration options to individuals arrested for drug use and/or possession.[15] Medicalized approaches have been piloted across a few of Nairobi's law enforcement agencies, but have yet to establish national support. Similarly, harm reduction educational trainings for police and medical professionals were

previously implemented in Kenyan counties with a high density of PWID; however, trainings could be offered regularly to ensure that law enforcers and medical providers have all been exposed to and are implementing evidence-based harm reduction strategies.

In Kenya, WWID are disproportionally affected by HIV, but they also possess a different risk profile than men who inject drugs and may not be comfortable accessing services in male dominate facilities, particularly if they have children.[5] Several countries have moved towards women-only facilities that not only address issues of substance use and HIV, but also provide support for women experiencing partner violence, childcare, reproductive healthcare and other social services.[114,123] Understanding that HIV funding resources may be limited, more proximal cost-effective interventions may include having facilities offer days or hours that are only for women or pairing the most experienced female peer educators with WWID-LH who are experiencing multiple environmental risks that are associated with suboptimal care. Thus, working towards both distal HIV interventions that provide non-judgmental, safe spaces for WWID-LH and more proximal HIV interventions that pair experienced peer educators with WWID-LH, may improve HIV care outcomes among an extremely marginalized group.

Finally, our study findings suggest that public health professionals should continue working towards offering services outside of Nairobi's city limits through transportation vouchers, mobile clinics within peri-urban settings, and take-home OAT options, like buprenorphine. Flexible OAT options, like buprenorphine, address transportation costs and interference with employment that are large barriers associated with daily clinic visits that are required for methadone. Buprenorphine and methadone are both on Kenya's Essential Medicines List, but buprenorphine is largely cost prohibitive and limited to internationally funded programs.[73] International funding organizations, like PEPFAR, have set OAT service goals that outline 40% of PWID should have access to OAT services, but they do not provide specific guidance or support for OAT options that could benefit marginalized, peri-urban communities.[130] Addressing this oversight, providing additional OAT funding and offering more flexible OAT options has the potential to close Kenya's OAT service gap and improve HIV care outcomes.

Future Directions

Future studies should continue to incorporate ecological frameworks to better understand the complex nature of HIV risk and barriers to care, which should be followed by interventions that consider

where people live, work and travel, so that we can provide better patient-centered care that addresses HIV, addiction and co-morbidity service needs in parallel. Our characterization of the physical risk environments offers insight to HIV risk production; however, current HIV service evaluations and resource allocations are based on larger county jurisdictions.[81] Future evaluations should explore various spatial units of analysis (e.g., rural, peri-urban, urban) that fall outside of the traditional county jurisdictions in order to provide more targeted resource allocations. Similarly, research should be comprised of interdisciplinary teams that include health professionals, demographers and policy experts to track and address underlying issues of suboptimal care.

Furthermore, while this body of evidence offers a step towards identifying individuals experiencing suboptimal care, additional work is needed to (a) identify PWID-LH at higher risk of experiencing suboptimal care, in order to design more tailored prevention interventions and (b) understand mechanistically, which risk factors, services or programs may be causing suboptimal care. Ultimately, we should be moving towards processes and tools, like intake forms, that identify individuals who are more likely to experience suboptimal care than others, so that we can provide better support and wraparound services like mental health counseling, patient navigation and peer support. Additionally, tailoring services to PWID-LH who need them most is a more cost-effective strategy than a one-size fits all approach that offers the same resources to every individual. As HIV researchers, specialists and clinical professionals, we should be advocating for the inclusion of community health workers and peer educators at each stage of service development, from design, to implementation and evaluation. Their perspectives are rarely requested, despite being at the forefront of service delivery and should be seen as an opportunity to improve HIV service uptake.

In closing, interdisciplinary research studies are needed to continue exploring the underpinnings of PWID-LH characteristics, including environmental risks, and their influences on the later stages of the HIV care continuum, particularly engagement in care, treatment adherence, and viral suppression to better serve PWID-LH communities in Kenya.

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Supplemental Materials

Figure A: Depicting cluster analysis using Ward's Method with SHARP study participants (n=783)

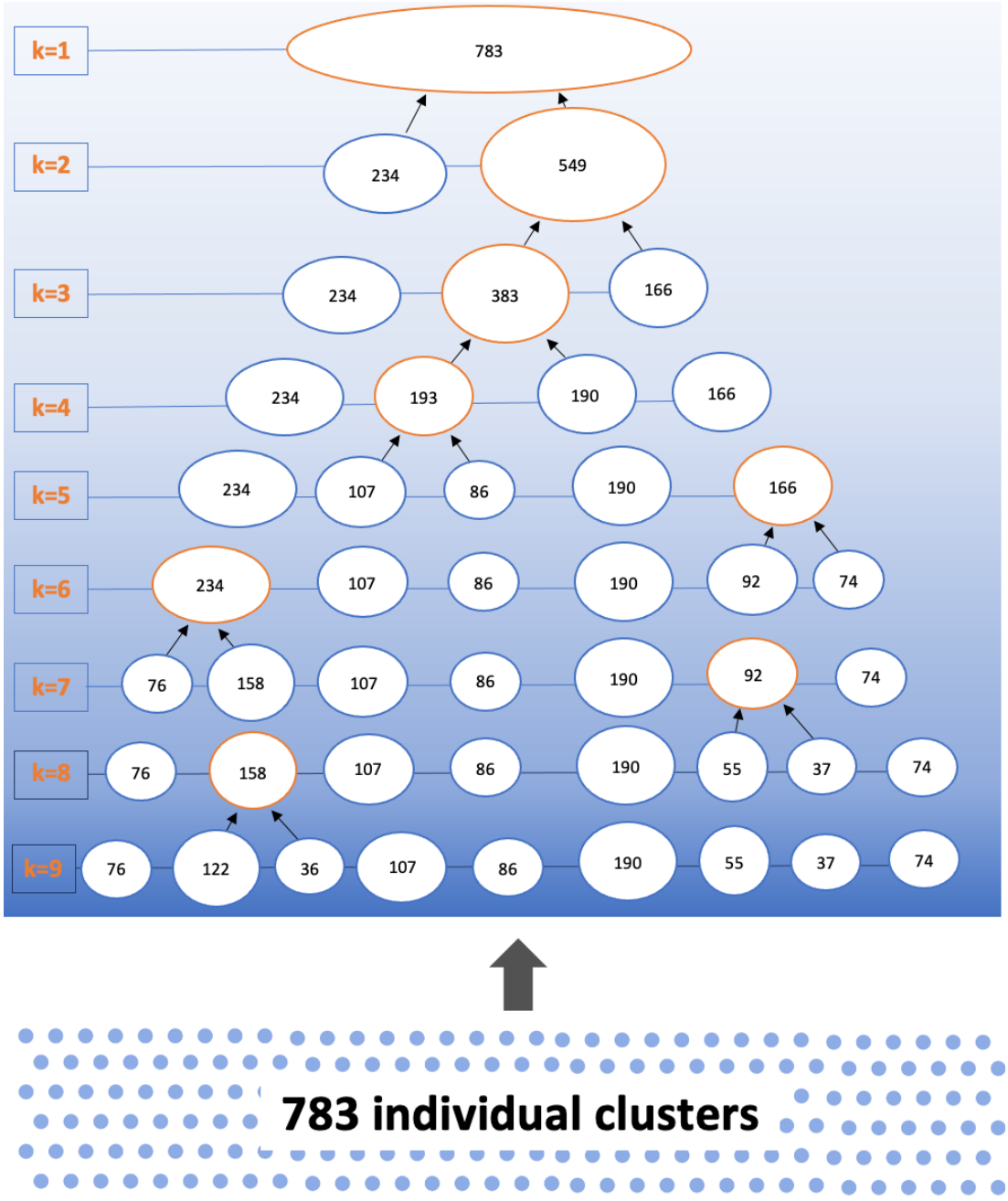

Table A: SHARP participant baseline characteristics associated with suboptimal care (n=783)

	Crude OR	95% CI	p-value	Adj OR	95% CI	p-value
Demographics						
Age: 18-30 yrs (ref)						
Age: 31-40 yrs	0.72	0.47-1.11	0.14	0.76	0.49-1.17	0.21
Age: 41-50 yrs	0.45	0.27-0.74	**0.002**	0.48	0.29-0.79	**0.004**
Age: >50 yrs	0.74	0.33-1.66	0.47	0.79	0.35-1.79	0.57
Rel Status: Single (ref)						
Rel Status: Married	0.61	0.39-0.96	**0.03**	0.63	0.40-1.01	0.06
Rel Status: Partnered	0.95	0.23-2.24	0.91	0.92	0.39-2.19	0.85
Rel Status: Divorced/Separated	0.71	0.51-1.10	0.13	0.73	0.47-1.14	0.16
Rel Status: Widowed	0.66	0.37-1.20	0.18	0.69	0.37-1.24	0.21
Children <18 yrs: 0 (ref)						
Children <18 yrs: 1	0.58	0.37-0.90	**0.02**	0.53	0.33-0.83	**0.01**
Children <18 yrs: 2 or more	0.65	0.43-0.97	**0.04**	0.59	0.39-0.90	**0.01**
Income cat: Formal employment	0.62	0.42-0.92	**0.02**	0.68	0.45-1.04	0.08
Income cat: Formal Self-employment	1.13	0.78-1.62	0.52	1.07	0.74-1.54	0.73
Income cat: Informal illegal work	0.97	0.70-1.34	0.85	0.85	0.60-1.22	0.38
Income cat: Informal work	1.03	0.74-1.43	0.88	1.02	0.73-1.44	0.90
Income cat: Other	1.14	0.72-1.81	0.58	1.09	0.67-1.76	0.73
Num incomes: 0 (ref)						
Num incomes: 1	0.75	0.38-1.49	0.41	0.77	0.39-1.55	0.17
Num incomes: >1	0.63	0.30-1.33	0.23	0.61	0.28-1.29	0.20
Stable housing: Yes (ref)						
Stable housing: No	2.07	1.37-3.14	**<0.001**	2.08	1.37-3.16	**<0.001**
Slept past month: Home (personal, friends, relatives) (ref)						
Slept past month: Outside in the open	1.89	1.06-3.36	**0.03**	1.95	1.09-3.49	**0.01**
Slept past month: Temporary housing	2.47	1.36-4.48	**0.003**	2.37	1.29-4.34	**0.02**
Seven nights away from area: No (ref)						
Seven nights away from area: Yes	0.98	0.66-1.44	0.90	1.11	0.74-1.67	0.61
HIV diagnosis, year positive, barriers						
Yrs HIV positive: <3 (ref)						
Yrs HIV positive: 3-7	0.75	0.53-1.09	0.13	0.79	0.55-1.13	0.20
Yrs HIV positive: >7	0.51	0.35-0.75	**<0.001**	0.54	0.37-0.80	**0.001**
Barrier to care: not cost (ref)						
Barrier to care: cost	1.46	0.89-2.37	0.13	1.67	1.01-2.77	**0.04**
Barrier to care: not transportation (ref)						
Barrier to care: transportation	0.95	0.70-1.30	0.76	1.07	0.77-1.48	0.67
Barrier to care: not clinicians (ref)						
Barrier to care: clinicians	1.13	0.76-1.68	0.54	1.16	0.77-1.73	0.48
Barrier to care: not stigma (ref)						
Barrier to care: stigma	1.75	1.25-2.44	**0.001**	1.61	0.14-2.27	**0.01**
Barrier to care: not administrative (ref)						

Barrier to care: Administrative	1.10	0.77-1.56	0.61	1.64	0.81-1.64	0.44
Number of barriers: 0 (ref)						
Number of barriers: 1	1.99	1.35-2.95	**<0.001**	2.01	1.35-2.98	**<0.001**
Number of barriers: 2	1.10	0.71-1.70	0.67	1.12	0.72-1.74	0.61
Number of barriers: 3 or more	1.57	1.00-2.46	0.05	1.68	1.07-2.65	**0.03**
Violence						
Violence physical: no (ref)						
Violence physical: yes	0.83	0.61-1.16	0.28	0.86	0.58-1.27	0.43
Violence sexual: no (ref)						
Violence sexual: yes	0.64	0.35-1.17	0.15	0.68	0.36-1.25	0.21
Threaten violence: no (ref)						
Threaten violence: yes	0.81	0.54-1.24	0.16	0.96	0.62-1.49	0.85
Worried about safety: no (ref)						
Worried about safety: yes	2.04	1.17-3.55	**0.01**	2.01	1.15-3.50	**0.01**
Sexual Behaviors						
Number of sex partner (past 3 month): 0 partners (ref)						
Number of sex partner (past 3 month): 1-2 partners	0.98	0.69-1.39	0.90	1.14	0.78-1.65	0.50
Number of sex partner (past 3 month): 3 or more partners	0.93	0.63-1.39	0.73	0.96	0.63-1.45	0.84
Partner types: opposite sex (ref)						
Partner types: both sexes	0.38	0.16-0.93	**0.03**	0.42	0.17-1.07	**0.05**
Partner types: same sex	0.20	0.03-1.55	0.12	0.22	0.03-1.67	0.14
Number times sex (past month): 0 times (ref)						
Number times sex (past month): 1-10	0.85	0.59-1.22	0.37	0.83	0.57-1.21	0.33
Number times sex (past month): >10 times	1.14	0.76-1.71	0.52	0.99	0.64-1.53	0.96
Condom use (last sex act): no (ref)						
Condom use (last sex act): yes	0.85	0.63-1.16	0.31	0.84	0.61-1.15	0.27
Condom use (last sex act): not sure	0.94	0.28-3.13	0.92	1.03	0.31-3.45	0.96
Ever received money or goods for sex: no (ref)						
Ever received money or goods for sex: yes	1.00	0.74-1.36	0.98	0.84	0.58-1.22	0.36
Ever given money or goods for sex: no (ref)						
Ever given money or goods for sex: yes	0.72	0.52-0.99	**0.05**	0.80	0.53-1.21	0.29
Sex w/ PLWH (last year): no (ref)						
Sex w/ PLWH (last year): yes	0.74	0.53-1.03	0.08	0.74	0.54-1.04	0.09
Substance Use						
Heroin: no (ref)						
Heroin: yes	1.41	0.79-2.53	0.24	1.29	0.72-2.34	0.39
Methamphetamine: no (ref)						
Methamphetamine: yes	0.83	0.48-1.44	0.52	0.81	0.46-1.41	0.45
Cocaine: no (ref)						
Cocaine: yes	1.13	0.63-2.04	0.66	1.22	0.67-2.20	0.51
Benzodiazepines: no (ref)						
Benzodiazepines: yes	0.70	0.37-1.33	0.28	0.77	0.40-1.47	0.43
Khat: no (ref)						

Khat: yes	0.83	0.53-1.33	0.44	0.88	0.55-1.41	0.59
Alcohol: no (ref)						
Alcohol: yes	0.88	0.63-1.21	0.42	0.84	0.60-1.16	0.29
Other: no (ref)						
Other: yes	0.88	0.57-1.38	0.58	0.79	0.50-1.25	0.31
Poly-substance use: no (ref)						
Poly-substance use: yes	1.08	0.78-1.48	0.65	1.05	0.76-1.44	0.77
Ease locating drugs: yes (ref)						
Ease location drugs: no	0.81	0.58-1.16	0.25	0.87	0.61-1.24	0.45
Concerned about drug quality: no (ref)						
Concerned about drug quality: yes	0.97	0.71-1.34	0.87	1.30	0.89-1.88	0.17
Ever overdose: no (ref)						
Ever overdose: yes	0.81	0.59-1.10	0.18	0.89	0.64-1.23	0.48
Ever witness fatal overdose: no (ref)						
Ever witness fatal overdose: yes	1.17	0.84-1.61	0.35	1.17	0.84-1.62	0.36
Currently on methadone: no (ref)						
Current on methadone: yes	0.64	0.43-0.95	**0.03**	0.77	0.48-1.09	0.12
Injection Drug Use						
Years injecting drugs: <4 yrs (ref)						
Years injecting drugs: ≥4 yrs	0.91	0.67-1.23	0.53	0.97	0.70-1.33	0.83
Injections per day: 0 times (ref)						
Injections per day: 1 time	0.68	0.32-1.44	0.31	0.74	0.35-1.57	0.43
Injections per day: 2 or more	0.78	0.41-1.50	0.46	0.87	0.45-1.69	0.69
Injection location: home (ref)						
Injection location: den	0.92	0.60-1.42	0.71	0.86	0.55-1.34	0.49
Injection location: street/public	1.20	0.48-2.99	0.70	1.12	0.45-2.83	0.81
Injection location: uninhabited structure	0.67	0.39-1.34	0.14	0.77	0.45-1.35	0.37
Injection location: other	0.20	0.04-0.90	**0.04**	0.18	0.04-0.82	**0.03**
Inject alone (past month): no (ref)						
Inject alone (past month): yes	0.99	0.73-1.36	0.97	1.09	0.79-1.50	0.62
Injected w/ non-IDU friend (past month): no (ref)						
Injected w/ non-IDU friend (past month): yes	0.97	0.68-1.39	0.86	1.15	0.78-1.69	0.48
Injected w/ IDU friend (past month): no (ref)						
Injected w/ IDU friend (past month): yes	1.05	0.71-1.56	0.79	0.97	0.65-1.44	0.86
Injected w/ non-IDU sex partner (past month): no (ref)						
Injected w/ non-IDU sex partner (past month): yes	0.83	0.50-1.51	0.54	0.93	0.50-1.70	0.81
Injected w/ IDU sex partner (past month): no (ref)						
Injected w/ IDU sex partner (past month): yes	1.02	0.66-1.59	0.92	1.05	0.66-1.64	0.85
Injected w/ stranger (past month): no (ref)						
Injected w/ stranger (past month): yes	1.44	0.59-3.52	0.42	1.66	0.67-4.09	0.27

Injected w/ family (past month): no (ref)						
Injected w/ family (past month): yes	0.77	0.08-7.46	0.82	0.76	0.08-7.40	0.82
Rushed injection: no (ref)						
Rushed injection: yes	1.00	0.74-1.36	0.99	0.95	0.69-1.30	0.74
Reason rushed injection: People: no (ref)						
Reason rushed injection: People: yes	0.47	0.19-1.13	0.09	0.58	0.22-1.38	0.21
Reason rushed injection: Withdrawal: no (ref)						
Reason rushed injection: Withdrawal: yes	1.11	0.82-1.51	0.51	1.04	0.76-1.43	0.79
Reason rushed injection: Police: no (ref)						
Reason rushed injection: Police: yes	1.18	0.70-1.99	0.55	1.22	0.72-2.07	0.46
Ever shared needles: no (ref)						
Ever shared needles: yes	0.98	0.52-1.87	0.95	0.86	0.45-1.66	0.66
First on needle: no (ref)						
First on needle: yes	1.17	0.51-2.63	0.71	1.03	0.45-2.36	0.94
Second on needle: no (ref)						
Second on needle: yes	1.16	0.59-2.32	0.66	1.03	0.51-2.05	0.94
Ever inject another's blood "flashblood": no (ref)						
Ever inject another's blood "flashblood": yes	0.32	0.10-1.09	0.07	0.30	0.09-1.04	0.06

Figure B: Dendrograms following hierarchical cluster analysis using Ward's Method with SHARP participants (n=783).

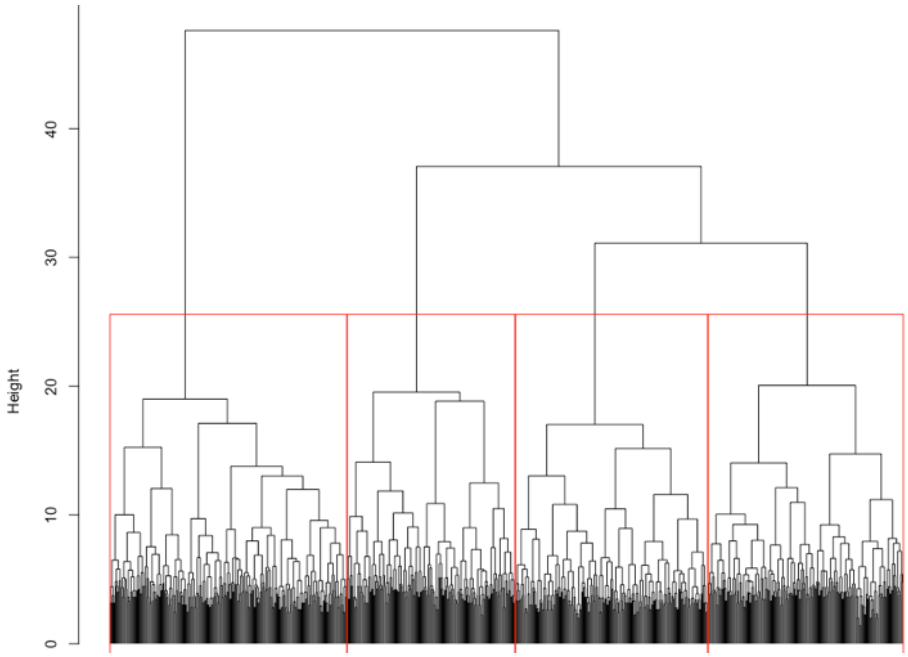

Table B: SHARP participant cluster characteristics according to demographics, HIV barriers, drug use, injection drug use, sexual behaviors and violence

Variables	2 n=193 (24.6%)	3 n=190 (24.3%)	4 n=166 (21.2%)	1 n= 234 (29.9%)
Demographics	Median age: 35 yrs Majority males (52%) Marital status: Single (61%) Marital status: Married (34%) Living w/ children (52%) Informal employment (30%) Informal illegal employment (42%) Unstable housing (17%) Temporary housing (8%) Living outside in open (6%) Relocation/mobility (19%)	Median age: 36 yrs Majority females (62%) Marital status: Single (62%) Marital status: Married (37%) Living w/ children (57%) Informal employment (34%) Informal illegal employment (33%) Unstable housing (13%) Temporary housing (5%) Living outside in open (7%) Relocation/mobility (9%)	Median age: 37 yrs Majority males (64%) Marital status: Single (33%) Marital status: Married (30%) Living w/ children (49%) Informal employment (26%) Informal illegal employment (37%) Unstable housing (10%) Temporary housing (8%) Living outside in open (1%) Relocation/mobility (19%)	Median Age: 38 yrs Majority males (53%) Marital status: Single (0%) Marital status: Married (1%) Living w/ children (41%) Informal employment (31%) Informal illegal employment (28%) Unstable housing (15%) Temporary housing (5%) Living outside in open (9%) Relocation/mobility (16%)
HIV	Newly diagnosed (16%) >7 yrs living w/ HIV (22%) 3+ HIV barriers to care (40%) Barrier to care: Cost (19%) Barrier to care: Transport (68%) Barrier to care: Admin (48%) Barrier to care: Stigma (53%)	Newly diagnosed (6%) >7 yrs living w/ HIV (31%) 3+ HIV barriers to care (0%) Barrier to care: Cost (2%) Barrier to care: Transport (6%) Barrier to care: Admin (3%) Barrier to care: Stigma (15%)	Newly diagnosed (9%) >7 yrs living w/ HIV (39%) 3+ HIV barriers to care (18%) Barrier to care: Cost (12%) Barrier to care: Transport (55%) Barrier to care: Admin (25%) Barrier to care: Stigma (8%)	Newly diagnosed (7%) >7 yrs living w/ HIV (35%) 3+ HIV barriers to care (10%) Barrier to care: Cost (7%) Barrier to care: Transport (38%) Barrier to care: Admin (23%) Barrier to care: Stigma (27%)
Drug use (past month)	Poly substance use (73%) Concern for drug quality (59%) Personal OD (45%) Current methadone use (26%)	Poly substance use (50%) Concern for drug quality (64%) Personal OD (25%) Current methadone use (13%)	Poly substance use (68%) Concern for drug quality (80%) Personal OD (54%) Current methadone use (40%)	Poly substance use (64%) Concern for drug quality (57%) Personal OD (38%) Current methadone use (15%)
Injection drug use	>= 4 years IDU (53%) IDU Location: Uninhab building (2%) Injected alone (39%) Rushed injection (70%) Shared needles (10%)	>= 4 years IDU (50%) IDU Location: Uninhab building (2%) Injected alone (37%) Rushed injection (60%) Shared needles (5%)	>= 4 years IDU (56%) IDU Location: Uninhab building (76%) Injected alone (41%) Rushed injection (63%) Shared needles (2%)	>= 4 years IDU (50%) IDU Location: Uninhab building (6%) Injected alone (35%) Rushed injection (42%) Shared needles (6%)
Sexual Behaviors	3+ new sex partners (21%) M/F sex partners (6%) >10 sex acts (36%) No condom use during last sex (49%) Received goods/money for sex (54%) Sex w/ PLWH (31%)	3+ new sex partners (15%) M/F sex partners (2%) >10 sex acts (30%) No condom use during last sex (36%) Received goods/money for sex (53%) Sex w/ PLWH 29%)	3+ new sex partners (34%) M/F sex partners (14%) >10 sex acts (24%) No condom use during last sex (44%) Received goods/money for sex (57%) Sex w/ PLWH (45%)	3+ new sex partners (18%) M/F sex partners (1%) >10 sex acts (18%) No condom use during last sex (37%) Received goods/money for sex (47%) Sex w/ PLWH (31%)
Violence	Physical violence (37%) Sexual violence (9%) Fear for safety (11%)	Physical violence (22%) Sexual violence (3%) Fear for safety (6%)	Physical violence (51%) Sexual violence (17%) Fear for safety (4%)	Physical violence (33%) Sexual violence (6%) Fear for safety (6%)

Table C: SHARP participant clusters associated with suboptimal care (k=4)

	Proportion Suboptimal Care	OR	95% CI	p-value	Adj OR	95% CI	p-value
Cluster 1	33 of 101 (34%)	1.00	ref				
Cluster 2	65 of 196 (33%)	1.49	(1.01 - 2.21)	**0.05**	1.48	(1.00-2.20)	**0.05**
Cluster 3	59 of 133 (44%)	1.04	(0.71 – 1.53)	0.83	1.01	(0.68-1.50)	0.95
Cluster 4	57 of 151 (38%)	0.84	(0.53 – 1.32)	0.44	0.88	(0.55 -1.41)	0.58