Research Article

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Assessment of Retrospective and Current Substance Use in Women who Inject Drugs in Low-Income Urban Settings in Kenya

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Abstract

Women who inject drugs (WWIDs) continue to experience challenges that accumulate their risk to HIV transmission and other co-morbidities. However, data that conceptually link diverse substance use dimensions in WWIDs are lacking particularly in developing countries. We assessed retrospective and current substance use among 306 WWIDs in low-income urban settings in Kenya using mixed methods. Descriptive analyses were performed on quantitative data while qualitative narratives revealed insights from quantitative findings. The mean age of the study participants was 17 (range 11, 30) years. Out of the 306 WWIDs 57% commenced with substance use by combining both licit and illicit drugs. Intimate sexual partners including spouses and casual sex partners introduced seventy-four percent of WWIDs to substance use. Majority of the WWIDs (39.9%) commenced with 2-way substance combination with bhang and cigarette having the highest usage. However, 4-way substance combinations containing heroin, cigarette, bhang, valium, Rohypnol had the highest frequency (12.8%) at the time of the survey. Varied routes of heroin administration were mentioned including injection, smoking and sniffing as separate routes and as 2-way or 3-way mode combinations of these. To inform policies targeting the health and rights of girls and women in low income settings, this study recommends urgent upstream policies targeting the girl adolescent life in form of a multifunctional package composed of identifying girls at risk, substance use interventions, sexual health education, improved educational attainment, and progressive social policies that target low social economic status in the adolescent phase. Harm reduction programs in Kenya should target people who use heroin through both injection and non-injection modes of administration.

Keywords: WWID`s; Substance use; Human immunodeficiency virus

Abbreviations: WWID: Women Who Inject Drugs; PWID: People Who Use Drugs; SA: Substance Use; IPV: Intimate Partner Violence; NSP: Needles and Syringes Programs; PWID: People Who Inject Drugs; FGD: Focus Group Discussion

Introduction

Illicit substance use poses significant global public health challenges linked to multiple negative health outcomes [1]. This is particularly so in the transmission of human immunodeficiency virus (HIV) and other blood-borne viruses [2]. Equally important is the elevated risk of morbidity and mortality related to substance use overdose [3]. Research on substance use patterns in women who inject drugs (WWIDS) serves to better understand determinants and pathways to substance dependency such as age of onset of use [4], motivation for primary substance use [5], characteristics of social networks that introduce and maintain licit and illicit substance use [6], prospective polysubstance use trends [7] and polyroute of substance administration [8]. Moreover, these issues feature additional complex interactions with socio-economic disadvantages highlighting the role of social contexts [9,10]. This underscores the urgent need to strengthen linkages between substance use prevention policies, HIV

prevention programmes and addressing social determinants of poverty in specific settings.

Characterization of interplay between age of onset, motivation and primary introduction of substance use in WWIDS is a crucial first step in identifying pathways into substance dependency later in life. Research has shown that the first introducers of drugs of abuse to young girls at adolescence are intimate sexual partners who may be already dependent on licit and or illicit drugs [8,10-12]. With concurrent sexual debut in girls during adolescence, critical sound judgments about both sexual relationships and psychosocial transitions to adulthood are limited [13]. For this reason, blind securities among the adolescent girls in the hands of intimate sexual partners and relational power dynamics that are skewed towards the man results in diverse forms of violence meted to the girls [14]. Consequently, the girls experience stress and other mental and social suffering on which they may medicate with licit and or illicit drugs [15]. Often, these intimate relationships do not last, and the girl transitions into adulthood with substance dependence. For instance, available studies suggest that use of alcohol, marijuana, and cigarette during adolescence predicts subsequent substance use problems in adulthood [16]. These observations provide an important background for specific studies on early substance use onset and pathways to substance dependency in adulthood [17].

Instances of substance dependence after onset of use among young women are followed by combining of multiple categories of drugs either simultaneously or sequentially over time, a process normally termed poly substance use [11]. These categories may include depressants, stimulants or hallucinogens. Poly substance use can be further characterized by diverse modes of administration including injection and non-injection modes such as smoking, snorting, sniffing and oral consumption [18,19]. Factors related to the choice of mode of administration of heroin among WWIDs is dependent upon the type and quality of heroin, physiological status such as pregnancy and sicknesses, speed of desired effect and unavailability of heroin for diverse reasons [19,20].

Interest in achieving HIV and universal health care goals related to sexual and reproductive health and rights of women and girls has grown on the realization that it has implications for all Sustainable Development Goals (SDG) [21]. Evidently, few empirical studies on these important concepts have been carried out in sub-Saharan Africa, a region currently burdened by progressive substance use and HIV among adolescent girls and women [22,23]. This study therefore aimed to conceptually link the age of onset of substance use, the first substance used, the first-time introducers of the drugs, poly substance use trends and poly route of substance used among WWIDs in a low socio-economic setting in Kenya. Through analyses of quantitative and focus group narrative data, we theorized that to effectively prevent harms related to illicit substance use later in the life of a woman, it is better to target the early adolescent phase of life prior to progression to full-blown substance dependence and related HIV risk.

Methods

Study design and setting

This study adopted a cross-sectional study design with a mixed methods approach that was explanatory sequential. Study participants were Women Who Injected drugs (WWIDs) recruited from two sites supported by Support for Addiction Prevention and Treatment in Africa (SAPTA) in Nairobi respectively. A total of 306 participants were enrolled from SAPTA Drop in Centers (DIC)s in Pangani and Githurai between January 2017 to July 2017. The two study sites in Nairobi County are urban-situated and near each other. The study sites are also close to locations of substance sales and injecting hotspots, which facilitates access of active PWIDs to program sites for services, such as Needle and Syringe Program, linkage to Opioid substitution therapy (OST) and other substance dependence treatment, HIV Testing Services (HTS), Antiretroviral therapy, Prevention and treatment of sexually transmitted infections, Condom distribution, Targeted information, education and communication materials, Vaccination, diagnosis and treatment of viral hepatitis, Prevention, diagnosis and treatment of tuberculosis.

The two study sites offer WHO-recommended nine-element package of PWID services and have a growing infrastructure for prevention, treatment and care of PWID.

Selection and recruitment and recruitment of participants

A total of 306 respondents and 5 relevant stakeholders participated in the study. Of the 306 respondents, 48 participated in four Focus Group Discussions. To be included, participants had to be older than 18 years of age, so that they could provide independent consent; be within the reproductive age bracket of 18-49 years; and have a history of injecting drugs within one year preceding the study and have had more than one sexual partner continuously for 6 months preceding the study. The Kenya Medical Research Institute (KEMRI) Institutional Review Board approval was obtained before recruitment of Participants. Targeted Mobilizer Driven Sampling procedure that utilizes existing information about the study sites to systematically recruit respondents was used in this study. Existing information about the injecting sites was provided by SAPTA, an NGO working with PWIDs, and included the name, location of the injecting site, the number of WWIDS in each of the hotspots and the peak day and time with the highest number of WWIDs in each site. Mobilizers who were peer educators recruited participants from the injecting sites and those who accepted the invitations based on availability were screened and scheduled for appointments. In consultation with representatives from the NGO, key stakeholders were purposively sampled based on their roles, expertise, and political or community representation. The selected stakeholders included two female peer educator, one clinicians, one counselors and one ministry of health official.

Data collection and management

Data collection was conducted in two phases: an interviewer-administered questionnaire was employed in the quantitative phase and focus group discussions (FGDs) and in-depth interviews in the qualitative phase. The interviewer-administered questionnaire covered socio-demographics characteristics and comprehensive substance use information. The FGDs and in-depth interviews explored in-depth understanding of motivation for substance use, social networks that introduce and maintain licit and illicit substance use, and poly substance and poly route of administration of heroin and other drugs, life in the informal settlements, lived experiences and effects of violence and experience with risky sexual behavior.

The FGDs lasted for 45 minutes while the In-depth interviews lasted for 60 minutes. All interviews were conducted in private rooms in the NGO premises or in the stakeholder's offices by trained research assistant in English or Kiswahili.

Quantitative measures

Substance use: We included licit substance (Alcohol, Cigarette), illicit substance (Bhang, Heroin, Cocaine) and prescription pharmaceuticals (Valium, Rohypinol, artaine). Information was collected on age of first use of the drugs (numeric), persons who introduced the participants to drugs (regular partner, casual partner, peers, brother, sisters), substance used by participants at initiation, substance used at 6 months, mode of administration of substance at 6 months (Injection, smoking, sniffing), substance used at the time of the study, mode of administration of substance at the time of the study (injection, smoking, sniffing). Poly substance use was defined as the use of any two or all drugs at initiation, at 6 months and at the time of the survey.

Quantitative data analysis

Quantitative data analysis was carried out to assess the relationship between quantitative variables using chi-square or Fisher exact test to test for associations depending on expected number cell of frequencies in case of small sample sizes. These analyses tested for bivariate associations between:

(1) Age of onset of substance use.

(2) Substance use at onset collapsed into a binary variable coded single substance use (combination of women commencing with alcohol alone plus bhang alone plus heroin plus cigarette alone) versus poly substance use (women commencing with >1 substance at onset).

(3) Category of persons who introduced the drugs.

(4) Categories of the different counts of current poly substance use.

Qualitative data analysis

The study used a mixed methods approach where qualitative data to helped explain, or elaborate on, the quantitative findings.

Inductive approach described as detailed readings of raw data to derive concepts, themes or a model was used to conduct qualitative analysis [24]. The transcripts for the FGDs were reviewed separately and coded thematically by 4 members of the research team. A comparison of the coding was done across all the four members, expanded and then refined to develop a codebook. The research team discussed the transcripts identifying the key constructs, new themes and emerging findings and modifying codes as necessary. Interview transcripts were entered into Nvivo version 12 and coded accordingly. The research team then focused gaining in-depth understanding the experience of substance use at initiation and the context in which it occurred, motivators of progression of substance use from initiation to full substance dependence, motivation of poly substance use at initiation and at the time of the study, experience of heroin mode of administration at 6 months and at the time of the study. Through this perspective transcript were re-read and re-analyzed to get off the full range of data that described and helped illuminate the patterns and pathways of substance use at initiation and progression to substance use dependence later in life. The data was then grouped into themes and codes. Since this was a mixed method study, matrices were developed that summarized quantitative and qualitative findings in key topic areas [25]. Data was integrated in order to add depth and richness to findings, rather than a directed effort at triangulation.

Results

Of the 360 respondents recruited into the study, 306 respondents or 85% participated in the study. Table 1 gives a breakdown of the demographic profiles of WWIDs respondents to the study in Nairobi County. The mean and median age was approximately 30 years (5.7 years) and 27 years respectively. A greater proportion of the respondents were aged between 28 and 32 years (Table 1). The youngest and the oldest age among the respondents were 18 and 42 years respectively.

The mean and median duration of time lived in the informal settlements was approximately 22 years (SD=10 years) and respondents were either born there (54%) or relocated (46%). The respondents had lived in the informal settlements for between 4 and 42 years with the highest proportion living for a period of between 21 and 30 years (Table 1).

Women who inject drugs were characterized with low levels of education. Approximately 7.2% of the respondents never attended school, 60.1% were educated to primary school level and a further 32.7% reported having post-primary level of education. Fifty two percent (52%) of the respondents were Protestants and 30.1% were of the catholic faith. Over ninety percent (90.5%) of respondents were cohabiting and 9.5% were either single or married.

More than half (56%) of the respondents got their first child between the age of 16 and 20 years with a mean (SD) and median age of first child of 18.5 years (3.2 years) and 18 years respectively. An estimated 41% (n=125) of the respondents got their first child aged below 18 years which is the recognized age of adulthood in Kenya.

The mean and median number of children of the respondents was 3 and a higher number of respondents had 1 to 3 children (Table 1). Majority of the respondents (54%) began living with a partner when they were under 18 years and a greater than half of the respondents (51%) grew up in a conventional nuclear family.

Majority of the respondents (48.7%) engaged in sex work as their main source of income and overall most of the WWIDs earned a 3-monthly mean income in Kenya shillings (Ksh) (SD) of approximately Ksh 12,877 (USD 130) (Ksh 5,035 (USD 50). Sixty percent (60%) obtained a 3-monthly income of more than Ksh 10,000 (USD 100). In this study, a combined 90% depended on self, spouse and both (self and spouse) (Table 1).

Variable	Characteristics	
	Category	N (%)
Age	18-22	39 (12.7)
	23-27	79 (25.8)
	28-32	100 (32.7)
	33-37	59 (19.3)
	38-42	16 (5.2)
	>42 years	13 (4.2)
Time living in informal settlement	1-10 years	65 (21.2)
	11-20 years	76 (24.8)
	21-30 years	96 (31.4)
	>30 years	69 (22.6)
Reason for living in informal settlement	Place of birth	164 (53.6)
	Relocation	142 (46.1)
Education level	No- formal	22 (7.2)
	Primary	184 (60.1)
	Post -primary	100 (32.7)
Religion	Roman Catholic	92 (30.1)
	Protestant	159 (52)
	Muslim	31 (10.1)
	Traditional	24 (7.8)
Marital status	Married	21 (6.9)
	Cohabiting	277 (90.5)

	Single	8 (2.6)
Number of children	0	63 (20.6)
	1-3	123 (40.2)
	4-6	119 (38.9)
Age when got first child	11-15 years	67 (21.9)
	16-20 years	171 (55.9)
	>20 years	68 (22.2)
Age commenced living with a partner	≤ 18	165 (53.9)
	≥ 18	141 (46.1)
Type of family	Single parent	101 (33)
	Nuclear (Father and mother)	157 (51.3)
	Divorced/Separated	33 (10.8)
	Extended (Polygamous)	15 (4.9)
Source of income	Self-employed	44 (14.4)
	Stealing	113 (36.9)
	Sex work	149 (48.7)
Income (every 3 months)	Kshs 0-10,000	120 (39.9)
	Kshs >10,000	181 (60.1)
Persons who works to get an income	Self	45 (14.7)
	Spouse	100 (32.7)
	Spouse and Self	129 (42.2)
	Relatives	32 (10.5)

Table 1: Characteristics of the sampled participants.

Gateway pattern of substance use

The mean and median age at first substance use was 17.6 years (range 11, 30 years) and 17 years respectively. More women (57%) were likely to commence with combined drugs (poly substance use) relative to single drugs (Table 2). The largest and least proportions of women who commenced with a single substance used bhang and heroin respectively. At the mean age of onset (17 years), 53.6% of the women were already on substance use (Table 2).

Only one-woman participant each initiated substance use by use of Valium alone at age 19 years and Artane alone at age 17 years; none initiated substance use by use of Rohypnol alone.

Persons who introduced substance of abuse to WWIDs at the age of onset

Whereas 56% (n=170) of WWIDs were introduced to substance use by spouses or regular partners, 18% (n=56) were introduced by casual sexual partners totaling to 74% being introduced by intimate sexual partners. Peer-led and siblings introduction to substance use accounted for approximately 20% (n=60) and 6% (n=20) of WWIDs respectively.

Poly substance use and trends

Table S1 unpacks individual combinations of drugs used from initiation to the current survey. Heroin use at initiation, either alone or in combination, was practiced by 27% of the WWIDs. On initial use, 2-way combination had the highest frequency at 40.5% relative to other combinations. However, at 6 months prior to the survey and at the time of the survey, the reported 4-way combination had the highest frequency at approximately 49% and 34% respectively.

The substance combination with the highest usage at initial use was the 2-way combination of bhang and cigarette at 11.9%. However, at 6 months prior to the survey, the substance combinations with the highest usage was the 4-way combination of heroin, bhang, valium and Rohypnol at 22.9% and heroin, bhang, Valium and cigarette at 9.2% of the WWIDs. At the time of the survey, the substance combinations with the highest usage was the 4-way combination were heroin, bhang, valium and cigarette at 22.9% and heroin, bhang, valium and Rohypnol 11.1% of the WWIDs. A noteworthy observation is that heroin was never used alone following initiation.

Route of administration at 6 month and time of the study

Varied routes of heroin use were mentioned including injection, smoking and sniffing alone and two way and three-way combinations of these. Routes of heroin use altered substantially between 6 months preceding the survey and during the survey. While majority of women injected heroin 6 months preceding the survey, there was a near equivalent distribution in the routes of administration at the time of the survey including the two way and three-way combinations except smoking and or sniffing (Figure 1).

Age of substance use onset	Alcohol alone, n (%)	Bhang alone, n (%)	Heroin, alone, n (%)	Cigarette, alone n (%)	Poly substance use n (%)
11	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
12	2 (0.7)	8 (2.8)	1 (0.3)	1 (0.3)	8 (2.8)
13	0 (0.0)	3 (1.0)	0 (0.0)	1 (0.3)	4 (1.4)

14	5 (1.7)	8 (2.8)	1 (0.3)	0 (0.0)	12 (4.2)
15	5 (1.7)	9 (3.1)	0 (0.0)	3 (1.0)	22 (7.7)
16	7 (2.4)	6 (2.1)	0 (0.0)	1 (0.3)	18 (6.3)
17	2 (0.7)	3 (1.0)	2 (0.7)	2 (0.7)	20 (7.0)
18	6 (2.1)	3 (1.0)	0 (0.0)	3 (1.0)	18 (6.3)
19	5 (1.7)	3 (1.0)	0 (0.0)	0 (0.0)	17 (5.9)
20	0 (0.0)	1 (1.6)	0 (0.0)	0 (0.0)	2 (0.7)
21	1 (0.3)	7 (2.4)	0 (0.0)	2 (0.7)	19 (6.6)
22	0 (0.0)	2 (0.7)	1 (0.3)	0 (0.0)	4 (1.4)
23	1 (0.3)	2 (0.7)	0 (0.0)	1 (0.3)	13 (4.5)
24	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
>24	1 (0.3)	7 (2.4)	0 (0.0)	2 (0.7)	5 (1.7)
Totals	37 (12.9)	62 (21.7)	5 (1.7)	16 (5.6)	164 (57.3)

Table 2: Distribution of drugs used at age of onset of substance use.
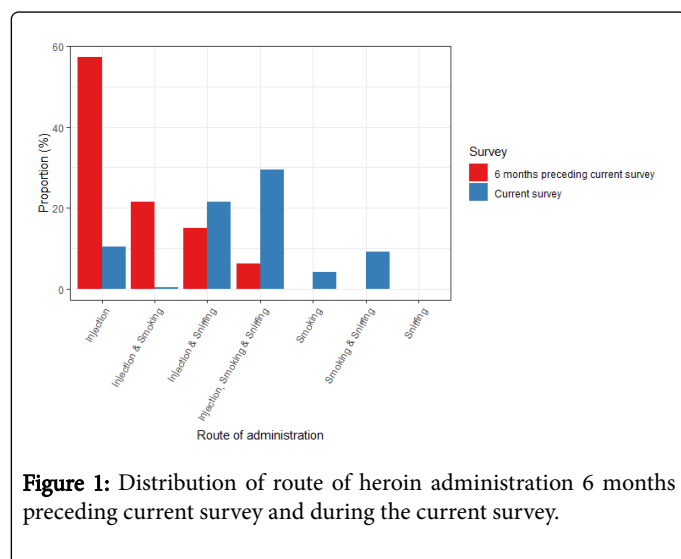

Figure 1: Distribution of route of heroin administration 6 months preceding current survey and during the current survey.

Associations between quantitative variables

Age of onset was not associated with the following variables: drugs used at age of onset (Fishers exact p=0.208), persons who introduced the drugs (Fisher exact p=0.240) and current poly substance use (Fisher exact p=0.799). Substance used at age of onset was also not associated with the persons who introduced (fisher exact =0.947) and current poly substance use ($\chi2$ 4.3; degrees of freedom =2; p=0.115).

However, persons who introduced substance used at onset was associated with current poly substance use (Fisher exact p=0.000.) Further analysis was carried out to tease out the differences in categories of the persons who introduced drugs used at age of onset by current poly substance use. These analysis showed there was no significant difference between:

(1) Regular partners and peers (Fishers exact p=0.415).

(2) Regular partner and siblings (Fishers exact p=0.143).

(3) Casual partners and siblings (Fishers exact p=0.220).

(4) Peer and sibling (Fishers exact p=0.673) on the number of substances used at the time of the survey.

However, there was a statistical difference between:

(1) Regular and casual partners on the number of substances used at the time of the survey (Fishers exact p=0.000).

(2) Casual partners and peers (Fishers exact p=0.01).

Qualitative findings

The selected stakeholders included forty-eight (48) participants for the FGDs, two female peer educator, one clinicians, one counselor and one ministry of health official for the in-depth interviews. Eighteen codes and basic themes came out of the transcripts and the basic themes were categorized into three organizing themes based on the framework used for the quantitative analysis for explanatory sequential and synthesis of the findings. The three organizing themes were- initiation of substance use, progression of substance use and substance use dependency. Figure 2 depicts a hierarchical illustration of the basic and organizing themes around the global theme of patterns and pathways to substance use.

Initiation of substance use

Early initiation of substance use occurred among girls who had dropped out of school or those who did not progress with education past secondary or tertiary levels. This occasioned economic hardships which resulted into girls initiating sexual debut at an early age with male partners who were already abusing licit and illicit drugs. P (8) "Aaah………..: I took dom (bhang) at the age of 16 when I dropped out of school in Form 3 in a day school near mathare slums… my

boyfriend gave me….he was about 40 years and gave me everything I wanted.....then after some time I learned he was married… unfortunately I was already pregnant….he was not good to me anymore …he abused me…I cried ..cried..I took more ..more dom (bhang) to feel better…….''said one of the FGD participant.

The young girls got into sexual relationships with older men who were controlling and abusive. This resulted into the relationship breaking up after a short time. P (12) "Aaah……..my mother had 8 children and was struggling to raise us all so I dropped out of school in class 6 at 14 years….then I met mark who was my neighbor and we loved each other and moved together as man and wife….but it did not last … (long pause)……he beat me a lot was a drunkard…and also used dom (bhang)….''said an FGD participant.

The girls moved on to other relationships with other men who were abusing different types of licit and illicit drugs. This resulted into the girls using multiple drugs at a young age. P (2)"….aaah, I dropped out of school when I was 17 years…. we did not have money …. got married to my boyfriend ….I think he was something like 27 years…. …aah at first he was a good man….had lots of fun together, drunk together…aah then he changed …battered me a lot …even when I was pregnant….aah I ran away went back to my parents…after one year… then life was hard ….very hard ….aah I hustled …..Moved with many men ….drunk more and more alcohol …, heroin …but I made money….'' said one of the FGD participants.

Progression of substance use: The girls experienced stress as a result of violence and relationship break up which they medicated using more licit and illicit drugs. P (4) "aah…….then something happened after a while (long pause) ……then he could not provide for us anymore…started beating me…one time he broke my arm…I thought he would kill me….my sister came to my rescue….. After that life was hard…had a baby to provide for but I did not have money ... my family hated me… (long pause) ..it was all pain …stress …I took more and more dom (cannabis) to feel better.. " said one of the FGD participant.

Substance use dependency: The girls graduated into heroin use in early adulthood and it was an expensive habit. To get money to purchase heroin the women engaged in sex work, transactional sex and forced relationship with male partners who were also using heroin and could share heroin with the women. P (12) "…. I took dom (cannabis) for a long time… then one day my boyfriend gave me stuff (heroin) which I smoked together with dom (cannabis)…..it was a very good feeling…pause…..but it was expensive….my boyfriend told me I had to get heroin myself if I wanted to smoke…I would insist …but he was violent ….I felt bad …very bad…I felt hated …. but I did not have money….so I shop lifted, stole but it was dangerous…I was beaten up by police …then I started sleeping with men and got paid…I bought heroin ….." said one of the FGD participant.

Heroin was used in combination with other licit drugs and prescription drugs. P (11) "…. I use bhang, valium, rohypinol. I also inject heroin. It has a better feeling but sometimes I get over dosed. I almost died the other day because of these many drugs" said one of the FGD participants.

It was explained that heroin in combination with other drugs gave a better 'high', medicated heroin withdrawal symptoms like lack of sleep. P (6). "….I Smoke heroin but also inject some times….. I take bhang, Ropypinol, especially when I don't have enough heroins….. aah Mixing heroin, rohypinol, valium… I get the courage to shop lift. Many times am successful but a few times am caught" Said one of the FGD participants.

P (3): "……. when I cannot sleep I take valium….You know lack of heroin makes you not have sleep ….when you have not taken. Aah… Sometimes I can sleep for only 5 minutes then my mind shows me I have slept for 24 hours. It's horrible…scaring".

Heroin was either injected, sniffed or smoked. It was explained that when the potency of heroin was good most of the women sniffed or smoked heroin but when the potency was poor most of the women injected heroin. P (10)…. "sfuff (heroin) when it is strong I smoke because I will use a little….. when the stuff (heroin)is weak…has no 'steam'…" said one of the FGD participant. Women who became pregnant said that they stopped injecting and reverted to smoking….P (7)... "I Smoked,…sniffed…snorted….only when I was pregnant…..then I continued injecting" said one of the FGD participants.
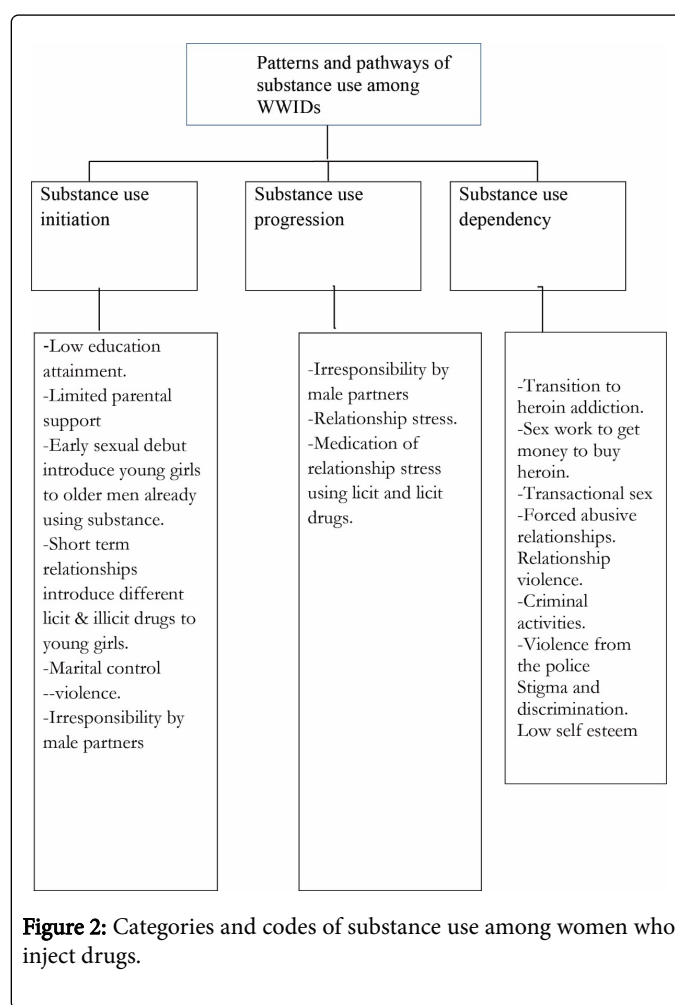

Figure 2: Categories and codes of substance use among women who inject drugs.

Discussion

This study identified broad patterns in substance use among WWIDs in Kenya, finding that >73% of them commenced use between the adolescent age of 11 and 19 years either *via* combining various licit and illicit drugs (42%) or single use (31%) of varied drugs. In this age bracket, >90% of the WWIDs were introduced to substance use by intimate sexual partners. On a mean time of 12 years after onset of substance use (range 2 to 34 years, 6 months prior to the current survey), all the participants were already on heroin with >98% on poly

substance use. At the time of the survey, 85% of the participants were combining injection and non-injection modes of heroin use such as smoking and sniffing. To the best of our knowledge, this is the first study to conceptually identify and explore the complex landscape of gateway substance use, temporal poly substance use and poly route patterns among WWIDs in sub-Saharan Africa.

The findings seem to suggest that mitigation strategies targeting early onset of substance use and inadequate sexual health information need to be integrated with health policies and programs that scale up harm reduction interventions among WWIDs in developing countries. In particular, the findings underscore the need to better understand how combined early onset of substance use and early sexual debut serve as frontrunners to substance dependency and risky sexual behavior resulting in accelerated HIV and other blood-borne viruses transmission along the age continuum.

Findings from this study indicated that low educational attainment (early school dropout) and underage natal of the first child, both attributed to socio-economic disadvantage. It is noteworthy that these adverse outcomes happen during the adolescent phase of life, a unique developmental period generally characterized by immature cognitive control that imposes limited regulatory influence over rational decisions on the girls [26,27]. Incidentally, this time coincides with the phase of heightened sexual consciousness due to hormonal changes. While all these happen in resource-limited contextual settings, they place the girls at an increased vulnerability that results in early sexual debut. Often, the adolescent girls take up marriage and parental responsibilities or engage in spontaneous short-lived relationships that present opportunities for licit and illicit drugs exposure by casual or regular male sexual partners [12,28]. Commencing substance use in this context is referred to as gateway to substance dependence [29].

The gateway pattern of substance use is widely described in literature as a normative sequence to poly substance use, beginning with alcohol and tobacco use, followed by cannabis and later transits to other illicit drugs [29]. However, our findings deviated from this clear sequential order of progression. Besides differences in study settings and design, the reasons for the inconsistent substance progression patterns are perhaps attributable to the greater influence the intimate sexual partners have on vulnerable girls relative to individual choices of the girls at the onset of substance use [30]. Casual sexual partners had least influence on poly substance use at the time of the survey as compared to other persons who introduced drugs of abuse to WWID at onset probably because on the limited duration of the sexual contact with the male partners and possible future engagements. The high proportion of 4-way substance combinations observed in this study was perhaps attributable to the need for medication of heroin withdrawal symptoms and the quest for a better "high" over time. For instance, bhang was consistently included in these combinations as its use addresses certain withdrawal symptoms of heroin [31]. This was further evidenced by the greater proportion of non-medical use of prescription drugs, e.g. Valium and Rohypnol that we found.

Other factors such as substance availability can also affect the described atypical sequence. In the developed world, 'atypical' patterns of sequence such as the ones we found in our study have been reported and more so from individuals from disadvantaged backgrounds [32]. Equally important is the nature of frequent short-term sexual relationships each introducing a different substance (s) to the adolescent girl. The short-term relationships are characterized by unequal power relations as outlined in the focus group discussions. To medicate or alleviate the stress and pain that results from the

relationship break ups, the adolescents are further trapped by the need to use licit and illicit drugs.

In many developing countries, Kenya included, many existing policies on substance use prevention, safe reproductive and sexual health target downstream interventions when adverse health outcomes have already been experienced by women [33]. Limited awareness and understanding about these issues have led to the general populations being replenished with new substance-dependent individuals and thereby generating a vicious cycle of early motherhood and perpetuation of socio-economic deprivation. For instance, offspring borne of adolescent girls are also likely to become mothers during their own adolescence [34]. In addition, offspring borne of adolescent girls are more likely to be at risk of lower cognitive and physical development, inadequate social connections and deprivation of education [35,36]. Our findings suggest that immense opportunities exist in reorienting downstream policies in form of integrated interventional packages in the adolescent phase. This package ought to consist of identifying adolescent girls at risk, substance use and sexual health education, improved educational attainment and progressive social policies that target socio-economically disadvantaged girls. The global health community needs to partner with developing countries in employing sustainable strategies that focus on the above-mentioned policies. Nonetheless, and given the inherent limitations of our cross-sectional design, further studies are needed in similar settings to authenticate these patterns to better inform upstream intervention policies.

Consistent with other studies, there was reported increase in combinations of substance used with >50% of the women having transited from single substance or two-way substance combinations to ≥ 3 substance combinations at the time of the survey [16]. The most popular combinations at 2-way, 3-way, 4-way and 5-way (heroin being present in each combination) constituted at least bhang and Valium with Rophypnol, cigarette and alcohol being reported at lower frequencies. Our narrative analyses showed that Poly substance use was motivated by the need for a better "high", need to medicate withdrawal symptoms that resulted from limited availability of heroin such as lack of sleep, experimentation and belief in the ability of greater risk-taking effect produced by combination of heroin, other illicit drugs and non-prescription drugs as explained during the FGDs. Yet, research has shown that poly substance users have greater levels of mental disorders and other psycho-behavioral problems, such as major depression, panic disorder and memory loss and risk of overdose toxicity and fatality [3,37]. Notably, use of controlled prescription depressants perhaps from the black market, private pharmacy stores and other substance user need further investigations to establish the sources [38].

Consistent with existing literature, maintenance of the heroin addiction was related to sex work and sharing of injection paraphernalia putting participants at risk of contracting HIV and other blood-borne viruses [39]. In addition, related criminal activities put participants at risk of experiencing violence from the police and stigma the community [2]. These actions lead to frequent disruptions of harm reduction services affecting their uptake.

Pronounced discrepancies in the route of administration of drugs used were evident at 6 months prior and at the time of the survey. While we could not rule out recall decay over time, choice of route of administration among participants in this study was influenced by specific factors as expounded during the qualitative interviews. The specific factors cited included heroin availability, quality of heroin, the

need for a better "high", physiological factors including pregnancy and sicknesses, availability of finances, interruptions of heroin use such as happens during period of incarceration as explained during the FGDs.

Contrary to foundational notions in substance use patterns that heroin is majorly injected, our findings demonstrate that use of heroin, as relates to route of administration, is neither a static phenomenon nor does it progress through a predictable sequential pattern from non-injection to injection routes nor from single route to poly route [40]. This broadly agrees with previous studies but in the developed world [40,41]. For this reason, we suggest that harm reduction programs in Kenya need to target people who use heroin through use of injection and non-injection routes of administration.

While the findings presented here provide valuable contributions to the literature, there are limitations in the adopted cross-sectional design that reduce the ability to make causal inferences among all issues investigated here. Links between components of our hypothesized framework (age of onset of substance use, motivation for primary substance use, characteristics of social networks and persons who introduce licit and illicit drugs to women, prospective poly substance use trends and poly route of substance use) need to be interpreted within the context of this study design limitation. Further, the retrospective recall of age of onset may have been affected by the systematic tendency by some individuals to shift their estimated age of onset upwards as they get older [42].

Nonetheless, the novel insights from the findings presented here have important implications. Cognizant of the fact that HIV prevalence is disproportionately high among adolescents (aged 11-19 years) and young adults (<24 years old) 23, upstream strategies (implemented during early adolescence) need to lie at the heart of policy formulation in the ministries of health in developing countries. Internationally, this would align well with SDG 5 that aims to achieve gender equality and empowering all women and girls. At the national level, our findings also support the Kenya AIDS Strategic Framework (KASF), 2014/2015-2018/2019 that identifies adolescent and young people as a priority population for the HIV response. This study, therefore, proposes upstream policies in form of a multifunctional package composed of identifying girls at risk, substance abuse interventions, sexual health education, improved educational attainment, and progressive social policies that target social economic status in the adolescent phase. Finally, as both injection and non-injection substance use has a strong link to HIV and other blood-borne virus transmission, harm reduction programs in Kenya should target people who use heroin through both injection and non-injection modes of administration.

Conclusion

In conclusion increased HIV risk among WWIDs can be mitigated early in the women's adolescent phase through upstream health policies that target prevention of early onset of licit and illicit drugs and inadequate sexual health information. At program level increased HIV risk can be addressed by implementing an integrated intervention package that consists of identifying adolescent girls at risk, substance use and sexual health education, improved educational attainment and socio-economically disadvantage.

Competing Interests

The authors declare that they have no competing interests.

Availability of Data and Materials

Due to the nature of the study and criminalized nature of substance use in the study context, entire data and materials from this study are not publicly available. Requests for data can be submitted to the corresponding author.

Authors' Contributions

MC conceptualized and coordinated the study, conducted literature review, MC, KS, WV and NZ designed the study and tools. MC and GJ collected the data, analyzed the data and drafted the manuscript, KS,WV and NZ reviewed the manuscript and provided critical inputs. All authors read and approved the final manuscript.

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Ethics approval and consent to participate

This research was approved by the Kenya Medical Research Institute, Ref: KEMRI/SERU/CPHR/003/10/3242.

Consent for Publication

Participants provided written informed consent for publication of data collected during this study.

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