



Typologies of Sex Work Practice and Associations with the HIV Risk Environment and Risk Behaviors in Kazakhstan

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Abstract

Women engaged in sex work (WESW) who use drugs are a key population in Kazakhstan's HIV epidemic. Global research suggests susceptibility to HIV varies by sex work environment. This study aims to identify evidence-based typologies of WESW and examine their associations with HIV risk. We surveyed 400 WESW who use drugs in two Kazakhstani cities, including questions on sociodemographic characteristics, social, physical, and economic risk environments, and sexual risk behaviors. Latent class analysis identified four distinct typologies of sex work practice: occasional sex work ($n=61$, 15%), professional sex work for money ($n=187$, 47%), sex work in exchange for drugs, goods, or other services ($n=117$, 29%), and managed sex work under a boss/pimp/madam ($n=35$, 9%). We then used logistic regression to examine associations between typologies and risk behaviors. Compared to professional sex work, occasional sex work was associated with lower odds of multiple sexual partners (aOR:0.46[95%CI:0.24,0.90]), of multiple paid clients (aOR:0.25[0.13,0.49]), and of > 1 instance of unprotected sex with a paying partner (aOR:0.33[0.17,0.63]). Compared to professional sex work, sex work for nonmonetary items was associated with higher odds of multiple sexual partners (aOR:1.85[0.96,3.67]) and of > 1 instance of unprotected sex with a paying partner (aOR:1.71[1.01,2.93]). Results suggest heterogeneity among WESW who use drugs in Kazakhstan, and that typologies of sex work are associated with varying HIV risk environment factors and risk behaviors. Effective HIV prevention efforts must be tailored to address these varying risk environments and the resulting variety of needs.

Keywords HIV · Sex work · Substance use · Risk Environment · Central Asia

Introduction

Eastern Europe and Central Asia (EECA) is one of the few regions in the world with a growing HIV epidemic, which remains concentrated among key populations, including

women engaged in sex work (WESW) [1]. In 2022, Kazakhstan had an estimated 20,300 WESW, whose HIV prevalence is 1.3% [1]. Globally, sex workers have 13.5 times the odds of contracting HIV compared to reproductive-aged women [2]. Substance use can further increase this risk, as it elevates likelihood of engaging in sex work and experiencing gender-based violence, and lowers ability to negotiate condom use. Injection drug use has been associated with 20 times the odds of HIV infection among WESW; [3] non-injection drug use and alcohol use have also been associated with increased HIV prevalence and risk behaviors [4,5].

WESW who use drugs are not a uniform population, and individual risk for HIV and sexually transmitted infections (STIs) is influenced by a multitude of factors, including exposure to violence, access to health care, and criminal-legal "policies" [6–8]. The risk environment framework, originally developed within a context of understanding substance use-related harms, [9] describes how multilevel

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structural factors increase or constrain an individual's level of risk. For WESW populations, the risk environment may consist of peer support, experiencing physical or sexual violence or harassment by clients, partners, or police, access to social resources and support (social); service access (physical); housing and food insecurity, bribes, or economic incentives for non-condom use (economic); and criminalization of sex work, sex work advocacy (policy). All these features have been associated with risk behaviors as well as HIV/STI infections among WESW [6,10,11]. These features can also impact HIV risk within transactional sex, which differs from professional sex work in terms of women's self-identification as a sex worker and characterization of the relationship with her sexual partner [12].

Prior research has often taken a narrower view of HIV/STI risks among WESW, characterizing them within single-dimension categories, referred to as typologies. Typologies have primarily been based on either the formality of sex work ("direct" practice of sex in exchange for money vs. "indirect" practices such as pornography, erotic dancing, etc.) [13] the venue for client solicitation (brothel-based vs. street-based), or even self-identification (self-identified sex worker vs. transactional sex within intimate or casual relationships) [12,14]. While these unidimensional categorizations help focus research and interventions on specific groups of WESW, there are empirical and methodological weaknesses with existing categories [15,16]. One systematic review determined that categorization by venue reveals inconsistent results across the literature: brothel-based sex workers had higher, lower, or equal risk of positive HIV serostatus in different studies [16]. Some have called for more attention to underlying structural risk factors that may cut across typologies [14]. Another systematic review of India-based studies noted the lack of systematic methods for categorizing WESW [15]. Therefore, while typologies of WESW may have utility, they should reflect evidence-based and data-driven approaches to categorization.

Latent class analysis (LCA) methodology can create data-driven typologies of WESW. In one study, investigators identified five classes of WESW in Zimbabwe based on self-reported mobility patterns [17]. Women in these five classes exhibited different HIV/STI risk behaviors; for example, WESW who moved frequently or who travelled with clients had significantly less consistent condom use. In another study with women engaged in street-based sex work in Mongolia, investigators identified three classes of WESW based on varying financial risks (including personal and family income, savings/debt, dependents, and reliance on sex work as a primary source of income) and personal health risks (including those related to unprotected sex, substance use, mental health, and experience of violence) [18]. More recently, a study of female sex workers based in

Baltimore, US, identified three classes of participants based on client solicitation locations (predominantly street-based, mixed street and venue-based, and multisource). These had significantly different proportions of condom use with clients (with mixed street/venue-based solicitation having the lowest) and also different rates of HIV/STI testing (with street-based solicitation group having the lowest rates of testing in the past 6 months [19]).

Despite WESW being a key population in both the overall EECA and Kazakhstan-specific HIV epidemics, no prior research has explored typologies of sex work practices among this group, or the varied risk environments they face. This study seeks to create an evidence-based typology of WESW in Kazakhstan using LCA of factors related to how women engage in sex work. We then explore how these typologies are associated with identified features of the physical, social, and economic risk environments, as well as HIV risk behaviors.

Methods

This study utilized baseline data from Nova, a cluster-randomized controlled trial evaluating the effectiveness of a combination HIV prevention and microfinance intervention among WESW who use drugs [20,21]. 400 WESW completed baseline assessments between 2015 and 2017. The Columbia University IRB and the ethics committee of the Kazakhstan School of Public Health approved all research protocols and materials.

Settings, Recruitment & Eligibility Screening

Nova recruited WESW from two Kazakhstani cities, Temirtau and Almaty. This study utilized convenience sampling, recruiting WESW through sex work and service venues as well as through their peer networks. Venue-based recruitment included hotels, saunas, and streets, as well as medical organizations and NGOs with services for economically-disadvantaged women. Trained research assistants approached potential participants with information about the study and conducted eligibility screening. For peer network recruitment, eligible study participants received a small financial incentive (\$5 USD) to refer friends and acquaintances.

Eligibility criteria included: (1) using drugs (injection or non-injection) in the prior year; (2) trading sex for money, drugs, goods, or services in the prior 90 days; (3) having at least one incidence of unprotected sex with an intimate or paying partner in the prior 90 days; (4) planning to remain in Temirtau/Almaty for one year; (5) fluency in Russian; and (6) 18+ years. Participants were ineligible if they showed

signs of cognitive impairment affecting their ability to participate, as determined by staff. Participants were not asked if they identified themselves as a sex worker, and thus, the second eligibility criterion was intended to encompass both professional sex workers and those engaged in transactional sex. Eligible participants were invited to complete informed consent, then a computerized survey, in a field office location at each study site.

Measures

Full intervention protocols and outcomes have been described elsewhere, including a complete list of measures [20,21]. The present analysis utilized the following **sociodemographic indicators**: study site (Temirtau or Almaty), age (years), ethnicity (Russian, Kazakh, other Central Asian, or other), marital status (single/never married, married, divorced/separated, or widowed) and education (did not complete high school vs. higher).

We assessed participants' **sex work practices** in the prior 90 days through a series of researcher-developed questions. Dichotomous variables included whether sex work was a participants' primary form of income (vs. supplementary), whether participants engaged in sex work throughout the year (vs. seasonally), and whether they worked through a manager (boss, pimp, madam; vs. independently). Participants reported if they had received any of the following in exchange for sex in the past 90 days: money (cash), substances (drugs, alcohol, cigarettes), goods (food, electronics, jewelry, clothes), and/or services (transportation, legal aid, housing). Finally, participants reported whether they had used any of the following methods to solicit clients in the past 90 days: at a hotel, on the street, through the phone or internet, through introductions from friends or acquaintances, or through a boss/pimp/madam.

To assess **social features of the risk environment**, we collected data on (1) problematic alcohol use, as defined by a score of 8 or higher on the AUDIT, [22] (2) any prior 90-day injection drug use; (3) scale rating of social support using the Multidimensional Scale of Perceived Social Support (MSPSS; range: 12–84) [23]; and (4) any prior 90-day experience of physical or sexual violence from an intimate partner, paying partner, or other individual using an adapted Revised Conflict Tactics Scale (CTS-2) [24]. To assess **physical features of the risk environment**, we collected data on imprisonment, self-reported access to HIV/STI counseling and education, access to any social services (legal, educational, employment, housing, public benefits), access to general medical care (primary or specialized care) and women-specific healthcare (reproductive healthcare and birth control education), all in the prior 90 days. To assess

economic features of the risk environment, we collected data on prior 90-day homelessness and food insecurity, being the primary breadwinner in her family, and household income (dichotomized as above/below the sample median). No variables related to the policy level of the risk environment were included in the survey and were thus excluded from this analysis.

To assess **sexual risk behaviors**, we collected data on number of sexual partners (overall and paying) in the past 90 days, number of sex acts with these partners, and number of times of condom use with these partners. These indicators were used to construct four dichotomous outcome variables: Multiple sex partners, multiple paying partners, more than one incident of unprotected sex with any partner, and more than one instance of unprotected sex with a paying partner.

Analysis

We performed Latent Class Analysis (LCA) using the *mirt* package in R, [25,26] including all variables related to sex work practice. We fit four separate LCA models of 2–5 latent classes, each with 10,000 iterations. We used the following information criteria along with class interpretability to select the best fitting latent class model: Likelihood ratio (G2), Akaike Information Criterion (AIC); Bayesian Information Criterion (BIC); Sample size-adjusted BIC (adjBIC); root mean square error of approximation (RMSEA); and a likelihood ratio test for nested models. We performed tests for conditional independence. Class interpretations were conducted with input from US and Kazakhstan-based research team members. As described in more detail below, we selected a four-class model and used item response probability measures to assign each participant to one class based on the highest item response probability.

We then assessed the distribution of the selected sociodemographic and social, physical, and economic risk factors across these identified classes, utilizing chi-squared tests to identify significant differences among classes. Finally, we used logistic regression models to examine associations between class membership and HIV sexual risk behaviors. Models were then adjusted for all sociodemographic and risk environment factors which were significantly different among classes at the $p < 0.05$ level in the chi-squared distributions.

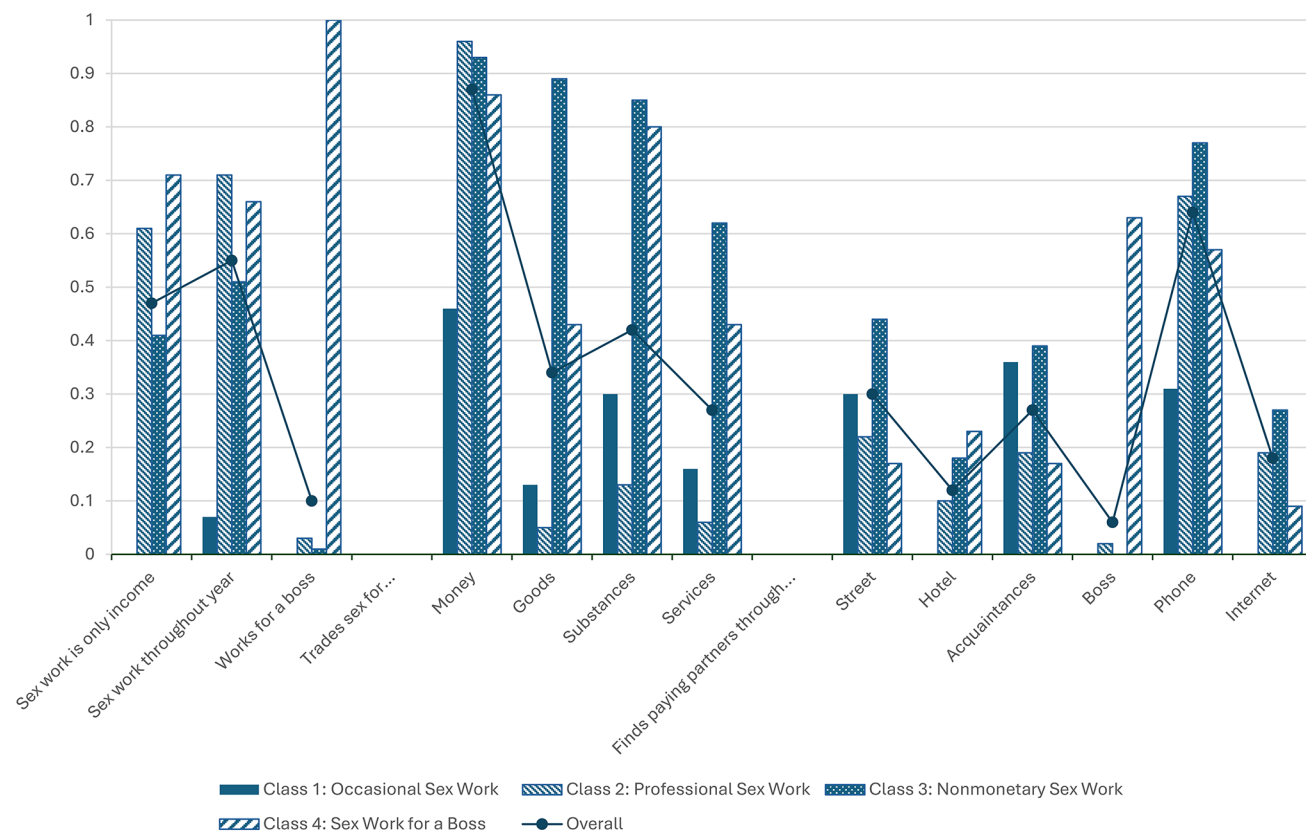
Results

We recruited and screened 763 women for study eligibility, 410 of whom met eligibility criteria. Four hundred participants completed informed consent and baseline assessments.

Table 1 Latent class models fit criteria

	AIC	BIC	aBIC	Log likelihood Ratio Goodness of Fit (G2)	RMSEA (95% CI)	df	Log likelihood	Likelihood Ratio Test for nested models (chi squared, <i>p</i> value)
2-Class	5374.773	5482.543	5396.870	1217.577	0.102 (0.091, 0.113)	8164	-2660.387	n/a
3-Class	5311.599	5475.249	5345.154	1126.403	0.093 (0.081, 0.106)	8150	-2614.800	91.174, <i>p</i> < 0.01
4-Class	5223.668	5443.198	5268.679	1010.472	0.051 (0.035, 0.068)	8136	-2556.834	115.932 , <i>p</i> < 0.01
5-Class	5222.660	5498.071	5279.129	981.4639	0.048 (0.025, 0.069)	8122	-2542.330	29.008 <i>p</i> < 0.01

AIC = Akaike Information Criterion; BIC = Bayesian Information criterion; adjBIC = Sample size-adjusted BIC; G2: Chi-square statistics; RMSEA: root-mean-squared error of approximation

**Fig. 1** Variable distribution within 4-class model

Sex Work Typologies

Fit statistics for each of the LCA models tested (2–5 latent classes) are shown in Table 1.

We selected a four-class model based on these criteria and the interpretability of the resulting classes. The four-class model is represented visually in Fig. 1 and in Supplementary Table 1:

Class 1, Occasional sex work ($n=61$, 15.25% of sample): Women in this class reported sex work as a supplemental form of income, practiced seasonal or part-time sex work, and worked independently. Women in this class

mostly exchanged sex for money (46%), but also for substances (30%).

Class 2, Professional sex work ($n=187$, 46.75% of sample): Compared to the sample average, a higher proportion of this class reported sex work as their primary form of income (61% vs. 47%) and engage in sex work throughout the year (71% vs. 55%). This class reported the highest proportion of exchanging sex for money (96%) and of soliciting partners by phone (67%).

Class 3, Sex work for nonmonetary items ($n=118$): Women in this class exchanged sex for goods (89%), substances (85%), and services (62%), in addition to money. Compared to the sample average, higher proportions found

clients on the street (44% vs. 30%), through acquaintances (39% vs. 27%), or by phone (77% vs. 64%). Nearly all reported working independently, and most (59%) reported that sex work was a supplemental source of income.

Class 4, Managed sex work ($n=37$): All participants in this class reported working for a boss/pimp/madam. Like Class 3, women in this class exchanged sex for substances (80%) and goods and services (43%). In addition to soliciting clients through their boss/pimp/madam (63%), they also had a higher proportion who solicited sex at hotels than the sample average (23% vs. 12%).

Risk Environment by Latent Class

Table 2 compares sociodemographics, social, economic, and physical risk environment factors, and HIV risk outcomes among these four classes. Chi-squared tests identified a statistically significantly different distribution among the four classes on several sociodemographic and risk environment variables, including study site, age, experience of violence in the prior 90 days, monthly income below the sample median, experience of homelessness in the prior 90 days, and access to medical care in the prior 90 days. Of note, occasional sex workers (Class 1) had the oldest average age, and most were recruited in Almaty. Nonmonetary sex exchange (Class 3) had the highest proportion of members experiencing violence recently, as well as elevated economic risks: this class had a higher-than-average proportion of participants with both lower than median household income and experienced recent homelessness. Those who exchanged sex for nonmonetary items also had the youngest average age, the highest proportion experiencing homelessness, and the lowest proportion who had accessed medical care in the prior 90 days.

Chi-squared tests were also used to identify associations between classes and HIV risk behaviors; significant differences were identified for most outcomes, including having multiple sexual partners, multiple paying partners, and more than one instance of unprotected sex with a paying partner. Classes did not differ by more than one instance of unprotected sex with any partners.

Associations between Sex Work Typologies and HIV Risk Behaviors

Table 3 provides both unadjusted and adjusted models of association between class membership and sexual HIV risk behaviors. Professional sex workers (Class 2) were selected as the reference group due to their position as the largest class and their moderate experience with the risk environment factors in the chi-squared models. In the unadjusted models, compared to professional sex work, occasional sex

work (Class 1) was associated with a significantly lower likelihood of multiple risk behaviors, including multiple sexual partners (OR=0.35 [95% CI: 0.19, 0.65]), multiple paying partners (OR=0.21 [95% CI: 0.11, 0.38]), and having had more than one instance of unprotected sex with a paying partner (OR=0.26 [95% CI: 0.14, 0.49]). In addition, nonmonetary sex work (Class 3) was associated with a significantly increased likelihood of having had more than one instance of unprotected sex with a paying partner (OR=1.67 [95% CI: 1.02, 2.76]).

The adjusted models showed similar findings. Compared to professional sex work (Class 2), occasional sex work (Class 1) was associated with reduced odds of multiple sexual partners (aOR=0.46 [95% CI: 0.24, 0.90]), multiple paying partners (aOR=0.25 [95% CI: 0.13, 0.49]), and of having had more than one instance of unprotected sex with a paying partner (aOR=0.33 [95% CI: 0.17, 0.63]). Adjusted models showed additional differences between professional sex work for money (Class 2) and sex for nonmonetary items (Class 3): Sex work for nonmonetary items was significantly associated with increased odds of multiple sexual partners (aOR=1.85 [95% CI: 0.96, 3.67]) and of having had more than one instance of unprotected sex with a paying partner (aOR=1.71 [95% CI: 1.01, 2.93]).

In addition to differences between the sex work typology, adjusted models demonstrated significant associations by city. Recruitment in Almaty was associated with significantly increased odds of all HIV risk behavior outcomes compared to participants in Temirtau; this included nearly an 8-fold (aOR=7.81 [95% CI: 3.80, 17.63]) increase in having multiple sexual partners and a 5.5-fold (aOR=5.51 [95% CI: 2.86, 11.34]) increase in having had more than one instance of unprotected sex with sexual partners. Experience of recent violence was associated with increased odds of more than one instance of unprotected sex with any partner (aOR=1.77 [95% CI: 1.00, 3.13]). Access to medical care was associated with reduced odds (aOR=0.62 [95% CI: 0.38, 0.99]) of more than one instance of unprotected sex with paying partners. Age and economic risk factors were not significantly associated with any of the HIV risk behaviors in adjusted models.

Discussion

Our results elucidate four distinct patterns of engagement in sex work among WESW who use drugs in Kazakhstan and suggest these are associated with varying risk environment factors and HIV risk behaviors. Ours is one of the few evidence-based typologies of sex work practice developed through LCA methods, particularly among WESW who use drugs and WESW in the EECA region. It uniquely

Table 2 Participant sociodemographic and risk environment characteristics by class and total

	Occasional sex work (Class 1)	Professional sex work (Class 2)	Non-monetary sex work (Class 3)	Sex work for a boss (Class 4)	Total	χ^2 statistic ¹ , <i>p</i> -value
	n (%) or Mean [SD]					
	61	187	117	35	400	
Sociodemographics						
<i>Study site</i>						10.01, <i>p</i> =0.018
Almaty	48 (78.7)	110 (58.8)	71 (60.7)	26 (74.3)	255 (63.8)	
Temirtau	13 (21.3)	77 (41.2)	46 (39.3)	9 (25.7)	145 (36.2)	
<i>Age</i>	37.87 [8.59]	33.75 [8.03]	33.85 [8.13]	30.40 [8.41]	34.12 [8.36]	19.35 ² , <i>p</i> <0.001
<i>Ethnicity</i>						14.384, <i>p</i> =0.109
Kazakh	7 (11.5)	17 (9.1)	9 (7.7)	5 (14.3)	38 (9.5)	
Russian	45 (73.8)	127 (67.9)	81 (69.2)	16 (45.7)	269 (67.2)	
Other Central Asian	2 (3.3)	17 (9.1)	10 (8.5)	8 (22.9)	37 (9.2)	
Other	7 (11.5)	26 (13.9)	17 (14.5)	6 (17.1)	56 (14.0)	
<i>Marital Status</i>						16.22, <i>p</i> =0.063
Single, never married	18 (29.5)	53 (28.3)	36 (30.8)	17 (48.6)	124 (31.0)	
Married	19 (31.1)	55 (29.4)	28 (23.9)	4 (11.4)	106 (26.5)	
Divorced/Separated	14 (23.0)	60 (32.1)	44 (37.6)	13 (37.1)	131 (32.8)	
Widowed	10 (16.4)	19 (10.2)	9 (7.7)	1 (2.9)	39 (9.8)	
<i>Education</i>						5.02, <i>p</i> =0.170
Less than high school	12 (19.7)	63 (33.7)	41 (35.1)	11 (31.4)	127 (31.8)	
High school or more	49 (80.3)	124 (66.3)	76 (64.9)	24 (68.6)	273 (68.2)	
Social risk environment						
Risky alcohol use	58 (95.1)	182 (97.3)	117 (100.0)	35 (100.0)	392 (98.0)	6.19, <i>p</i> =0.103
Injection drug use (90 days)	27 (44.3)	59 (31.6)	42 (35.9)	8 (22.9)	136 (34.0)	5.49, <i>p</i> =0.139
Social support (MSPSS score)	49.16 [18.44]	45.35 [20.56]	44.86 [18.81]	47.77 [18.20]	46.01 [19.54]	2.48 ² , <i>p</i> =0.479
Violence in past 90 days	32 (52.5)	122 (65.2)	94 (80.3)	27 (77.1)	275 (68.8)	17.07, <i>p</i> <0.001
Economic risk environment						
Monthly income below median (50,000 tenge)	26 (42.6)	69 (36.9)	66 (56.4)	13 (37.1)	174 (43.5)	11.85, <i>p</i> =0.008
Participant is highest earner in family	31 (50.8)	127 (67.9)	77 (65.8)	25 (71.4)	260 (65.0)	6.76, <i>p</i> =0.080
Homeless (90 days)	31 (50.8)	90 (48.1)	84 (71.8)	27 (77.1)	232 (58.0)	23.18, <i>p</i> <0.001
Food insecure (90 days)	53 (86.9)	162 (86.6)	111 (94.9)	32 (91.4)	358 (89.5)	5.81, <i>p</i> =0.121
Physical risk environment						
Jail or prison (90 days)	3 (4.9)	4 (2.1)	4 (3.4)	2 (5.7)	13 (3.2)	1.96, <i>p</i> =0.581
<i>Service access in past 90 days</i>						
General medical care	15 (24.6)	55 (29.4)	47 (40.2)	6 (17.1)	123 (30.8)	9.16, <i>p</i> =0.027
Ob-gyn/women's healthcare	9 (14.8)	35 (18.7)	27 (23.1)	7 (20.0)	78 (19.5)	1.91, <i>p</i> =0.592
HIV/STI counseling	15 (24.6)	46 (24.6)	31 (26.5)	9 (25.7)	101 (25.2)	0.16, <i>p</i> =0.984
Social services	18 (29.5)	55 (29.4)	39 (33.3)	13 (37.1)	125 (31.2)	1.18, <i>p</i> =0.757
Past 90 day HIV risk behaviors						
Multiple sex partners	33 (54.1)	144 (77.0)	100 (85.5)	24 (68.6)	301 (75.3)	22.36, <i>p</i> <0.001
Multiple paying sex partners	18 (29.5)	125 (66.8)	81 (69.2)	22 (62.9)	246 (61.5)	31.60, <i>p</i> <0.001
More than one incidence of unprotected sex with all partners	41 (67.2)	140 (74.9)	98 (83.8)	24 (68.6)	303 (75.8)	7.57, <i>p</i> =0.056
More than one incidence of unprotected sex with paying partners	17 (27.9)	111 (59.4)	83 (70.9)	21 (60.0)	232 (58.0)	30.98, <i>p</i> <0.001

¹Chi-squared test for differences among the four identified latent classes, except where otherwise noted²Kruskal-Wallis H test for differences among the four identified latent classes

Table 3 Associations between latent class membership and HIV risk outcomes, adjusted for all sociodemographics and risk environment factors

	Multiple sex partners	Multiple paying partners	More than one instance of unprotected sex (any partner)	More than one instance of unprotected sex with a paying partner
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Unadjusted Models				
Class membership (ref=Professional sex work, Class 2)				
Occasional sex work (Class 1)	0.35 (0.19, 0.65)***	0.21 (0.11, 0.38)***	0.69 (0.37, 1.31)	0.26 (0.14, 0.49)***
Nonmonetary sex work (Class 3)	1.76 (0.96, 3.33)*	1.12 (0.68, 1.84)	1.73 (0.97, 3.19)*	1.67 (1.02, 2.76)**
Sex work for boss (Class 4)	0.65 (0.30, 1.48)	0.84 (0.40, 1.82)	0.73 (0.34, 1.66)	1.03 (0.50, 2.18)
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Adjusted Models				
Class membership (ref=Professional sex work, Class 2)				
Occasional sex work (Class 1)	0.46 (0.24, 0.90)**	0.25 (0.13, 0.49)***	1.00 (0.51, 2.00)	0.33 (0.17, 0.63)***
Nonmonetary sex work (Class 3)	1.85 (0.96, 3.67)***	1.08 (0.63, 1.85)	1.77 (0.95, 3.41)*	1.71 (1.01, 2.93)**
Sex work for boss (Class 4)	0.69 (0.29, 1.67)	0.82 (0.37, 1.85)	0.76 (0.33, 1.82)	0.98 (0.45, 2.16)
Sociodemographics				
Study site Almaty (ref= Temirtau)	7.81 (3.80, 17.63)***	3.45 (2.02, 6.03)***	5.51 (2.86, 11.34)***	2.66 (1.60, 4.50)***
Age (years)	1.00 (0.97, 1.03)	0.99 (0.97, 1.02)	0.99 (0.96, 1.02)	0.98 (0.95, 1.01)
Social Risk Environment				
Recent Violence	1.26 (0.70, 2.27)	1.68 (1.00, 2.82)*	1.77 (1.00, 3.13)**	1.47 (0.88, 2.44)
Physical Risk Environment				
Medical Care	0.81 (0.46, 1.41)	0.71 (0.44, 1.16)	0.80 (0.46, 1.38)	0.62 (0.38, 0.99)**
Economic Risk Environment				
Income below median	0.70 (0.42, 1.19)	0.81 (0.51, 1.29)	0.71 (0.43, 1.19)	1.07 (0.68, 1.68)
Recent homelessness	1.30 (0.76, 2.22)	1.25 (0.78, 2.00)	1.13 (0.67, 1.90)	1.04 (0.66, 1.66)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

All outcomes are measured over the prior 90 days

incorporates multiple dimensions (including income exclusively from sex work, seasonality, management, the item exchanged for sex, and methods of soliciting clients) into evidence-based categorizations of WESW. The four typologies that we identified not only go beyond simple classifications of street vs. venue-based sex work, but they expand on prior research that has examined various features of the sex work environment individually. Particularly notable is the occasional sex work class, containing WESW who have additional sources of income and do not practice sex work throughout the year. Limited prior research [27,28] has defined this group through a single-item survey question or qualitatively, although this prior research was conducted among mixed-gender samples. Additionally, prior research suggests that exchanging sex for drugs (vs. money) may increase HIV risks among WESW; [29–31] our distinction between professional and nonmonetary sex work classes allows us to further explore this association. The differences between these two classes cannot fully represent the differences between sex work and transactional sex, as professional identification was not explicitly asked about, and Class 3 did also report receiving cash payments for sex work. However, the differences in risk environment,

particularly in substance use and gender-based violence experienced, align with other research that emphasizes the role of structural factors, rather than sex work categories, in driving risk [14]. Finally, the latent class distinction we identified between nonmonetary sex work and managed sex work are also of note; only qualitative data exists on differences between independent vs. managed sex work, exploring whether managed sex work has a protective effect on health and safety for WESW [11]. Our four identified classes not only reflect patterns seen in the existing literature, but also elucidate some of the patterns observed within this study sample; in other publications describing the full intervention procedures, [32] we note that group facilitators often noted tensions and diverging experiences between those participants who identified as sex workers (perhaps those who this analysis identified as being in Class 2 or 4), and those who may have engaged in occasional sex work or transactional sex, yet who did not identify as such (perhaps those who this analysis identified as being in Class 1 or 3).

Our overall sample of WESW who use drugs had high levels of HIV risk behaviors, as measured by number of partners (paying and overall) and instances of unprotected sex with those partners. Our study uncovered several

notable differences by latent class. A low proportion of women engaged in sex work occasionally, and while they did report HIV risk behaviors, these were significantly less than those who professionally engaged in sex work. This finding suggests that HIV prevention programming may be better focused on those who engage in sex work full time, either for money (as our professional sex work class did), or for substances, goods, or services (as our nonmonetary sex work and managed sex work classes did).

At the same time, the class of women engaged in sex for nonmonetary items (marked by higher levels of exchanging sex for substances, goods, or other services as opposed to only money) emerged as a potentially higher risk group, having increased odds of both having more than one sexual partner and of having unprotected sex with paying partners compared to professional sex workers in the adjusted models. The significant differences between classes noted in risk environment factors may contribute to these differences; nonmonetary sex workers had higher than average experience of recent violence and economic risks (homelessness and lower than median household income). Prior research among this same study sample has identified distinct classes of police violence victimization and associated poly-victimization with higher likelihood of having a positive HIV status; [33]. While our models did not consider the perpetrators of the recent violence experienced by women in our sample, it emphasizes the syndemic risks of violence and HIV faced by WESW populations [8]. Combined with their economic vulnerability, it suggests that this class may be particularly vulnerable to abuse and coercion by paying clients, which perhaps accounts for the significantly elevated odds of multiple partners and reduced odds of condom use with paying partners. The sex work for nonmonetary items class also had the highest proportion (89%) of participants who exchanged sex for substances (alcohol, drugs, or cigarettes), suggesting that they might have elevated levels of substance use. To effectively reach this group, intervention programs must account for these multiple structural risks and incorporate activities such as safety planning and referrals to substance use services.

While the differences that emerged by latent class are the primary focus of this analysis, it is also notable that WESW in Almaty exhibited significantly higher odds of risk behaviors than those in Temirtau across all four study outcomes assessed. The two study sites are geographically distant and diverse, and there are several elements that may explain this difference. Temirtau's longtime status as the center of Kazakhstan's HIV epidemic has prompted investments in local HIV prevention programming by Kazakhstan's Ministry of Health and international organizations, [34,35], which may have contributed to the lower odds of risk behaviors observed in the present study. This difference between cities may also reflect the

shifting nature of the HIV epidemic in Kazakhstan from parenteral to sexual transmission, [1] and the resulting decrease in Temirtau's centrality in the country's HIV epidemic.

Limitations

The non-probability sampling methods used for recruitment limit the generalizability of our results within Kazakhstan and across EECA. Additionally, the Nova baseline survey contained a limited number of variables that were applicable to the policy level of the risk environment framework, and therefore, we did not incorporate this into our analyses. As the study was cross-sectional, our findings were correlational; other research has noted that individual sex work practices may change over time, and risks may change with them [36].

Conclusions

Our findings emphasize that typologies of sex work differ among WESW who use drugs in Kazakhstan and that we must consider population heterogeneity when designing HIV prevention interventions to meet their needs. HIV prevention interventions must acknowledge this variety and be targeted and tailored to the needs of these varying typologies of WESW.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10461-024-04443-7>.

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Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Competing Interests The authors declare that they have no competing interests.

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