

Food Insecurity Increases HIV Risk Among Young Sex Workers in Metro Vancouver, Canada

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Abstract This research aimed to determine the effect of food insecurity on sexual HIV risk with clients among youth sex workers (YSWs) <30 years in Metro Vancouver, Canada. Data were drawn from a prospective community cohort of sex workers (2010–2013). We examined the independent relationship between YSWs' food insecurity and being pressured into sex without a condom by clients ("client condom refusal"). Of 220 YSWs, 34.5 % (n = 76) reported client condom refusal over the 3.5-year study period and 76.4 % (n = 168) reported any food insecurity. Adjusting for other HIV risk pathways, food insecurity retained an independent effect on client condom refusal (AOR 2.08, 95 % CI 1.23–3.51), suggesting that food insecurity is significantly associated with HIV risk among YSWs. This study indicates a critical relationship between food insecurity and HIV risk, and demonstrates YSWs' particular vulnerability. Public policies for food assistance as a harm reduction measure may be key to addressing this disparity.

Keywords Sex work · Youth · HIV · Food insecurity

Introduction

Globally and in the Canadian context, food insecurity is increasingly acknowledged as a critical determinant of health [1, 2]. Food insecurity has been shown to precipitate negative health outcomes and disproportionately affect marginalized populations, including people living with Human Immunodeficiency Virus (HIV) [3]. Food insecurity has been defined as "the limited or uncertain availability of nutritionally adequate, safe foods or the inability to acquire personally acceptable foods in socially acceptable ways" [4]. A growing body of research from multiple global settings suggests a complex relationship between food insecurity and HIV outcomes along the continuum of HIV prevention, treatment and care [5–8].

Among people living with or affected by HIV, the reciprocal relationship between food insecurity and HIV outcomes has been studied via multiple pathways [9]. Women are particularly affected by the impacts of food insecurity and HIV through key social and structural factors, including gender inequities, discrimination, and poverty [3, 9, 10]. Studies from Botswana, Swaziland, and Brazil find that food insecurity for women is associated with inconsistent condom use [5, 11]. These and other studies suggest that unmet basic needs, including food insecurity, lead to increased sexual vulnerability for women, and can result in transactional sex to ensure adequate access to these necessities [11–13]. Women sex workers can be further impacted by factors representing social and structural vulnerability, including sex work criminalization, homelessness, and violence [14–16], yet the role of food insecurity in this context remains poorly understood. As a known element of structural vulnerability, food insecurity has the potential to play a substantial role in influencing condom negotiation and use between sex

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workers and their clients (e.g., being pressured into sex without a condom by clients [“client condom refusal”], an important indicator of HIV/sexually transmitted infection [STI] risk).

Youth, especially youth who are street-involved, are disproportionately affected by HIV/STIs [17]. Moreover, adolescent initiation into sex work is associated with heightened risk for acquiring HIV later in life [18]. For these reasons, the World Health Organization identifies youth who sell sex as a key vulnerable population in the global HIV epidemic [19]. However, limited research has been conducted with youth sex workers (YSWs) in large part due to the hidden nature of the population, fuelled by laws surrounding sex work and age, criminalization, and stigmatization. Food insecurity for YSWs may have a heightened impact on HIV/STI risk and reduce retention in HIV care due to socio-structural factors that amplify vulnerability for young people, such as fewer resources and limited personal agency. Much of the existing research on sex work and food insecurity has been conducted in resource-poor countries, typically in the Global South, with limited data from resource-rich countries in the Global North. Evidence shows that food insecurity is largely concentrated among key affected populations in resource-rich settings, such as people in poverty, sex workers and youth [3, 20]. Research from these settings indicates a need to further examine the effects of food insecurity on populations affected by HIV to understand the mechanisms contributing to HIV risk in vulnerable groups and the relationship between structural factors such as food insecurity and HIV/STI risk [21, 22]. The objective of this research was therefore to use longitudinal data to examine the independent effect of food insecurity on sexual HIV risk with clients among YSWs aged 14–29 years in Metro Vancouver, Canada.

Methods

Study Design and Data

Data for this study were drawn from a prospective cohort in Metro Vancouver, An Evaluation of Sex Workers Health Access (AESHA). This particular study used data from the 3.5-year period between January 2010 and August 2013. AESHA was developed based on substantial community collaborations with sex work agencies beginning in 2005 and an active Community Advisory Board of representatives from more than 15 community agencies. Eligibility for AESHA includes self-identifying as a woman (trans inclusive), having exchanged sex for money within the last 30 days, and providing written informed consent. Given the challenges of recruiting sex workers in isolated/hidden

locations, as in previous studies [23], time-location sampling was used to recruit youth and adult women and transgender sex workers through day and late night outreach to outdoor/public sex work locations (i.e. streets, alleys) and indoor sex work venues (i.e. massage parlours, micro-brothels, and in-call locations) across Metro Vancouver. Additionally, online recruitment was used to reach sex workers working through online solicitation spaces. Indoor sex work venues and outdoor solicitation spaces (‘strolls’) were identified through community mapping conducted together with current/former sex workers and continue to be updated by the outreach team. The study holds ethical approval through Providence Health Care/University of British Columbia Research Ethics Board.

At enrolment and on a bi-annual basis, sex workers completed an administered questionnaire from a trained interviewer (AESHA staff includes both sex workers and non-sex workers) and HIV/STI/HCV serology testing by a project nurse. The main interview questionnaire elicited responses related to socio-demographics (e.g. age, gender/sexual identity, ethnicity, housing history), sex work patterns (e.g. number of clients, fees/types of sexual services, client characteristics, condom use), drug use patterns of sex workers and their clients, physical work environment factors (e.g. type of work environment, access to condoms and other prevention resources), social/interpersonal environment factors [e.g. social cohesion among sex workers, exposure to intimate partner and occupational violence and structural environment factors (e.g. adverse interactions with police, prostitution arrests)]. Following a pre-testing counselling questionnaire with the project nurse, Biolytical INSTI rapid tests were used for HIV screening, with reactive tests confirmed by blood draw for western blot. Urine samples were collected for gonorrhoea and chlamydia, and blood was drawn for syphilis, HSV-2 antibody, and HCV. Women visited one of two office locations in Metro Vancouver or completed the interviewer-administered questionnaire and nursing component at their work or home location. All participants received an honorarium of \$40 CAD at each bi-annual visit for their time, expertise and travel. Treatment was provided by our project nurse onsite for symptomatic STI infections, and free serology and Papanicolaou testing was also available, regardless of enrolment in the study.

Outcome

As condoms are an effective means of reducing the risk of sexual HIV/STI transmission, our outcome of interest represented condom non-use by clients through pressure, and was conceptualized as “client condom refusal” based on discussions with community partners and participants. It was defined from a survey item to which YSWs responded

“yes” to being coerced into vaginal or anal sex without a condom versus “no” (i.e. responded “yes” to “always”, “usually”, “sometimes”, or “occasionally” versus “never” for one-time or regular clients) in the last 6 months. This variable was time-updated and intended to represent the critical role that clients play in condom use during a sexual encounter. The “client condom refusal” variable is consistent with other papers from our research group [24].

Food Insecurity Measures

The Radimer–Cornell Food Security Scale is a validated scale to measure household food security and is frequently employed as a tool to evaluate food insecurity and inform policy recommendations [7, 25]. As in other studies, [26, 27] this study used a modified version of the Radimer–Cornell Scale (Table 1). The scale used in our study was pilot-tested and adapted to our study population and setting, including adding a variable relating to exchanging sex directly for food. Some studies have used only one question from the scale, or created a binary yes/no measure of food insecurity (i.e., responding yes to at least one food insecurity question) to obtain a more focused understanding of one relationship, [26] whereas others have combined the scale measures to better understand the global effect of food insecurity [28]. Since we were interested in understanding the independent impact of the different types of food insecurity on HIV risk, we used factor analysis to identify food insecurity types/subscales. Specifically, we used factor analysis with varimax rotation to assess the number of factors present among the items from the Radimer–Cornell Scale, using a maximum likelihood method, as in previous studies [15]. Factors were retained based on the following criteria: eigenvalues of >1 ; collectively accounted for 70–80 % of the variance; and preceded the elbow in a Scree plot. We then used factor loadings to determine the number of items included within each factor. In addition, we used Tucker and Lewis’ Reliability coefficient (0.93) to assess the reliability of the remaining factors. Finally, Cronbach’s alpha scores were used to assess internal consistency within each subscale. All survey items (factors) from the scale in the original questionnaire were recoded as “yes” (“often true” or “sometimes true”) or “no” (“never true”) to use the Cronbach method for validation.

Using this method, we grouped the survey items from the scale into three sub-scales: (1) food insecurity due to limited financial ability to afford food (combining items 6, 7, 8, 12 and 13); (2) food insecurity related to having dependent children (combining 9, 10 and 11); and (3) food insecurity based on being worried about running out of food (combining 1, 2, 3 and 4). Two items (5 and 15) were

excluded from the subscales because of low factor loading scores (Chronbach Alpha <0.4). Removing these items increased the score to 0.82. For the three sub-scales overall, the Tucker and Lewis Reliability Coefficient was >0.93 . We considered item 15, exchanging sex directly for food, separately as our fourth factor, as it was of particular interest in this study.

Potential Confounding Variables

We included multiple hypothesized variables that could be potential confounders in the relationship between food insecurity and client condom refusal. These included: identifying as a gender/sexual minority (gay, lesbian, bisexual, transgender, transsexual, two-spirit or ‘other’ [LGBT+], vs. straight); Indigenous ancestry (First Nations, Métis, Inuit vs. not); new immigrant/migrant to Canada, location of residence (homeless; outside or within Metro Vancouver, not including within the inner city epicentre [Downtown Eastside]; vs. Metro Vancouver—within the Downtown Eastside); primary place servicing clients (outdoor or public space [including street, public wash-room, car, tent, underground parkade, squat or ship], informal indoor space [including crack/drug house, sauna/steam bath, bar, nightclub, exotic dance club, strip club, show lounge, hotel, hourly rental, client’s place, single room occupancy (SRO) or supportive housing], brothel or quasi-brothel [massage/beauty parlour, micro-brothel, managed indoor space/brothel]), non-injection drug use, injection drug use, any physical or sexual violence by a client in the last 6 months, police harassment without arrest, and using sex worker support services [WISH drop-in centre, PACE, PEERS, MAP Van, SWUAV, SWAN]). With the exception of social-demographic variables, all variables were time-updated and measured in the last 6 months.

Statistical Analyses

We first used data from participants’ baseline surveys to illustrate characteristics of our sample, including univariate descriptive statistics and bivariate associations between key sample variables and client condom refusal (Table 2). We used Chi squared or Fisher’s exact test for categorical sample variables and the Wilcoxon rank-sum test for continuous sample variables.

We employed bivariate and multivariable generalized estimating equations (GEE) with a logit link for the dichotomous outcome to examine the relationships between food insecurity measures and client condom refusal, combining data from both baseline and follow-up surveys. This approach has been used in previous studies [29] to take into account repeated measures on the same

Table 1 Original and modified Radimer–Cornell scales

Original ^a	Modified
<i>Household hunger</i>	<i>Worried about food running out</i>
1. Do you worry whether your food will run out before you get money to buy more?	1. I worry about whether my food will run out before I get money to buy more
2. I worry about where the next day's food is going to come from	2. I worry about whether the food that I can afford to buy for my household will be enough
3. The food that I bought just didn't last, and I didn't have money to get more	3. The food that I bought just didn't last and I didn't have money to buy more
4. I ran out of the foods that I needed to put together a meal and I didn't have money to get more food	4. I ran out of the foods that I needed to put together for a meal and I didn't have money to get more food
<i>Women's hunger</i>	5. We eat the same thing for several days in a row because we only have a few different kinds of food on hand and didn't have money to buy more (Excluded from factor loading)
1. I can't afford to eat the way I should	<i>Limited Financial Ability to Afford Food</i>
2. How often are you hungry but you don't eat because you can't afford enough food?	6. I am often hungry, but I don't eat because I can't afford enough food
3. Do you eat less than you think you should because you don't have enough money for food?	7. I eat less than I think I should because I don't have enough money for food
4. Can you afford to eat properly?	8. I can't afford to eat properly
<i>Children's hunger</i>	12. Sometimes people lose weight because they don't have enough to eat. In the past year, did you lose weight because there wasn't enough food?
1. My child (ren) is/are not eating enough because I just can't afford enough food	13. In the past 6 months, have you had hunger pains but couldn't eat because you couldn't afford food?
2. I know my child(ren) is/are hungry sometimes, because I just can't afford more food	<i>Dependent Children</i>
3. I cannot give my child(ren) a balanced meal because I can't afford that	9. My child (children) are not eating enough because I just can't afford enough food
4. I cannot afford to feed my child(ren) the way I think I should	10. I know my child (children) are hungry sometimes, but I just can't afford more food
	11. I cannot afford to feed my child (children) a balanced meal because I can't afford that
	<i>Exchanging sex directly for food</i>
	14. Have you ever exchanged sex (including oral/BJ on him) directly for food? (Excluded from factor loading)
	15. In the last 6 months, have you exchanged sex (including oral/BJ on him) directly for food? (Excluded from factor loading, included separately)

^a [52]

individuals using longitudinal data and increase effective sample size. As in previous similar studies [30, 31], we considered variables that were statistically significant at $p < 0.10$ in the bivariate analyses as candidates for inclusion as potential confounders in the multivariable models, in addition to one a priori confounder (gender/sexual minority). For the multivariable models, we fitted a confounder model using logistic regression for the outcome using the methods of Maldonado and Greenland [32]. Adjusted Odds Ratios and 95 % confidence intervals were reported (AOR: [95 % CIs]). We used a manual backward model selection process to identify the multivariable model with best overall fit, indicated by the lowest quasi-likelihood under the independence model criterion value [33].

All p-values are two-sided and all analyses were performed using SAS software version 9.3. (SAS Institute, Cary, NC, USA).

Results

Sample Characteristics

Of a total of 708 sex workers enrolled in AESHA over the 3.5-year study, this analysis was restricted to 220 YSWs between the ages of 14 and 29. Table 2 presents sample characteristics of participants from only the baseline survey. Almost one-third, 31.4 % ($n = 69$), self-identified as a

Table 2 Baseline characteristics of 220 female youth (14–29 years) sex workers in Vancouver, Canada, stratified by client condom refusal

Baseline sample characteristics (n = 220)	Overall	Client condom refusal ^a		p value
		Yes % (n)	No % (n)	
Age (median (IQR))	25.0 (23.0–27.5)	24.2, 24.0 (22.0–27.0)	25.1, 25.0 (23.0, 28.0)	0.087
Indigenous ancestry				
Yes	44.0 (97)	8.6 (19)	35.5 (78)	0.165
No	55.9 (123)	15.5 (34)	40.5 (89)	
Gender/sexual minority ^b				
Yes	31.4 (69)	5.5 (12)	25.9 (57)	0.116
No	68.6 (151)	18.6 (41)	50.0 (110)	
Current place of residence ^c				
Downtown Eastside (DTES)	30.0 (66)	6.4 (14)	23.6 (52)	0.602
Outside DTES	58.2 (128)	15.5 (34)	42.7 (94)	
Homeless	9.5 (21)	1.8 (4)	7.7 (17)	
Primary place of servicing clients ^a				
Outdoor	48.2 (106)	13.6 (30)	34.6 (76)	0.298
Informal indoor	30.5 (67)	6.8 (15)	23.6 (52)	
Brothel	21.4 (47)	3.6 (8)	17.7 (39)	
Non-injection drug use ^a				
Yes	79.1 (174)	21.8 (48)	57.3 (126)	0.018
No	20.9 (46)	2.3 (5)	18.6 (41)	
Injection drug use ^a				
Yes	42.7 (94)	12.3 (27)	30.5 (67)	0.165
No	57.3 (126)	11.8 (26)	45.5 (100)	
Experienced any physical/sexual violence by clients ^a				
Yes	29.6 (65)	12.7 (28)	16.8 (37)	<0.001*
No	70.5 (155)	11.4 (25)	59.1 (130)	
Accessed major sex work/outreach programs ^a				
Yes	60.0 (132)	15.5 (34)	44.6 (98)	0.479
No	40.0 (88)	8.6 (19)	31.4 (69)	
Immigrated to Canada from another country				
Yes	17.3 (38)	2.3 (5)	15.0 (33)	0.083
No	82.7 (182)	21.8 (48)	60.9 (134)	
Experienced police harassment without arrest ^a				
Yes	38.2 (84)	8.6 (19)	29.6 (65)	0.687
No	61.8 (136)	15.5 (34)	46.4 (102)	
Food insecurity measures				
Limited financial ability to afford food ^a				
Yes	61.8 (136)	18.2 (40)	43.6 (96)	0.019
No	38.2 (84)	5.9 (13)	32.3 (71)	
Food insecurity related to having dependent children ^a				
Yes	0.5 (1)	0 (0)	0.5 (1)	0.759
No	99.6 (219)	24.1 (53)	75.5 (166)	
Worried about food running out ^a				
Yes	61.4 (135)	16.4 (36)	45.0 (99)	0.260
No	38.6 (85)	7.7 (17)	30.9 (68)	
Exchanged sex directly for food ^a				
Yes	9.1 (20)	2.3 (5)	6.8 (15)	0.921

Table 2 continued

Baseline sample characteristics (n = 220)	Overall	Client condom refusal ^a		p value
		Yes % (n)	No % (n)	
No	90.9 (200)	21.8 (48)	69.1 (152)	

^a As measured in the last 6 months

^b Including: ‘gay’, ‘lesbian’, ‘bisexual’, ‘transgender’, ‘transsexual’, ‘two-spirit’, ‘other’

^c No information on place of residence from 5 individuals

gender/sexual minority, and 44.0 % (n = 97) reported Indigenous ancestry (First Nations, Métis or Inuit). At baseline, over the previous 6 months, 61.8 % (n = 136) of YSWs had limited financial ability to afford food, 61.4 % (n = 135) were worried about food running out and 9.1 % (n = 20) had exchanged sex directly for food. (See Table 2 for details).

Over the entire observation period, 34.5 % (n = 76) YSWs reported client condom refusal and (76.4 %, n = 168) experienced at least one type of food insecurity at any point during the study period, 64.1 % (n = 141) experienced more than one type of food insecurity at any point during the study period, and 46.8 % (n = 103) reported food insecurity at each interview for the duration of the study. Limited financial ability to afford food was reported by 67.3 % (n = 148) YSWs, 72.3 % (n = 159) were worried about food running out and 13.6 % (n = 30) YSWs exchanged sex directly for food at some point over the study period.

Food Insecurity and Condom Use

Table 3 describes the bivariate and multivariable relationships between the food insecurity measures and client

condom refusal. In bivariate logistic regression using GEE, limited financial ability to afford food [OR 2.83, 95 % confidence intervals (CIs) (1.77–4.55)] and worry about food running out (AOR 1.54, 95 %CIs 0.96–2.47) were statistically significantly associated with client condom refusal, while exchanging sex directly for food was not statistically significantly associated with the outcome. Based on results from bivariate analysis, the following variables were included as potential confounder variables in the multivariable model to start: age, gender/sexual minority, Indigenous ancestry; recent (last 6 months) homelessness; recent client violence; and recent non-injection drug-use. The final variable set for each separate multivariable model for the relationship between each food insecurity measure and the outcome, based on model-fitting criteria is included in the footnote in Table 3. In the final multivariable logistic regression models using GEE, limited financial ability to afford food remained statistically significantly associated with client condom refusal after adjusting for confounders (AOR 2.08, 95 %CIs 1.23–3.51). Neither worrying about food running out (AOR 1.25, 95 %CIs 0.71–2.21) nor exchanging sex directly for food (AOR 0.68, 95 % CIs 0.26–1.74) were statistically significantly associated with client condom refusal in

Table 3 Bivariate and multivariable ORs and AORs using GEE for the relationship between food insecurity measures and client condom refusal among 220 youth (14–29 years) sex workers in the AESHA Cohort in Metro Vancouver, Canada

Food insecurity measure	Client condom refusal ^a			
	Bivariate Crude odds ratios (95 % CI)	p value	Multivariate Adjusted odds ratios (95 % CI)	p value
Limited financial ability to afford food	2.83 (1.77–4.55)	<0.000*	2.08 (1.23–3.51)	0.006*
Food insecurity related to having dependent children	N/A		N/A	
Worried about food running out	1.54 (0.96–2.47)	0.072	1.25 (0.71–2.21)	0.433
Exchanged sex directly for food	1.15 (0.51–2.59)	0.734	0.68 (0.26–1.74)	0.415

^a Each food insecurity measure was examined in a separate multivariable model, adjusted for confounders. *Limited financial ability* final variables: Indigenous ancestry; homeless in the last 6 months (time-updated [TU]); non-injection drug use in the last 6 months (TU); experienced client violence in the last 6 months (TU). *Worried about food running out* final variables: age; gender/sexual minority; Indigenous ancestry; homeless in the last 6 months (TU); experienced client violence in the last 6 months (TU); non-injection drug use in the last 6 months (TU); injection drug use in the last 6 months (TU). *Exchanged sex directly for food* final variables: age; homeless in the last 6 months (TU); experienced client violence in the last 6 months (TU); non-injection drug use in the last 6 months (TU); injection drug use in the last 6 months (TU)

* Statistically significant at p < 0.05

multivariable analysis. The food insecurity measure related to having dependent children was omitted in both analyses because very low numbers of youth in the sample reported having children.

Discussion

This study provides quantitative evidence supporting the relationship between financial food insecurity and vulnerability to HIV/STIs among YSWs. Over three-quarters of YSWs were considered food insecure at some point over the study period. The national estimate of overall general food insecurity from the Canadian Community Health Survey (CCHS) in 2012 was 8.3 % [34]. In our study, the prevalence of food insecurity for YSWs is alarmingly disproportionate at more than ninefold the national average. Moreover, the CCHS excludes populations most susceptible to food insecurity, such as homeless populations and Indigenous populations on reserve, and likely underestimates the prevalence of food insecurity in Canada.

These results suggest the critical importance of ensuring the availability and accessibility of food to marginalized youth both independent of as well as embedded within HIV/STI prevention programming. Financial food insecurity may have been associated with heightened client condom refusal because it represents the most straightforward and strongest representation of limited economic resources and limited access to food for marginalized YSWs. The outcome in question represents condom non-use by clients in a sexual transaction. Condom non-use has been shown in a number of studies to be associated with higher fees for sexual services [35, 36], frequently driven by poverty and drug use. The relationship detected in our study may reflect difficult decisions made by YSWs to agree to clients' refusal to use condoms in order to earn more money for food, among other necessities. Worry about food insecurity may not necessarily mean YSWs are unable to afford food but indicates its uncertain availability—a key element to food insecurity. As in other settings [37], while some YSWs may be in indirect or informal 'transactional' relationships with intimate partners including access to food, the exchange of sexual acts directly for food may be uncommon. Women may prefer directly meeting financial needs and pressures first and may make decisions about accessing food later. Nutritious food is challenging to find and hard to afford in Vancouver's poorest neighbourhood, the Downtown Eastside [38], where many YSWs live, work, and/or access services.

Direct comparisons across studies are difficult due to differences in how food insecurity is measured, differences in population structure, including how "youth" is defined,

and differences in timescales over which food insecurity is measured. Of concern is that the prevalence of financial food insecurity (67.3 %) and worry about food running out (72.3 %) among YSWs in our study appears higher relative to other studies of marginalized youth, including street youth aged 16–25 years in Toronto where 48 % reported hunger or "absolute food deprivation" [39], and street youth aged 18–30 in Quebec City where 48 % reported hunger due to not able to afford enough food [40]. The prevalence of food insecurity among YSWs is approximately 20 % higher when paralleled with these comparable groups of marginalized youth.

Food insecurity can be interrelated with other social determinants (e.g. education; age; employment) and it is difficult to isolate these factors, especially in communities such as this where intersecting factors may increase vulnerability to food insecurity. To address these issues we adjusted for homelessness in the last 6 months as an indicator of extreme socioeconomic vulnerability; nonetheless, the association between food insecurity itself and client condom refusal was maintained in our multivariable models. While it may be useful to adjust for more direct measures of socioeconomic status such as income, it is difficult to use this variable as the sole marker of economic status/poverty. This is because in this population of YSWs, income may be quite variable and thus difficult to estimate over longer time periods; income may be obtained from casual employment (e.g. day labour; housecleaning) or illegal employment (drug trade; sex work; panhandling); and because income is often untracked in detail by participants. Similar to many other populations, there may also be hesitation by sex workers to divulge accurate information on finances for personal reasons.

Our results are consistent with other studies regarding sex workers' health and safety. Sex workers in vulnerable situations often need to consider immediate gain versus long-term risk [41]. Rushed transactions in the context of criminalization of sex work can dramatically impact sex workers' ability to negotiate safely with clients due to the threat of police harassment and fear of arrest [14]. Sex workers with high levels of food insecurity may have less power in negotiations with clients and may be more willing to agree to sex without a condom in order to avoid the threat of hunger [41]. YSWs who are food-insecure may generally have fewer assets or resources than YSWs who are food-secure and agree to sex without a condom in exchange for possibly earning more money. Additionally, as the cost of housing in Vancouver is high, including in Single Room Occupancy (SRO) units with inadequate kitchen facilities, residents in poverty may reallocate their money to ensure shelter first and remain uncertain about how to later access food [38]. Since almost a third of YSWs in our study self-identify as a gender/sexual

minority, the social vulnerabilities faced by gender/sexual minority youth need to be considered, as they may influence the relationships between food insecurity and client condom refusal, especially among those who are racialized and/or street-involved. These vulnerabilities are well documented and include discrimination, violence, and homelessness [12, 19, 42]. For example, gender/sexual minority YSWs may have been discriminated against or abused at home and school and had difficulty completing an education, impacting their access to income/employment options; further, these youth may experience discrimination in accessing housing, all contributing to negative health outcomes [43–45].

Implications for Policy and Future Research

There is no government-run food program in Canada [46] so people often access food assistance through not-for-profit organizations. Close to one million people rely on food banks monthly in Canada, with 100,000 users each month in British Columbia alone [47]. Food from not-for-profit organizations may not always be plentiful or of high nutritional quality due to capacity constraints and finances. Food assistance programming in Metro Vancouver is often community-based, ad-hoc, open to the public and rarely designed for women, sexual minorities or youth. The occasional women-/youth-/sexual minority-centered programming may have exclusive hours (e.g., women-only hours; youth-only hours) or locations for members where people feel safer, free from harassment, and the fear of encountering abuse from former partners or people with discriminatory beliefs. Research in this population supports the effectiveness of women-only spaces [48]. Many services are general and open to everyone, but this approach can paradoxically exclude individuals who are more vulnerable to food insecurity because safety from abuse and discrimination in a public environment is not guaranteed [38]. Since a high proportion of youth in this study self-identify as LGBT+, inclusivity should be a key concern in program design and further research. Food banks, not-for-profit organizations, or religious services can require referrals, ID, have restrictions, short opening hours, or mandatory sermons, all of which can be barriers to quick access to food. Evidence suggests that the existence of generalized, independent, non-profit food programs such as food banks can mislead policy-makers to believe there is no serious need to develop targeted food security solutions for particularly susceptible populations [49]. Our research reaffirms the demand for such solutions while developing provincial and national public strategies to address the causes of poverty and food insecurity among youth. Harm reduction has traditionally been conceptualized around reducing the harms associated with drug use while taking a

non-judgmental and supportive approach [50] (e.g., by supporting needle exchanges to help prevent transmission of blood-borne pathogens); however, it can be useful to conceptualize food security as harm reduction for YSWs and other marginalized youth, with respect to the potential positive effect food security could have on reducing HIV/STI risk. Increasing access to healthy, nutritious food for marginalized women could help reduce the financial pressure to engage in sex work or agree to client condom refusal in exchange for increased fees. We further argue that food security should be pursued on its own as a basic human right in addition to being framed as a harm reduction measure to reduce HIV/STI risk for socially marginalized groups. Given the high proportion of YSWs of Indigenous ancestry in our study, policies must also include culturally and historically sensitive considerations and strive to explicitly include Indigenous youth. Addressing the unmet need for accessible, nutritious food by YSWs may address a catalyst for unsafe sexual behaviours and lessen the HIV/STI risk in this population.

Further, the criminalization of sex work in Canada impacts women's agency, safety, and ability to access health services [14, 16]. When women's means of acquiring money for food is criminalized, their self-sufficiency in meeting basic nutritional needs is prevented. Because YSWs are likely to avoid areas that have health and support services due to violence and policing [51], and because youth who begin sex work in adolescence are more likely to acquire HIV and be arrested for sex work when they are older [18] these laws have a particular impact on YSWs. It is imperative that policy- and lawmakers approach issues of public health from a human rights standpoint, employ the empirical evidence in support of decriminalization, and act to ensure positive social determinants of health, including ensuring access to healthy food that satisfies Canadian nutritional requirements.

Strengths and Limitations

Investigating criminalized and highly stigmatized contexts such as sex work make identifying a representative sample challenging for research. This study sample may not be representative of all sex workers and settings; however, the inclusion of highly experienced interview, outreach and nursing staff, including youth and experiential staff, as well as comprehensive mobile outreach allows for a large and diverse study population. This is a quantitative analysis and we were unable to assess definitive reasons that YSWs are food insecure in Vancouver, where general charitable food sources do exist, however these findings support other work with street-involved and drug-using youth [39, 40]. Qualitative studies may further elucidate the particular barriers for YSWs. In this study we have collapsed gender identity

and sexual identity into a “sexual/gender minority” variable for sample size considerations. We acknowledge, however, that there is heterogeneity in terms of the risks and vulnerabilities regarding HIV faced by women, depending on their sexual and gender identity. Further research, particularly with a qualitative approach, should be conducted into the specific experiences of sex workers who do not identify as cisgender and heterosexual. As all survey items are self-reported, responses may be subject to a measure of social desirability bias, although this is expected to be minimal due to explicit assurances of confidentiality and interviewer rapport with participants, especially through the peer-to-peer nature of interview staff with lived experiences in sex work and other strong community linkages in Metro Vancouver. Food insecurity is not intended as a proxy for poverty in this study but we acknowledge the limitations that may exist for policy implications when examining one element of poverty that may reflect multiple factors. The Radimer–Cornell scale has the potential to be a useful framework for gaining important insights about food insecurity in different populations. This scale has been implemented and interpreted in many ways in different studies, however, making valuable comparison across different study populations is difficult. In the absence of a unifying guide to construct and assess a single measure of food insecurity, we have used an iterative, data-driven, and conceptual approach based on our extensive community-involved work with our study population. We used factor analysis to group scale items into categories and critically examined the results to ensure that the relationships were appropriate for our study population. While this approach may not produce consistent measures across all populations, we suggest that our approach could be useful for other researchers to replicate, as developing measures unique to individual study populations may be necessary to capture patterns of food insecurity specific to these populations.

Conclusions

One-third of YSWs reported client condom refusal over the study period. Three-quarters of YSWs experienced some measure of food insecurity and two-thirds were financially food insecure over the study period. Financially food insecure YSWs had twice the odds of client condom refusal compared to food secure YSWs. Access to adequate, nutritious food for marginalized youth is necessary to facilitate positive sexual and reproductive health outcomes for YSWs made vulnerable to HIV/STIs. Youth-centered programs that address critical social and structural factors shaping HIV/STI risk negotiation should be integrated into HIV/STI programming and prevention. Programs focused

on food security and sexual health education must include an intentional focus on gender/sexual minority youth and Indigenous youth as there is a high proportion of YSWs from these groups in Metro Vancouver. Public policies supporting access to healthy food that satisfies Canadian nutritional requirements must be pursued and can be conceptualized as a harm reduction measure. Food assistance that does not rely on strained charitable organizations must become a priority for inclusive public programs to address the stark food security disparity faced by the most marginalized communities in Metro Vancouver.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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