Food insufficiency is associated with depression among street-involved youth in a Canadian setting

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Abstract

Objective: Food insufficiency, defined by the experience of hunger, is known to be prevalent and a source of health-related harm among-street involved youth, but little is known about its relationship with depression in this population. Therefore, we sought to assess the association between food insufficiency and symptoms of depression among a cohort of street-involved youth.

Design: Multivariable logistic regression was used to assess the relationship between food insufficiency, defined as being hungry but not having enough money to buy food, and depression as measured by the Center for Epidemiological Studies Depression (CES-D) scale.

Setting: Data from April 2006 to November 2013 were derived from the At-Risk Youth Study (ARYS), a prospective cohort of street-involved youth who use illicit drugs in Vancouver, Canada.

Subjects: There were 1066 street-involved youth enrolled in the study, including 340 (31·9 %) females.

Results: Of 1066 youth enrolled in the study, 724 (67·9 %) reported some food insufficiency and 565 (53·0 %) met criteria for depression. Compared with youth who did not report food insufficiency, those who reported often experiencing food insufficiency had a higher likelihood of reporting depression (adjusted OR = 2·52; 95 % CI 1·74, 3·67), as did those who reported sometimes experiencing food insufficiency (adjusted OR = 1·99; 95 % CI 1·47, 2·70).

Conclusions: Food insufficiency was prevalent and associated in a dose-dependent trend with symptoms of depression among street-involved youth in our setting. Findings highlight the need to address the nutritional and mental health needs of youth and identify pathways by which food insufficiency may contribute to depression among vulnerable populations.

Youth and young adults who live or work on the street contend with an array of health and social challenges, including engagement in injection drug use[1], sex work[2] and substandard housing[3]. In turn, these challenges have resulted in elevated morbidity and mortality among this population relative to other youth[4,5]. Street-involved youth also frequently struggle to obtain nutritious and reliable food supplies[6,7], which has been associated with nutritional deficiencies[8–10], kidney disease[11], poor mental health[12,13], obesity[14] and diabetes[15] in high-risk populations and in the general adult population. In addition, mental illness, such as major depressive disorder, disproportionately affects street-involved youth[16,17].

Food insecurity is a broad conceptual term referring to the inability to acquire, through socially acceptable means, adequate food supplies for a healthy life[18]. Food insufficiency is an individual-level stage of food insecurity that is defined by the experience of hunger[19]. Previous studies have found associations between experiences of food insecurity and depressive symptoms among selected populations, such as people who are HIV-positive[20,21], adults who use injection drugs[22], recent mothers[23], individuals with diabetes[24] and youth[25,26]. However, to our knowledge, there has been no investigation of the relationship between food insecurity and symptoms of depression among populations of street-involved youth who use illicit drugs.

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Drawing on a prospective cohort study of street-involved youth who use illicit drugs in a Canadian setting, we undertook the present study to examine the relationship between food insufficiency and symptoms of depression, including changes in depression with rising levels of food insufficiency.

Methods

The At-Risk Youth Study (ARYS) is an open prospective cohort study of street youth who use illicit drugs based in Vancouver, Canada. Youth aged 14–26 years who have used any illicit drug (other than or in addition to cannabis) in the preceding 30 d are eligible for study enrolment. Recruited youth are street-involved at baseline, defined as having been without stable housing or having accessed street-based services in the preceding 6 months[4,27,28]. Street-based outreach is used to enhance study recruitment both during daytime and night-time hours in a range of neighbourhoods throughout Vancouver where street youth are known to congregate. Snowball sampling is also used to maximize study enrolment. After providing informed consent, participants complete an interviewer-administered questionnaire regarding sociodemographic and socio-economic details, engagement with health and social services, substance use patterns and other behavioural data. All participants are provided with monetary compensation for their time ($CAN 30).

The present analysis draws on baseline data from youth recruited between April 2006 and November 2013. The primary outcome of interest was depression as measured by the Center for Epidemiological Studies Depression (CES-D) scale. CES-D is a scored twenty-item survey measuring depressive symptoms[29] that has been shown to be both valid and reliable when administered to young people[30] and homeless populations[31]. A cut-off of ≥22 has been used successfully in previous studies as a measure of depression among high-risk populations[32–34]. The primary exposure variable of interest, food insufficiency, was based on responses to the following ARYS survey question: 'I am often hungry but I don't eat because I can't afford enough food'. Participants who responded 'never true' were compared on CES-D scores with those who responded 'sometimes true' and with those who responded 'often true'. This individual statement was extracted from a validated food insecurity scale published by Radimer/Cornell[35]. This item prompts respondents for their current hunger status and has been shown to have good specificity and sensitivity compared with dietary proxies of food insufficiency[36]. Because this population of youth experiences high rates of housing instability and homelessness, our analysis focuses on the relationship between depression and individual-level food insecurity, as opposed to household-level food insecurity.

To adjust for variables that might confound the relationship between food insufficiency and depressive symptoms, we examined an array of covariates, including: age (per year older, continuous); gender (male *v.* female); Caucasian/white ethnicity (yes *v.* no); incarceration in last 6 months (detention, prison or jail; yes *v.* no); currently in a stable relationship (legally married/common law, separated, divorced/widowed or regular partner; yes *v.* no); homelessness in the last 6 months (yes *v.* no); employment in the last 6 months (yes *v.* no); high school completion (yes *v.* no); sex work in the last 6 months (received money, gifts, food, shelter, clothes or drugs in exchange for sex; yes *v.* no); daily cocaine use in the last 6 months (yes *v.* no); daily heroin use in the last 6 months (yes *v.* no); daily meth use in the last 6 months (yes *v.* no); daily crack use in the last 6 months (yes *v.* no); any injection drug use in the last 6 months (yes *v.* no); drug or alcohol treatment in the last 6 months (yes *v.* no); and heavy alcohol use (yes *v.* no). Heavy alcohol use was defined as: >14 drinks/week or >4 drinks on one occasion for men; and >7 drinks/week or >3 drinks on one occasion for women. This measure of heavy alcohol use has been described by the National Institute on Alcohol Abuse and Alcoholism[37].

Initially, we examined the descriptive characteristics, stratified by depression (CES-D score ≥22) at the first study visit. Comparisons were made using the Pearson's χ^2 test for binary variables (Fisher's exact test when cell counts were less than or equal to 5) and the Wilcoxon rank-sum test for continuous variables. Next, we examined the bivariate associations between each explanatory variable and depression using logistic regression. As the last step, we fitted a multivariable model, considering all variables in bivariate analyses as the full model. All statistical analyses were performed using RStudio version 0.99.892 (R Foundation for Statistical Computing, Vienna, Austria). All *P* values were two-sided and tests were considered significant at $P < 0.05$.

Results

Of 1066 street-involved youth who were eligible for inclusion in the analysis, 340 (31·9 %) identified as female, 726 (68·1 %) identified as Caucasian/white, and the median age was 21·8 years (interquartile range = 19·9–23·6 years). In total, 724 (67·9 %) reported some food insufficiency and 565 (53·0 %) reported CES-D score ≥22. Among those who reported food insufficiency, 241 (33·3 %) reported experiencing it 'often' and 483 (66·7 %) reported experiencing it 'sometimes'.

Table 1 lists sociodemographic, socio-economic and substance use characteristics stratified by CES-D score ≥22. Factors positively associated with depression in bivariable analyses included: food insufficiency

Table 1 Bivariate analyses of factors associated with depression among a cohort of street-involved youth (*n* 1066); At-Risk Youth Study (ARYS), Vancouver, Canada, April 2006–November 2013

| | CES-D score ≥22 | | | | | | |
| | Yes (*n* 565, 53·0 %) | | No (*n* 501, 47·0 %) | | | | |
Characteristic	*n*	%	*n*	%	OR	95 % CI	*P* value
Food insufficiency							
Often	156	27·6	85	17·0	2·75	1·96, 3·88	<0·001
Sometimes	272	48·2	211	42·1	1·93	1·46, 2·56	<0·001
Never	137	24·2	205	40·9	1·00	Ref.	
Age (years)							
Median and IQR	21·9	20·2–23·6	21·7	19·5–23·5	1·05	1·00, 1·10	0·060
Gender							
Male	356	63·0	370	73·9	0·60	0·46, 0·78	<0·001
Female	209	37·0	131	26·1	1·00	Ref.	
Caucasian/white ethnicity							
Yes	392	69·4	334	66·7	1·13	0·88, 1·47	0·343
No	173	30·6	167	33·3	1·00	Ref.	
Homelessness*							
Yes	433	76·6	353	70·5	1·36	1·03, 1·79	0·029
No	131	23·2	145	28·9	1·00	Ref.	
Currently in a stable relationship							
Yes	151	26·7	148	29·5	0·87	0·66, 1·13	0·292
No	410	72·6	348	69·5	1·00	Ref.	
High school completion							
Yes	185	32·7	196	39·1	0·75	0·58, 0·97	0·026
No	379	67·1	302	60·3	1·00	Ref.	
Employment*							
Yes	288	51·0	292	58·3	0·74	0·58, 0·95	0·017
No	277	49·0	209	41·7	1·00	Ref.	
Incarceration*							
Yes	109	19·3	84	16·8	1·18	0·86, 1·62	0·292
No	456	80·7	416	83·0	1·00	Ref.	
Daily cocaine use*							
Yes	21	3·7	15	3·0	1·25	0·64, 2·46	0·513
No	539	95·4	482	96·2	1·00	Ref.	
Daily heroin use*							
Yes	69	12·2	34	6·8	1·92	1·25, 2·95	0·003
No	488	86·4	461	92·0	1·00	Ref.	
Daily meth use*							
Yes	82	14·5	49	9·8	1·56	1·07, 2·28	0·020
No	478	84·6	446	89·0	1·00	Ref.	
Daily crack use*							
Yes	114	20·2	58	11·6	1·92	1·36, 2·70	<0·001
No	449	79·5	438	87·4	1·00	Ref.	
Injection drug use*							
Yes	221	39·1	112	22·4	2·24	1·71, 2·93	<0·001
No	343	60·7	389	77·6	1·00	Ref.	
Sex work*							
Yes	89	15·8	26	5·2	3·42	2·17, 5·38	<0·001
No	476	84·2	475	94·8	1·00	Ref.	
Heavy alcohol use*							
Yes	201	35·6	195	38·9	0·86	0·67, 1·11	0·246
No	362	64·1	303	60·5	1·00	Ref.	
Drug or alcohol treatment*							
Yes	185	32·7	119	23·8	1·56	1·19, 2·05	0·001
No	379	67·1	381	76·0	1·00	Ref.	

CES-D, Center for Epidemiological Studies Depression scale; IQR, interquartile range; Ref., reference category.
*In the last 6 months.

'sometimes'; food insufficiency 'often'; homelessness; daily heroin use; daily meth use; daily crack use; any injection drug use; sex work; and drug or alcohol treatment. Male gender, high school completion and employment were negatively associated with depression.

Table 2 shows the adjusted odds ratios (AOR) for CES-D score ≥22 and variables of interest. Variables independently positively associated with depression in the multivariable analysis included: food insufficiency 'sometimes' (AOR = 1·99; 95 % CI 1·47, 2·70); food insufficiency 'often' (AOR = 2·52; 95 % CI 1·74, 3·67); daily crack use (AOR = 1·76; 95 % CI 1·20, 2·61); any injection drug use (AOR = 1·81; 95 % CI 1·31, 2·49); and sex work (AOR = 2·43; 95 % CI 1·49, 4·09). Male gender remained negatively associated with depression (AOR = 0·61; 95 % CI 0·45, 0·84).

Table 2 Multivariate analysis of factors associated with depression among a cohort of street-involved youth (*n* 1066); At-Risk Youth Study (ARYS), Vancouver, Canada, April 2006–November 2013

Variable	AOR	95 % CI	*P* value
Food insufficiency			
'Sometimes' *v.* 'never'	1·99	1·47, 2·70	<0·001
'Often' *v.* 'never'	2·52	1·74, 3·67	<0·001
Age			
Per year older, continuous	1·03	0·98, 1·09	0·272
Gender			
Male *v.* female	0·61	0·45, 0·84	0·002
Caucasian/white ethnicity			
Yes *v.* no	1·08	0·81, 1·43	0·613
Homelessness*			
Yes *v.* no	1·05	0·77, 1·43	0·758
Currently in a stable relationship			
Yes *v.* no	0·85	0·63, 1·15	0·290
High school completion			
Yes *v.* no	0·83	0·63, 1·10	0·195
Employment*			
Yes *v.* no	0·95	0·72, 1·25	0·713
Incarceration*			
Yes *v.* no	1·05	0·74, 1·48	0·805
Daily cocaine use*			
Yes *v.* no	0·86	0·40, 1·89	0·706
Daily heroin use*			
Yes *v.* no	1·18	0·72, 1·95	0·517
Daily meth use*			
Yes *v.* no	1·09	0·72, 1·67	0·687
Daily crack use*			
Yes *v.* no	1·76	1·20, 2·61	0·004
Injection drug use*			
Yes *v.* no	1·81	1·31, 2·49	<0·001
Sex work*			
Yes *v.* no	2·43	1·49, 4·09	0·001
Heavy alcohol use*			
Yes *v.* no	1·04	0·78, 1·37	0·807
Drug or alcohol treatment*			
Yes *v.* no	1·23	0·91, 1·66	0·180

AOR, adjusted odds ratio.
*In the last 6 months.

Discussion

In the present study of street-involved youth who use illicit drugs, we observed a high prevalence of both depression and food insufficiency, with more than five in ten youth reporting CES-D score ≥22, and nearly seven in ten youth reporting some level of food insufficiency. Compared with youth who reported having sufficient food, the odds of depression (CES-D score ≥22) were higher among youth who reported any level food insufficiency. In addition, the odds of depression increased as the level of food insufficiency increased and we observed little change in these estimates after adjustment for confounders. Depression was also independently positively associated with daily crack use, injection drug use and sex work, and was independently negatively associated with male gender.

Our findings build on previous studies that have found associations between food insecurity and depression among youth[26,38] and among adults who use injection drugs[22]. One study using a nationally representative sample of Canadian youth found that hunger was

significantly associated with future risk of depression, even after accounting for previous depressive symptoms[38]. Street-involved youth who are food insufficient often experience poverty, which has been repeatedly associated with depression[39,40]. However, one study found that while family food insufficiency was independently associated with depressive symptoms (dysthymia and suicide symptoms) among adolescents, low family income was not[41]. These findings suggest that pathways other than poverty may mediate the relationship between food insufficiency and depression. For instance, stress and anxiety have been associated with both food insecurity and depression[42,43]. Further, nutritional deficiencies[44], shame[45], childhood trauma[46] and hopelessness[47] have all been associated with symptoms of depression and may mediate this relationship. There is also evidence of a bidirectional relationship between food insecurity and depression[48], which may suggest that depression contributes to food insecurity in street-involved youth by acting as a barrier to services[49] or by impeding the purchase and preparation of meals. The associations found in

the current analysis between depression and daily crack use, injection drug use and female gender are consistent with what has previously been found in the literature[50,51].

The findings from the current study suggest that there is a need to increase access to quality mental health and food security interventions among this population of youth. Previous studies have found that street-involved youth experience high rates of mental illness[16,17]. The high-risk environment and trauma associated with living or working on the streets often intensify pre-existing mental health issues and make it challenging for clinicians to diagnose youth appropriately[52]. In addition to these high rates of mental health issues, unstably housed youth face many barriers to care including fear of discrimination, long waiting lists and lack of specialized youth services[53–56]. Further, due to the large nutritional gap that still exists for Canada's most vulnerable populations, food security interventions (e.g. food banks) are often unable to meet demands[57] and some homeless youth have described food assistance programmes to be of poor quality and associated with food sickness[58].

Because of the tremendous health and economic burden associated with both food insecurity and mental illness, it is critical that policies and programmes focus on the social and environmental determinants of food access, such as formal employment (hindered by factors such as educational limitations, discrimination and incarceration)[17] and stable housing (hindered by factors such as family breakdown, abuse and 'ageing out' of the foster care system)[52]. It is also important that mental health programmes consider how food insufficiency may act as an underlying cause or contributing factor to depression, and that interventions addressing food insecurity gain capacity to support youth who are experiencing mental illness and refer them to appropriate services. There is evidence that social support may moderate the relationship between food insufficiency and depression[21,59], which highlights the potential benefits of incorporating social support interventions into food security programmes.

There are limitations to the present study. First, because it is a cross-sectional study, we are unable to determine the direction of the relationship between food insufficiency and depression. Second, our sample was not randomly selected (as there are no registries of street youth to draw upon) and included only youth who had used illicit drugs in the 30 d prior to baseline. Therefore, our sample may not be representative of all street youth in Vancouver. However, we note that the characteristics of the ARYS sample are similar to those from other studies of high-risk youth[60–62]. Third, we relied on self-report, which may have been subject to response biases, including recall bias and socially desirable responding, although we know of no reason why this would explain the associations we identified in our study. Fourth, the Radimer/Cornell scale is no longer frequently used in food security research, as

newer scales such as the Household Food Security Survey Module (HFSSM)[63] have been developed. However, we note that the individual item on the Radimer/Cornell scale used in the current study has been incorporated into several recently developed food insecurity scales (including the HFSSM) and has remained relatively consistent across them[64]. Lastly, the current study did not include a detailed analysis of race or ethnicity. To control for confounding, we included an 'ethnicity' variable that was limited to 'Caucasian/white' v. 'other'. However, given that youth who identify as 'non-white' are more likely to experience unstable housing relative to youth who identify as 'white'[65], and that race has previously been associated with food insecurity[66], it would have been useful to further examine whether race/ethnicity has a modifying effect on the relationship between food insufficiency and depression.

To our knowledge, the present study is the first to document a relationship between food insufficiency and depression among street-involved youth who use illicit drugs. These findings call attention to the limitations of current food security interventions in meeting their nutritional needs, as well as the importance of addressing structural factors that contribute to the high rates of food insufficiency within this population. The current study also highlights the importance of addressing the mental health concerns of youth who are already food insufficient. Further research is needed to identify potential pathways by which food insufficiency may lead to depression and how depression may lead to further food insufficiency by hindering access to food supplies and/or nutritional support programmes.

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