

RELATIONSHIP BETWEEN FOOD INSECURITY AND MORTALITY AMONG HIV-POSITIVE INJECTION DRUG USERS RECEIVING ANTIRETROVIRAL THERAPY IN BRITISH COLUMBIA, CANADA

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Background

Illicit drug use is a well-known risk factor for food insecurity and poor nutritional status. Drug addiction alters dietary consumption patterns, leading individuals to eat fewer meals, to often skip meals for an entire day, and to rely on food distribution services for subsistence. Studies suggest that the diets of illicit drug users are often calorically insufficient and poor in quality, and may lead to adverse HIV outcomes through nutritional, mental health and behavioral pathways. To our knowledge, no studies have examined whether food insecurity increases risk of excess death in this population.

Methods

**Objective:** This study assess the potential relationship between food insecurity and all-cause mortality among HIV+ injection drug users (IDU) initiating antiretroviral therapy (ART) across British Columbia (BC). **Study sample:** Data for this analysis were obtained from the provincial HIV/AIDS Drug Treatment Program (DTP) administrative database. In BC, antiretrovirals have been distributed free of charge to HIV+ individuals since 1986, and coordinated centrally since 1992 by the BC Centre for Excellence in HIV/AIDS (BC-CfE). Details of the HIV/AIDS DTP have been described elsewhere [6]. **Variable selection:** The outcome variable was all-cause mortality, collected by physician reports and confirmed through e-linkage to the BC vital statistics registry. The primary explanatory variable was food insecurity, captured cross-sectionally at baseline in 1998/1999, and measured using the Radimer/Cornell scale. Secondary explanatory variables hypothesized to confound the relationship between food insecurity and mortality were selected by literature review. **Statistical analysis:** Bivariate analyses were performed, applying Pearson’s Chi-Square to categorical variables and Wilcoxon Rank Sum Test for continuous variables. Cox proportional hazard confounder models were constructed to ascertain the potential independent association between food insecurity/hunger and all-cause mortality, controlling for potential confounders.

Results

Baseline characteristics of IDU enrolled in the BC-wide HIV/AIDS DTP, stratified by food security status, are shown in Table 1. Among 254 participants included in the analysis, 181 (71.26%) reported being food insecure, and 108 (42.5%) were hungry. Over the study period (June 21, 1998-Sept 30, 2011), 105 (41.34%) individuals died. Unadjusted and adjusted analyses of factors associated with mortality among IDU are presented in **Table 2**. In adjusted analyses, controlling for confounders, food insecurity was significantly associated with all-cause mortality (adjusted hazard ratio [AHR] = 1.95, 95% CI: 1.07 – 3.53) (Column 2); hunger was no longer significant (AHR = 1.05, 95% CI: 0.65 – 1.70) (Column 3).

Discussion

This study builds on our existing body of research regarding the relationship between food insecurity and mortality among people living with HIV/AIDS. This study is the first to examine the potential impact of food insecurity and hunger on mortality among HIV-positive IDU. Mortality rates were elevated in this sample of HIV-positive IDU. After 13.3 years of follow-up, individuals who reported being food insecure at baseline were almost twice as likely to die, when controlling for potential confounders. Hunger was associated with increased risk of death in univariate analysis, but the association was no longer significant after controlling for potential confounders in the adjusted analyses. Our results suggest that addressing food insecurity, in addition to other known social and structural barriers to ART adherence and virologic suppression among illicit drug user, such as

Table 1 Baseline characteristics among HIV-positive injection drug users initiating antiretroviral therapy across British Columbia, by food security status, between June 1998 and Sept 2011 (n=254)

Characteristic	Total N (%)	Food Insecure 181 (71.3%)	Food Secure 73 (28.7%)	p - value
Age				
Median, IQR <sup>1</sup>	38.0 (34.0 - 43.0)	38.0 (34.0 - 43.0)	38.0 (34.0 - 43.0)	0.933
Gender				
Male	211 (83.1%)	148 (81.8%)	63 (86.3%)	0.492
Female	43 (16.9%)	33 18.2%)	10 (13.7%)	
Aboriginal ancestry				
Yes	58 (22.9%)	45 (25.0%)	13 (17.8%)	0.286
No	195 (77.1%)	135 (75.0%)	60 (82.2%)	
Unstable housing				
Yes	28 (11.8%)	21 (12.2%)	7 (10.8%)	0.936
No	209 (88.2%)	151 (87.8%)	58 (89.2%)	
Education status				
≥ High school	161 (64.7%)	110 (61.5%)	51 (72.9%)	0.122
< High school	88 (35.3%)	69 (38.5%)	19 (27.1%)	
Annual income				
>\$15,000	63 (28.1%)	23 (14.7%)	40 (58.8%)	<0.001
≤\$15,000	161 (71.9%)	133 (85.3%)	28 (41.2%)	
Body Mass Index				
≥18.5 kg/m <sup>2</sup>	219 (96.9%)	153 (96.2%)	66 (98.5%)	0.629
<18.5 kg/m <sup>2</sup>	7 (3.1%)	6 (3.8%)	1 (1.5%)	
AIDS diagnosis				
Yes	63 (24.8%)	44 (24.3%)	19 (26.0%)	0.899
No	191 (75.2%)	137 (75.7%)	54 (74.0%)	
ART start year				
Median, IQR <sup>1</sup>	1997 (1995 – 1998)	1997 (1996 – 1998)	1996 (1994 – 1998)	0.015
HAART use <sup>2</sup>				
Yes	191 (75.2%)	138 (76.2%)	53 (72.6%)	0.655
No	63 (24.8%)	43 (23.8%)	20 (27.4%)	
PI-based regimen <sup>3</sup>				
Yes	154 (60.6%)	101 (55.8%)	53 (72.6%)	0.019
No	100 (39.4%)	80 (44.2%)	20 (27.4%)	
Adherence to ART <sup>4</sup>				
≥ 95%	123 (48.4%)	82 (45.3%)	41 (56.2%)	0.153
< 95%	131 (51.6%)	99 (54.7%)	32 (43.8%)	
CD4 cell count (per 100 cells/μL)				
Median, IQR <sup>1</sup>	380 (220 - 510)	360 (210 – 500)	400 (230 – 555)	0.149
Plasma HIV RNA (per log <sub>10</sub> copies/mL)				
Median, IQR <sup>1</sup>	2.6 (2.6 – 3.7)	2.6 (2.6 – 3.8)	2.6 (2.6 – 3.2)	0.250
All-Cause Mortality				
Yes	105 (41.3%)	87 (48.1%)	18 (24.7%)	0.001
No	149 (58.7%)	94 (51.9%)	55 (75.3%)	

1) inter-quartile range; 2) highly active antiretroviral therapy use; 3) protease Inhibitor-based regimen; 4) within last 12 months of interview

Table 2 Unadjusted and adjusted factors associated with all-cause mortality among HIV-positive injection drug users initiating highly active antiretroviral therapy in British Columbia, between June 1998 and Sept 2011 (n=254)

Characteristic	Unadjusted model HZ <sup>1</sup> (95% CI) <sup>2</sup>	Adjusted model including food insecurity AHZ <sup>3</sup> (95% CI) <sup>2</sup>	Adjusted model including hunger AHZ <sup>3</sup> (95% CI) <sup>2</sup>
Food insecure			
Yes vs. no	2.41 (1.45 – 4.01)	1.95 (1.07 – 3.53)	--
Hunger			
Yes vs. no	1.78 (1.21 - 2.61)	--	1.05 (0.65 – 1.70)
Age			
Per 10 year increase	1.19 (0.94 – 1.50)	1.27 (0.98 – 1.65)	1.46 (1.09 – 1.94)
Gender			
Male vs. female	0.64 (0.41 – 1.01)	--	0.59 (0.34 – 1.02)
Aboriginal ancestry			
Yes vs. no	1.92 (1.27 – 2.92)	2.15 (1.34 – 3.45)	--
Unstable housing			
Yes vs. no	1.50 (0.87 – 2.60)	--	0.92 (0.46 – 1.82)
Education status			
>High school vs. ≤high school	0.85 (0.57 – 1.25)	--	--
Annual income			
>\$15,000 vs. ≤\$15,000	0.27 (0.14 – 0.50)	0.33 (0.16 – 0.68)	0.28 (0.14 – 0.58)
AIDS diagnosis			
Yes vs. no	0.95 (0.61 – 1.49)	--	--
Body Mass Index			
≥18.5 kg/m <sup>2</sup> vs. <18.5 kg/m <sup>2</sup>	0.74 (0.27 – 2.01)	--	--
ART start year			
Per year increase	1.03 (0.93 – 1.14)	0.88 (0.78 – 1.00)	0.93 (0.81 – 1.06)
HAART use <sup>5</sup>			
Yes vs. no	1.21 (0.76 – 1.93)	--	--
PI-based regimen <sup>6</sup>			
Yes vs. no	0.69 (0.47 – 1.01)	--	--
Adherence to ART <sup>7</sup>			
≥95% vs. <95%	0.59 (0.40 – 0.87)	--	0.77 (0.48 – 1.22)
CD4 cell count			
Per 100 increase	0.89 (0.82 – 0.98)	0.96 (0.87 – 1.06)	0.96 (0.86 – 1.07)
HIV RNA viral load			
Per Log <sub>10</sub> increase	1.50 (1.23 – 1.84)	1.42 (1.12 – 1.80)	1.36 (1.05 – 1.75)

1) Hazard Ratio; 2) 95% Confidence Interval; 3) Adjusted Hazard Ratio; 4) highly active antiretroviral therapy; protease Inhibitor; 5) within the last 12 months of interview

incarceration, homelessness, and gender-related factors, are of paramount public health importance. Further research is needed to understand the mechanisms by which food insecurity leads to mortality, and to examine the modifying effects of nutritional, mental health and behavioral factors in this relationship.