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Food Insecurity and Other Poverty Indicators among People Living with HIV/AIDS: Effects on Treatment and Health Outcomes

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Abstract

Health disparities in access to antiretroviral therapy (ART) as well as the demands of long-term medication adherence have meant the full benefits of HIV treatment are often not realized. In particular, food insecurity has emerged as a robust predictor of ART non-adherence. However, research is limited in determining whether food insecurity uniquely impedes HIV treatment or if food insecurity is merely a marker for poverty that interferes more broadly with treatment. This study examined indicators of poverty at multiple levels in a sample of 364 men and 157 women living with HIV recruited through an offering of a free holiday food basket. Results showed that 61% (N = 321) of participants had experienced at least one indicator of food insecurity in the previous month. Multivariate analyses showed that food insecurity was closely tied to lack of transportation. In addition, food insecurity was associated with lacking access to ART and poor ART adherence after adjusting for neighbourhood poverty, living in an area without a supermarket (food desert), education, stable housing, and reliable transportation. Results therefore affirm previous research that has suggested food insecurity is uniquely associated with poor ART adherence and calls for structural interventions that address basic survival needs among people living with HIV, especially food security.

HIV infection is clinically manageable when patients can access and adhere to antiretroviral therapies (ART). (1) Unfortunately, health disparities in access to ART as well as the demands of long-term medication adherence have meant that the full benefits of HIV treatment are often not realized. (2 3) Adverse social conditions of poverty are among the

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most consistent predictors of disease progression and morbidity in people living with HIV. (4) Food insecurity, defined as limited access to nutritious food to meet dietary needs for an active and healthy life, is prevalent in US urban centers among people living with HIV. (5, 6) Nearly half of HIV positive individuals receiving drug treatment in British Columbia, Canada are food insecure, a rate that is five times greater than the general Canadian population. (7) Studies conducted in San Francisco and Atlanta also show that despite considerable social and health resources in the US there are alarmingly high-rates of food insecurity in people living with HIV. (8–10)

Food insecurity is a known barrier to accessing and adhering to ART. (11) In a study of homeless and marginally housed people living with HIV in San Francisco, Weiser et al. (12) found that one in three persons were severely food insecure. Among those taking ART, more than half were food insecure and food insecurity was associated with incomplete adherence and unsuppressed HIV. (13) Ultimately, food insecurity in combination with being underweight as well as overweight can contribute to the mortality of people living with HIV. (14–16) Food insecurity is directly related to malnutrition, obesity, and metabolic syndrome, all of which significantly predict mortality in people living with HIV. (4, 17, 18) Food insecurity can also interfere with the absorption of medications and pharmacokinetics of ART, placing individuals at further risk of disease progression. (19) Recent research shows that food insecurity among people living with HIV contributes to immune system decline, and increases the odds of hospitalizations more than two-fold. (20)

Food insecurity is only one of multiple facets of poverty, each of which can interfere with ART adherence and health outcomes. (21) For example, lack of housing is also associated with poor access to treatment and medication non-adherence in people living with HIV. (22) Similarly, lack of transportation impacts attending health care appointments and disrupts medication adherence. (23,24) Not having adequate transportation will also impede the ability to gain access to food, especially for individuals living further distances from supermarkets and grocery stores, so called food deserts. More generally, lack of resources, daily stressors, and life disruptions that come with living in impoverished neighborhoods all potentially impede HIV treatment and health outcomes. (25, 26) Thus far, research has rarely examined multiple challenges of poverty in relation to treatment and health outcomes in people living with HIV.

In the current study we investigated co-occurring multiple facets of poverty among people living with HIV who experience food insecurity. The study was guided by Conservation of Resources Theory (27, 28), which posits that lack of resources, especially those most essential and basic to survival, expose individuals to stress and expend internal resources to cope with everyday challenges. Limited resources associated with poverty therefore impact coping and stress management, which in turn directly interferes with health behaviors including medication adherence. In this study, we examined the prevalence of food insecurity and associated poverty markers in people living with HIV. We used a sampling frame designed to over-recruit people living with HIV in need of food. We compared individuals who have recently experienced food insecurity to those who were food secure on distal (e.g., neighbourhood poverty, living in a food desert) and proximal (e.g., housing, transportation) indicators of poverty. Finally, we tested multivariable models to determine

the independent associations of demographic characteristics and poverty markers with HIV-related health characteristics.

Methods

Participants and Setting

Participants were 364 men and 157 women living with HIV infection in Atlanta metropolitan, a city with over 23,000 reported cases of AIDS. Mirroring the national HIV epidemic, the poverty rate in Atlanta is 21% compared to the state of Georgia's 14%, and 12% of Atlanta residents have incomes below 50% of the poverty line.

Measures

Participants completed a survey to assess demographic, social, and health characteristics, food insecurity, housing, transportation, HIV treatment access and ART adherence. Surveys were collected anonymously with assistance provided to participants as requested. We also asked each participant to step on a scale to obtain his or her body mass index (BMI).

Demographic characteristics—Participants were asked their gender, age, years of education, income, ethnicity, employment status, and provided the 5-digit postal code for the place they were currently residing.

Health characteristics—We asked participants their current CD4 cell count and most recent HIV RNA viral load. These health markers were coded for clinically meaningful categories, which have been found reliable and valid, rather than absolute values. (29) Participants also reported the year they first tested HIV positive and whether they were currently taking ART. For those who were receiving ART, we used a visual analogue rating scale to assess ART adherence over the previous month. The visual analogue adherence rating scale asks individuals to indicate on a 100-point continuum how much of their ART they have taken in the past month, anchored by 0%, 50% and 100%. The standard instructions are designed to counter socially desirable response biases by acknowledging that it can be difficult to take ART. (30) Scores on this rating scale correlate with adherence obtained by unannounced pill counts (r = .48) and are significantly associated with HIV suppression. (31–33) In addition, we dichotomized adherence ratings using 85% of medications taken as a cut-off for acceptable adherence. (34) We also asked participants to indicate whether they had run out of ART or had to choose between ART and food in the previous month. Finally, we calculated participant's BMI from their height and weight obtained at the time of the survey.

Proximal indicators of poverty—To measure food insecurity we adapted four items from a standard food security measure. (35) Each indicator of food insecurity in the previous month was responded to as having occurred or not occurred. Indicators of food insecurity in the previous month were summed to provide an index score. We also asked participants if they had received food stamps, meals from social services, and meals from faith-based groups in the previous month. We also asked participants if they had stable housing and whether they had reliable transportation to both their health care provider and where they

access food. Specifically, participants indicated whether they did not have a place to stay in the past month, and whether they were unable to get to a health appointment or were unable to get to where they obtain their food/meals.

Distal indicators of poverty—Using participant's postal code, we determined the poverty rate and food access for the place that they currently resided. Poverty rates were obtained from the 2011 American Community Survey data from the US Census. We obtained the percentage of zip-code level population that fell below the US poverty line, as determined from the poverty status of all individuals assessed in the population. We also assessed participants' access to food. Using data from the United States Department of Agriculture Economic Research Service http://www.ers.usda.gov/data-products/food-access-research-atlas) we determined whether participants lived in a zip code defined as a food desert. Specifically, food access was delineated for census tracts using 1-mile demarcations to the nearest food market for urban areas. We therefore dichotomously coded whether participants resided or did not reside in proximity of 1-mile of a food market.

Procedures

We conducted a cross-sectional survey of people living with HIV in Atlanta, GA, USA. The study was conducted in November, 2012 at a community-based research site. People living with HIV were notified that they could obtain a holiday food basket ($25 value) through notices posted at local infectious disease clinics and AIDS-related social services as well as word-of-mouth. Individuals called the research office to schedule their food pick-up time. Participants were required to prove their HIV positive status by presenting a photo-identification along with a name matching ART prescription, HIV clinic card, or other verification of HIV status. During the course of the food distribution, we asked participants to complete an anonymous survey and to step on a scale to obtain their height and weight. Nearly every person (98%) picking up the food basket agreed to complete the survey. The University of Connecticut Institutional Review Board approved all of the study procedures.

Data Analyses

We used logistic regressions to examine the social and health characteristics of people living with HIV who were and were not food insecure in the previous month. Participants who endorsed any one indicator of food insecurity were defined as food insecure. We first examined demographic and health characteristics of the food secure and insecure groups using bivariate regression models. We also examined the associations between each of the four food insecurity indicators and the proximal (i.e., education, housing, transportation) and distal (i.e., poverty rate and food desert status) indicators of poverty. For these models we report the overall significance and odds ratios for each poverty marker. Comparisons of food secure and food insecure participants were performed for treatment and health indicators with proximal and distal markers of poverty included in the models. We report the adjusted odds ratios for each health indicator. Finally, we performed a three-stage hierarchical logistic regression to compare the food secure and food insecure groups on (1) demographic characteristics, (2) poverty markers, and (3) health indicators, with adjusted odds ratios reported for each respective model.

Results

Comparisons of food secure and food insecure people living with HIV on socio-demographic and poverty markers are shown in Table 1. As expected, results showed that food insecurity was associated with multiple poverty markers, including fewer years of education, greater likelihood of unstable housing, lack of transportation for health care and food/meals and a greater likelihood of receiving food from faith-based services.

Logistic regression models that tested the association between indicators of food insecurity and proximal and distal markers of poverty are shown in Table 2. All of the multivariable models were significant, indicating that all of the food insecurity indicators were related to the broader spectrum of poverty markers. Examination of the adjusted odds ratios for each variable entered in the models shows that the neighbourhood poverty rate and residing in a food desert were not significantly associated with any indicators of food insecurity. Adequate transportation was the only proximal poverty marker consistently related to food insecurity, with stable housing associated with two of the four food insecurity indicators; eating less than needed due to a lack of money and not having sufficient food to eat for a whole day. Years of education were only related to the composite food insecurity index.

Food insecurity, HIV treatment and health outcomes

Tale 3 shows the associations of food insecurity and health status in unadjusted and adjusted multivariable models. Results indicated that relative to their food secure counterparts, people living with HIV who were food insecure were significantly less likely to be taking ART, were less adherent to ART, had run out of their medications, and had to choose between medications and food. All of these associations remained statistically significant after adjusting for the proximal and distal poverty markers. In addition, food insecurity was associated with a greater likelihood of having a lower CD4 cell count in the unadjusted model, but was not significant when adjusted for other poverty markers.

Hierarchical models

Results of the hierarchical logistic regression models testing associations between food insecurity and health status markers are shown in Table 4. In the first model, age and gender were not associated with food insecurity. For model 2, we found that education and lack of transportation were related to food insecurity. In the final model adjusting for all other factors, lack of transportation to food remained significantly associated with food insecurity, and food insecurity was associated with poorer ART adherence, running out of ART, and having to choose between medications and food.

Discussion

Results of the current study replicate past research to show that people living with HIV infection who experience food insecurity are at risk for sub-optimal HIV treatment adherence and disparate health outcomes. Food insecurity was significantly related to not receiving ART and poorer ART adherence even after adjusting for all other poverty markers. While food insecurity was related to lower CD4 cell counts in the unadjusted model, other poverty markers accounted for this relationship and viral suppression was not

significant. Although food insecurity is a marker for the broader constellation of poverty experiences, adjusted regression models showed that only lack of transportation was uniquely associated with every indicator of food insecurity. Our final multivariable model indicated that after adjusting for all relevant demographic, poverty, and health characteristics, food insecurity remained significantly associated with poorer HIV treatment adherence including running out of medications and having to choose between accessing food and medications. Thus, we affirmed previous research that suggests a unique association between food insecurity and suboptimal medication adherence in a sample of people living with HIV infection.

Our results failed to show an association between distal indices of poverty, specifically neighborhood poverty rates and food desert demarcations, and HIV-related health markers. Furthermore, distal indicators of poverty did not account for the association between food insecurity and HIV treatment adherence. A likely explanation for these results is the high-level of poverty found across all areas within which participants resided, specifically Atlanta's inner-city. Thus, while there was variation in levels of poverty across neighborhoods, the range was restricted. Furthermore, there was variation in having a supermarket nearby, defining a food desert. However, market proximity is irrelevant for persons who cannot pay for food. Distal indicators of poverty may therefore lack sensitivity to factors most central to treatment access and adherence. In contrast, proximal poverty indicators, particularly access to food and transportation may have immediate impacts on HIV treatment access, adherence, and health outcomes.

These findings should be interpreted in light of the study limitations. First, we relied on a convenience sample that cannot be considered representative of people living with HIV infection. We intentionally aimed to over sample people who may be experiencing food insecurity by using a food give-away event to recruit our sample. Thus, our study cannot be taken as a prevalence estimate of food insecurity among people living with HIV. Rather, our sample reflects those persons living with HIV under conditions of poverty. The sample also consisted of people who may not have been in care as well as those receiving care from a wide-range of providers that likely varied in health services and prescription practices. While we used state-of-the-science measures of self-reported ART adherence, health status and food insecurity these data may still be subject to social response biases. Our data also do not allow precise measurement of whether missed medication doses occurred in relation to times when food was scarce as well as other conditions of poverty. With these limitations in mind, we believe that our findings have implications for future research.

More concerning than sporadic single missed medication doses are prolonged periods of treatment interruption.(36) Parienti et al. found that medication interruptions of 10 days were associated with a 20% probability of antiretroviral therapy (ART) failure and interruptions of 15 days were associated with a 50% probability of failure. Periodic disruptions in meeting basic survival needs, particularly access to food, may therefore be more detrimental to treatment than periodic forgetting to take medications. In addition, lack of transportation to the pharmacy and having to choose between food and medications are likely to result in periods of missed medications that place people at high-risk for developing treatment resistant strains of HIV. These results therefore show that non-adherence resulting

from food insecurity and lack of transportation will require targeted solutions that go far beyond any attempts to improve individual's pill taking routines and strategies.

There is evidence that increasing access to food improves treatment adherence among people living with HIV in resource-impoverished places. (37) In Haiti, for example, Ivers et al. (38) showed marked improvements in both body mass index and medication adherence when food was provided. Improving adherence in the context of poverty will therefore require structural approaches to supporting adherence. However, the challenges facing individuals in our sample were not tapped by broad societal indices of poverty such as neighbourhood poverty rates or geographical demarcations of food access. The association between poverty and health for our sample therefore lies between the broad distal geo-social level (macro-factors) and intrapersonal characteristics (micro-factors). Thus, resources are most needed to address indicators of poverty that are proximal to the individual but outside of their immediate control. Strategies for providing food access, transportation, and uninterrupted prescription refills will likely have their greatest impact on people faced with greatest challenges to adherence posed by conditions of poverty.

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Table 1

Characteristics of food secure and food insecure people living with HIV.

	Food Secure (N = 321)		**Food Insecure (N = 200)**			
Characteristic	M	SD	M	SD	OR	95%CI
Age	48.5	7.5	45.9	8.9	0.95**	0.93–0.98
Education	12.3	1.8	12.4	2.1	1.04	0.94–1.14
Years since testing HIV+	14.2	7.1	12.9	7.8	0.97	0.94–1.00
Poverty rate	25.6	11.0	26.7	10.8	1.00	0.99–1.02
	N	%	N	%		
Male	214	67	150	75		
Female	107	33	50	25	0.68+	0.44–1.05
African American	295	92	181	91	0.94	0.67–1.33
Unemployed	313	98	196	98	0.98	0.48–1.63
Resides in food desert	117	36	69	35	1.04	0.70–1.55
Unstable housing	33	10	53	27	1.81**	1.11–2.94
Lacks transportation to clinic	20	6	56	28	4.75**	2.84–7.90
Lacks transportation to food source	24	8	76	38	5.64**	3.54–8.99
Receives food stamps	231	72	130	63	0.76	0.50–1.15
Receives meal from social services	91	29	72	36	1.33	0.88–1.99
Receives food from faith-based services	124	39	106	53	1.61**	1.09–2.37
BMI > 25	87	30	67	38	1.10	0.86–1.41

Note:

+ p < .10,

** p < .01

Table 2

Associations of food insecurity indicators and other poverty markers among people living with HIV.

				Adjusted Model OR's				
Past Month	**N**	**%**	**Model X^2**	**Education**	**Housing**	**Trans-portation**	**Poverty Rate**	**Food Desert**
Cut the size of meals or skipped meals because there wasn't enough money to buy more.	146	28	35.9**	1.1	1.3	4.4**	1.0	0.9
Ate less than needed because wasn't enough money for food	173	33	52.7**	1.1	1.8*	5.4**	1.0	0.8
Was hungry but did not eat because couldn't afford food	130	25	56.3**	1.0	1.6	6.3**	1.0	0.7
Did not eat for a whole day because there was not enough money to get food.	77	15	44.1**	0.9	2.1*	5.0**	1.0	0.7
Number of indicators								
0	321	62						
1	41	8						
2	49	9						
3	53	10						
4	57	11						
Any one indicator	200	38	60.4**	1.1*	2.8**	5.1**	1.0	0.8

Note:

* $p < .05$,

** $p < .01$

Table 3

Health characteristics of food secure and food insecure people living with HIV.

	Food Secure		Food Insecure				
	N	%	N	%	Unadj. OR	95% CI	Adj.OR
Receives ART	296	92	159	81	0.4**	0.21–0.61	0.5*
< 85 Adherent	59	20	54	34	0.5**	0.31–0.75	0.5**
Runs out of ART	23	7	35	19	2.6**	1.70–5.25	1.9*
Had to choose between food & medications	18	6	63	31	7.0**	4.43–13.62	5.2**
CD4 < 500	108	47	66	60	1.6*	1.04–2.62	1.4
Detectable viral load	32	14	23	20	1.4	0.80–2.61	1.3

Note:

* $p < .05$,

** $p < .01$

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Table 4

Hierarchical logistic regression models of health characteristics associated with food insecurity among people living with HIV.

	Model 1		Model 2		Model 3	
Characteristic	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
Block 1						
Age	0.97	0.93–1.00	0.97	0.94–1.01	0.98	0.94–1.03
Gender	0.64	0.35–1.48	0.66	0.35–1.28	0.65	0.31–1.32
Block 2						
Poverty rate			1.00	0.97–1.03	1.00	0.97–1.04
Reside in food desert			0.70	0.34–1.42	0.66	0.31–1.41
Education			1.18*	1.01–1.39	1.18	0.99–1.40
Unstable housing			1.61	0.59–4.35	1.03	0.33–3.15
Lack transportation/clinic			2.81*	1.04–7.64	2.36	0.81–6.91
Lack transportation/food			5.21**	2.11–12.82	5.78**	2.21–15.14
Block 3						
Receiving ART					4.48	0.49–40.68
< 85 Adherent					0.43*	0.20–0.92
Runs out of ART					3.22**	1.33–7.81
Had to choose between food and Medications					3.25**	1.29–8.18
CD4 < 500					1.21	0.64–2.30
Detectable viral load					1.88	0.81–4.41

Note:

* $p < .05$,

** $p < .01$