Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 88, No. 2
doi:10.1007/s11524-010-9535-4

Housing Circumstances are Associated with Household Food Access among Low-Income Urban Families

Sharon I. Kirkpatrick and Valerie Tarasuk

ABSTRACT *Household food insecurity is a pervasive problem in North America with serious health consequences. While affordable housing has been cited as a potential policy approach to improve food insecurity, the relationship between conventional notions of housing affordability and household food security is not well understood. Furthermore, the influence of housing subsidies, a key policy intervention aimed at improving housing affordability in Western countries, on food insecurity is unclear. We undertook a cross-sectional survey of 473 families in market rental (n=222) and subsidized (n=251) housing in high-poverty urban neighborhoods to examine the influence of housing circumstances on household food security. Food insecurity, evident among two thirds of families, was inversely associated with income and after-shelter income. Food insecurity prevalence did not differ between families in market and subsidized housing, but families in subsidized housing had lower odds of food insecurity than those on a waiting list for such housing. Market families with housing costs that consumed more than 30% of their income had increased odds of food insecurity. Rent arrears were also positively associated with food insecurity. Compromises in housing quality were evident, perhaps reflecting the impact of financial constraints on multiple basic needs as well as conscious efforts to contain housing costs to free up resources for food and other needs. Our findings raise questions about current housing affordability norms and highlight the need for a review of housing interventions to ensure that they enable families to maintain adequate housing and obtain their other basic needs.*

KEYWORDS *Household food insecurity, Food access, Housing affordability, Social housing, Housing subsidy, Poverty, Urban, Families*

INTRODUCTION

Household food insecurity, the inability to obtain adequate food due to financial constraints, is associated with compromised dietary intakes[1–5] and poor physical and mental health.[6–14] The most recent statistics indicate that food insecurity is not uncommon in North America, affecting 8% of Canadian households in 2007/2008[15] and 15% of US households in 2008 (up from 11% in 2007),[16] (though it should be noted that estimates from the two countries are not directly comparable due to differences in the thresholds used to determine food security status). In both countries, rates of food insecurity are higher in urban areas.[16,17] Although food

Kirkpatrick is with the Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD, USA; Tarasuk is with the Department of Nutritional Sciences, Faculty of Medicine, University of Toronto, Toronto, ON, Canada.

Correspondence: Sharon I. Kirkpatrick, Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD, USA. (E-mail: sharon.kirkpatrick@nih.gov)

insecurity is linked to the adequacy of household incomes to cover basic needs,[6,9,16–18] the policy and program interventions required to address this problem remain ill-defined. While there have been numerous calls for affordable housing policy as an important dimension of responses,[19–22] the relation between housing affordability and household food security is not well understood.

Qualitative research with low-income families indicates that food purchasing decisions are made in a context of competing demands for scarce resources.[23–26] Within this context, while food expenditures may be readily altered to free up money for other needs, housing costs appear to be relatively inelastic with rent and utility charges being foregone only in extreme crises. In North America, housing is typically considered affordable if shelter costs (including rent or mortgage payments plus utility charges where applicable) consume 30% or less of the gross income of a household.[27,28] This norm is routinely used to establish rents in subsidized housing. Although such housing is meant to provide an affordable option for households with limited financial resources and not necessarily aimed at ensuring food security among families in poverty, housing that is "affordable" would presumably leave adequate income for other necessities. In this regard, the application of the 30% standard regardless of income level has been criticized because it does not consider the sufficiency of the amount of income remaining after housing costs are paid.[29,30] An improved understanding of the relationship between housing circumstances and household food security could provide insights into the appropriateness of current housing affordability norms and assist in the identification of interventions to address problems of food insecurity.

We undertook a study of low-income families residing in high-poverty urban neighborhoods, employing survey methods, neighborhood mapping, and qualitative interviewing, to gain an understanding of factors associated with vulnerability to food insecurity. We have previously reported on the food security circumstances of this sample in relation to their sociodemographic characteristics and participation in community programs,[31] as well as food shopping behaviors.[32] An analysis of food insecurity in relation to neighborhood characteristics, which demonstrates that proximity to food retail and food programs does not mitigate food insecurity, has also been conducted.[33] In this paper, we draw upon data from the survey to assess the relationship between income, housing costs, and food security, and the relation between receipt of a housing subsidy and food security. We also examine associations between indicators of housing quality and stability and food security to explore the possibility that housing is compromised to free up money for food.

METHODS

Sampling and Data Collection

Respondents were recruited from 12 high-poverty census tracts in Toronto, Canada, between November 2005 and January 2007 using quota sampling to achieve an approximately balanced sample of families in subsidized and market rental accommodations. Rental buildings and units within each census tract were identified and potential respondents were approached at the door and screened for inclusion by trained interviewers. Respondents were deemed eligible if (1) their household included at least one child 18 years of age or younger, (2) they had lived in their current dwelling for at least 1 month, (3) the potential respondent had sufficient fluency in English to complete an oral interview, and (4) the gross household income

was at or below a low-income threshold adopted from Statistics Canada—this level, selected to ensure that we recruited low-income households including both "working poor" and those on social assistance, meant the inclusion of two-person households with incomes below $30,000, three- and four-person households with incomes below $40,000, and five or more person households with incomes below $60,000.[34]

Data were collected via a structured interview with the person who had primary responsibility for food shopping and management. The survey instrument included questions to assess household food security, food expenditures, income, and housing circumstances. The study protocol was approved by the Human Subjects Research Ethics Board at the University of Toronto, and participants gave written consent after being informed about the study objectives and methods. A sample size of 500 was sought to support the assessment of the impact of housing affordability on food insecurity, accounting for clustering in the sample design and the addition of covariates to regression models. A total of 501 families were interviewed, reflecting a response rate of 62%. Seventeen families were later found to have incomes that exceeded the eligibility threshold and were excluded from analysis. Eleven families reporting shelter costs exceeding their income, including two that reported zero income, were also excluded because of our inability to accurately assess the association between their incomes, housing costs, and household food security. The final analytic sample includes 473 families.

Measures

The Household Food Security Survey Module[35] was used to assess food security over the past 12 months, and thresholds developed by Health Canada were applied to characterize families as food secure or insecure, a state indicative of compromises in the quality and/or quantity of food consumed by adults and/or children.[17]

A 12-month measure of shelter costs was derived using data on monthly rent charges as well as expenditures on utilities over the past 30 days for those whose rent did not include utility costs (21.8% of families). After-shelter income was calculated as gross income from all sources over the past 12 months minus shelter costs. Among market families, a variable to indicate whether housing was affordable according to current norms (i.e., consuming 30% or less of income) was also derived. Indicators of housing quality included dichotomous variables demarcating crowding and whether the dwelling was in need of major repair.[36] Indicators of housing stability included whether the family was in rent arrears and whether they had borrowed money for rent or obtained rent money from other sources such as pay advances or credit in the past 12 months.

To provide context for the housing expenditure data in relation to food security, we also report on food expenditures over the 30 days prior to the survey. Food expenditures were expressed in relation to the estimated cost of a basic nutritious diet as defined by the Nutritious Food Basket (NFB) using estimates for Toronto for 2006.[37]

Statistical Analyses

Analyses were performed using SAS, version 9.1.3 (SAS Institute, Cary, NC). The clustering in the sampling design was accounted for using SAS survey procedures, which use a Taylor expansion to approximate sampling error.[38]

Linear regression was used to assess associations between income, housing costs and food expenditures, and housing type. The remaining analyses were conducted using logistic regression. We first assessed the association between food security

status and household income, after-shelter income, and housing and food expenditures. Among market families, we examined the association between food security and the proportion of income allocated to housing as well as the binary housing affordability indicator.

We then estimated the odds of food insecurity in relation to whether a family lived in subsidized or market housing. Sociodemographic characteristics associated with food security[31] and housing type among this sample, including income, main source of income, household type, immigrant status, and the household respondent's highest educational attainment, were included to account for their potential confounding effect. Recognizing a possible selection effect in terms of whether families chose to apply for and were deemed eligible for subsidized housing, we also computed the odds of food insecurity among subsidized families in relation to market families who were on a waiting list for subsidized housing ($n=65$).

Finally, we examined the relationship between household food security status and indicators of housing quality and stability, with the models stratified by housing type because preliminary analysis indicated that these factors differed between types of housing stock.

To account for potential changes in some families' housing circumstances within the 12 months preceding the survey interview, all regression models utilizing housing variables included a dummy variable to indicate whether each family moved to their current dwelling within the past year (applicable to 18.4% of families). Variables indicating the number of children and number of adults in the family were also included in models using income and expenditure estimates to account for the influence of household composition (with the exception of the ratio of food expenditures to the NFB which includes a household composition adjustment).

RESULTS

Sample characteristics in relation to housing type are outlined in Tables 1 and 2. Families in subsidized housing had lower incomes and shelter costs, and allocated a lower proportion of income to shelter (Table 2). There was no significant difference in after-shelter incomes by housing type (Table 2). Food expenditures and the proportion of income allocated to food did not differ by housing type (Table 2).

Two thirds (65.5%) of families were food insecure in the past 12 months. Household food insecurity was inversely associated with income, and a similar association was observed with after-shelter income (Table 3). Among families in market rental housing, there was a significant association between food insecurity and the proportion of income allocated to shelter (Table 3; preliminary analyses suggested that a curvilinear model provided a better fit; thus, we report only the results of this model). The relationship is depicted by the cumulative density function in Figure 1, which indicates an increased probability of food insecurity as the proportion of income allocated to housing rises, with a leveling off when the proportion reaches approximately 50% (the upper tail of the figure should be interpreted with caution given the small number of households ($n=18$) with shelter costs exceeding 70% of income). Market families allocating over 30% of their incomes to shelter (89.2% of families) had increased odds of food insecurity compared to those that allocated 30% or less (64.1% versus 41.7%, OR=2.87, 95% CI=1.19–6.90). Among market families, the proportion of income allocated to housing was also inversely associated with food expenditures, both in dollars ($t=-3.15$, $p=0.01$) and expressed in relation to the NFB ($t=-3.11$, $p=0.01$). Among

TABLE 1 Household characteristics in relation to housing type ($n=473$)

	All families ($n=473$)	Families in market housing ($n=222$)	Families in subsidized housing ($n=251$)	Odds (95% CI)[a] of living in subsidized housing
		n (%)		
Main source of income				
Employment and other non-governmental sources[b]	267 (56.4)	156 (70.3)	111 (44.2)	1.0
Welfare and other government transfers[c]	206 (43.6)	66 (29.7)	140 (55.8)	3.26 (2.08–5.12)
Household type				
Two parents and lone father[d]	215 (45.4)	145 (65.3)	70 (27.9)	1.0
Lone mother	258 (54.6)	77 (34.7)	181 (72.1)	5.02 (2.82–8.94)
Highest level of education attained by household respondent				
High school graduate or less	267 (56.4)	96 (43.2)	171 (68.1)	2.70 (1.66–4.38)
Some or completed post-secondary training	206 (43.6)	126 (56.8)	80 (31.9)	1.0
Immigrant status[e]				
Born in Canada	84 (17.8)	26 (11.7)	58 (23.1)	1.0
Immigrated<10 years ago	202 (42.7)	137 (61.7)	65 (25.9)	0.25 (0.13–0.49)
Immigrated≥10 yrs ago	187 (39.5)	59 (26.6)	128 (51.0)	1.08 (0.66–1.77)
No. of children				
One or two	332 (70.2)	161 (72.5)	171 (68.1)	1.0
Three or more	141 (29.8)	61 (27.5)	80 (31.9)	0.87 (0.57–1.35)

[a]Odds ratios were derived from logistic models (PROC SURVEYLOGISTIC) adjusted for whether the household moved in the past year

[b]Other non-governmental sources were the main source of income for only 4.2% of all families and included child support, rent received from someone living in the household, or informal sources of income

[c]Other government transfers include employment insurance, workers' compensation, child tax benefits, goods and services tax credits, and seniors' benefits

[d]Lone-father families made up only 3.8% of all households

[e]Immigrant status is based on the respondent and his/her partner if applicable. In households in which both the respondent and his/her partner were born outside of Canada, immigrant status is based on the individual who immigrated most recently

all families, food expenditures and the proportion of income allocated to food did not significantly differ by food security status (Table 3).

Over the past 12 months, 61.7% of families in market housing were food-insecure compared to 68.9% of those in subsidized housing. After adjusting for household sociodemographic characteristics, there was no association between whether families received housing subsidies and their food security status (OR=0.73, 95% CI=0.50–1.08). However, the odds of food insecurity were lower among subsidized families compared to only those market households on a waiting list for subsidized housing (OR=0.51, 95% CI=0.30–0.86).

Almost one half of families lived in crowded housing and one fifth lived in housing in need of major repair (Table 4). Among market families, crowding was inversely associated with housing costs ($t=-3.74$, $p<0.01$), whereas poor state of repair was not associated with housing costs among either market or subsidized families. Among subsidized families, neither crowding nor state of repair was associated with household food security (Table 4). Among market families, living in housing in need of major repair was associated with increased odds of food insecurity, but crowding was not associated with food security (Table 4). One in ten families were in rent arrears and one in four borrowed money for rent or got money

TABLE 2 Income, shelter costs, and food expenditures in relation to housing type ($n=473$)

	Mean (SE)	Median	p value for housing type[a]
Yearly income			
All families	23,401 (436)	22,600	<0.01
Market	26,674 (523)	26,275	
Subsidized	20,506 (620)	19,940	
Yearly shelter costs			
All families	8,033 (172)	9,000	<0.01
Market	11,102 (207)	10,980	
Subsidized	5,319 (243)	4,428	
Yearly after-shelter income			
All families	15,368 (358)	14,508	0.56
Market	15,572 (528)	14,342	
Subsidized	15,187 (511)	14,534	
Proportion of income allocated to shelter			
All families	35.6 (0.6)	32.8	<0.01
Market	45.4 (1.1)	42.8	
Subsidized[b]	26.9 (0.9)	25.4	
Monthly food expenditures			
All families	468 (14)	430	0.41
Market	488 (17)	440	
Subsidized	450 (27)	410	
Food expenditures in relation to the NFB			
All families	1.05 (0.03)	0.97	0.89
Market	1.05 (0.04)	0.96	
Subsidized	1.06 (0.04)	0.97	
Proportion of income allocated to food			
All families	27.2 (1.0)	22.3	0.16
Market	25.0 (1.4)	19.7	
Subsidized	29.1 (1.6)	24.0	

[a]*P* value derived using ANOVA (PROC SURVEYREG) with Box-Cox transformed dependent income and expenditure variables, adjusted for the number of adults and the number of children in the household (except food expenditures in relation to the NFB which already incorporates a household composition adjustment) and whether the household moved in the past year

[b]Although the proportion of income allocated to housing is regulated among subsidized households, some variation is apparent, likely due to fluctuations in income

for rent from another source (e.g., credit, payday advances) in the past 12 months (Table 4). Both of these stability indicators were associated with increased odds of food insecurity among the full sample of families (Table 4).

DISCUSSION

Although prior studies have documented an association between housing tenure and household food insecurity,[6,9,17,39] our research indicates the relevance of shelter costs and housing quality to the food security of low-income urban families. Food-insecure families had significantly lower incomes than food-secure families, consistent with previous literature,[9,17,18,40,41] but declining after-shelter income was also positively associated with food insecurity, as were rent arrears and having borrowed for rent. The proportion of income allocated to housing was also inversely associated with food expenditures, consistent with our earlier analysis of Canada's Survey of Household

TABLE 3 Income, shelter costs, and food expenditures in relation to household food security (n=473)

	Mean (SE)	Median	B (SE)[a,b] for food insecurity	Wald chi-square[a,b]	Odds (95% CI)[a,b] of food insecurity	p value[a,b]
Yearly income						
Food secure	25,478 (698)	24,400	−0.048 (0.0092)	26.76	0.95 (0.94–0.97)	<0.01
Food insecure	22,309 (493)	21,479				
Yearly shelter costs						
Food secure	8,460 (265)	9,432	−0.0025 (0.0019)	1.77	1.00 (0.99–1.00)	0.18
Food insecure	7,808 (154)	8,742				
Yearly after-shelter income						
Food secure	17,017 (635)	16,060	−0.055 (0.013)	17.38	0.95 (0.92–0.97)	<0.01
Food insecure	14,501 (437)	13,460				
Proportion of income allocated to shelter[c]						
Food secure	43.3 (1.8)	38.8	Linear coefficient: −1.45 (0.31)	22.35	0.24 (0.13–0.43)	<0.01
Food insecure	46.7 (1.4)	44.9	Quadratic coefficient: 0.012 (0.0029)	15.56	1.01 (1.01–1.02)	<0.01
Monthly food expenditures						
Food secure	481 (19)	450	−0.019 (0.044)	0.18	0.98 (0.90–1.07)	0.67
Food insecure	461 (20)	415				
Food expenditures in relation to the NFB						
Food secure	1.07 (0.04)	1.0	−0.080 (0.15)	0.27	0.92 (0.68–1.25)	0.60
Food insecure	1.04 (0.04)	0.96				
Proportion of income allocated to food						
Food secure	27.3 (2.2)	20.7	−0.017 (0.065)	0.068	0.98 (0.87–1.12)	0.79
Food insecure	27.1 (1.2)	22.9				

[a]Regression estimates were derived from multivariate logistic regression (PROC SURVEYLOGISTIC) adjusted for household composition (except in the case of food expenditures in relation to the NFB which incorporates a household composition adjustment). For models including housing variables (housing costs, after-shelter income, and proportion of income allocated to housing), a covariate was included to indicate whether the household moved in the past year

[b]Regression estimates for income and after-shelter income pertain to $1,000 increments, and the odds ratio for shelter costs and food expenditures pertain to $100 increments. For the proportions of income allocated to shelter and to food, regression estimates pertain to increments of 10%

[c]Because the proportion of income allocated to shelter is regulated among subsidized households, the examination of this variable in relation to household food security was conducted among the subsample of market households (n=222)

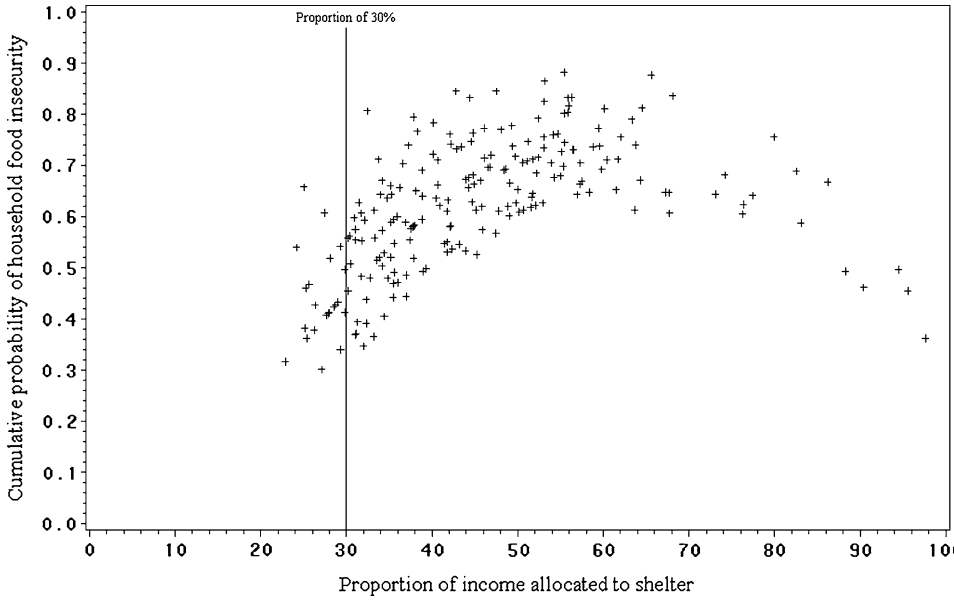

FIGURE 1. Cumulative probability of household food insecurity in relation to the proportion of income allocated to shelter among households in market rental accommodations ($n=222$).

Spending which revealed a decline in the adequacy of food spending among low-income households as the share of income allocated to housing increased.[42]

Our findings indicate that for many low-income families, compromises in housing quality are concomitant with food insecurity. Living in subsidized housing does not appear to insulate families from housing quality issues. Housing quality problems (particularly crowding) were also common among those in market housing. We observed a positive association between living in a dwelling in need of major repair and food insecurity among market families, suggesting that families in desperate straits are forced to make multiple serious compromises in basic needs. In contrast, the lack of heightened odds of food insecurity among those in crowded housing might reflect a conscious effort to reduce housing costs by living in cramped conditions, potentially freeing up money for non-shelter goods including food. Our data do not enable us to determine the extent to which the observed quality problems reflect deliberate choices to limit shelter costs. However, the significant inverse association between after-shelter income and food insecurity suggests that housing costs could not be increased without exacerbating food insecurity.

Sixty-nine percent of families in subsidized housing were food insecure, and although the subsample of market families paying 30% or less of their incomes for shelter was limited, 42% of the families in this category were also food insecure. These results point to the need for a redefinition of housing affordability to take into account the adequacy of after-shelter income. Housing costs in dollars did not differ between food-secure and food-insecure families, lending credence to the notion of an affordability norm which considers housing costs relative to income; however, the current definition is inadequate because of its failure to account for the adequacy of income remaining after housing costs are paid. We are unable to derive a definition which would take adequacy of after-shelter income into account using the current data because so many families had poor housing quality, suggesting that their housing costs underestimate what they need to spend to obtain adequate housing.

TABLE 4 Odds of household food insecurity in relation to housing quality and stability indicators ($n=473$)

	All families ($n=473$)		Families in market housing ($n=222$)		Families in subsidized housing ($n=251$)	
	(%)	Odds (95% CI) of food insecurity[a]	(%)	Odds (95% CI) of food insecurity[a]	(%)	Odds (95% CI) of food insecurity[a]
Crowding	47.4	0.80 (0.62–1.04)	70.7	0.94 (0.52–1.68)	26.7	0.90 (0.61–1.32)
In need of major repair	20.1	1.51 (0.90–2.53)	14.0	4.92 (1.67–14.49)	25.5	0.82 (0.45–1.50)
Rent arrears	10.8	2.34 (1.13–4.82)	10.8	3.62 (1.18–11.12)	10.8	1.66 (0.84–3.30)
Obtained money for rent from borrowing, credit, pay advances, etc.	27.9	3.55 (2.39–5.26)	29.3	3.35 (2.20–5.12)	26.7	3.87 (1.92–7.80)

[a]Odds ratios were derived from multivariate logistic regression (PROC SURVEYLOGISTIC) adjusted for whether the household moved in the past year

However, our findings highlight the need for future research to consider both costs in terms of the adequacy of after-shelter income and housing quality in assessing the affordability of housing.

The observed differences in sociodemographic characteristics between families in subsidized and market rental housing suggest a selection effect whereby those that apply for and obtain subsidized housing are systematically different from those that do not apply or qualify. This is also implied by the screening procedures for subsidized housing in Toronto whereby housing authorities prioritize particularly disadvantaged households such as homeless people, youths, and families separated because of lack of housing,[43] and in previous US research with low-income female-headed households that found a positive association between receipt of housing subsidies and child hunger.[44] We endeavored to account for a selection effect by including potential sociodemographic confounders in our model and repeating the analysis including only those market households on a waiting list for subsidized housing. Although longitudinal data are needed to understand the impact of moving into subsidized housing on food security, the lower odds of food insecurity among families in subsidized housing compared to those on the waiting list implies that subsidies afford some advantage. This is also suggested by the lack of difference in after-shelter incomes between subsidized and market families despite the lower overall incomes of subsidized families. Nonetheless, we posit that housing that is truly affordable should enable families to meet their non-shelter needs after paying rent and utilities, and thus, the pervasiveness of food insecurity among subsidized families raises questions about the adequacy of current subsidy levels.

The findings of this study shed light on the complexity of the relationships between income, housing and utility costs, housing affordability interventions, and food security at the household level, highlighting that it is not simply the income entering a household that influences the resources available for food but also the financial burden of non-discretionary expenses. Housing and utility costs are the major non-discretionary expenditure for most households and therefore should be considered along with income in determining the financial health of a household.[29] A focus on after-shelter income could help to more effectively identify vulnerable households in need of targeted interventions to improve their food security and their access to other non-discretionary goods and services related to healthcare and education, for example.

This study is not without limitations. Our analysis of shelter costs over the past year was based on detailed data from the previous month, but families' costs may have changed during the year. However, most families had lived in their current dwelling for at least 12 months and changes in their shelter costs would be limited given legislation that restricts the extent and frequency of rent increases.[43,45] It is also possible that utility costs fluctuated among the 22% who were paying them separately from their rent. Insofar as we sampled across the calendar year, this source of error should add random variation to our estimates, decreasing our ability to discern significant differences.

We relied on self-reported data to assess housing quality rather than objective measures. It is possible that respondents were reluctant to report the actual number of persons residing in the dwelling for fear of reprisal by landlords or municipal authorities, perhaps leading to an underestimation of crowding. Similarly, while we used a standard indicator used by the Canada Mortgage and Housing Corporation[36] to assess whether a dwelling was in need of major repair, it is possible that respondents either were not aware of or were resistant to reporting the full extent of problems due to their status as tenants. As a result, we may have underestimated the true extent of housing quality problems in this sample.

We did not observe lower food expenditures among food-insecure households (although the medians are suggestive of lower food spending and a higher proportion of income allocated to food among food-insecure families), in contrast to US population-based analysis.[16] Given that the receipt of charitable food assistance was more common among food-insecure families than food-secure families,[31] this cannot account for the lack of observed difference in their food spending. It is possible that given the limited size and low-income nature of our sample, there was inadequate variation in expenditures to discern an effect, perhaps complicated by the possibility that some low-income but food-secure families may have had more plentiful existing food supplies or better social support and thus better access to supplemental sources of food (e.g., from family or friends). We did not use a food expenditure diary to collect food spending data, and it is likely that there is more error in their recall as compared to housing costs, which tend to remain relatively stable, with such error making it difficult to see patterns in the data. Nonetheless, the associations between share of income allocated to housing and both food insecurity and declining food spending suggest that the burden of housing costs exerts pressure on food access among low-income households.

Our study is limited insofar as it was conducted with a sample of low-income tenant families residing in high-poverty neighborhoods in one Canadian city. Although the associations between food security and sociodemographic factors are consistent with Canadian[6,9,17,18] and US[16,39] literature, more research is needed to establish the generalizability of the relationship between housing circumstances and household food security identified here.

Housing tenure, housing affordability, and housing quality have been linked to self-rated health, mental health, and some physical health outcomes (most notably, respiratory ailments).[30,46–48] This study extends that body of literature by documenting the relevance of housing circumstances to the food security of low-income urban families. Our finding that housing and food problems coexist among poor families is perhaps not surprising; nonetheless, this study provides empirical evidence of the need for a reconsideration of current definitions of affordable housing and a review of interventions based on such definitions to ensure that they enable families to maintain adequate housing and meet their other basic needs.

ACKNOWLEDGMENTS

The authors gratefully acknowledge our collaborators at the City of Toronto Shelter, Support and Housing Division, and Toronto Public Health. This study was supported by grants from the Canadian Institutes for Health Research (IGP-74207, MOP-77766) and funding from the Neighbourhood Change & Building Inclusive Communities from Within Community University Research Alliance (CURA) program of the Social Sciences and Humanities Research Council of Canada. Sharon Kirkpatrick was a doctoral candidate at the time that this study was conducted and received financial support from an Ontario Graduate Scholarship and a Social Sciences and Humanities Research Council of Canada Doctoral Scholarship.

REFERENCES

1. Cristofar SP, Basiotis PP. Dietary intakes and selected characteristics of women ages 19–50 years and their children ages 1–5 years by reported perception of food sufficiency. *J Nutr Educ*. 1992; 24(2): 53–58.
2. Rose D, Oliveira V. Nutrient intakes of individuals from food-insufficient households in the United States. *Am J Public Health*. 1997; 87(12): 1956–1961.
3. Dixon LB, Winkleby MA, Radimer KL. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third National Health and Nutrition Examination Survey, 1988–1994. *J Nutr*. 2001; 131(4): 1232–1246.
4. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health, and household circumstances. *J Nutr*. 2001; 131(10): 2670–2676.
5. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr*. 2008; 138(3): 604–612.
6. Che J, Chen J. Food insecurity in Canadian households. *Health Rep*. 2001; 12(4): 11–22.
7. Alaimo K, Olson CM, Frongillo EA, Briefel R. Food insufficiency, family income, and health of US preschool and school-aged children. *Am J Public Health*. 2001; 91(5): 781–786.
8. Siefert K, Heflin CM, Corcoran ME, Williams DR. Food insufficiency and the physical and mental health of low-income women. *Women Health*. 2001; 32(1–2): 159–177.
9. Vozoris N, Tarasuk V. Household food insufficiency is associated with poorer health. *J Nutr*. 2003; 133(1): 120–126.
10. Heflin CM, Siefert K, Williams DR. Food insufficiency and women's mental health: findings from a 3-year panel of welfare recipients. *Soc Sci Med*. 2005; 61(9): 1971–1982.
11. Seligman HK, Bindman AB, Vittinghoff E, Kanaya AM, Kushel MB. Food insecurity is associated with diabetes mellitus: results from the National Health Examination and Nutrition Examination Survey (NHANES) 1999–2002. *J Gen Intern Med*. 2007; 22(7): 1018–1023.
12. Rose-Jacobs R, Black MM, Casey PH, et al. Household food insecurity: associations with at-risk infant and toddler development. *Pediatrics*. 2008; 121(1): 65–72.
13. Kirkpatrick SI, McIntyre L, Potestio M. Child hunger and long-term adverse consequences for health. *Arch Pediatr Adolesc Med*. 2010; 164(8): 754–762.
14. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr*. 2010; 140(2): 304–310.
15. Statistics Canada. *Household food insecurity*, 2007–2008. Ottawa, ON: Statistics Canada; 2010. Health Fact Sheet No. 2, Cat. No. 82-625-XWE.
16. Nord M, Andrews M, Carlson S. *Household Food Security in the United States*, 2008. *Economic Research Service*, US Dept of Agriculture; 2009. Report No. ERR-83.
17. Office of Nutrition Policy and Promotion. *Income-Related Household Food Security in Canada*. Ottawa, ON: Health Canada; 2007. Report No. H164-42/2007E.

18. Ledrou I, Gervais J. Food insecurity. *Health Rep*. 2005; 16(3): 47–51.
19. McIntyre L. Food security: more than a determinant of health. *Policy Options*. 2003; 24 (3): 46–51.
20. Canadian Association of Food Banks. *HungerCount 2007*. Toronto: Canadian Association of Food Banks; 2007.
21. Power E. Individual and household food insecurity in Canada: position of Dietitians of Canada (background paper). *Can J Diet Prac Res*. 2005.
22. Chronic Disease Prevention Alliance of Canada. *CDPAC Policy Position: Food Security in Canada—A Leadership Opportunity Towards Health Promotion and Reduction in Chronic Disease*. Ottawa, ON: Chronic Disease Prevention Alliance of Canada; 2007.
23. Campbell CC, Desjardins E. A model and research approach for studying the management of limited food resources by low income families. *J Nutr Educ*. 1989; 21 (4): 162–171.
24. Tarasuk V, Maclean H. The food problems of low-income single mothers: an ethnographic study. *Can Home Econ J*. 1990; 40(2): 76–82.
25. Travers KD. The social organization of nutritional inequities. *Soc Sci Med*. 1996; 43(4): 543–553.
26. Hamelin AM, Beaudry M, Habicht J-P. Characterization of household food insecurity in Quebec: food and feelings. *Soc Sci Med*. 2002; 54(1): 119–132.
27. Hulchanski JD. The concept of housing affordability: six contemporary uses of the housing expenditure-to-income ratio. *Hous Stud*. 1995; 10(4): 471–491.
28. Canada Mortgage and Housing Corporation. *Canadian Housing Observer 2003*. Ottawa, ON: Canada Mortgage and Housing Corporation; 2003.
29. Stone ME. *Shelter Poverty: New Ideas on Housing Affordability*. Philadelphia: Temple University Press; 1993.
30. Moloughney B. *Housing and Population Health: The State of Current Research Knowledge*. Ottawa, ON: Canadian Population Health Initiative & Canada Mortgage and Housing Corporation; 2004.
31. Kirkpatrick SI, Tarasuk V. Food insecurity and participation in community food programs among low-income Toronto families. *Can J Public Health*. 2009; 100(2): 135–139.
32. Dachner N, Ricciuto L, Kirkpatrick S, Tarasuk V. Food purchasing and food insecurity among low-income families in Toronto. *Can J Diet Prac Res*. 2010; 71(3):126.
33. Kirkpatrick SI, Tarasuk V. Assessing the relevance of neighbourhood characteristics to the household food security of low-income Toronto families. *Public Health Nutr*. 2010; 13 (7): 1139–1148.
34. Statistics Canada. *Canadian Community Health Survey (CCHS) Cycle 2.2, (Nutrition) 2004*: *Public Use Microdata File (PUMF) Derived and Grouped Variable Specifications*. Ottawa, ON: Statistics Canada; 2005.
35. Bickel G, Nord M, Price C, Hamilton WL, Cook J. *Guide to Measuring Household Food Security*. Alexandria, VA: US Dept of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition and Evaluation; 2000.
36. Canada Mortgage and Housing Corporation. *Canadian Housing Observer 2004*. Ottawa, ON: Canada Mortgage and Housing Corporation; 2004.
37. Toronto Public Health. *Weekly Cost of the Nutritious Food Basket in Toronto (May 2006)*. Toronto: City of Toronto; 2007.
38. An A, Watts D. *New SAS® Procedures for Analysis of Sample Survey Data*. Cary, NC: SAS Institute Inc.; 1998.
39. Rose D. Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr*. 1999; 129(2S Suppl): 517S–520S.
40. McIntyre L, Connor SK, Warren J. Child hunger in Canada: results of the 1994 National Longitudinal Survey of Children and Youth. *Can Med Assoc J*. 2000; 163(8): 961–965.

41. McIntyre L, Walsh G, Connor SK. *A Follow-up Study of Child Hunger in Canada*. Ottawa, ON: Applied Research Branch, Human Resources Development Canada; 2001. Report No. W-01-1-2E.
42. Kirkpatrick SI, Tarasuk V. Adequacy of food spending is related to housing expenditures among lower-income Canadian households. *Public Health Nutr*. 2007; 10(12): 1464–1473.
43. City of Toronto. *Rent-Geared-to-Income Guide*. Toronto: Social Housing Unit, City of Toronto; 2003.
44. Wehler C, Weinreb LF, Huntington N, et al. Risk and protective factors for adult and child hunger among low-income housed and homeless female-headed families. *Am J Public Health*. 2004; 94(1): 109–115.
45. Ontario Ministry of Municipal Affairs and Housing. *2005 Annual Rent Increase Guideline*. Toronto: Ontario Ministry of Municipal Affairs and Housing; 2004.
46. Dunn JR. Housing and inequalities in health: a study of socioeconomic dimensions of housing and self reported health from a survey of Vancouver residents. *J Epidemiol Community Health*. 2002; 56: 671–681.
47. Shaw M. Housing and public health. *Annu Rev Public Health*. 2004; 25: 397–418.
48. Rauh VA, Landrigan PJ, Claudio L. Housing and health: intersection of poverty and environmental exposures. *Ann NY Acad Sci*. 2008; 1136: 276–288.