

Food Insecurity and Homelessness in the Journeys Home Survey*

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Abstract:

Homelessness deprives people of comfort, safety, security, and dignity. Worse, it may contribute to other problems, including food hardships. In this study, we use newly-available data from the Journeys Home survey, a large national longitudinal survey of Australians who were homeless or at risk of homelessness, to estimate multivariate ordered categorical variable models of the association between homelessness and an index of food insecurity. The Journeys Home survey includes an extensive set of measures of people's circumstances, and we use these to control for background characteristics and mediators for the possible impacts of homelessness on food insecurity. Estimates from the models reveal that homeless is strongly positively associated with food insecurity for men but less strongly associated for women. Homeless women's lack of access to kitchen facilities appears to mediate part of the relationship. Previous experiences with food problems, current financial stresses, poor health, and living far from public transportation increased the risks of food insecurity, while social supports reduce the risk. Additionally, alcohol consumption is positively associated with men's food hardships. We also use the Journeys Home survey to investigate the relationship between homelessness and food consumption, meal consumption, and food expenditures.

Keywords: food insecurity, homelessness, Journeys Home survey

JEL codes: I32

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Introduction

Without a doubt, homelessness is a hardship. People who lack accommodations altogether (the primary homeless) brave the physical discomforts and risks of sleeping rough. They along with those who double up with friends or relatives and those who shelter in emergency or culturally inadequate arrangements (the secondary and tertiary homeless) also often lack access to the full facilities of a home, confront uncertainty and volatility regarding their housing situation, and suffer losses of privacy and dignity. As uncomfortable, stressful, and demeaning as these circumstances may be, homelessness may also beget other deprivations, including food hardships that extend to food insecurity and hunger.

We can easily conceive of how homelessness might contribute to food problems. Among other things, homelessness may preclude access to kitchen and food storage facilities and interfere with other market and nonmarket activities that are essential to the acquisition of food and the preparation of meals. Moreover, the attention and concern that the homeless give to their housing problems may detract from the attention that is needed to achieve food security. A substantial body of descriptive research not only documents very high levels of food hardships and nutritional deficits for the homeless but also points to serious possible consequences of food insecurity for this group, including increased rates of being overweight or obese (Richards and Smith 2010; Smith and Richards 2008; Tsai and Rosenheck 2013), suffering from poor health or chronic conditions (Hamelin and Hamel 2009), and undergoing hospitalization or emergency room treatment (Baggett et al. 2011).

These logical and descriptive linkages notwithstanding, the empirical basis for an impact of homelessness on food hardships is surprisingly tenuous. Few of the descriptive studies directly compare outcomes for homeless and housed people, with most relying on implicit comparisons.

Only a handful of multivariate studies have been conducted (Furness et al. 2004; Gundersen et al. 2003; Lee and Greif 2008; Wehler et al. 2003), and each of these has been hampered by limitations on their samples (e.g., samples of single cities or just of homeless populations) and measures. The multivariate studies have also relied exclusively on self-reports of food hardships, despite evidence that people (Gundersen and Ribar 2011) and even the homeless (Drake 1992 and Luder et al. 1990) may not report these problems the same way that they report food consumption or expenditures. In addition, multivariate studies have investigated only a few of the potential conceptual explanations regarding why homelessness may lead to food problems.

We address these limitations in this study, using newly-available data from the Journeys Home (JH) survey, a large, national survey, which has longitudinally followed Australians who were either homeless or at high risk of homelessness or housing insecurity since late 2011. Unlike the data used in previous multivariate analyses, the JH survey spans many geographic contexts and includes a heterogeneous at-risk population. JH was designed to examine the circumstances and consequences of homelessness, and its interviews have asked numerous questions about people's economic, demographic, health, and well-being outcomes in addition to gathering detailed information about their housing situations. Among the well-being measures was a battery of questions in the fifth wave of the survey regarding food hardships, food and meal consumption, and food expenditures. We use these data to estimate multivariate models of how homelessness and other observable characteristics are associated with food outcomes.

Besides examining a more general sample of the disadvantaged population at risk of homelessness, a wider set of control measures, and a broader set of food outcomes than other multivariate studies, our investigation extends our understanding of homelessness and food insecurity in several other important directions. First, we frame our analysis in the context of a

general conceptual model of food insecurity (Barrett 2002) and use that model to propose and examine several specific mechanisms through which homelessness might affect food hardships. The analysis of mechanisms strengthens and reinforces our basic knowledge regarding food outcomes. We are also able to investigate several mechanisms that previous descriptive studies have identified as being especially relevant to the homeless population, including the lack of kitchen and food storage facilities, the use of alcohol that might interfere with or substitute for other food intakes, and the reliance on community food services as a coping mechanism.

Second, we have sufficient data from the JH survey to support the estimation of separate models for men and women. Previous multivariate studies either estimated outcomes for a single gender (Gundersen et al. 2003; Wehler et al. 2003) or included simple controls for gender (Furness et al. 2004; Lee and Greif 2008). Estimates from our models reveal that there are substantial differences between men and women. Most importantly, we find that homelessness is much more strongly associated with food hardships for men than for women. In addition, alcohol plays a bigger role in men's food hardships and the availability of kitchen facilities plays a bigger role in women's.

Third, we investigate these relationships with data from Australia, a developed, high-income country with extensive social supports that also has modestly high levels of homelessness and food hardships. The Australian Bureau of Statistics (ABS) estimated that just over 100,000 Australians, or about 0.5 percent of the population, were homeless on the night of the nation's census in 2011 (ABS 2012), and Foley et al. (2010) estimated that seven percent of South Australians experienced food hardships. An interesting aspect of the Australian policy context is the availability of cash transfer payments and various service supports for homeless people. This contrasts sharply with the U.S. where homeless people not only face social

exclusion and deprivation but also often fall outside the cash social safety net.

The remainder of this paper is organized as follows. The next section describes Barrett's (2002) theoretical rational-choice model of food insecurity and uses that model to develop causal and non-causal explanations for the empirical relationship between homelessness and food insecurity. The following section reviews the empirical research literature on these relationships. In the next section, we describe the JH survey, the construction of our empirical measures, and the selection of our analysis sample. We next report results from our multivariate empirical models. The final section of the paper offers conclusions.

Conceptual framework

To analyse how homelessness might contribute to food hardships, we consider Barrett's (2002) rational-choice model of food insecurity. Following that model, we consider a person who has life-cycle preferences regarding her physical well-being and her own consumption of other goods in the present and future periods. The model further assumes that the level of physical well-being in each period depends on the level of well-being from the previous period; is augmented through inputs of nutrition, the person's time, and purchasable goods and services; and is subject to potential shocks. Nutrition, in turn, depends on purchases of food and inputs of time. The person's total available time is constrained, with the time that she can devote to investing in her nutrition and physical well-being being reduced by time that she spends in the labour market. The person also faces a life-cycle budget constraint in which expenditures on goods and services in a given period are constrained by her per-period earnings, the returns on her net savings (or interest payments on her debt), other unearned income, and borrowing or savings. In each period, the person chooses allocations of time and expenditures on goods and services to maximize her life-time utility subject to the production, time, and budget constraints.

Based on these choices, the person is able to attain given levels of nutrition and physical well-being. If the nutritional inputs are above a particular threshold, the person will be food secure, meaning that she has access to sufficient food to meet her physical well-being needs. If the nutritional inputs are below this, she will be food insecure, and if the inputs are very low, she will experience hunger. The consequences of food insecurity and hunger are severe enough that people will engage in a number of coping strategies to avoid these conditions, especially when their resources are low. These coping strategies take the form of less and less socially desirable ways of obtaining food or the resources for food that may include seeking emergency services, borrowing, begging, foraging, and stealing.

The model is most helpful in identifying general characteristics of people that increase their risks of food insecurity. First, food insecurity is more likely if people's market and non-market productivities are low and they have trouble either obtaining the economic resources to buy food or converting food into nutritious meals. Second, the risks of food insecurity rise when wages fall or prices increase, as both of these conditions reduce what people can purchase. Third, food insecurity is more likely if people lack access to labour markets where they can "sell" their effort or product markets where they can buy goods. Fourth, food risks increase when people lack wealth and assets that they can potentially spend down to obtain food. Fifth, food risks also increase when people have limited ability to borrow or to shift financial resources from one period to another. Sixth, food insecurity is more likely in the absence of reliable social, private, or public insurance arrangements and safety nets. Seventh, food risks increase when people's circumstances put them close to nutritional margins; in these circumstances, any negative shocks are more likely to move people below those margins. Eighth, risks also increase when people's occupations, health, or living conditions make them more susceptible to shocks and volatility.

Ninth, food risks are higher when people's available coping strategies are limited.

If we apply this framework, we can see many ways that homelessness might cause food insecurity and food hardships. For example, homelessness might reduce people's physical (Dennis et al. 1991) and mental health (Hodgson et al. 2013), which might, in turn, reduce their market and non-market productivity. Homeless people may suffer from low wages and a lack of work opportunities (Shier et al. 2012) and have limited access to some types of food markets (Crawford et al. 2014), public assistance (Koegel et al. 1990), and social supports (Meadows-Oliver 2005). In general, homelessness will increase the chances of food insecurity if it contributes to any of the risk factors from Barrett's model. Thus, the risk factors represent potential mechanisms for the transmission of homelessness to food insecurity.

There are also some unique circumstances of homelessness that might lead to food insecurity. For one thing, primary homelessness (e.g., sleeping rough) not only implies the loss of an accommodation but all the things associated with that accommodation, including kitchen and food storage facilities. Lack of access to these facilities could contribute to food insecurity (Crawford et al. 2014; Dachner and Tarasuk 2002; Miewald and Ostry 2014; Wicks et al. 2006). Poor dentition is a risk factor that constitutes a special productivity loss that may interfere with eating and hence the conversion of food inputs into nutrition (Wicks et al. 2006). Homeless people may also face negative, rather than positive, effects of social networks if their networks include other homeless members who put reciprocal obligations on them (Dachner and Tarasuk 2002; Koegel et al. 1990; Tsai and Rosenheck 2013). Homeless people are also vulnerable to victimization which would be injurious, reduce available resources, and contribute to psychological stress (Milburn and D'Ercole 1991).

Aspects of homeless people's coping behaviours may also affect food security. Some

behaviours may lead to worse outcomes. For example, alcohol consumption tends to be high among homeless, and drinking is a source of calories which might substitute for the intake of other nutrients and for regular eating (Darmon et al. 2001; Darnton-Hill and Ash 1988; Malmauret et al. 2002). However, other coping behaviours may be more beneficial to food security and consumption. Homeless people may develop fewer inhibitions about utilizing soup kitchens, begging, foraging, and theft (Booth 2006; Hamelin and Hamel 2009; Koegel et al. 1990; Lee and Greif 2008; Quine et al. 2004; Tarasuk et al. 2009; Tsai and Rosenheck 2013; Wicks et al. 2006).¹ Part of this response may be an adaptation by homeless people to their circumstances (Koegel et al. 1990; Lee and Greif 2008), perhaps through increased identification with homelessness (Snow and Anderson 1987).

Although there are many reasons why homelessness might itself reduce food security, the observed relationship may reflect other things and not be causal. Homelessness, like food security, is an endogenous (behavioural) outcome. The empirical association between these outcomes might stem from other characteristics that mutually cause each of them. Lee et al. (2010) have reviewed the empirical literature on the causes of homelessness; many of the characteristics they identified, such as reduced economic resources, high costs, poor health, inadequate social buffers (Moulton 2013), and vulnerability to negative shocks (Curtis et al. 2013), overlap with the risk factors from Barrett's model. Similarly, Joyce et al. (2012) have documented that food insecurity, rather than occurring in isolation, is frequently accompanied by economic, health, and energy insecurity in addition to housing insecurity. Dachner and Tarasuk (2002) similarly reported multiple forms of insecurity specifically among homeless youth. Although empirical studies, including ours, can control for many of these characteristics, they

¹ Quine et al. (2004) reported an especially unique coping strategy of older homeless men in Sydney using a local health clinic to get vitamin injections that would facilitate their drinking.

cannot account for all of them, leaving the possibility of omitted variables bias.

Another methodological concern is that food hardships, if they are prolonged and severe enough, could contribute to homelessness and hence to the potential for reverse causation. The most likely mechanism for reverse causation would be through impacts of food insecurity on health (see, e.g., Cook et al. 2013 and the references therein) which would reduce the person's productivity or otherwise affect homelessness (Curtis et al. 2013). However, food insecurity could also motivate people to obtain social or public assistance that could alleviate other resource strains and reduce homelessness.

As this discussion indicates, theory provides ample explanations for why homelessness might affect food security. Many of these explanations center on possible indirect effects of homelessness through general risk factors that contribute to food hardships. The conceptual analysis also points to non-causal explanations for the observed relationships, which need to be kept in mind as we interpret results. In the next section we consider previous empirical research regarding the effects of homelessness, and in the empirical section, we develop new evidence, using the rich data from the Journeys Home survey.

Previous studies

The vast majority of empirical studies that have investigated homelessness and food hardships have been descriptive and have focused on characterizing the outcomes and circumstances of homeless people. Quantitative studies by Booth (2006), Koegel et al. (1990), Ora et al. (2008), and Tarasuk et al. (2009) and qualitative studies by Crawford et al. (2014), Dachner and Tarasuk (2002), Miewald and Ostry (2014), Quine et al. (2004) and Wicks et al. (2006) have generally documented high levels of hunger, food insecurity, and other food hardships among the homeless as a whole and among subpopulations, such as homeless youths and older homeless

adults, across many different country and geographic contexts. Evidence from this descriptive research is consistent with the conceptual analysis from the previous section. For example, nearly all of the studies have reported on the lack of economic resources and on the importance of coping strategies, often in the form of getting meals from soup kitchens and other community organizations but also in more extreme forms. Studies have also reported problems with access to food markets and fresh foods (Crawford et al. 2014), lack of cooking facilities (Dachner and Tarasuk 2002; Miewald and Ostry 2014; Wicks et al. 2006), and reciprocal obligations (Dachner and Tarasuk 2002).

A large related descriptive literature has examined food intakes and documented numerous nutritional deficits among the homeless (Darmon et al. 2001; Darnton-Hill and Ash 1988; Drake 1992; Gelberg et al. 1995; Langnäse and Müller 2001; Luder et al. 1990; Malmauret et al. 2002; Quine et al. 2004; Richards and Smith 210; Smith and Richards 2008; Sprake et al. 2014; and Wolgemuth et al. 1992). Many of these studies have further reported high levels of alcohol consumption and substantial calorie intakes from drinking. The studies by Drake (1992) and Luder et al. (1990) additionally report a disconnect between homeless people's perceptions of food sufficiency, which many see as adequate, and their actual nutritional intakes, which are often unhealthy. This raises the possibility that food access hardships—the outcomes that we consider in this study—may be reported differently by homeless people from other food well-being measures and motivates us to also consider measures of food and meal consumption.

The descriptive studies have yielded strong evidence that homeless people face high risks of food hardships and nutritional problems; however, most fail to indicate the strength of the relationship because they lack comparisons between homeless and housed people, and they also fail to provide causal results because they lack multivariate controls. Only a few studies have

conducted multivariate analyses.

Gundersen et al. (2003) and Wehler et al. (2003) estimated models of food hardships, using a modest-sized convenience sample of homeless and housed low-income, single-parent families in Worcester, Massachusetts. Wehler et al. found that counts of recent housing problems, receipt of housing subsidies (among the housed), and a short tenure in the area predicted child food hardships but not adult hardships. They also found results that were consistent with hunger and food insecurity being managed processes. The companion study by Gundersen et al. estimated instrumental-variable models of food hardships in an attempt to obtain causal effects of homelessness; the models indicated that homelessness increased food hardships, but the estimates were imprecise and most could not be distinguished from zero.

Two other studies found stronger associations between aspects of homelessness and food problems. Furness et al. (2004) analysed data from a large telephone survey of low-income households in Los Angeles that included a question about homelessness within the past five years. Although only about seven percent of the sample had experienced past homelessness, it was a strong and significant predictor of current food insecurity. Two weaknesses with this study were its reliance on past homelessness as an explanatory measure and its very limited set of other control variables. Lee and Greif (2008) examined a large national survey of people who were utilizing homelessness services and who lacked permanent or suitable accommodations. Although their study was limited to people who were homeless, they were able to distinguish between different types of homelessness and different housing problems. They found that being on the street (sleeping rough) and the number of homeless spells within the past month were each associated with increased food hardships. They also found that a need to obtain money through subsistence activities, such as begging or illegal activities, was also positively related to food

problems but only among those who were transitorily, rather than chronically, homeless.

As these descriptions indicate, each of the existing multivariate studies suffers from limitations with their samples. Three of the studies covered individual U.S. cities that might not be representative of homelessness experiences elsewhere; the other study was restricted to people who were homeless. One of the studies (Furness et al. 2004) could only consider past homelessness, and all of the studies had relatively modest sets of control variables. The Journeys Home survey, which we describe in the next section, overcomes these limitations.

Analysis data from the Journeys Home Survey

Our empirical analyses use data from the fifth and earlier waves of the Journeys Home survey. JH is a large, national, interviewer-administered survey that has followed a sample of Australian social security customers who were at risk of homelessness and housing insecurity over time. Importantly for the purposes of investigating effects of homelessness, the JH sample was drawn from a broad, albeit disadvantaged, at-risk population that included homeless and housed people, and was not restricted to people who were homeless or utilizing shelter or drop-in facilities. Interviews began in 2011 and continued in six-month intervals with each wave asking people about their housing, economic, health, demographic, and other circumstances.²

In the initial round of interviews, 1,682 people participated, which represented a response rate of 62 percent of the in-scope sample. This response rate not only compares favourably with other studies that sample from seriously disadvantaged populations (O’Callaghan 1996; Randall and Brown 1996; Weitzman et al. 1990), but it is also in line with panel surveys of the general population, including the Household Income and Labour Dynamics in Australia survey, the

² See Wooden et al. (2012) for a more complete description of the JH survey.

German Socio-Economic Panel study, and the British Understanding Society Survey. Retention in subsequent waves of JH has also been high, with 91, 88, 86 and 84 percent of the initial respondents successfully re-interviewed in waves two through five, respectively.

Food outcomes. Our principal outcome measure is an ordered-categorical index of food insecurity that comes from questions that were asked in the fifth wave of JH and that were adapted from the Household Food Insecurity Access Scale (HFIAS). The HFIAS was developed to measure hardships in food access across different cultural contexts (Coates et al. 2007) and has previously been used to assess food insecurity among homeless adults (Holland et al. 2011). Wave five of JH asked six of the nine HFIAS questions, inquiring whether and how often during the “past four weeks” the person had to:

1. “worry that you would not have enough food,”
2. “eat a limited variety of foods because of a lack of money,”
3. “eat some foods that you really did not want to eat because of a lack of money,”
4. “eat a smaller meal than you felt you needed because there was not enough food,”
5. “skip a meal because of a lack of money,” and
6. “go a whole day and night without eating anything because there was not enough food.”

The possible responses to each item were “never,” “rarely (once or twice in the past four weeks),” “sometimes (three to ten times in the past four weeks),” and “often (more than ten times in the past four weeks).” We formed an index by first assigning values of zero to the “never” responses, one to the “rarely” and “sometimes” responses, and two to the “often” responses and then summing these values for the questions regarding worrying, eating a limited variety of foods, eating unwanted foods, and going a day and night without food. The resulting index takes on values between zero and eight, with higher values indicating greater food insecurity. Formal

analyses supported the construction of our four-item, three-response-category index. Appendix A details these analyses and describes how we developed and validated the index. In sensitivity analyses, we examined alternative indices that incorporated all of the available items and response categories; the use of less parsimonious indices did not substantively alter our findings.³

The fifth wave of the JH survey also asked about usual weekly meals, food expenditures, and food consumption. An advantage of these measures is that they provide direct, objective indications of food behaviours, but a disadvantage is that they may provide less information about people's well-being. Descriptive evidence from studies of nutritional intakes (Drake 1992; Luder et al. 1990) and expenditures (Gundersen and Ribar 2011) suggests that objective measures should be considered alongside of self-reported hardships. From JH questions on the usual numbers of weekly breakfasts, lunches, and dinners consumed, we summed the responses to form a count (0-21) of weekly meals. JH also asked about the usual weekly expenditures that the respondent and people living with him or her made on food and drink, including meals eaten away from home. We constructed an equivalised measure by dividing the total reported expenditures by the ABS needs adjustment for the people covered by the expenditures.⁴ Finally, for food consumption, we formed a factor score from responses to questions about the usual weekly servings of fruits and vegetables and the usual days on which the person ate seafood, meat, and legumes. External validation analyses reported in Appendix A confirmed that these measures were negatively but imperfectly correlated with self-reported food hardships.

Homelessness. Our primary explanatory variable is a binary indicator for whether the respondent was homeless at any point during the month preceding the fifth wave interview.

³ We omit the detailed results for purposes of brevity; however, they are available upon request.

⁴ The ABS has modified the OECD equivalence scale to apply weights of 1.0 for the first covered adult, 0.5 for each additional adult, and 0.3 for each child under the age of 15.

Definitions of homelessness are highly contested with considerable debate regarding who should be considered homeless (see Argeriou et al. 1995; Chamberlain and MacKenzie 1992; Culhane and Hornburg 1997; Jacobs et al. 1999; Lee et al. 2010; Toro 2007). In this analysis we follow Chamberlain and MacKenzie (2008) and adopt a “cultural” definition of homelessness, which refers to living in situations that fall below community standards. This includes people who are primary homeless (those without accommodation), secondary homeless (those in short-term, rent-free arrangements with friends or family), and tertiary homeless (those in long-term arrangements but below community standards, such as living in boarding houses or caravan parks). In preliminary analyses we examined separate categorizations into primary, secondary, and tertiary homelessness but found that these did not have distinguishably different associations with food insecurity.

Mediating variables. We test for a number of risk factors representing potential mechanisms for the transmission of homelessness to food insecurity. First, we include in our empirical framework characteristics that affect market and non-market productivities. Specifically, we constructed variables for weekly gross household earnings and weekly gross household non-labour income (i.e. received from Centrelink, rent assistance, Family Tax Benefits and other sources). As with food expenditure, we use an equivalised measure by dividing the relevant income amount by the modified OECD equivalence scale. We then control for a number of health characteristics which may restrict the respondent’s non-market productivity: a dummy variable for whether the respondent was diagnosed with Bipolar Affective Disorder, Schizophrenia, depression, anxiety or Post Traumatic Stress Disorder since she was last interviewed; a dummy variable for whether the respondent had any physical health problem since she was last interviewed (among sight/hearing problems, migraines, stomach

ulcer, eye/ear/skin infection, pneumonia or gastro problems); a dummy variable for whether the respondent has any long term health/disability condition causing restrictions); a self-assessed general health status variable (5 values 1-5 from excellent to poor). Second, we characterize the lack of access to labour markets through a dummy for whether the respondent lives more than 500m from public transport. Third, we control for wealth and assets through the amount of total outstanding debt (top coded at 50,000). Fourth, we include in our model a dummy for whether the respondent holds a credit card to characterize borrowing capacities. Fifth, we construct variables to capture the use of social support and safety nets: a dummy variable for having access to social support (i.e. the respondent does not often feels lonely and they can get help from others, can lean on people, have people to cheer them up, and feel better talking to people they know); and a dummy variable for having received welfare services in the last 6 months (i.e. housing, tenancy, emergency relief, legal aid, financial support, gambling support, family violence services). Sixth, we proxy the respondent's vulnerability to shocks via a variable for the count of types of non-food financial hardships the respondent experienced in the last 6 months because of a shortage of money (pawned or sold something; asked a welfare agency for food, clothes, accommodation or money; asked for financial help from friends or family; could not afford to go out with friends; could not pay electricity, gas or telephone bills on time). Seventh, a dummy variable for whether the respondent used emergency meal services in the last 6 months characterizes the coping strategy she may have put in place to adapt to homelessness. In terms of circumstances which may be unique to homelessness, we include controls for having access to a kitchen; having a resourceful social network (i.e. having friends, none of which are homeless and most of which have a full-time job); having a resourceless social network (i.e. either no friends or friends but most of which are homeless or none of which have a full-time job); having suffered

from physical or sexual violence in the last 6 months; and the average number of alcoholic drinks per day (top coded at 20).

Background controls. The econometric framework also controls for standard background characteristics: age; age squared; a dummy for identifying as Aboriginal or a Torres Strait Islander; a dummy for being born in a non-English-speaking country; a dummy for being married (or being in a de facto marriage); the number of children; a dummy for completing a tertiary education; a dummy for having completed high school (but not completing a tertiary degree). We also control for variables characterizing the respondents' childhood: a dummy for having ever been placed into foster, residential or kin care; a dummy for having been exposed to emotional abuse, physical violence, or sexual abuse as a child; three specific dummies for not being with both parents at age 14 either because they were divorced/separated or dead or because of conflict. Finally, we control for past adult characteristics (i.e. measured prior to homelessness and food insecurity) which could partly drive the association between homelessness and food insecurity but are unlikely to be mediators: a dummy for having a chronic health condition (i.e. having ever had/been diagnosed with stroke; any other heart or circulatory condition; diabetes; asthma; chronic bronchitis or emphysema; problems with your liver; arthritis, gout or rheumatism; epilepsy; kidney disease; hepatitis C; chronic neck or back problems; intellectual disability or acquired brain injury); the proportion of time the respondent spent in paid work since finishing her education; dummies for the type of area the respondent lives in a rural area or in an urban area outside of a major city (the omitted category is residence in major city); and a dummy for whether the respondent ever had to go without food in the two years preceding wave 4.

Sample selection. Our sample includes wave 5 respondents who answered the six food security questions (N = 1,406). To maximize the sample size, we set values of variables with missing values to zero and include dummy controls for missing responses when the number of missing responses exceeds 40: measures of being abused as a child, work experience, distance to public transportation, history of food hardships, earnings, unearned income, outstanding debt, financial stress, and recent exposure to violence. For measures with smaller levels of item non-response, we drop observations with missing values. We are left with 1,273 observations: 681 men and 592 women.

Descriptive analysis. Table 1 reports means of the food outcome, background, and mediating variables separately for the homeless and housed men and women in our analysis sample. As the numbers of observations in each column indicate, the rate of homelessness was nearly twice as high among the men in our sample (24 percent) than among the women (13 percent).

[Table 1 about here]

Means for the food insecurity index, which are listed in the first row of the table, reveal that at-risk men and women reported similar average levels of food insecurity and that homeless people reported worse food security than housed people. These differences notwithstanding, the incidence of food hardships was modest. Figure 1 displays the proportions of men and women reporting each food insecurity response. Approximately five out of nine people in our sample reported never experiencing any food hardships during the preceding month. About half of homeless women reported never experiencing a hardship, and 40 percent of homeless men reported never experiencing a hardship. Homeless women were less likely than housed women to report scores of three or less and more likely to report scores of four or higher. Homeless men

were less likely to report scores of zero but more likely to report nearly all the higher scores.

[Figure 1 about here]

Consistent with their reports of higher food insecurity, estimates from Table 1 indicate that homeless people reported eating about one fewer meal per week than housed people and spending \$15-\$17 less per week on food on an equivalised basis. However, only the expenditure differences can be statistically distinguished from zero. There were no discernible differences between homeless and housed people's food consumption factor score measures.

Comparisons of the means of the background variables indicate that homeless people in the JH survey were older than housed people and more likely to have reported going without food in a previous wave because of a lack of money. Homeless women were more likely to identify as Aboriginal or Torres Strait Islanders, were less likely to have migrated to Australia from a non-English-speaking country or to have divorced parents, and had fewer children than housed women. Homeless men were half as likely to be married as housed men.

Among the potential mediating variables, homeless people reported substantially lower equivalised earnings than housed people but somewhat higher equivalised non-labour incomes (mostly from public assistance). On balance, the homeless people in the JH reported having lower total equivalised incomes (the sum of their earned and unearned incomes) than their housed counterparts. Also, reflecting the general disadvantage in the JH sample, both the homeless and housed respondents reported deriving less of their income from earnings than from unearned sources. When we consider other resources, homeless people were less likely to have kitchen facilities, hold credit cards, or enjoy social supports than housed people. However, homeless people were more likely to use emergency food services and other social services, reported more non-food financial hardships, had more homeless and unemployed friends, and

suffered from more violence than housed people. Thus, although homeless people reported worse food security outcomes than their housed counterparts, they also differed in many other observed characteristics, which motivates us to conduct multivariate analyses.

Multivariate empirical analyses

Food insecurity. The main outcome measure for our multivariate empirical analyses is an ordered, categorical (0-8) variable of food insecurity. Let f_i^* be a continuous, latent index of person i 's food insecurity, and let f_i be the actual categorical report of food insecurity. In addition, let h_i be a binary indicator of whether the person was homeless, X_i be a vector of the person's other observed characteristics, and ε_i be a normally distributed random variable with mean zero and variance one that represents the person's unobserved characteristics. We estimate ordered probit models of the form

$$f_i^* = \alpha h_i + \beta X_i + \varepsilon_i$$

$$f_i = \begin{cases} 0 & \text{if } f_i^* < 0 \\ 1 & \text{if } 0 \leq f_i^* < \delta_1 \\ \vdots & \vdots \\ 8 & \text{if } \delta_7 \leq f_i^* \end{cases}$$

where α is a scalar coefficient, β is a vector of coefficients, and $\delta_1 - \delta_7$ are threshold parameters to be estimated. The ordered probit specification accounts for f_i being an ordered but non-cardinal measure of food insecurity.⁵ The model is also more efficient than an ordinary least squares (OLS) model.

Table 2 lists estimated coefficients and standard errors from ordered probit models that were run separately for men and women in the JH sample. The first columns for each gender group lists estimates from specifications that include homelessness as the only explanatory

⁵ We also estimated OLS models that treat f_i as a cardinal measure; these did not substantively change our findings.

variable. The next columns add controls for the background variables, and the final columns add controls for the potential mediating variables. For all of the specifications, we report robust standard errors that were calculated using the Huber-White method.

[Table 2 about here]

As with the simple differences in the means from Table 1, the unconditional associations between homelessness and the latent food insecurity indices in the ordered probit models are significantly positive for men and women in the first columns of Table 2. Thus, the use of non-linear ordered probit specifications does not fundamentally alter the patterns of association in the data.

When we add controls for background variables, the estimated associations between homelessness and food insecurity remain positive but diminish in magnitude with the association for men remaining significantly positive and the association for women falling just short of statistical significance (p -value 0.125). Among the background variables, the binary control for previous food hardships and the quadratic controls for age are statistically significant for both genders; the controls for health problems and the death of a parent are significant for men; and the control for living in a rural area is significant for women. The results indicate that a portion of the empirical association between homelessness and food insecurity comes from background characteristics—especially previous food problems—that are mutually related to these two outcomes. However, the specifications also tell us that a substantial association remains for men and that a possible association remains for women.

In the third set of specifications that add potential mediators, several of the included variables appear to be important. Having better social supports is estimated to reduce food insecurity while living farther from public transportation and experiencing more non-food

financial hardships are estimated to increase food insecurity for men and women. For men, reporting worse self-assessed health and greater alcohol consumption are associated with more food hardships. For women, those with physical health conditions have more food hardships, and those with access to kitchen facilities and a network of employed friends fewer hardships. Each of the statistically significant associations is consistent with predictions from Barrett's (2002) model.

Nevertheless, estimates from these specifications provide mixed initial evidence regarding mediation. For men, the residual association between homelessness and food insecurity is essentially unchanged after the candidate mediating variables are added. This occurs despite several of the variables being significant. For women, the evidence regarding mediation is stronger with the residual association for homelessness being reduced substantially.

Analysis of mediating relationships. To establish whether the associations between homelessness and food insecurity are mediated, we not only need to consider how the inclusion of the candidate mediating variables alters the empirical associations (direct relationships) between homelessness and food insecurity but also need to consider how homelessness might be associated with the variables themselves (components of the indirect relationships). Table 3 reports coefficient estimates and standard errors from gender-specific OLS regressions of each of the potential mediating variables on our homelessness measure and on the other background characteristics. For brevity, the table only lists the coefficients and standard errors for the homelessness measure (complete results are available upon request).

[Table 3 about here]

The estimates from Table 3 indicate that for men, homelessness is significantly associated with lower earnings, lacking a credit card, greater use of social services and meal

services, fewer friends who are employed and more friends who are unemployed or homeless, and higher rates of violence. All of these associations are consistent with expectations; however they do not contribute to mediating relationships because none of the characteristics was directly associated to food insecurity in Table 2. One further result—a significant positive association between non-food financial hardships, which were themselves significantly positively associated with food insecurity—is consistent with mediation in the anticipated direction and acts to reduce the residual relationship between homelessness and food insecurity. However, another two results—significant negative associations with reporting poor self-assessed health and living far from public transportation, which were also positively related to food insecurity—lead to stronger rather than weaker residual relationships between homelessness and food problems. Men’s homelessness is not estimated to be strongly associated with the other measures that have significant relationships in Table 2—namely, social supports and alcohol consumption. Thus, although homeless men have weak social supports and high levels of alcohol consumption, the disadvantaged at-risk population of housed men has similar characteristics.

Estimates from Table 3 indicate that women’s homelessness is associated with lower earnings, less debt, increased use of social and meal services, more friends who are homeless or unemployed, and increased violence. However, from Table 2, none of these characteristics is strongly associated with food insecurity. Women’s homelessness is also negatively related to access to kitchen facilities and positively related to non-food financial hardships (this latter result is imprecisely estimated but the same magnitude as the relationship for men). These results are consistent with mediating relationships for these characteristics. Women’s homelessness is not strongly associated with access to public transportation, social supports, the onset of physical health conditions, or the number of employed friends. On balance, the estimated relationships

from Tables 2 and 3 are consistent with some mediation for women.

Other food outcomes. The JH survey also asked about food consumption, meal consumption, and food expenditures. Tables 4a and 4b report results from OLS models that regress these outcomes on homelessness, the respondents' background characteristics, and the candidate mediating variables. The models for Tables 4a (men) and 4b (women) are specified to include exactly the same explanatory variables as the food insecurity models from Table 2.

[Tables 4a and 4b about here]

The estimates from Table 4a indicate that men's homelessness is significantly negatively associated with equivalised food expenditures. The inclusion of background and mediating controls reduces the association from the bivariate comparisons in Table 1; however, statistically significant associations remain. Men's homelessness is also negatively associated with the number of weekly meals; however, the estimates are not statistically significant. Men's homelessness is estimated to have a weak positive association with the factor score for food consumption. In general, the multivariate estimates for men suggest that homelessness is negatively associated with a number of food outcomes.

For women, none of the estimated associations between homelessness and food outcomes is statistically significant. As with men, homelessness for women is negatively associated with meal consumption and food expenditures and positively associated with food consumption; however, most of these estimated relationships are weaker than the corresponding relationships for men, and all of them are insignificant. These results are consistent with the weak association that we found for women's homelessness and food insecurity.

Sensitivity tests. We subjected the multivariate results to a number of sensitivity tests and

robustness checks.⁶ First, we re-estimated the ordered probit models using an alternate scale of food insecurity that incorporated all six of the available hardship items (i.e., included the two items that our other analyses had found to be redundant) and that used all four of the response categories. The use of those outcome variables led to substantively similar findings. Second, we re-estimated all of our models using the sample weights for non-response and attrition that are provided with the JH survey. Our multivariate models distinguish between men and women and include controls for many elements that were associated with differential response. Because of this, estimates from the models are very similar regardless of whether sample weights are used.

Third, we re-estimated our models using alternative time periods for the exposure to homelessness, including homelessness over the six months prior to the survey, homelessness at any point during the JH survey period (i.e., during the preceding 30 months), and the proportion of time over the JH survey period that the person was homeless. The estimated associations between these alternative measures of homelessness and the different food outcomes were all similar but weaker than the associations that we found for homelessness in the previous month. We also estimated several models that included our preferred previous-month measure and these longer-period measures in the same specifications. In most models, the estimated associations for the previous-month measure were similar to the associations that we have reported.

Conclusions

In this study, we use the rich data available in the Journeys Home survey to conduct descriptive and multivariate analyses of how homelessness is associated with disadvantaged Australians' food insecurity and other food outcomes. The JH data cover a more heterogeneous

⁶ For brevity, we discuss the general findings without reporting detailed results; those results are available upon request.

at-risk population than the data used in most previous multivariate studies and include many more covariates. There are also sufficient observations to let us investigate relationships separately for men and women.

Our descriptive analyses confirm previous findings that homelessness is associated with worse food security, with the relationships being stronger for men than women. When we extend the analysis to consider other food outcomes, we find supporting evidence that homeless people spend less on food than their housed counterparts, some more tentative evidence that they eat fewer meals, but no evidence that they have lower overall food intakes. We also find that homeless and housed Australians differ in many other dimensions, including in their economic resources, access to kitchen facilities, access to public transportation, social networks, financial stresses, victimization, and history of food hardships. These differences motivate us to undertake multivariate analyses that can account for confounding influences from observed characteristics.

Estimates from the multivariate models yield similar though slightly weaker patterns of association for men—that is, worse food security, lower food expenditures, and possibly fewer meals for homeless men than for housed men. In contrast, the associations between homelessness and food outcomes largely disappear in the multivariate models for women. In this regard, our findings are similar to those of Gundersen et al. (2003) who also generally failed to detect significant associations between single mothers' homelessness and their reported food hardships. The results suggest that women may be more able than men to accommodate the deprivations of homelessness in terms of accessing food and generating food outcomes.

One way that homelessness does appear to impact women's food insecurity is by interfering with access to kitchen facilities. Our multivariate analyses indicate that homelessness reduces both men's and women's access to kitchen facilities. However, this diminished access

only appears to be consequential for women's food insecurity. This result could reflect women being more likely than men to prepare food to produce meals. Along the same lines, the result could be related to homeless women's reluctance to take advantage of emergency meal services.

We also find evidence that broader sets of financial stresses may contribute to men's and women's food insecurity and that homelessness may exacerbate these stresses. The estimated associations between homelessness and financial stresses are similar for men and women but only statistically significant for men. As with the study by Joyce et al. (2012), these results remind us that hardships of various forms are often clustered, with each hardship possibly compounding the others.

A caveat to our findings is that our evidence is mostly associational. Although the JH data allow us to account for an extensive set of observed characteristics, many of those characteristics are likely to be endogenous. The possibly endogenous variables not only include homelessness status but also include the mediating measures. The potential endogeneity of so many measures limits our ability to draw causal inferences. Our multivariate models do benefit from the inclusion of a measure of lagged food problems, which might perform like a lagged dependent variable and control for some biasing unobserved background and time-invariant characteristics. However, this estimation approach does not account for contemporaneous, time-varying characteristics.

Our estimates nevertheless help to fill in the incomplete picture left by previous studies. For example, several descriptive studies have implicated alcohol consumption as a coping mechanism that impinges upon food security. Our results confirm that higher levels of drinking are associated with worse food security for disadvantaged men, but we also find similar levels of drinking among homeless and at-risk men. Similarly, research has pointed to the availability of

social supports as a critical protector against food hardships. We uncover the same evidence in our analyses of food insecurity but find little difference in our multivariate models between homeless and housed people's social supports.

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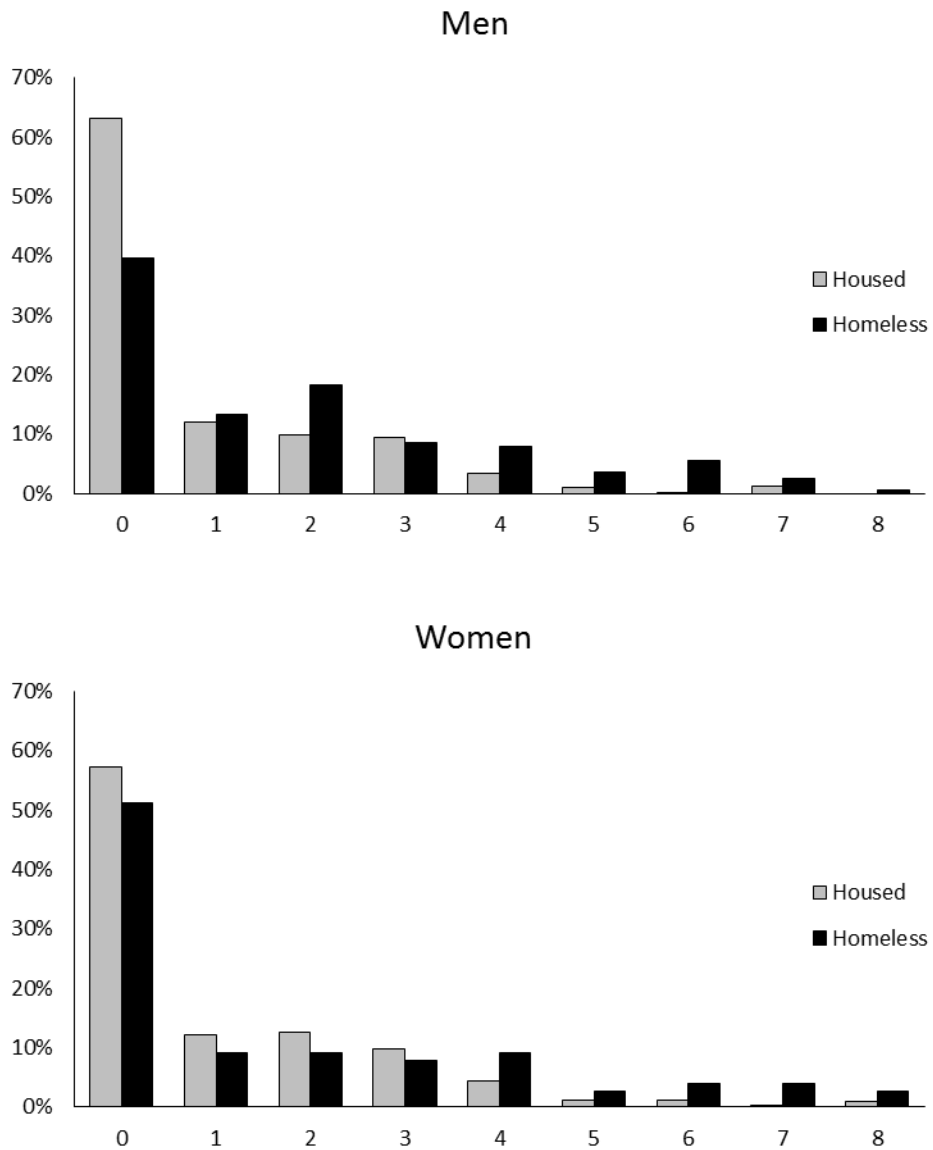
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Figure 1. Distribution of Food Insecurity Responses by Gender and Homelessness



Note: Authors' calculations of percentages of respondents with each food insecurity score value from Journeys Home analysis sample.

Table 1. Means of Analysis Measures Estimated Separately by Gender and Homelessness

	Men		Women		
	<i>Housed</i>	<i>Homeless</i>	<i>Housed</i>	<i>Homeless</i>	
<i>No. of obs.</i>	517	164	516	76	
<i>Outcome variables</i>					
Food security index	0.87	1.80 ***	1.08	1.74 ***	***
Consumption factor score	0.00	0.06	-0.03	-0.04	
Meals consumed during the week	15.43	14.65 *	15.62	14.73	
Weekly food expenditure pp	104.89	87.57 ***	105.46	90.75 **	**
<i>Background controls</i>					
Age	34.14	39.39 ***	31.15	36.21 ***	***
Indigenous	0.16	0.15	0.16	0.29 ***	***
Born in a non-English speaking country	0.06	0.07	0.08	0.03	*
Married or de facto	0.25	0.12 ***	0.30	0.25	
No. of children	0.26	0.14 *	0.79	0.47 **	**
Tertiary education	0.36	0.30	0.38	0.26 **	**
Completed high-school	0.12	0.11	0.11	0.07	
Ever placed in State care	0.24	0.27	0.27	0.24	
Abused as a child	0.71	0.69	0.70	0.63	
Missing abuse variable	0.05	0.04	0.07	0.09	
Not with both parents at 14 because div/sep	0.33	0.29	0.39	0.25 **	**
Not with both parents at 14 because dead	0.05	0.09 *	0.07	0.05	
Not with both parents at 14 because conflict	0.07	0.04	0.10	0.07	
Chronic health condition	0.69	0.74	0.66	0.70	
Proportion of time in paid work since finishing education	0.45	0.42	0.31	0.29	
Missing proportion of time in employment	0.03	0.02	0.03	0.05	
Major urban area	0.76	0.77	0.78	0.72	
Other urban area	0.18	0.17	0.17	0.17	
Non-urban area	0.06	0.06	0.04	0.11 **	**
Missing distance to public transport	0.00	0.07 ***	0.02	0.13 ***	***
Ever financial stress meal skipping	0.61	0.76 ***	0.57	0.75 ***	***
Missing financial stress variable	0.05	0.02 *	0.05	0.07	
<i>Mediators</i>					
Household earnings per adult equi.	0.18	0.08 ***	0.18	0.05 ***	***
Missing earnings	0.03	0.02	0.02	0.01	

	Men			Women		
	<i>Housed</i>	<i>Homeless</i>		<i>Housed</i>	<i>Homeless</i>	
Household non-labour income per adult equi.	0.26	0.30	***	0.27	0.31	**
Missing non-labour income	0.07	0.06		0.05	0.07	
Mental health	0.16	0.17		0.21	0.30	*
Any long term health/disability condition causing restrictions	0.46	0.51		0.41	0.51	*
Physical health condition	0.39	0.45		0.46	0.50	
Self-assessed general health status	3.04	3.02		3.06	3.29	*
Access to cooking facilities	0.98	0.81	***	0.99	0.84	***
Less than 500m from public transport	0.77	0.83		0.77	0.82	
More than 500m from public transport	0.23	0.17		0.23	0.18	
Total outstanding debt	3.85	3.45		3.52	1.67	**
Missing debt variable	0.05	0.06		0.07	0.05	
Holding a credit card	0.11	0.04	***	0.12	0.04	**
Social support	0.27	0.18	**	0.33	0.24	
Receipt of services	0.38	0.55	***	0.40	0.54	**
Sum of other financial stress questions	1.37	1.79	***	1.54	2.00	**
Any financial stress variable missing	0.06	0.18	***	0.07	0.14	**
Use of emergency meal services	0.09	0.29	***	0.04	0.13	***
No. of alcoholic drinks per day on average	2.04	2.22		0.86	1.45	**
Resourceful social network	0.34	0.22	***	0.31	0.22	
Resourceless social network	0.35	0.58	***	0.39	0.58	***
Exposed to violence in the last 6 months	0.14	0.21	*	0.14	0.29	***
Missing violence variable	0.04	0.02		0.04	0.03	

Note: Authors' calculations using data from the Journeys Home analysis sample. Asterisks indicate statistically significant differences in means between homeless and housed people.

* Significant at 0.1 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.

Table 2. Results from Ordered Probit Models of Food Insecurity

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Homeless	0.607 *** (0.100)	0.509 *** (0.106)	0.517 *** (0.130)	0.324 ** (0.151)	0.250 (0.163)	0.098 (0.170)
Age		0.044 ** (0.022)	-0.018 (0.026)		0.097 *** (0.026)	0.080 *** (0.027)
Age squared		-0.049 * (0.028)	0.033 (0.032)		-0.112 *** (0.036)	-0.094 *** (0.034)
Indigenous		0.040 (0.128)	-0.072 (0.142)		-0.078 (0.140)	-0.137 (0.148)
Born in a non-English speaking country		0.163 (0.174)	0.410 ** (0.203)		-0.130 (0.202)	-0.127 (0.218)
Married or de facto		-0.051 (0.125)	-0.048 (0.146)		-0.058 (0.111)	0.068 (0.127)
No. of children		0.013 (0.087)	0.032 (0.081)		-0.069 (0.046)	-0.093 (0.057)
Tertiary education		0.127 (0.104)	0.186 (0.117)		-0.191 (0.119)	-0.118 (0.127)
Completed high-school		-0.144 (0.155)	-0.187 (0.162)		0.065 (0.173)	-0.059 (0.195)
Ever placed in State care		-0.008 (0.114)	0.008 (0.125)		0.095 (0.116)	0.052 (0.124)
Abused as a child		0.034 (0.113)	0.012 (0.124)		0.206 (0.128)	0.078 (0.145)
Not with both parents at 14 because div/sep		-0.059 (0.103)	-0.052 (0.118)		0.056 (0.110)	-0.183 (0.122)
Not with both parents at 14 because dead		-0.465 ** (0.231)	-0.612 ** (0.246)		0.271 (0.194)	0.141 (0.208)
Not with both parents at 14 because conflict		0.045 (0.160)	0.213 (0.207)		0.065 (0.163)	0.027 (0.189)
Chronic health condition		0.218 * (0.113)	0.027 (0.125)		-0.051 (0.115)	-0.188 (0.133)
Proportion of time in paid work since finishing education		-0.256 (0.189)	-0.252 (0.241)		-0.197 (0.206)	0.033 (0.226)
Geographical area (ref. is Major urban)						
Other urban area		-0.055 (0.126)	0.130 (0.141)		-0.137 (0.129)	-0.214 (0.140)
Non-urban area		0.195 (0.211)	0.477 ** (0.227)		-0.802 *** (0.278)	-1.183 *** (0.300)
Ever financial stress meal skipping		1.057 *** (0.117)	0.717 *** (0.126)		0.922 *** (0.109)	0.527 *** (0.126)
Household earnings per adult equi.			0.204 (0.186)			-0.071 (0.185)
Household non-labour income per adult equi.			0.051 (0.421)			0.557 (0.540)

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Mental health			0.007 (0.130)			0.206 (0.127)
Any long term health/disability condition causing restrictions			0.055 (0.120)			-0.159 (0.130)
Physical health condition			-0.020 (0.107)			0.310 ** (0.120)
Self-assessed general health status			0.148 *** (0.053)			0.006 (0.057)
Access to cooking facilities			-0.090 (0.226)			-0.556 * (0.314)
More than 500m from public transport			0.247 * (0.126)			0.312 ** (0.138)
Total outstanding debt			-0.001 (0.008)			-0.003 (0.007)
Holding a credit card			0.168 (0.167)			0.037 (0.171)
Social support			-0.237 * (0.133)			-0.365 *** (0.135)
Receipt of services			-0.170 (0.123)			0.188 (0.124)
Sum of other financial stress questions			0.559 *** (0.044)			0.443 *** (0.041)
Use of emergency meal services			0.133 (0.147)			-0.224 (0.216)
No. of alcoholic drinks per day on average			0.031 ** (0.015)			0.006 (0.023)
Resourceful social network			-0.172 (0.134)			-0.262 * (0.149)
Resourceless social network			-0.00002 (0.128)			0.084 (0.129)
Exposed to violence in the last 6 months			0.117 (0.130)			-0.064 (0.141)
Sample size	681	681	681	592	592	592
Log-likelihood	-926.69	-859.95	-707.46	-839.47	-775.43	-650.96

Note: Authors' calculations of ordered probit model coefficients (and robust standard errors in parentheses) using data from the Journeys Home analysis sample. In addition to the listed coefficients, the models with background measures include controls for missing responses for the measures of being abused as a child, work experience, distance to public transportation, and the history of food hardships; and the models with mediating measures also include controls for missing responses to the measures for earnings, unearned income, outstanding debt, financial stress, and recent exposure to violence.

* Significant at 0.1 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.

Table 3. Results from OLS Models of Mediating Variables

	Men	Women
Household earnings per adult equi.	-0.050* (0.029)	-0.085* (0.043)
Household non-labour income per adult equi.	0.006 (0.014)	0.023 (0.019)
Mental health	-0.023 (0.034)	0.075 (0.052)
Any long term health/disability condition causing restrictions	-0.034 (0.041)	-0.017 (0.055)
Physical health condition	0.020 (0.045)	-0.028 (0.060)
Self-assessed general health status	-0.167* (0.100)	-0.033 (0.127)
Access to cooking facilities	-0.172*** (0.021)	-0.138*** (0.022)
More than 500m from public transport	-0.064* (0.036)	-0.067 (0.051)
Total outstanding debt	0.036 (0.693)	-1.792** (0.887)
Holding a credit card	-0.051* (0.027)	-0.052 (0.039)
Social support	-0.040 (0.040)	-0.024 (0.057)
Receipt of services	0.112*** (0.043)	0.143** (0.061)
Sum of other financial stress questions	0.250* (0.130)	0.293 (0.186)
Use of emergency meal services	0.159*** (0.030)	0.060** (0.029)
No. of alcoholic drinks per day on average	-0.018 (0.357)	0.229 (0.305)
Resourceful social network	-0.071* (0.042)	-0.042 (0.057)
Resourceless social network	0.147*** (0.043)	0.140** (0.062)
Exposed to violence in the last 6 months	0.069** (0.034)	0.140** (0.046)

Note: Authors' calculations of OLS coefficients (and robust standard errors in parentheses) of the variables listed in the rows on homelessness using data from the Journeys Home analysis sample. In addition to the listed coefficients, the models include controls for all of the background measures (including controls for missing responses) from the 2nd and 5th specifications of Table 2.

* Significant at 0.1 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.

Table 4a. Results from OLS Models of Food Consumption, Meal Consumption, and Food Expenditures—Men

	Food Consumption		Meal Consumption		Food Expenditures	
	(1)	(2)	(1)	(2)	(1)	(2)
Homeless	0.074 (0.058)	0.045 (0.063)	-0.426 (0.424)	-0.682 (0.446)	-15.303 ** (6.691)	-12.465 * (7.069)
Age	-0.014 (0.012)	-0.020 (0.012)	-0.188 ** (0.086)	-0.203 ** (0.089)	-0.624 (1.339)	0.222 (1.393)
Age squared	0.022 (0.015)	0.028 * (0.016)	0.226 ** (0.109)	0.256 ** (0.111)	0.178 (1.704)	-0.255 (1.744)
Indigenous	0.318 *** (0.068)	0.344 *** (0.070)	0.954 * (0.500)	0.774 (0.498)	14.146 * (7.763)	10.366 (7.834)
Born in a non-English speaking country	0.173 * (0.100)	0.239 ** (0.101)	0.265 (0.736)	0.289 (0.720)	1.882 (11.589)	-0.211 (11.447)
Married or de facto	0.030 (0.065)	-0.017 (0.074)	0.422 (0.480)	0.071 (0.523)	-1.599 (7.655)	-9.725 (8.253)
No. of children	0.026 (0.037)	0.042 (0.038)	-0.022 (0.273)	0.046 (0.267)	2.565 (4.406)	2.061 (4.364)
Tertiary education	0.166 *** (0.055)	0.161 *** (0.055)	0.510 (0.398)	0.547 (0.393)	-2.213 (6.254)	-3.828 (6.209)
Completed high-school	0.043 (0.080)	0.068 (0.080)	-0.046 (0.581)	0.202 (0.567)	-0.215 (9.030)	-0.912 (8.880)
Ever placed in State care	-0.016 (0.059)	0.000 (0.060)	-0.228 (0.430)	-0.102 (0.423)	0.635 (6.685)	1.831 (6.660)
Abused as a child	-0.078 (0.059)	-0.071 (0.060)	-0.527 (0.428)	-0.387 (0.422)	5.806 (6.705)	6.457 (6.674)
Not with both parents at 14 because div/sep	-0.043 (0.054)	-0.022 (0.055)	-0.271 (0.397)	-0.294 (0.389)	-6.011 (6.181)	-6.631 (6.105)
Not with both parents at 14 because dead	-0.044 (0.104)	-0.014 (0.106)	-0.120 (0.759)	0.223 (0.744)	-2.918 (11.978)	-3.765 (11.897)
Not with both parents at 14 because conflict	-0.229 ** (0.105)	-0.195 * (0.105)	-0.419 (0.767)	-0.062 (0.747)	-11.004 (11.964)	-7.702 (11.744)
Chronic health condition	0.066 (0.056)	0.041 (0.058)	-0.591 (0.408)	-0.421 (0.413)	-4.365 (6.384)	1.082 (6.509)
Proportion of time in paid work since finishing education	0.148 (0.098)	0.136 (0.109)	0.128 (0.719)	-0.594 (0.774)	28.699 ** (11.251)	5.873 (12.245)
Geographical area (ref. is Major urban)						
Other urban area	0.048 (0.064)	0.058 (0.067)	-0.252 (0.465)	-0.057 (0.471)	6.906 (7.279)	0.813 (7.442)
Non-urban area	0.200 ** (0.102)	0.250 ** (0.108)	0.378 (0.739)	1.099 (0.760)	3.503 (11.546)	-2.322 (11.949)
Ever financial stress meal skipping	-0.071 (0.054)	-0.036 (0.058)	-1.340 *** (0.394)	-0.658 (0.412)	5.988 (6.221)	12.387 * (6.558)
Household earnings per adult equi.		0.097 (0.096)		1.373 ** (0.681)		42.162 *** (10.655)
Household non-labour income per adult equi.		0.573 ** (0.231)		1.472 (1.647)		29.181 (25.712)
Mental health		-0.008		-0.085		-6.790

	Food Consumption		Meal Consumption		Food Expenditures	
	(1)	(2)	(1)	(2)	(1)	(2)
Any long term health/disability condition causing restrictions		0.112 *		0.070		-13.330 **
Physical health condition		(0.069)		(0.486)		(7.582)
Self-assessed general health status		(0.059)		(0.418)		(6.606)
Access to cooking facilities		-0.083		-0.692 *		12.292 **
More than 500m from public transport		(0.054)		(0.383)		(6.084)
Total outstanding debt		-0.029		-0.551 ***		-3.945
Holding a credit card		(0.025)		(0.175)		(2.756)
Social support		-0.025		-1.211		10.851
Receipt of services		(0.127)		(0.879)		(14.137)
Sum of other financial stress questions		-0.070		-1.227 ***		3.093
Use of emergency meal services		(0.063)		(0.449)		(7.045)
No. of alcoholic drinks per day on average		-0.003		-0.039		0.374
Resourceful social network		(0.003)		(0.024)		(0.379)
Resourceless social network		0.059		-0.687		-3.279
Exposed to violence in the last 6 months		(0.085)		(0.606)		(9.603)
Sample size		0.132 **		0.451		11.420 *
Log-likelihood		(0.060)		(0.425)		(6.709)
		0.011		1.048 **		1.001
		(0.057)		(0.407)		(6.472)
		-0.007		-0.176		-4.231 *
		(0.020)		(0.145)		(2.276)
		0.083		0.559		-9.738
		(0.079)		(0.555)		(8.695)
		0.004		-0.036		-0.371
		(0.006)		(0.045)		(0.711)
		0.029		0.823 *		2.532
		(0.065)		(0.458)		(7.224)
		-0.085		-0.661		-1.214
		(0.063)		(0.448)		(7.061)
		0.103		-0.784		2.896
		(0.068)		(0.486)		(7.638)
Sample size	673	673	680	680	661	661
Log-likelihood	-615.68	-595.78	-1978.01	-1936.97	-3730.69	-3695.76

Note: Authors' calculations of OLS coefficients (and robust standard errors in parentheses) using data from the Journeys Home analysis sample. In addition to the listed coefficients, the models with background measures include controls for missing responses for the measures of being abused as a child, work experience, distance to public transportation, and the history of food hardships; and the models with mediating measures also include controls for missing responses to the measures for earnings, unearned income, outstanding debt, financial stress, and recent exposure to violence.

* Significant at 0.1 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.

Table 4b. Results from OLS Models of Food Consumption, Meal Consumption, and Food Expenditures—Women

	Food Consumption		Meal Consumption		Food Expenditures	
	(1)	(2)	(1)	(2)	(1)	(2)
Homeless	0.008 (0.081)	0.009 (0.085)	-0.553 (0.613)	-0.329 (0.626)	-12.152 (7.757)	-7.632 (7.929)
Age	-0.008 (0.013)	0.002 (0.013)	-0.452 *** (0.095)	-0.303 *** (0.096)	-0.661 (1.208)	0.166 (1.220)
Age squared	0.011 (0.017)	0.002 (0.017)	0.563 *** (0.126)	0.426 *** (0.124)	0.244 (1.587)	-0.825 (1.570)
Indigenous	0.147 ** (0.073)	0.157 ** (0.073)	1.313 ** (0.546)	1.299 ** (0.534)	11.517 * (6.982)	9.751 (6.838)
Born in a non-English speaking country	0.210 * (0.107)	0.169 (0.109)	1.245 (0.809)	0.700 (0.803)	10.986 (10.384)	10.242 (10.327)
Married or de facto	-0.003 (0.059)	-0.056 (0.065)	0.226 (0.444)	-0.136 (0.477)	-2.656 (5.682)	-13.025 ** (6.025)
No. of children	0.079 *** (0.027)	0.069 ** (0.029)	0.486 ** (0.204)	0.349 * (0.209)	4.571 * (2.595)	2.610 (2.642)
Tertiary education	0.106 * (0.061)	0.041 (0.062)	0.393 (0.460)	0.009 (0.455)	-0.065 (5.861)	-4.705 (5.786)
Completed high-school	-0.057 (0.090)	-0.074 (0.089)	0.732 (0.679)	0.684 (0.656)	-5.767 (8.585)	-9.001 (8.298)
Ever placed in State care	-0.057 (0.064)	-0.075 (0.064)	-0.576 (0.478)	-0.786 * (0.472)	-8.596 (6.075)	-10.953 * (5.997)
Abused as a child	-0.005 (0.066)	0.059 (0.066)	-0.709 (0.496)	-0.177 (0.486)	-1.231 (6.323)	2.844 (6.192)
Not with both parents at 14 because div/sep	-0.024 (0.059)	0.010 (0.060)	0.009 (0.442)	0.203 (0.437)	3.113 (5.639)	2.120 (5.581)
Not with both parents at 14 because dead	-0.064 (0.110)	-0.010 (0.112)	-1.938 ** (0.833)	-1.678 ** (0.822)	-1.869 (10.461)	-6.362 (10.342)
Not with both parents at 14 because conflict	-0.040 (0.093)	-0.065 (0.094)	-0.265 (0.705)	-0.023 (0.693)	7.770 (9.057)	4.072 (8.899)
Chronic health condition	-0.042 (0.058)	-0.003 (0.061)	-0.225 (0.440)	0.298 (0.450)	-0.361 (5.611)	0.511 (5.721)
Proportion of time in paid work since finishing education	0.157 (0.103)	0.074 (0.109)	1.051 (0.777)	-0.112 (0.802)	13.439 (9.883)	0.980 (10.221)
Geographical area (ref. is Major urban)						
Other urban area	0.064 (0.071)	0.036 (0.071)	0.005 (0.533)	0.069 (0.521)	-0.177 (6.783)	1.812 (6.639)
Non-urban area	0.000 (0.118)	-0.099 (0.123)	0.516 (0.888)	0.704 (0.902)	30.994 *** (11.486)	24.863 ** (11.685)
Ever financial stress meal skipping	-0.053 (0.058)	0.058 (0.061)	-1.612 *** (0.439)	-0.612 (0.448)	-1.320 (5.610)	2.684 (5.730)

	Food Consumption		Meal Consumption		Food Expenditures	
	(1)	(2)	(1)	(2)	(1)	(2)
Household earnings per adult equi.		0.145 (0.092)		0.6379 (0.675)		52.843 *** (8.522)
Household non-labour income per adult equi.		0.215 (0.232)		-1.566 (1.688)		67.423 *** (21.571)
Mental health		0.051 (0.068)		-0.134 (0.495)		3.381 (6.286)
Any long term health/disability condition causing restrictions		0.057 (0.064)		-0.154 (0.473)		-3.540 (6.103)
Physical health condition		-0.047 (0.059)		-0.203 (0.431)		6.269 (5.501)
Self-assessed general health status		-0.093 *** (0.028)		-0.722 *** (0.208)		-1.687 (2.635)
Access to cooking facilities		-0.230 (0.168)		-0.108 (1.225)		-4.886 (15.456)
More than 500m from public transport		0.067 (0.067)		-0.707 (0.490)		-3.952 (6.212)
Total outstanding debt		0.006 (0.004)		-0.005 (0.030)		-0.379 (0.375)
Holding a credit card		0.009 (0.092)		-0.306 (0.674)		0.858 (8.773)
Social support		-0.024 (0.064)		0.399 (0.466)		-4.342 (5.922)
Receipt of services		0.035 (0.060)		0.389 (0.440)		4.085 (5.615)
Sum of other financial stress questions		-0.073 *** (0.021)		-0.525 *** (0.153)		-3.705 * (1.943)
Use of emergency meal services		-0.059 (0.118)		0.996 (0.870)		-9.014 (10.899)
No. of alcoholic drinks per day on average		-0.017 (0.011)		-0.236 *** (0.082)		-2.370 ** (1.031)
Resourceful social network		0.011 (0.072)		0.054 (0.524)		5.501 (6.687)
Resourceless social network		-0.021 (0.065)		-0.623 (0.473)		13.736 ** (6.019)
Exposed to violence in the last 6 months		-0.028 (0.077)		-0.602 (0.562)		2.191 (7.268)
Sample size	585	585	591	591	570	570
Log-likelihood	-544.60	-519.40	-1745.04	-1704.29	-3123.22	-3082.67

Note: Authors' calculations of OLS coefficients (and robust standard errors in parentheses) using data from the Journeys Home analysis sample. In addition to the listed coefficients, the models with background measures include controls for missing responses for the measures of being

abused as a child, work experience, distance to public transportation, and the history of food hardships; and the models with mediating measures also include controls for missing responses to the measures for earnings, unearned income, outstanding debt, financial stress, and recent exposure to violence.

* Significant at 0.1 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.

Appendix A. Developing and Validating a Food Insecurity Scale for Journeys Home

Wave five of the Journeys Home survey asked six questions that were adapted from the nine-item Household Food Insecurity Access Scale (Coates et al. 2007). These questions asked whether and how often during the “past four weeks” the person had to:

1. “worry that you would not have enough food,”
2. “eat a limited variety of foods because of a lack of money,”
3. “eat some foods that you really did not want to eat because of a lack of money,”
4. “eat a smaller meal than you felt you needed because there was not enough food,”
5. “skip a meal because of a lack of money,” and
6. “go a whole day and night without eating anything because there was not enough food.”

The possible responses to each item were “never,” “rarely (once or twice in the past four weeks),” “sometimes (three to ten times in the past four weeks),” and “often (more than ten times in the past four weeks).”⁷ Following Deitchler et al. (2010), we constructed and validated a summary scale based on the responses to these measures.

We began by fitting the ordered responses to the six JH items to a polytomous Rasch item-response-theory model (Rasch 1960; Andersen 1977), using Christensen’s (2013) conditional maximum likelihood routine and an unweighted sample of 1,406 wave five JH respondents who answered all the food hardship questions. Rasch models are used to relate responses to multiple items to a single, underlying, latent scale—in this case, the respondent’s level of food insecurity. In the ordered-response case, the model assumes that the latent scale is increasing in the frequency of affirmed conditions (in the ordinal responses). It also assumes that the responses to the items are independent of each other, conditional on the value of the latent scale. Finally, it assumes that response behavior is the same across different subpopulations. If these conditions are met, the sum of the ordinal responses is a sufficient statistic for the underlying latent scale.

Estimated parameters from the polytomous Rasch model can be used to estimate $k-1$ “item step” values for each of the k possible responses to a given item; higher estimated item step values can be interpreted as indicating that reported condition is more severe. For the responses to be meaningful, we would like the estimated item steps to increase with the ordinal response values. When we fit the six JH items with all four possible response values, monotonically increasing item steps were found for items 1, 2, and 3 but not for items 4, 5, and 6. For the items with non-monotonic steps, the item step values for “rarely” and “sometimes” were reversed. As with Deitchler et al. (2010), we collapsed the “rarely” and “sometimes” responses into a single category and re-estimated the Rasch model as a six-item, three-response specification. For this specification, monotonically increasing step values were estimated for all of the items.⁸

A related testable property of a Rasch scale is that the expected ordinal responses of each item should increase as the latent index increases. To test this property, we examined average ordinal

⁷ The JH items differ from the HFIAS in asking about the respondent rather than the household. The fifth JH item differs from the corresponding HFIAS item in asking about the respondent “skip(ping) a meal” rather than “eat(ing) fewer meals in a day,” and the JH survey omits HFIAS items about “not (being) able to eat the kinds of foods you preferred,” “there ever (being) no food of any kind in your household,” and “go(ing) to sleep at night hungry.”

⁸ There are two other ways to collapse the responses for a three-response model. The approach that we adopted led to the greatest distance between the item step values.

responses for each item conditional on the total summary scale value. With the six-item, three-response (0-12) scale, the average values of the ordinal responses were monotonically non-decreasing for several but not all of the items. Items 4 (smaller meal) and 5 (skip meal) had average severities that were almost identical to item 3 (eat unwanted foods) but had smaller gaps between the item steps. Items 4 and 5 were removed, and a four-item, three-response (0-8) scale was re-estimated. Estimated standardized item-step values from the least to most severe items are shown in Table A.1. This revised scale had monotonically non-decreasing average ordinal responses for all of its items.

Table A.1. Estimated standardized item-step values for four-item, three-response (0-8) scale from conditional maximum likelihood polytomous Rasch model

Item	Step 1	Step 2
Eat a limited variety of foods	-2.66	0.67
Worry about not enough food	-1.62	1.18
Eat some foods did not want	-1.44	1.56
Go whole day and night without eating	-0.18	2.48

To test whether response behaviors were the same across different subgroups, we re-estimated Rasch models for the four-item, three-response scale separately for men and women, people who had experienced homelessness or been consistently housed, and people with below and above average weekly incomes. With one exception, the item-step parameter values were similar in value and followed the same ordering as Table A.1 for all subgroups (The ordering of the step-2 parameters for items 1 [worry] and 3 [eat unwanted foods] was reversed for women, but the values were very close to each other).

To examine the external validity of our scale, we estimated simple (Pearson) correlations between the four-item, three-response (0-8) scale and

- the sum of the person’s reported usual breakfasts, lunches, and dinners in a week (correlation -0.31),
- the person’s usual weekly food expenditures scaled by the square root of the number of people covered by that expenditure (correlation -0.09),
- a factor score of the usual weekly servings of fruits and vegetables and the usual days on which the person eats seafood, meat, and legumes (correlation -0.16), and
- an indicator from a separate financial stress scale of whether the person ever skipped meals (correlation $+ 0.66$), and
- the person’s weekly income (correlation -0.10).

The correlations were all statistically distinguishable from zero and in the anticipated directions.