

# The relationship between income and food insecurity among Oregon residents: does social support matter?

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## Abstract

**Objective:** Millions of US households experienced food insecurity in 2005. Research indicates that low wages and little social support contribute to food insecurity. The present study aimed to examine whether social support moderates the relationship between income and food insecurity.

**Design:** Using a mail survey, we collected data on social support sources (social network, intimate partner and community) and social support functions from a social network (instrumental, informational and emotional). We used hierarchical logistic regression to examine the potential moderation of various measures of social support on the relationship between income and food insecurity, adjusting for potential confounding variables.

**Setting:** Oregon, USA.

**Subjects:** A stratified random sample of Oregonians aged 18–64 years ( $n$  343).

**Results:** We found no evidence of an association between social support and food insecurity, nor any evidence that social support acts as a moderator between income and food insecurity, regardless of the measure of social support used.

**Conclusions:** Although previous research suggested that social support could offset the negative impact of low income on food security, our study did not find support for such an effect.

**Keywords**  
Food insecurity  
Social support  
Oregon  
Moderation analysis

The Universal Declaration of Human Rights declared the right to food one of the most basic human rights<sup>(1)</sup>. This statement is profound, yet many in the USA take this right for granted<sup>(2)</sup>. Many US residents are regularly unable to obtain an adequate diet. As of 2004, food insecurity had increased for five consecutive years to 13·5 million US households (11·9%), with 4·4 million US households (3·9%) experiencing food insecurity with hunger<sup>(3)</sup>.† In 2005, the rate of food insecurity decreased to 11·0%, although the hunger rate remained unchanged<sup>(7)</sup>, and rates for 2006 were essentially the same (10·9% food-insecure, 4·0% hunger)<sup>(8)</sup>.

Food insecurity can have harmful health consequences due to undernutrition or overnutrition with unhealthy foods, leading to overweight and obesity<sup>(9,10)</sup>. Overweight and obesity are linked to cancer, diabetes and CVD<sup>(11,12)</sup>. Further, children in food-insecure households

are often sent to school hungry, which is associated with poor concentration<sup>(13)</sup>. Poor concentration in school has been linked to cognitive, behavioural and physiological delays that, in already disadvantaged children, contribute to the cycle of poverty<sup>(13,14)</sup>.

US residents experience food insecurity for numerous reasons including economic conditions and low levels of food skills<sup>(15)</sup>. Evidence for an inverse relationship between income and food insecurity has been found<sup>(16)</sup>. One study compared the relationship between household poverty index ratio‡ and food insecurity, finding that food insecurity decreased as the ratio increased<sup>(17)</sup>. Other researchers assessed the income and food insecurity relationship using the income-to-poverty ratio,§ finding that food insecurity decreased as the income-to-poverty ratio increased<sup>(18)</sup>. Thus, in these studies, households with lower incomes were more likely to experience food insecurity.

† A household is defined as 'food-insecure' if it is uncertain of having the ability to acquire enough food to meet the needs of all members due to scarce resources. A household is defined as 'food-insecure with hunger' if it experiences food insecurity severe enough so that one or more members were hungry, at least some time during the year, because they could not afford enough food<sup>(4–6)</sup>. Hereafter, the term 'hunger' will be used instead of 'food insecurity with hunger' for ease of reading.

‡ The poverty index ratio is the ratio of household income to the federal poverty level multiplied by 100.

§ The income-to-poverty ratio is the ratio of household income to the federal poverty line for a given family size.

Low-income individuals employ many strategies to cope with food insecurity including bargain shopping, using alternative food sources and drawing on social relationships<sup>(19,20)</sup>. Examples of the latter include obtaining information from others about locating cheaper food and sending children to others' homes for meals<sup>(21)</sup>. This concept, termed social support, may be an important factor in coping with the possibility of food insecurity, although little social support literature focuses on food insecurity. Social support is the receipt of help imparted through social transactions<sup>(22)</sup> and is multidimensional<sup>(23)</sup>. The most frequently assessed dimensions of social support are its functions and sources<sup>(22,24)</sup>. Social support can have an instrumental function characterized by the receipt or provision of tangible resources<sup>(22)</sup>, an emotional function distinguished by reassurance and sympathy<sup>(25)</sup>, or an informational function that involves giving and receiving helpful information<sup>(26)</sup>.

The sources of social support include an intimate partner, a social network and the community<sup>(22,24)</sup>. The most proximal source is an intimate partner, usually a spouse<sup>(27)</sup>. A second source is the social network, which consists of relationships between kin, co-workers and friends<sup>(28)</sup>. The third and most general source is the community. Community social support is typically discussed in terms of the ties individuals have to their communities that result in feelings of belongingness<sup>(29)</sup>. These ties include participation in formal or informal groups (civic groups, sports teams) and faith community membership<sup>(30,31)</sup>.

Researchers in various fields have provided convincing evidence that social support improves well-being<sup>(22,32,33)</sup>. Most studies have evaluated social support's relationship with mortality, depression and well-being<sup>(34,35)</sup>. Only a few studies have explored the food insecurity–social support relationship. For example, in a qualitative study with low-income North Carolinians, participants described three sources of social support to help in coping with food insecurity: (i) a close family member like a spouse; (ii) friends; and (iii) neighbours/acquaintances<sup>(19)</sup>. Other researchers found that food-insecure Canadians had greater odds of reporting poor social support<sup>(10)</sup>. Recently, researchers assessed the effects of social support on food insecurity in two rural Iowa counties, determining that individuals with higher social support were less likely to experience food insecurity, although receipt of food from one's network was not a significant predictor of food insecurity<sup>(36)</sup>. Perhaps developing stronger social ties can lower food insecurity.

Social support can buffer against stressors, diminishing the stressor's influence on well-being<sup>(37,38)</sup>. Social support has been shown to moderate the relationship between stress and mental health<sup>(39)</sup>, poverty and negative parenting behaviours<sup>(40)</sup>, and acculturative stress and health<sup>(41)</sup>. A few studies have examined the interaction effects of income and social support on outcomes like parenting style and depression. One study found that the presence of social support reduced negative parenting

behaviour among low-income families<sup>(40)</sup>. Another found that, in the presence of economic challenges, mothers with more social support were less likely to experience depression than similarly burdened mothers with less social support<sup>(39)</sup>. Taken together, these findings suggest the existence of joint effects of income and social support.

Given the evidence that social support moderates the relationship between income and some health-related outcomes, social support may also moderate the relationship between income and food insecurity. However, most studies that have explored this relationship are qualitative in nature, and none specifically assessed the moderating role of social support<sup>(19,42)</sup>. Even so, research suggests that social support is often used to cope with the stress of food insecurity<sup>(20,43)</sup>. Accordingly, the research questions addressed in the present study were:

1. Does social support moderate the relationship between income and food insecurity?
2. Do the moderating effects of social support differ by the function and source of the social support received?

## Methods

### Sample

The current study focuses on Oregon because of the state's unique pattern of food insecurity. Oregon had the highest rate of food insecurity during the late 1990s and early 2000s until 2004, when it was the only state with a significant decline<sup>(5,44)</sup>. Oregon's rates have been attributed to high rates within households expected to be vulnerable to food insecurity (i.e. those with no employed adults, with adults who work only part-time or part-year, and those who have relocated in the last year) and households not normally expected to be vulnerable (i.e. those with no unemployed adult, with adults who work full-time and full-year, and two-parent households)<sup>(5)</sup>.

The target population was Oregonians aged 18–64 years. Persons over 64 years of age were excluded because they often receive social security and retirement benefits and are more likely to have lower household expenses than younger individuals, and thus have more income to purchase food<sup>(45)</sup>. Individuals under 18 years of age were excluded because they do not often have financial responsibility for a household. We used disproportionate stratified random sampling with systematic selection to oversample rural Oregonians, which afforded broader representation of residents across the state<sup>(46)</sup>. Urban and rural strata were created at the census tract level: census tracts with more than 10% of their geographic area contained within an urban growth boundary were considered urban. All other tracts were considered rural. Survey Sampling International (Fairfield, CT, USA) created the sampling frame and drew the sample using a large database of US households based predominantly on telephone records. The sample list included names and

addresses of the household head, to whom the questionnaire was mailed.

### **Procedures**

From August to November 2006, we collected data. The target person in each household was the individual (18–64 years) who last had a birthday. To be eligible, the person completing the survey had to consider Oregon her/his usual place of residence, following US Census procedures (K Vaidya, personal communication, 7 April 2006). To maximize response rate, we contacted each sampled household up to four times including use of a pre-notice, reminder postcard and a second questionnaire mailing<sup>(47)</sup>. We included a \$1 bill in each initial survey. Surveys were sent to a total of 1200 households (600 rural, 600 urban). Of those, eighty-three had undeliverable addresses, 110 had no one under 65 years old at the address, ten were addressed to deceased individuals, and one was a business. Of the remaining 996 households, 343 surveys were received (response rate 34.4%); sample characteristics are presented in Table 1.

### **Measures**

The questionnaire, which was eight pages in length and written at a 6th grade reading level, took approximately 10 min to complete and consisted of three sections: (i) social support; (ii) food security; and (iii) socio-demographics. We piloted the questionnaire to determine time for completion and if any questions were confusing or offensive. Minor changes were made. The Institutional Review Board at Oregon State University approved the protocol. The measures are described below. The social support items are listed in the Appendix.

#### *Social network support*

We measured social network support received from family and friends using twelve items, four for each function (instrumental, informational and emotional). The items were adapted from previous studies<sup>(22,24,25)</sup>. We created a mean scale score for each of the three social support functions (range 0–4) and a total social network support mean scale that included all twelve (range 0–4). These scales had  $\alpha$  coefficients ranging from 0.86 to 0.95, indicating high internal consistency reliability.

#### *Intimate partner social support*

We measured social support from an intimate partner with four items, which were adapted from a large body of previous work on social support<sup>(22,24,48)</sup>. We calculated the mean of the four items to create a scale score (range 0–4). This scale had an  $\alpha$  coefficient of 0.97, indicating high internal consistency reliability.

#### *Total social support*

We calculated a combined mean scale score for the amount of social support received from an intimate

partner and social network using the responses to the intimate partner support items and the social network support function items (range 0–4). The internal consistency reliability of the scale was high ( $\alpha = 0.91$ ).

#### *Community-level social support*

We measured community-level social support by asking about faith community attendance and organization membership using items from prior studies<sup>(49,50)</sup>.

We assessed the construct validity of the sixteen-item total social support scale using two recommended methods<sup>(51,52)</sup>. First, we examined the correlations between the social support scale and the following measures of theoretically related variables: faith community attendance, family size and frequency of social contact. We found positive correlations between the social support scale and faith community attendance (0.18), family size (0.21) and frequency of social contact (0.22), providing evidence of the construct validity of the scale. Second, we compared scores on the social support scale for the following groups, which we expected to differ on social support: (i) respondents who lived alone *v.* those who lived with others; and (ii) respondents who did not attend a faith community *v.* those who did. Those who lived alone or did not attend a faith community had significantly lower scores on the social support scale, providing evidence of the social support scale's construct validity.

#### *Food insecurity*

We measured food insecurity with ten questions from the US Department of Agriculture (USDA) Food Security Core Module<sup>(53)</sup>. The Module consists of eighteen questions; however, eight refer only to households with children and could be excluded without any loss in precision (M Nord, personal communication, 2 February 2006). A sample question is: 'In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?' The responses to the ten items were summed to create a scale; this scale had high internal consistency reliability (Kuder–Richardson 20 coefficient = 0.91). Using USDA-developed scaling procedures, we categorized individuals with zero to two affirmative responses as food-secure, with three to five affirmative responses as food-insecure without hunger, and with six to ten affirmative responses as food-insecure with hunger<sup>(54)</sup>. Because the rate of hunger in this sample was less than 8%, we created a binary outcome variable by combining the two food insecurity categories (0 = food-secure, 1 = food-insecure).

#### *Sociodemographics*

Respondents were asked their gender, age, race/ethnicity (using Office of Management and Budget guidelines<sup>(55)</sup>), education, employment, income, marital status, home ownership, possession of reliable transportation, household size and percentage of income spent on housing.

We measured income by asking: 'Which of the following categories would best describe your total household income before taxes for 2005?' We provided twelve answer choices. We then initially collapsed income using the 2005 poverty guidelines for a family of four such that the first category (\$19 999 or less) was approximately 100% of poverty or less, the second category (\$20 000 to 39 999) was approximately 101% to 200% of poverty, and the third category (\$40 000 or more) was approximately 200% of poverty or more. Based on the US Department of Housing and Urban Development's affordable housing definition<sup>(56)</sup>, we created a dummy variable for affordable

housing with 1 = more than 30% of income goes to housing and 0 = 30% or less of income goes to housing.

### Data analysis

Prior to conducting our main analyses, we assessed all covariates including social support variables for multicollinearity and found no evidence of highly correlated variables. To answer our first research question, we used hierarchical logistic regression, in which sets of variables are entered into the regression model in blocks, to determine whether total social support (i.e. amount of social support received from intimate partner and social

**Table 1** Sociodemographic and social support characteristics of the sample of Oregon residents (*n* 343)

Characteristic	Total <i>n</i> † or Mean	% or SE
Age (years)		
18–34	31	9.38
35–49	123	38.50
50–64	189	52.13
Male	161	48.51
Race/ethnicity		
White/non-Hispanic	305	87.54
Other	34	12.46
Education		
≤High school degree	77	23.51
Some college or vocational training	123	35.05
≥College graduate	140	41.44
Employment status		
Unemployed	74	20.58
Employed	263	79.42
Current marital status		
Married	240	75.05
Not married	100	24.95
Household income based on poverty level		
≤\$19 999 (≤100% of poverty)	34	8.50
\$20 000–39 999 (101–200% of poverty)	70	19.50
≥\$40 000 (>200% of poverty)	226	72.00
Household income		
≤\$34 999	86	23.38
\$35 000–74 999	131	40.20
≥\$75 000	113	36.42
Home ownership		
Yes	285	84.76
No	50	15.24
Percentage of income for housing		
>30%	79	25.18
≤30%	230	74.82
Mean household size	3.05	0.09
Car in working condition		
Yes	321	95.20
No	18	4.80
Geographic location		
Rural	166	28.69
Urban	175	71.31
Food-insecure	48	14.44
Amount of social support from each source		
Social network support	2.63	0.05
Intimate partner support	3.03	0.09
Total support from partner and network	2.72	0.05
Amount of social network support by function		
Emotional support	2.89	0.05
Informational support	2.72	0.05
Instrumental support	2.28	0.07
Faith community attendance	114	37.13
Organization membership	105	31.95

All data are weighted except for the total *n* for each variable.

†Some numbers do not add up to the total sample because of non-response.

network) moderates the relationship between income and food insecurity. We followed standard procedures<sup>(57)</sup> used in other studies of social support<sup>(40,41,58)</sup>. Food insecurity was the dependent variable. We estimated both a constrained and a full model. The constrained model contained the main effects of income and total social support. The full model included both the main effects and the interaction of income and total social support. The covariates included in both models were those determined to have significant bivariate associations with food insecurity at  $P < 0.1$  (gender, marital status, age, education, employment, home ownership, percentage of income spent on rent, possession of a vehicle and rural residence)<sup>(59,60)</sup>. We used three post-estimation procedures to determine whether including the interaction of income and total social support improved the fit of the model to the data. These were the likelihood ratio  $\chi^2$  test to evaluate the coefficients of the two models and two measures of goodness-of-fit, the McFadden's adjusted  $R^2$  and the Bayesian information criterion<sup>(61,62)</sup>.

We used the same procedures to evaluate the moderating role of individual sources and functions of social support to answer our second research question. We produced both a constrained and a full model for each of seven social support measures: the three functions of social network support (instrumental, informational and emotional), total social network support, intimate partner support, and two measures of community support (faith community attendance and organization membership). The constrained models contained the main effects and the full models added the interactions of income and the social support measure of interest. We included the same covariates and generated the same post-estimation measures as we did to answer our first research question.

For all multivariate analyses, we ran an original set of models with income categorized based on the 2005 federal poverty guidelines. With this income categorization, we found evidence for moderation of the relationship between income and food insecurity for three of the eight social support measures (emotional support, social network support and organization membership). However, probably because of the small number of respondents in the lowest income category ( $n = 34$ , unweighted), the odds ratios for the main effects of the lowest income category (\$19 999 or less) in the presence of their interactions were very large for emotional and social network support. For example, the odds ratio for the main effect of the lowest income category in the presence of the interaction of income with emotional support was 4136.79. Further, wide confidence intervals for the odds ratio (i.e. 3.24, 227.74) for the main effect of income in the presence of the interaction of income and organization membership were seen. To address these issues, we created a different income categorization ( $\leq \$34\,999$ ,  $\$35\,000\text{--}74\,999$ ,  $\geq \$75\,000$ ) and re-ran the analyses. We present the results from the analyses with income recategorized.

The number of cases included in the multivariate analyses was 287 because cases with missing data were excluded. To ensure that the data were representative of all working-age Oregonians, we used a weight that is a product of weights accounting for: (i) the different sampling fractions used for disproportionate stratified random sampling; (ii) non-response due to low response rate; and (iii) the number of residents in each household who met the criteria for survey completion<sup>(46)</sup>. Except where noted, all data presented are weighted. We conducted all analyses using the STATA statistical software package version 9.2 (Stata Corp, College Station, TX, USA).

To ensure that our sample size provided adequate power for the complexity of these models, we conducted power calculations using the Power and Precision software (Biostat, Englewood, NJ, USA). The present analyses had adequate power (0.80 or greater) to detect moderate effects for the set of independent variables we had.

## Results

Social support characteristics are included in Table 1. The results of analyses to answer our first research question, shown in Table 2, suggest that the amount of total social support received does not moderate the relationship between income and food insecurity. The main effects of income and total social support contributed significantly to the constrained model, as evidenced by the block  $\chi^2$  ( $\chi^2_{(3)} = 8.52$ ,  $P < 0.05$ , block  $\chi^2$  not shown in table). One income category had a significant association with food insecurity; respondents with incomes less than or equal to \$34 999 were more likely to experience food insecurity than respondents with incomes of \$75 000 or greater. However, total social support was not significantly associated with food insecurity. In addition, the inclusion of the interaction between income and total social support did not further improve the fit of the model to the data (block  $\chi^2_{(2)} = 1.02$ ,  $P > 0.05$ , block  $\chi^2$  not shown in table). The post-estimation analyses comparing the constrained and full models support this; all three post-estimation procedures indicated that the constrained model (i.e. without the interaction) fit the data better.

To answer our second research question, we examined whether the moderating effects of social support differed by the function or source of the social support received. Results were similar to those for total social support (data not shown). In particular, the lack of a significant moderating effect was consistent across analyses using measures of individual sources and functions of social support.

We also conducted a non-response analysis by comparing sample demographics to Oregon data from the 2005 American Community Survey<sup>(63)</sup>. The results indicated that study respondents were more likely to be married, older, employed, college-educated and have higher incomes than the general Oregon population,

**Table 2** Hierarchical logistic regression analysis: predicting food insecurity with total social support among the Oregon residents (*n* 287)

Characteristic	Constrained		Full	
	OR	95 % CI	OR	95 % CI
Income				
≤\$34 999	8.13*	1.47, 45.02	1.38	0.06, 33.22
\$35 000–74 999	2.84	0.42, 19.12	1.16	0.02, 65.71
Total social support	0.73	0.40, 1.32	0.47	0.14, 1.61
Income ≤\$34 999 × Social support			2.07	0.46, 9.30
Income \$35 000–74 999 × Social support			1.47	0.27, 7.94
Wald $\chi^2$		62.65**		63.86**
df for the model		14		16
LR $\chi^2$ (df)		109.27 (14)**		109.97 (16)**
LR test comparing models (df)				0.70 (2)
McFadden's adjusted $R^2$		0.338		0.324
BIC		210.16		220.78

df, degrees of freedom; LR, likelihood ratio; BIC, Bayesian information criterion.

All data are weighted. Total social support is a combined measure of support from an intimate partner and social network. Both models were adjusted for gender, marital status, age, educational attainment, employment status, home ownership, percentage of income spent on rent, possession of a vehicle and rural residence. The full model included the income and social support interaction terms, while the constrained model did not.

\* $P < 0.05$ , \*\* $P < 0.001$ .

†Wald  $\chi^2$  for the entire model.

suggesting some selection bias. The bias toward those with higher socio-economic status was not unexpected because higher-income individuals are more likely to participate in research<sup>(64)</sup>.

## Discussion

The present study advances knowledge regarding the relationship between income and food insecurity through the examination of the potential moderating effects of social support, which had not been tested in prior research. Although other studies have suggested that social support may be important because individuals draw on such resources when threatened with food insecurity<sup>(10,19,36)</sup>, we found no evidence of an association between social support and food insecurity and no evidence that social support acts as a moderator between income and food insecurity. These findings may be attributable to several factors. First, perhaps no social support differences exist between the food-insecure and food-secure in Oregon. Second, differences may exist, but food-insecure respondents may have over-reported social support due to social desirability. Third, the effect of social support may be small. Our power calculations indicated that the sample size was sufficient to detect moderate, but not small, effects. In light of this, future studies should obtain a larger sample. In particular, the following techniques could help increase the proportion of low-income participants: increasing the number of contacts made with individuals, reducing survey length, increasing the incentive amount, and/or oversampling in low-income census tracts. Studies that include more participants with low incomes could produce different findings.

Another avenue for future research is the role of social capital<sup>(65)</sup>. Community context may be more important

than social support alone in determining why some individuals experience food insecurity and others do not. Studies focusing on social capital could provide richer information about the community, including whether relationships between neighbours are characterized by trust and reciprocity, and insight into the development of community support. The association between community-level social capital, measured by the percentage of the population involved in a community organization and residential stability<sup>(66)</sup>, and community food insecurity rates could be assessed to determine whether community social capital is a salient factor in the experience of food insecurity. Previous research found evidence of an inverse association between social capital and the risk of hunger<sup>(67)</sup>. At the individual level, extent of community involvement, feelings of community connectedness, and reciprocity and trustworthiness of relationships could be measured<sup>(68)</sup>. In fact, one study found that lower social capital at the individual level was associated with poorer diet<sup>(69)</sup>.

The present study has several strengths including the use of a rigorous probability sampling method that improved the generalizability of our findings. Another strength is our use of the USDA Food Security Core Module, which is widely used and has strong psychometric properties<sup>(54,70)</sup>. In addition, we measured a wide range of factors related to food insecurity. Further, the study was informed by a robust literature on social support. We used a large number of social support measures that have been used extensively in previous research, have strong properties, and capture various social support sources and functions.

Despite these strengths, the study also has several limitations. Compared with typical response rates for mail surveys<sup>(47)</sup>, ours was low (34.4%), which may be due to the study's focus on the general public. Some survey

recipients may not have been sufficiently interested in the topic to complete it. Moreover, initial surveys were mailed in August when people are often vacationing. Findings may not be generalized to other states or the nation. The study was cross-sectional, so causal inferences cannot be made<sup>(71)</sup>. Further, the study relied on self-reporting and is subject to the potential risks inherent in the methodology<sup>(72)</sup>. Last, the database from which the sampling frame was created was based primarily on data from telephone directories, so the sample may include fewer low-income Oregonians than would a sample drawn using another source.

Undoubtedly, food insecurity exists in Oregon. The State of Oregon has recognized food insecurity as an important issue for residents and is working to eliminate the environmental factors that contribute to it<sup>(73)</sup>. Although previous research suggested that social support could offset the negative impact of low income on food security<sup>(36)</sup>, we found no support for such a beneficial effect. Further research is clearly needed.

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### References

1. United Nations (1998) Fiftieth Anniversary of the Universal Declaration of Human Rights. <http://www.un.org/rights/50/anniversary.htm> (accessed May 2009).
2. Fitchen J (1997) Hunger, malnutrition, and poverty in the contemporary United States. In *Food and Culture*, pp. 384–401 [C Counihan and P Van Esterik, editors]. New York: Routledge.
3. Nord M, Andrews M & Carlson S (2004) *Household Food Security in the United States, 2003. Food Assistance and Nutrition Research Report* no. FANRR42. Washington, DC: Economic Research Service, US Department of Agriculture.
4. Anderson SA (editor) (1990) Core indicators of nutritional state for difficult to sample populations. *J Nutr* **120**, Suppl. 11, 1557S–1600S.
5. Edwards M & Weber B (2003) *Food Insecurity and Hunger in Oregon: A New Look. Working Papers in Agricultural and Resource Economics* no. 03-104. Corvallis, OR: Oregon State University.
6. Olson CM (1999) Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr* **129**, 2S Suppl., 521S–524S.
7. Nord M, Andrews M & Carlson S (2006) *Household Food Security in the United States, 2005. Economic Research Report* no. ERR29. Washington, DC: Economic Research Service, US Department of Agriculture.
8. Nord M, Andrews M & Carlson S (2007) *Household Food Security in the United States, 2006. Economic Research Report* no. ERR49. Washington, DC: Economic Research Service, US Department of Agriculture.
9. Cook JT (2002) Clinical implications of household food security: definitions, monitoring, and policy. *Nutr Clin Care* **5**, 152–156.
10. Vozoris NT & Tarasuk VS (2003) Household food insufficiency is associated with poorer health. *J Nutr* **133**, 120–126.
11. Klein S, Burke LE, Bray GA, Blair S, Allison DB, Pi-Sunyer X, Hong Y & Eckel RH; American Heart Association Council on Nutrition, Physical Activity, and Metabolism (2004) Clinical implications of obesity with specific focus on cardiovascular disease. *Circulation* **110**, 2952–2967.
12. Morin KH, Stark MA & Searing K (2004) Obesity and nutrition in women throughout adulthood. *J Obstet Gynecol Neonat Nurs* **33**, 823–832.
13. Casey PH, Szeto KL, Robbins JM, Stuff JE, Connell C, Gossett JM & Simpson PM (2005) Child health-related quality of life and household food security. *Arch Pediatr Adolesc Med* **159**, 51–56.
14. Sherman A (2004) *Hunger, Crowding, and Other Hardships are Widespread Among Families in Poverty*. Washington, DC: Center on Budget and Policy Priorities.
15. Olson C, Anderson K, Kiss E, Lawrence F & Seiling S (2004) Factors protecting against and contributing to food insecurity among rural families. *Fam Econ Nutr Rev* **16**, 12–20.
16. Bernell S, Weber B & Edwards M (2006) Restricted opportunities, poor personal choices, failed policies, social decay? What explains food insecurity in Oregon. *J Agric Resour Econ* **31**, 193–211.
17. Alaimo K, Briefel R, Frongillo E Jr & Olson CM (1998) Food insufficiency exists in the United States: results from the Third National Health and Nutrition Examination Survey (NHANES III). *Am J Public Health* **88**, 419–426.
18. Nord M & Winicki J (2000) Prevalence of household hunger declines in rural households. *Rural Cond Trends* **11**, 80–86.
19. Ahluwalia I, Dodds J & Baligh M (1998) Social support and coping behaviors of low-income families experiencing food insufficiency in North Carolina. *Health Educ Behav* **25**, 599–612.
20. Hoisington A, Shultz J & Butkus S (2002) Coping strategies and nutrition education needs among food pantry users. *J Nutr Educ Behav* **34**, 326–333.
21. Schwartz-Nobel L (2002) *Growing Up Empty*. New York: Harper Collins.
22. Heaney C & Israel B (2002) Social networks and social support. In *Health Behavior and Health Education*, pp. 185–205 [K Glanz, B Rimer and F Lewis, editors]. San Francisco, CA: Jossey-Bass.
23. Thoits P (1982) Conceptual, methodological, and theoretical problems in studying social support as a buffer against life stress. *J Health Soc Behav* **23**, 145–159.
24. Berkman L & Syme SL (1979) Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol* **109**, 186–204.

25. Lin N, Dean A & Ensel W (editors) (1986) *Social Support, Life Events, and Depression*. Orlando, FL: Academic Press, Inc.
26. Schaefer C, Coyne J & Lazarus R (1981) The health-related functions of social support. *J Behav Med* **4**, 381–406.
27. Coyne J & DeLongis A (1986) Going beyond social support: the role of social relationships in adaptation. *J Consult Clin Psychol* **54**, 454–460.
28. Berkman L (2000) Social support, social networks, social cohesion and health. *Soc Work Health Care* **31**, 3–14.
29. Green B & Rodgers A (2001) Determinants of social support among low-income mothers: a longitudinal analysis. *Am J Community Psychol* **29**, 419–441.
30. Cleak H & Howe J (2003) Social networks and use of social supports of minority elders in East Harlem. *Soc Work Health Care* **38**, 19–38.
31. Krause N & Shaw B (2002) Welfare participation and social support in late life. *Psychol Aging* **17**, 260–270.
32. Baxter J, Shetterly S, Eby C, Mason L, Cortese CF & Hamman RF (1998) Social network factors associated with perceived quality of life. The San Luis Valley Health and Aging Study. *J Aging Health* **10**, 287–310.
33. Cohen S & Wills T (1985) Stress, social support, and the buffering hypothesis. *Psychol Bull* **98**, 310–357.
34. Berkman L & Glass T (2000) Social integration, social networks, social support, and health. In *Social Epidemiology*, pp. 137–173 [L Berkman, editor]. New York: Oxford University Press.
35. Israel BA, Farquhar SA, Schulz AJ, James SA & Parker EA (2002) The relationship between social support, stress, and health among women on Detroit's East Side. *Health Educ Behav* **29**, 342–360.
36. Garasky S, Morton L & Greder K (2006) The effects of the local food environment and social support on rural food insecurity. *J Hunger Environ Nutr* **1**, 83–103.
37. Black A, Cook J, Murry V & Cutrona CE (2005) Ties that bind: implication of social support for rural, partnered, African American women's health functioning. *Womens Health Issues* **15**, 216–223.
38. Strogatz DS, Croft JB, James SA, Keenan NL, Browning SR, Garrett JM & Curtis AB (1997) Social support, stress, and blood pressure in black adults. *Epidemiology* **8**, 482–487.
39. Kohler J, Anderson E, Oravec L & Braun B (2004) Relationship constellations and dynamics of low-income rural mothers. *Affilia* **19**, 160–173.
40. Hashima P & Amato P (1994) Poverty, social support, and parental behavior. *Child Dev* **65**, 394–403.
41. Lee J, Koeske G & Sales E (2004) Social support buffering of acculturative stress: a study of mental health symptoms among Korean international students. *Int J Intercult Relat* **28**, 399–414.
42. Pierce M, Sheehan N & Ferris A (2002) Nutrition concerns of low-income elderly women and related social support. *J Nutr Elder* **21**, 37–53.
43. Rosenberger N & Gross J (2006) Food strategies amidst poverty: low-income people in rural Oregon. Paper presented at the *Annual Conference of the Society for Applied Anthropology*, Vancouver, British Columbia, Canada, 28 March–1 April 2006.
44. Brown S & Fournier J (2005) *Tables of Food Insecurity and Hunger for 2004 Rankings by Households by State (including DC and US)*. Waltham, MA: Brandeis University, Center on Hunger and Poverty.
45. Nord M, Andrews M & Carlson S (2002) *Household Food Security in the United States, 2001. Food Assistance and Nutrition Research Report* no. FANRR29. Washington, DC: Economic Research Service, US Department of Agriculture.
46. Trochim W (2002) *The Research Methods Knowledge Base*, 2nd ed. <http://trochim.human.cornell.edu/kb/index.htm> (accessed December 2006).
47. Dillman D (2000) *Mail and Internet Surveys: The Tailored Design Method*. New York: John Wiley & Sons, Inc.
48. Cohen S, Underwood L & Gottlieb B (editors) (2000) *Social Support Measurement and Intervention*, 1st ed. Oxford: Oxford University Press.
49. Abbey A, Andrews F & Halman LJ (1995) Provision and receipt of social support and disregard: what is their impact on the marital life quality of infertile and fertile couples? *J Pers Soc Psychol* **68**, 455–469.
50. Newsom JT, Nishishiba M, Morgan DL & Rook K (2000) Development of new comparable measures of negative and positive social exchanges. Paper presented at the *53rd Annual Scientific Meeting of the Gerontological Society of America*, Washington, DC, 17–21 November 2000.
51. Netemeyer R, Bearden W & Sharma S (2003) *Scaling Procedures*. Thousand Oaks, CA: Sage Publications.
52. Singleton R & Straits B (2005) *Approaches to Social Research*. New York: Oxford University Press.
53. Bickel G, Carlson S & Nord M (1999) *Household Food Security in the United States 1995–1998: Advance Report*. Washington, DC: US Department of Agriculture, Food and Nutrition Service.
54. Bickel G, Nord M, Price C, Hamilton W & Cook J (2000) *Guide to Measuring Household Food Security*. Washington, DC: US Department of Agriculture, Food and Nutrition Service.
55. Office of Management and Budget (1997) Federal Register Notice: Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity. <http://www.whitehouse.gov/omb/fedreg/ombdir15.html> (accessed May 2009).
56. US Department of Housing & Urban Development (2009) Affordable Housing. <http://www.hud.gov/offices/cpd/affordablehousing/> (accessed May 2009).
57. Baron R & Kenny D (1986) The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* **51**, 1173–1182.
58. Chou K, Chi I & Chow N (2004) Sources of income and depression in elderly Hong Kong Chinese: mediating and moderating effects of social support and financial strain. *Aging Ment Health* **8**, 212–221.
59. De Marco M (2007) The relationship between income and food insecurity: the role of social support among urban and rural Oregonians. PhD Thesis, Oregon State University.
60. De Marco M & Thorburn S (2008) The association between sociodemographic factors, participation in assistance programs, and food insecurity among Oregon residents. *J Hunger Environ Nutr* **3**, 36–50.
61. Long JS & Freese J (2006) *Regression Models for Categorical Dependent Variables using Stata*, 2nd ed. College Station, TX: Stata Press.
62. Hensher D & Johnson L (1981) *Applied Discrete-Choice Modelling*. London: Croom Helm/New York: Wiley.
63. US Census Bureau (2005) American Community Survey Dataset. <http://www.census.gov/acs/www/> (accessed May 2009).
64. Turrell G, Patterson C, Oldenburg B, Gould T & Roy MA (2003) The socioeconomic patterning of survey participation and non-response error in a multi-level study of food purchasing behaviour: area- and individual-level characteristics. *Public Health Nutr* **6**, 181–189.
65. Putnam R (2000) *Bowling Alone*. New York: Simon & Schuster Paperbacks.
66. Flora J (1998) Social capital and communities of place. *Rural Sociol* **63**, 481–506.
67. Martin K, Rogers B, Cook J & Joseph HM (2004) Social capital is associated with decreased risk of hunger. *Soc Sci Med* **58**, 2645–2654.
68. Liu A & Besser T (2003) Social capital and participation in community improvement activities by elderly residents in small towns and rural communities. *Rural Sociol* **68**, 343–365.

69. Locher J, Ritchie C, Roth D, Baker PS, Bodner EV & Allman RM (2005) Social isolation, support, and capital and nutritional risk in an older sample: ethnic and gender differences. *Soc Sci Med* **60**, 747–761.
70. Carlson S, Andrews M & Bickel G (1999) Measuring food insecurity and hunger in the United States: development of a national benchmark measure and prevalence estimates. *J Nutr* **129**, 2S Suppl., 510S–516S.
71. Portney L & Watkins M (2000) *Foundations of Clinical Research: Applications to Practice*, 2nd ed. Upper Saddle River, NJ: Prentice Hall.
72. Bradburn N, Rips L & Shevell S (1987) Answering autobiographical questions: the impact of memory and inference on surveys. *Science* **236**, 157–161.
73. Oregon Hunger Relief Task Force (2004) *Act to End Hunger*. Portland, OR: Oregon Hunger Relief Task Force.

## Appendix

### Social Support Survey Items

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#### Social network support

Q: How many friends do you feel close to? \_\_\_\_\_ friends

Q: How many of your close friends are also friends with each other? \_\_\_\_\_ people

Q: How many relatives do you feel close to? \_\_\_\_\_ relatives

Q: Select the four (4) friends and relatives you feel most close to (other than an intimate partner). On the table below list the relationship of each person to you (i.e. mother, friend) and how often you have contact with each of them (Response categories included once a month or less, twice a month, once a week, once every two days, and once a day or more)

Q: Thinking about the friends and relatives you feel close to (other than an intimate partner), how often can you rely on them for the following? (Response categories included never, rarely, sometimes, often, and always)

1. To make you feel he/she cares about you?
2. To be there with you (physically) in a stressful situation?
3. To listen to you talk about your private feelings?
4. To praise or compliment you?
5. To suggest some action you should take to deal with a problem you were having?
6. To tell you what they did in a stressful situation that was similar to one you were experiencing?
7. To give you information that made a difficult situation easier to understand?
8. To give you information, suggestions, and guidance that you found helpful?
9. To care for you following an illness or injury?
10. To provide you with transportation?
11. To pitch in to help do something that needed to get done, like household chores or yard work?
12. To give you money or other resources such as food?

#### Intimate partner social support

Q: In the past 4 weeks, how often did your intimate partner show that he/she loved and cared for you? (Response categories included never, once a month, once a week, once every two days, and once a day or more)

Q: How much do you agree that your intimate partner is someone who... (Response categories included strongly agree, disagree, neither agree/disagree, agree, and strongly agree)

1. You can really talk to about things that are important to you?
2. You can count on for understanding and advice?
3. You can rely on for practical things such as help with chores?

#### Community-level support

Q: How long have you lived in your current town?

Q: Do you regularly (at least once a month) attend a church, temple, mosque or synagogue?

Q: Are you a member of a formal or informal organization in your community (such as local government, Rotary, Elks, Parent and Teacher Association (PTA), sports teams)?

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