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Relationship of Household Food Insecurity to Health-Related Quality of Life (HRQOL) in a Large Sample of Rural and Urban Women

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Abstract

We examined the associations of household food insecurity and other characteristics with fair-to-poor general health, poor physical health, and frequent mental distress among 1,367 rural and urban women in Texas. The 2006 Brazos Valley Community Health Assessment provided data on demographic characteristics, economic risk factors, health-related quality of life (HRQOL), household food insecurity, and geographic residence. Multivariable logistic regression models were estimated for the three HRQOL measures: fair-to-poor health, poor physical health, and frequent mental distress, adjusting for confounding variables. Having less than 12 years of education, not employed full-time, and being household food insecure were independently significantly associated with increased odds for all HRQOL outcomes. Rural residence and being nonwhite were associated with fair-to-poor general health, but not physical or mental health. Results from the separate urban and rural models indicated that household food insecurity was associated with fair-to-poor general health among rural women, not among urban women. Poverty and being non-white were also associated with increased odds of reporting fair-to-poor general health, but were significant only among urban women. These results emphasize the need for health promotion and policy efforts to consider household food access and availability as part of promoting healthful food choices and good physical and mental health among women, especially rural women.

INTRODUCTION

In 2009, nearly 15% of households in the U.S. were considered food insecure, and the rates for both food-insecurity and very low food insecurity were the highest since the first food security survey in 1995 (Nord, Coleman-Jensen, Andrews, & Carlson, 2010). Food security is defined as having consistent, dependable access to enough food for active, healthy living (Nord et al., 2010). An alternate definition of household food insecurity is a set of circumstances in which households compromise quality of diet or amount of food as a result of insufficient household resources and/or obstacles to food acquisition (Seefeldt & Castelli, 2009). When faced with food insecurity, households may purchase more nutrient-poor, energy-dense foods and fewer nutrient-dense foods such as fruits and vegetables, milk, and meat and eat less varied diets and (Nord et al., 2010; Olson, 2005; Seefeldt & Castelli, 2009). Households with low or poverty-level incomes, with female heads, with racial or ethnic minorities, and located in rural areas were particularly hard-hit with higher food

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Conflicts of Interest
The authors declare that they have no conflicts of interest.

insecurity rates (Nord, Andrews, & Carlson, 2009; Nord et al., 2010; Olson, 2005; Probst, Moore, Glover, & Samuels., 2004; Siefert, Heflin, Corcoran, & Williams, 2001; Stuff et al., 2004). Similar disparities in health status – general, physical, and mental – have been identified among women, especially rural minorities (Bennett, Olatosi, & Probst, 2008; Centers for Disease Control and Prevention (CDC), 2000; James et al., 2009).

Women are more vulnerable to individual and household food insecurity (Nord et al., 2009; Nord et al., 2010; Olson, 2005; Seefeldt & Castelli, 2009; Siefert et al., 2001; Tarasuk, 2001; Tarasuk & Beaton, 1999). The gendered nature of food-related hardship may be related to women being more likely than men to be living in poverty, working in low-wage and part-time occupations, and primarily responsible for unpaid domestic work, and working in low-wage and part-time occupations (e.g., caring for children and other family members, food provisioning, doing housework) (Cawthorne, 2008; DeNavas-Walt, Proctor, Smith, & U.S. Census Bureau, 2010; Lichtenwalter, 2005; Tarasuk, 2001; Webber & Williams, 2008). Prior work has indicated that unstable employment and earnings are related to food insecurity and physical or mental health (CDC, 2000; Seefeldt & Castelli, 2009). Thus, the economic and social context surrounding food and family caretaking can increase household food insecurity and worsen nutritional status and health problems for women.

Although mothers try to diminish the effect of food-related hardship on their children, the direct consequences are manifested in women's health (Nord et al., 2009; Olson, 1999, 2005; Seefeldt & Castelli, 2009; Tarasuk, 2001). Food insecurity has been associated with poor nutrition, emphasizing the relationship between being food insecure, having poor nutrition or malnutrition and adverse health outcomes (Mathews, Morris, Schneider, & Goto, 2010; Olson, 2005; Sharkey, 2003; Siefert et al., 2001; Siefert, Heflin, Corcoran, & Williams, 2004; Stuff et al., 2004; Tarasuk, 2001). A food insecurity-obesity paradox has been described, in which food-insecure women have higher rates of overweight/obesity compared to healthy weight women (Adams et al., 2003; Olson, 1999, 2005; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). Diets of food-insecure or food-insufficient women tend to be lower in fruit and vegetables and deficient in key nutrients compared with those who are food secure or food sufficient (Mathews et al., 2010; Olson, 2005; Sharkey, 2003; Tarasuk, 2001). Others also have suggested that food insecurity and food insufficiency are associated with poor perceived general health, mental health, and physical health (Heflin, Siefert, & Williams, 2005; Mathews et al., 2010; Pheley, Holben, Graham, & Simpson, 2002; Siefert et al., 2001, 2004; Stuff et al., 2004; Tarasuk, 2001). However, no single reason explains the relationship between food insecurity and adverse health outcomes (Green, Kerstetter, & Nylander, 2008; Huddleston-Casas, Charnigo, & Simmons, 2009; Stuff et al., 2004; Zekeri, 2010). Binge eating or overeating when food is available may explain the relationship between food insecurity and obesity in women (Kendall et al., 1996; Olson, 2005;). Considering that the overall sense of well-being, referred to as health-related quality of life (HRQOL), which includes dimensions of general, physical and mental health, may affect chronic disease and health, household food insecurity may serve as a risk factor for diminished quality of life and subsequent health conditions (CDC, 2000; Moriarty, Zack, & Kobau, 2003).

Rural residence has been consistently related to being food-insecure, and estimates have suggested that food insecurity in rural areas is roughly 20% or twice that of the U.S. (Nord, 2002; Nord et al., 2009; The Lower Mississippi Delta Nutrition Intervention Research Consortium et al., 2004). Rural women and their families are particularly vulnerable to household food insecurity and its consequences. Rural women have unique characteristics, including less education, lower wages, and fewer long-term employment opportunities than urban women, while being more likely to be mothers and caring for children (Berry, Katras, Sano, Lee, & Bauer, 2008; Bove & Olson, 2006; Vondracek et al., 2006). The same could be

said for rural non-white populations who face severe disparities as a result of accumulated disadvantage that stems from limited education and economic opportunity (Probst et al., 2004). Although prior work has established that rural women and nonwhite groups experience unique challenges that affect their ability to maintain adequate nutrition and health for themselves and their families, little is known about the influence of being nonwhite and household food insecurity on women's HRQOL (Pheley et al., 2002; Stuff et al., 2004). Thus, the current study provided a multidimensional understanding of HRQOL among urban and rural women by: 1) assessing the frequency of fair-to-poor general health, poor physical health, frequent mental distress, and household food insecurity, 2) examining the correlates of three dimensions of HRQOL, and 3) determining the difference in correlates between urban and rural women in a large region of Texas.

METHODS

Sample and Study Design

In 2006, the Brazos Valley Health Status Assessment (BVHA) was developed by a collaboration of local and regional academic and community-based organizations in the Brazos Valley of central Texas to identify factors influencing health status, recognize health-related issues and needs of the local community, locate resources within the region, and produce a source of reliable information to develop effective solutions to identified health-related problems (Dean, Sharkey, & Johnson, 2011; Johnson, Sharkey, & Dean, 2010). A professional independent survey research firm recruited adult Brazos Valley residents (aged ≥ 18 years) through random digit dialing. Eligible participants included men and women who lived in the seven county area, comprised of one urban county and six rural counties, and were ≥ 18 years. Counties were designated as rural based on population density, which ranged from 5.5 to 19.3 persons/km^2; the population in the five largest towns in the study area ranged from 3,181 to 11,952 (Sharkey and Horel, 2008). From a list of valid telephone numbers, 15,517 households were contacted; 4,965 households (32%) agreed to participate in the survey. These individuals were mailed a 32-page survey booklet, a cover letter thanking them for participating, a $2 incentive, and postage paid return envelope (Center for Community Health Development, 2006). Of the men and women who agreed to participate, 2,582 (52%) returned completed surveys (19.4% nonwhite, 71% female, and 61% rural residents); overall survey response rate was 16.6% (Johnson, Sharkey, and Dean, 2010). Although the completed surveys were representative of the population distribution geographically (rural versus urban) and among persons with a household income below the poverty threshold, women and older adults were overrepresented and nonwhites, which included blacks or African Americans (8.4%), Hispanics (5.1%), and other races (5.8%), and individuals with limited education (completed less than 9th grade) were underrepresented in the survey sample. Complete data for household food insecurity and general health status were provided by 94% of women (n = 1,667); however this study used data from the 1,367 (82%) adult women participants who had complete responses for demographic characteristics, household food insecurity, and general health status; 300 women were excluded due to missing data on years of completed education. Significant differences were observed between included and excluded participants for the following variables: employment status (37.5% included vs. 50.7% excluded were employed full-time, p <0.001), income (20.0 % included vs. 11.7% excluded had annual household income at the poverty level, p <0.001), nonwhites (20.3% included vs. 10.3% excluded, p <0.001), household food insecurity (27.8% included vs. 7.7% excluded, p <0.001), and rural residence (69.3% included vs. 46.3% excluded, p <0.001). The Texas A&M University Institutional Review board approved the study protocol; all participants provided verbal consent and were provided with an information sheet, that provided the following information: nature of the study, minimal risks involved, no direct benefit from

participation, voluntary nature of participation, compensation, confidentiality of records, and contact information for questions about research or participant rights as a research participant.

Measures

Validated instruments were used to measure HRQOL including general, physical and mental well-being (CDC, 2000; Zack, Moriarty, Stroup, Ford, & Mokdad, 2004) and household food insecurity (Kendall, Olson, & Frongillo, 1995; Radimer, Olson, & Campbell, 1990). The Centers for Disease Control and Prevention established a core of measures as part of the Prevention Behavioral Risk Factor Surveillance System (BRFSS) to assess an individual's HRQOL through a perceived sense of general, physical, and mental well-being (CDC, 2000). These measures have been used at the state level and aggregated to the national level to inform the development of policy and interventions and are valid measures for use with nonwhite populations (CDC, 2000; Zack et al., 2004). Since 1993, women have shown greater susceptibility than men for reporting fair or poor self-rated health and 14 or more physically or mentally unhealthy days in the previous month (National Center for Chronic Disease Prevention and Health Promotion & Centers for Disease Control and Prevention (NCCDPHP), 2011). This analysis used three core Healthy Days measures from the CDC and BRFSS questionnaire that assessed an individual's perceived sense of well-being (HRQOL): 1) self-rated general health, 2) physical health, and 3) mental health (CDC, 2000, 2010). In assessing general health, participants were asked: "In general, would you say that your health is excellent, very good, good, fair, or poor?" A binary variable was constructed for self-rated general health as fair-to-poor or excellent-very good-good. To measure physical health, respondents were asked "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" For mental health, the question was "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" The Shapiro-Wilk test determined that physical and mental health measures were not normally distributed and could not be used as continuous variables. Poor physical health and frequent mental distress were each based on a cut point of 14 or more physically or mentally unhealthy days reported by the respondent (Moriarty et al., 2003).

Household food insecurity—Food insecurity was measured using the Radimer-Cornell scale, which has been shown to be valid for nonwhite participants (Kendall et al., 1995; Radimer et al., 1990; Olson and Holben, 2002; Carlson, Andrews, & Bickel,1999). The first quantitative food depletion item in the household hunger dimension was used to determine the presence of *household food insecurity* in the past 30 days (Bickel, Nord, Price, Hamilton, & Cook, 2000; Dean et al., 2011; Radimer et al., 1990; Seefeldt & Castelli, 2009). This indicator of not having sufficient money to buy needed food has been used previously to assess household food insecurity in lieu of the full 18-item scale to measure food depletion at the household level (Dean, Sharkey, and Johnson 2011; Sharkey, 2004). Respondents were asked to choose the frequency (often true, sometimes true, or never true) that the following occurred for their household in the past 30 days: "The food that we bought didn't last, and we didn't have enough money to buy more." Responses of often true and sometimes true were combined to indicate household food insecurity.

Based on the literature and our conceptual framework, the following demographic characteristics and economic risk factors were included as explanatory variables: *Demographic characteristics* (age: 18–44, 45–64, and ≥65 years; race: white, nonwhite; and education: <12 years completed). *Economic risk factors* included annual household income and employment status. Three categories for annual household income were based on the

Federal Poverty Level (FPL): poverty (≤100% FPL), low income (101%–199% FPL), and above low income (≥200% FPL). Employment status was constructed as a dichotomous variable (employed full-time outside the home, not employed full-time outside the home; part-time and unemployment status were compared against those with full-time employment).

Statistical analyses

Release 11 of Stata Statistical Software was used for all statistical analyses; $p < 0.05$ was considered statistically significant. Descriptive statistics were estimated for demographic characteristics, economic risk factors, HRQOL measures, and household food insecurity. The difference between urban and rural women who reported household food insecurity in the past 30 days and those who did not report food insecurity in relation to the prevalence of fair-to-poor general health, poor (≥14 days not good) physical health, and frequent mental distress (≥14 days not good mental health) was assessed with contingency tables by using the χ^2 statistic. To address the issue of multiple comparisons, a Bonferroni-corrected level of statistical significance ($p = 0.004$) was calculated. Using all *a priori* determined demographic characteristics, economic risk factors, and household food insecurity, which were based on the literature and our conceptual framework, adjusted multiple logistic regression models for the entire sample were estimated with robust (White-corrected) Standard Errors (SEs) for heteroscedasticity of unknown form for the three HRQOL measures: fair-to-poor health, poor physical health, and frequent mental distress; and controlled for age, race (white/nonwhite), education, household income, employment status, household food insecurity, and rural residence. Finally, separate subgroup (urban and rural) multivariable regression models were estimated for the three HRQOL measures.

RESULTS

Unadjusted results

Fair-to-poor general health was reported by 22.4% (n =306) of all women. On average, women reported their physical or mental health was “not good” for 5.0 and 5.2 days in the previous 30 days, respectively (data not shown). The number of physically unhealthy days was significantly greater for rural compared with urban women (5.5 v. 4.0, $p = 0.001$); the number of mentally unhealthy days did not differ significantly between rural and urban women (5.3 v. 5.0, $p = 0.643$). More than 14% of the combined sample reported at least 14 physically unhealthy days, and 15% reported at least 14 mentally unhealthy days in the previous month. Overall, 27.8% ($n = 380$) of women reported food insecurity during the previous 30 days; that is, the food they bought did not last and they did not have money to get more (Table 1). A greater proportion of rural women was older, reported having a household income <200% FPL, were not employed full-time, experienced fair-to-poor general health, poor physical health, and household food insecurity. At the same time, rural women were more likely to have completed less than 12 years of education. Four of the unadjusted differences between urban and rural adults remained significant after correcting for multiple comparisons with a Bonferroni-corrected level of statistical significance (Table 2). Both urban and rural women who reported household food insecurity in the past 30 days were more likely to report fair-to-poor general health, poor physical health, or frequent mental distress. Although similarly significant, the proportion of rural women who experienced household food insecurity and fair-to-poor general health was greater than among urban women ($p = 0.001$); the proportional difference was not significant for poor physical health or frequent mental distress.

Less than 12 years of education, not employed full-time, and household food insecurity independently increased the odds for all three HRQOL outcomes (Table 3). Rural residence

and being nonwhite were associated with fair-to-poor general health, but not physical or mental health. Poverty was associated with general health and poor physical health. Younger adults (18–44 years), compared with adults 65 years and older, were less likely to report fair-to-poor general health; but more likely to report frequent mental distress.

Adjusted results

The results from the separate urban and rural multivariable logistic regression models for fair-to-poor self-rated health (Table 4) indicated that household food insecurity was associated with fair-to-poor general health among rural women (OR 3.2, 95% CI 2.2, 4.6) but not among urban women (OR 1.8, 95% CI 0.9, 3.5). Not being employed full-time was significantly related to fair-to-poor general health in both subsamples; however, the effect was larger for urban women (OR 1.5, 95% CI 1.0, 2.2 for rural; OR 3.01, 95% CI 1.4, 6.4 for urban). Poverty and being nonwhite were associated with increased odds of reporting fair-to-poor general health and was significant among urban women (OR 2.7, 95% CI 1.3, 5.6 and OR 2.1, 95% CI 1.0, 4.2, respectively) but not rural women. Household food insecurity, low income, and limited education were associated with increased poor physical health for both rural (OR 2.0, 95% CI 1.3, 3.0; OR 1.9, 95% CI 1.1, 3.2; and OR 2.2, 95% CI 1.3, 3.6, respectively) and urban women (OR 2.4, 95% CI 1.3, 3.5; OR 3.1, 95% CI 1.3, 7.3; and OR 2.4, 95% CI 1.0, 5.8, respectively) (Table 5). Poverty-level income and not being employed full-time were significantly related to poor physical health for rural women (OR 2.1, 95% CI 1.3, 3.5; and OR 2.5, 95% CI 1.5, 4.0, respectively) but not for urban women. Household food insecurity increased the odds for frequent mental distress among both rural and urban women (OR 2.2, 95% CI 1.4, 3.3 and OR 2.3, 95% CI 1.3, 4.0, respectively); employment status (OR 1.9, 95% CI 1.2, 2.9), education (OR 2.2, 95% CI 1.3, 3.6), and age were associated with significantly increased odds of reporting poor mental health among rural women only (Table 6).

DISCUSSION

Although the importance of health-related quality of life (HRQOL) and physical and mental health perceptions is well-established (CDC, 2000; Moriarty et al., 2003), few studies have examined the influence of food insecurity on general, physical, and mental health among urban and rural women separately (Siefert et al., 2001, 2004; Stuff et al., 2004). This is critical, considering national prevalence of household food insecurity, and the health and socioeconomic challenges and greater susceptibility of women for poor HRQOL and adverse health outcomes (James et al., 2009; Nord et al., 2010; NCCDPHP, 2011). Findings from the current study expand our understanding of HRQOL and the association of demographic characteristics, economic risk factors, food insecurity and geographic location with fair-to-poor general health, poor physical health, and frequent mental distress among 1,367 urban and rural women who participated in a seven-county community health assessment.

The results of this study contributed three main findings to the literature. First, the prevalence of all three dimensions of HRQOL and food insecurity (household food depletion) were greater among rural than urban women, and statistically significant for fair-to-poor general health, poor physical health, and food insecurity. Second, among the overall sample, all three dimensions of HRQOL (general health, physical health, and mental distress) were associated with household food insecurity. Finally, household food insecurity was associated with all three dimensions of HRQOL among rural women, and for two dimensions (poor physical health and frequent mental distress) among urban women. This is apparently the first study, to our knowledge, that has examined the association of demographic, economic, household food insecurity, and geographic residence with three core Healthy Days measures from the BRFSS that assessed perceived sense of well-being in

a large sample of urban and rural women (CDC, 2000, 2010). Several findings warrant further discussion.

The percentage of rural women in this study with fair-to-poor self-rated health was greater than nationwide statistics for women in 2004–2008 (25.8% vs. 17.2%), but was less for urban women (NCCDPHP, 2011). Similarly, a greater prevalence for 14 or more physically unhealthy days or 14 or more mentally unhealthy days (frequent mental distress) was shown for rural women compared with nationwide data (16% vs. 12.1% and 15% vs. 12%, respectively) (NCCDPHP, 2011). More rural than urban women reported household food depletion; that is, that the food they bought last month did not last and they did not have money to get more (29.5% vs. 24% for urban women). The percentages for both rural and urban women were much higher than the 8.3% reported from the December 2009 Current Population Survey Food Security Supplement for men and women (Nord et al., 2010). These findings provide additional evidence for understanding the complex relationships between food security, mental, physical, and overall health, particularly for rural residents (Stuff et al., 2004)

In the present study, a greater proportion of women in rural or urban households indicating food insecurity reported fair-to-poor general health status and 14 or more physically or mentally unhealthy days in the previous month. Most notably, the proportion of food insecure households among rural women for each of these HRQOL dimensions was greater than among urban women. Our findings extend prior work in which a greater proportion of men and women in food insecure households reported fair/poor health status and lower SF-12 scores for physical and mental scales than their food secure counterparts (Stuff et al., 2004). The results of multiple variable regression models for the entire sample confirmed that household food insecurity (household food depletion) increased the odds at least two-fold for each of the three dimensions of HRQOL, after adjustment for demographic characteristics, economic risk factors, and geographic location. In addition, one demographic characteristic (<12 years completed education) and one economic risk factor (not being employed full-time) were associated with increased odds for each of the three HRQOL dimensions. Race, income, and geographic disparities were associated with fair-to-poor general health; poverty or low income increased the odds for poor physical health; and younger women were more susceptible to frequent mental distress.

Others also have suggested that food insufficiency and food insecurity are associated with poor perceived general health, mental health, and physical health (Heflin et al., 2005; Mathews et al., 2010; Pheley et al., 2002; Siefert et al., 2001, 2004; Stuff et al., 2004; Tarasuk, 2001) However, no single reason explains the relationship between food insecurity and adverse health outcomes (Green et al., 2008; Huddleston-Casas et al., 2009; Stuff et al., 2004; Zekeri, 2010). Considering that overall sense of well-being may affect chronic disease and health, household food insecurity may serve as a risk factor for diminished quality of life and subsequent health conditions (CDC, 2000; Moriarty et al., 2003; Stuff et al., 2004). Some have suggested that stress and anxiety from inadequacy of household food resources may mediate the relationship between food insecurity, nutritional status, and health outcomes (Stuff et al., 2004), which may be exacerbated by insufficient household income and lack of employment. Another possible explanation is that households dealing with material hardship may struggle to meet multiple ends such as paying rent, providing sufficient food, and needed medical care, and this amalgam of challenges adversely affects the health of family members (Boushey, Brocht, Gundersen, & Bernstein, 2001; Gershoff, Aber, Raver, & Lennon, 2007; Heflin & Iceland, 2009; Heflin et al., 2005). For example, Heflin and colleagues reported that material hardship, such as not being able to pay bills, was related to depression and that food insufficiency was related to poor mental health among women (Heflin & Iceland, 2009; Heflin et al., 2005).

Geographic location-stratified analyses found that household food security, lack of full-time employment, and limited education were associated with general, physical, and mental health among rural women; and among urban women, household food insecurity was associated with physical and mental health. The results suggest that the differential health burden of rural women may be the result of the economic and social context in rural areas. Several conditions intensify food insecurity for rural residents, including widespread poverty, lack of education, lack of economic opportunity, greater distance to food stores, no or limited transportation, few quality food stores and higher food prices (Arcury, Preisser, Gesler, & Powers, 2005; Blanchard & Lyson, 2006; Liese, Weis, Pluto, Smith, & Lawson, 2007; Probst et al., 2004; Sharkey, Horel, & Dean, 2010; Sharkey & Horel, 2008). In addition, rural areas are burdened with higher rates of chronic diseases and mortality, as well as a shortage of physicians, and hospitals, which exacerbates health disparities for rural residents (Bennett et al., 2008; Hartley, 2004). This manifestation of poor health may be greater among rural women who face an increased burden from lack of health insurance and greater prevalence of chronic diseases (Vondracek et al., 2006). Alternatively, rural women may experience symptoms of depression and compromised mental health associated with the stressors of living in rural areas (Huddleston-Casas et al., 2009; Olson, Anderson, Kiss, Lawrence, & Seiling, 2004; Probst, Moore, & Baxley, 2006; Vondracek et al., 2006). Extensive community-based research indicates that several of the challenges associated with rural areas are prevalent throughout the region (CCHD, 2006, 2010; Arcury et al., 2005). These include economic challenges (e.g., unemployment, lack of jobs), lack of public transportation, limited availability of health care providers, and limited access to supermarkets (Blanchard & Lyson, 2006; Smith & Morton, 2009; Sharkey & Horel, 2008). Other frequently identified community concerns included a growing number of uninsured residents, burgeoning population of older adults, and general access to medical care especially for mental health and specialty care for the uninsured or underinsured, obesity and chronic diseases.

The study had several methodological strengths. First, data came from a randomly recruited, community-based population that included a large number of rural and urban participants. Second, data included three dimensions from the BRFSS, which provided a more comprehensive picture of health status – general, physical, and mental health. The study also had several limitations. First, the cross-sectional nature of the data prevented an examination of the temporal relation of food insecurity to HRQOL. The direction of the relationship may be that HRQOL influences food security, in that health conditions may make it difficult to access food, or may prevent one from working and thus reduce income. Second, the sampling frame was determined using landline telephone numbers and thus omitted households that did not have telephones or only personal cell phones. This strategy may have altered our sample composition and the ability to generalize findings to other populations. However, the respondents were representative of the population distribution geographically, and persons with a household income below the poverty threshold. Unfortunately, black and Hispanic residents and individuals with limited education (completed less than 9^{th} grade) were underrepresented in the survey sample, which may limit the generalizability of the findigns. Third, only one item was used to assess household food insecurity due to the nature of a large-scale community health assessment, and this analysis was not able to distinguish between household food insecurity (as measured by household food depletion) and the more severe form of food insecurity at the child level. Using the full scale would be advantageous for assessing the prevalence of food insecurity in this large rural region. Fourth, participation bias may have played an important role, given the low participation rate, which may further limit the generalizability of the results. Finally, our study areas may not have been representative of other urban and rural areas.

Despite these limitations, the results of this study further our knowledge about the influence of food insecurity on perceived general, physical, and mental health among urban and rural women. Results from this study provide impetus for identifying and understanding the complex relationship between food insecurity and health outcomes, as well as exploring food security in the context of general material hardship. The results also indicate the importance of further examining the complex role of gender in HRQOL. Furthermore, this study emphasizes the need for health promotion and policy efforts to consider household food access and availability as part of promoting healthful food choices and good physical and mental health among women, especially rural women.

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Table 1

Demographic Characteristics, Economic Risk Factors, Health-Related Quality of Life, and Household Food Insecurity by Urban/Rural Residence (n = 1,367 women)[1]

	Urban (n = 420) % (n)	Rural (n = 947) % (n)	P - value
Demographic characteristics			
Age, years			
18–44	38.8 (163)	25.1 (238)	<0.001[2]
45–64	41.9 (176)	46.1 (437)	0.146
≥65	19.3 (81)	28.7 (272)	<0.001[2]
Race			
Nonwhite[a]	23.6 (99)	18.9 (179)	0.048
Education			
<12 years	10.5 (44)	14.4 (136)	0.050
Economic risk factors			
Annual household income			
Poverty (≤ 100% FPL)	15.7 (66)	21.9 (207)	0.009
Low income (101–199% FPL)	12.1 (51)	16.6 (157)	0.035
Above low income (≥200% FPL)	72.1 (303)	61.6 (583)	<0.001[2]
Employment			
Not employed full-time	58.3 (245)	64.3 (609)	0.035
Health-Related Quality of Life[b]			
Fair-to-poor general health	14.8 (62)	25.8 (244)	<0.001[2]
Poor physical health[c]	10.4 (42)	16.0 (140)	0.008
Frequent mental distress[d]	13.8 (55)	15.6 (139)	0.399
Household food security			
Food insecurity	24.0 (101)	29.5 (279)	0.039

[1] Difference in frequencies between urban and rural participants calculated with cross-tabulations and χ^2 statistic;

[2] Statistically significant after using Bonferroni correction for multiple comparison (Bonferroni-corrected p = 0.004).

[a] Nonwhite includes black or African Americans (urban = 47, 11.2%; rural = 95, 10%), Hispanics (urban = 33, 7.9%; rural = 36, 3.8%), and other races (urban = 19, 4.5%; rural = 5.1%)

[b] Cut-off scores for components of Health-Related Quality of Life: Fair-to-poor general health = fair or poor vs. excellent, very good, or good; Poor physical health = 14 or more physically unhealthy days in the past 30 days; Frequent mental distress = 14 or more mentally unhealthy days in the past 30 days.

[c] n = 1279 (urban = 404; rural = 875) due to missing data on healthy days of physical health.

[d] n = 1290 (urban = 399; rural = 891) due to missing data on healthy days of mental health.

Table 2

Unadjusted Prevalence of Self-reported Health-Related Quality of Life by Presence of Household Food Insecurity and Urban/Rural Residence, n=1367 women

	Urban			Rural		
	Household food security (*n* = 319)	**Household food insecurity (*n* = 101)**	***P*- value**	**Household food security (*n* = 668)**	**Household food insecurity (*n* = 279)**	***P*- value**
Health-Related Quality of Life						
Fair-to-poor general health	11.3	25.7	<0.001	18.3	43.7	<0.001
Poor physical health[a]	7.4	20.0	<0.001	11.7	26.6	<0.001
Frequent mental distress[b]	10.5	24.2	0.001	10.6	27.5	<0.001

[a] ≥14 days where physical health was not good (*n* = 404 urban and 875 rural women).

[b] ≥14 days where mental health was not good (*n* = 399 urban and 891 rural women).

Table 3

Adjusted Association of Demographic Characteristics, Economic Risk Factors, Household Food Supply, and Geographic Location with General Health, Physical Health, and Mental Distress among Urban and Rural Women[1]

Variable	Fair-to-poor general health (*n* = 1,367) OR (95% CI)	Poor physical health (*n* = 1,279) OR (95% CI)	Frequent mental distress (*n* = 1,290) OR (95% CI)
Demographic characteristics			
Age, years			
18–44	0.49 (0.32, 0.75)***	0.69 (0.43, 1.12)	2.50 (1.51, 4.12)***
45–64	1.12 (0.78, 1.60)	1.39 (0.91, 2.14)	2.13 (1.32, 3.45)**
Race			
Nonwhite[a]	1.52 (1.07, 2.16)*	1.16 (0.77, 1.75)	1.11 (0.76, 1.63)
Education			
< 12 years	2.70 (1.87, 3.91)***	2.25 (1.47, 3.45)***	1.90 (1.22, 2.96)**
Economic risk factors			
Annual household income[b]			
Poverty	1.68 (1.18, 2.39)**	2.06 (1.34, 3.15)***	1.28 (0.85, 1.93)
Low income	1.36 (0.92, 1.99)	2.13 (1.35, 3.34)***	1.24 (0.78, 1.96)
Employment			
Not employed full-time	1.80 (1.28, 2.52)***	2.29 (1.52, 3.45)***	1.75 (1.22, 2.52)**
Household food security			
Food insecurity	2.71 (1.96, 3.74)***	2.09 (1.46, 2.98)***	2.25 (1.59, 3.18)***
Geographic location			
Rural	1.70 (1.21, 2.38)**	1.31 (0.89, 1.95)	1.11 (0.77, 1.59)
Pseudo R^2 *of model*	0.141	0.117	0.073
Significance of χ^2 in model	<0.001	<0.001	<0.001

[1] All variables entered simultaneously; model estimated with White-corrected standard errors.

[a] Nonwhite includes black or African Americans, Hispanics, and “other races”

[b] Poverty = ≤ 100% FPL; Low income = 101–199% FPL

Table 4

Adjusted Association of Demographic Characteristics, Economic Risk Factors, and Household Food Insecurity with Fair-to-Poor General Health, by Urban/Rural Residence[1]

	Rural (n = 947)		Urban (n = 420)	
Variable	**OR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
Demographic characteristics				
Age (years)				
18–44	0.41 (0.25, 0.69)	0.001	0.58 (0.26, 1.30)	0.187
45–64	1.08 (0.72, 1.63)	0.700	1.16 (0.51, 2.63)	0.720
Race or ethnicity				
Nonwhite[a]	1.42 (0.94, 2.15)	0.098	2.08 (1.03, 4.17)	0.040
Education				
<12 years	3.15 (2.05, 4.84)	<0.001	1.62 (0.75, 3.48)	0.218
Economic risk factors				
Household income[b]				
Poverty	1.44 (0.96, 2.17)	0.077	2.72 (1.33, 5.58)	0.006
Low income	1.24 (0.80, 1.92)	0.334	1.77 (0.78, 4.02)	0.173
Employment				
Not employed full-time	1.52 (1.03, 2.23)	0.034	3.01 (1.42, 6.36)	0.004
Household food security				
Food insecurity	3.20 (2.20, 4.64)	<0.001	1.80 (0.92, 3.52)	0.084
Pseudo R^2 of model	0.135		0.135	
Significance of χ^2	<0.0001		<0.0001	

[1] All variables entered simultaneously; model estimated with White-corrected standard errors.

[a] Nonwhite includes black or African Americans, Hispanics, and “other races”

[b] Poverty = ≤ 100% FPL; Low income = 101–199% FPL

Table 5

Adjusted Association of Demographic Characteristics, Economic Risk Factors, and Household Food Insecurity with Poor Physical Health, by Urban/Rural Residence[1]

	Rural (n = 875)		Urban (n = 404)	
Variable	**OR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
Demographic characteristics				
Age, years				
18–44	0.72 (0.40, 1.27)	0.256	0.63 (0.25, 1.56)	0.314
45–64	1.53 (0.94, 2.48)	0.089	1.02 (0.41, 2.56)	0.957
Race/ethnicity				
Nonwhite[a]	1.28 (0.79, 2.09)	0.311	0.91 (0.42, 1.97)	0.804
Education				
<12 years	2.22 (1.35, 3.65)	0.002	2.45 (1.03, 5.82)	0.043
Economic risk factors				
Household income[b]				
Poverty	2.14 (1.30, 3.51)	0.003	1.68 (0.72, 3.89)	0.227
Low income	1.87 (1.10, 3.17)	0.021	3.12 (1.34, 7.26)	0.008
Employment				
Not employed full-time	2.49 (1.53, 4.05)	<0.001	1.85 (0.86, 3.98)	0.118
Household food security				
Food insecurity	1.99 (1.30, 3.04)	0.002	2.39 (1.26, 4.52)	0.008
Pseudo R^2 of model	0.115		0.111	
Significance of χ^2	<0.0001		<0.0001	

[1] All variables entered simultaneously; model estimated with White-corrected standard errors.

[a] Nonwhite includes black or African Americans, Hispanics, and “other races”

[b] Poverty = ≤ 100% FPL; Low income = 101–199% FPL

Table 6

Adjusted Association of Demographic Characteristics, Economic Risk Factors, and Household Food Insecurity with Frequent Mental Distress, by Urban/Rural Residence[1]

	Rural (n = 891)		Urban (n = 399)	
Variable	**OR (95% CI)**	***p*-value**	**OR (95% CI)**	***p*-value**
Demographic characteristics				
Age, years				
18–44	3.34 (1.84, 6.07)	<0.001	1.18 (0.47, 2.94)	0.718
45–64	2.43 (1.38, 4.29)	0.002	1.44 (0.57, 3.62)	0.435
Race/ethnicity				
Nonwhite[a]	1.16 (0.72, 1.85)	0.541	1.07 (0.56, 2.04)	0.844
Education				
<12 years	2.18 (1.30, 3.63)	0.003	1.25 (0.49, 3.19)	0.640
Economic risk factors				
Household income[b]				
Poverty	1.12 (0.69, 1.82)	0.649	1.99 (0.93, 4.26)	0.075
Low income	1.32 (0.77, 2.26)	0.309	1.02 (0.40, 2.58)	0.964
Employment				
Not employed full-time	1.88 (1.20, 2.92)	0.005	1.54 (0.82, 2.91)	0.179
Household food security				
Food insecurity	2.17 (1.40, 3.34)	<0.001	2.26 (1.26, 4.05)	0.006
Pseudo R^2 of model	0.088		0.054	
Significance of χ^2	<0.0001		<0.0001	

[1] All variables entered simultaneously; model estimated with White-corrected standard errors.

[a] Nonwhite includes black or African Americans, Hispanics, and “other races”

[b] Poverty = ≤ 100% FPL; Low income = 101–199% FPL