# Psychosocial Risk Factors for Food Insecurity in Puerto Ricans Living in the USA from Baseline to 5-Year Follow-Up

Nan Dou,[1] Dixin Xie,[1] Xiang Gao,[1] Natalia Palacios,[2,3,4] Luis M Falcon,[5] Katherine L Tucker,[2] and Muzi Na[1]

[1] Department of Nutritional Sciences, College of Health and Human Development, The Pennsylvania State University, University Park, PA, USA; [2] Department of Biomedical and Nutritional Sciences, University of Massachusetts Lowell, Lowell, MA, USA; [3] Department of Public Health, Zuckerberg College of Health Sciences, University of Massachusetts Lowell, Lowell, MA, USA; [4] Department of Veterans Affairs, ENRM VA Hospital, Bedford, MA, USA; and [5] College of Fine Arts, Humanities and Social Sciences, University of Massachusetts Lowell, Lowell, MA, USA

## ABSTRACT

**Background:** Food insecurity is prevalent among Puerto Rican adults in the USA and is associated with adverse psychosocial outcomes. However, the direction of this association has not been established in this understudied population.

**Objectives:** In this study, we aimed to examine the longitudinal association between a group of psychosocial risk factors and subsequent food insecurity in a cohort of Puerto Rican adults.

**Methods:** Secondary analysis was conducted using data from the prospective Boston Puerto Rican Health Study. A total of 517 Puerto Rican participants aged 45–75 y in the Boston area who were food secure at baseline, and who completed food security surveys at baseline and 5 y were included. Psychosocial factors, including depressive symptoms, stress, tangible social support, and acculturation were assessed with validated instruments. Multivariable logistic regression models were used to examine the risk of food insecurity at 5 y, as a function of psychosocial factors at baseline and their changes over 5 y, adjusting for age, sex, education, baseline and change in total annual household income, and in family size.

**Results:** The cumulative incidence of food insecurity at 5 y was 12.6%. The odds of incident food insecurity was significantly associated with baseline depressive symptom score [OR = 1.78 (1.16, 2.76) per each 10 score units], with change in depressive symptom score [OR = 1.50 (1.07, 2.09) per each 10-unit increase], and with change in perceived stress [OR = 1.59 (1.01, 2.51) per each 10-unit increase], after adjusting for potential confounders.

**Conclusion:** In this cohort of Puerto Rican adults, depressive symptoms at baseline, and increases in depressive symptoms and perceived stress over 5 y were associated with a higher risk of food insecurity. Psychosocial health and environment appear to play important roles in predicting risk of food insecurity in the Puerto Rican community. *J Nutr* 2020;150:2199–2203.

**Keywords:** food insecurity, Hispanic minorities, depression, stress, longitudinal study

## Introduction

Food insecurity is defined as "lacking secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life" (1). According to the USDA, 11.1% of US households experienced food insecurity in 2018 (2). The prevalence of food insecurity varied considerably among different subgroups and was particularly high among minority populations (3). Hispanics are the largest minority group in the USA, accounting for 18.1% of the total population (4). In 2018, 16.2% of households headed by Hispanics were food insecure, which was ~6 percentage points higher than the national average (2). Hispanic minorities may be more susceptible because of their unique psychosocial challenges, including limited acculturation (5), social isolation (6), and increased mental distress (7, 8). However, how the psychosocial environment determines access to food remains largely understudied in this minority population.

Concurrent food insecurity and adverse mental health status, such as depression and stress, have frequently been identified in cross-sectional studies. Pooling cross-sectional associations examined in 19 studies, a recent meta-analysis found that food insecurity was related to greater odds of depression (OR = 1.40, 95% CI: 1.30–1.58) and stress (OR = 1.34, 95% CI: 1.24, 1.44) (9). Although the temporality of these relations are not fully understood, a food-insecurity-to-poor-mental-health pathway has been more frequently conceptualized and examined according to a systematic review of existing longitudinal studies (10). There are several plausible explanations supporting this directional relation: 1) uncertainty over food acquisition provokes direct mental stress responses that may contribute to anxiety and depression; 2) compromises in food intake, in terms of quality and/or quantity increase risk of micronutrient deficiencies, some of which are critical to maintain healthy mental status; and 3) accessing foods in socially less acceptable ways can induce negative feelings of shame, anxiety, hopelessness, and guilt, which may result in compromised mental health (11). However, few studies have examined longitudinal effects of mental wellbeing on food insecurity, and these have been conducted with predominantly non-Hispanic white (12) or mixed-race samples (13, 14). To our knowledge, the longitudinal impact of the unique psychosocial environment among Hispanic minority populations on food equality has not been studied. The goal of this secondary data analysis was to explore how psychosocial risk factors, including depressive symptoms, perceived stress, tangible social support, acculturation, and changes in these factors over 5 y were associated with the risk of subsequent food insecurity in a cohort of Puerto Rican adults.

## Methods

### Participants

We used data from the Boston Puerto Rican Health Study, a prospective cohort of Puerto Rican adults, aged 45–75 y at baseline, residing in the Boston, MA area. Details of the study have been described previously (15). Briefly, participants were selected by stratified door-to-door enumeration and random sampling from Puerto Rican communities living in areas of high Hispanic density in the Greater Boston area. At baseline, 1502 Puerto Rican participants in the local communities were recruited, and 961 participants were followed-up at 5 y. We excluded participants who did not report food security status at baseline ($n = 26$) and/or at 5 y ($n = 3$), and those who reported being food insecure at baseline ($n = 255$). We also excluded participants with missing responses on questions regarding depressive symptoms, stress, tangible support, acculturation, age, sex, education, annual household income, or family size at baseline ($n = 58$) or 5-y follow-up ($n = 102$), leaving a total of 517 participants in our analytic sample.

### Assessment of food insecurity status

Food insecurity experience over the past 12 mo was assessed at both baseline and 5 y, using the 10-item USDA Household Food Security Survey module with household- and adult-referenced questions (16). Participants with <3 affirmative responses were categorized as "food secure," and those with ≥3 affirmative answers were categorized as "food insecure" per USDA food insecurity categorization guide (16).

### Assessment of psychosocial risks

Psychosocial risk factors, including depressive symptoms, perceived stress, tangible social support, and acculturation were assessed at both baseline and 5 y with questionnaires administered by bilingual interviewers in either Spanish or English (15). Depressive symptoms in the past week were assessed by the Center for Epidemiologic Studies

Depression Scale (CES-D) (17), which has been widely used in Hispanics (18) and older adults, with good validity (19). Participants reported the frequency of each depressive symptom on a 4-point Likert scale and a total score was calculated to represent overall depressive symptoms. The total score ranges from 0 to 60, with higher scores indicating more depressive symptoms.

Perceived stress was assessed by the Perceived Stress Scale (PSS). This scale has been widely used to measure recent stress and has been validated among the US Hispanic population (20). Participants reported the degree to which certain situations in their lives were considered stressful on a 5-point Likert scale, and a total score of perceived stress was calculated, yielding a total score from 0 to 40, with higher scores indicating higher stress.

Tangible social support was defined by the number of people within their social network who were able to provide support when needed, and how much support could be received. Two questions from the Norbeck Social Support Questionnaire (NSSQ) were administered to assess tangible support: 1) "If you need to borrow $10, a ride to the doctor, or some other immediate help, how much could this person usually help?" and 2) "If you were confined to bed for several weeks, how much could this person help you?" Participants were first asked to identify ≤16 people from their social network who may be able to provide support in the 2 hypothetical scenarios. Participants were then asked to report to what extent they could receive support from each identified person (0 = "not at all," 1 = "a little," 2 = "moderately," 3 = "quite a bit," and 4 = "a great deal"). We calculated the total level of tangible support in their social network by summing the total reported support in both scenarios. The total tangible support score ranged from 0 to 128, with a higher score indicating more tangible support in their social network.

Acculturation was assessed with the Bi-dimensional Acculturation Scale for Hispanics (BAS), which is a set of 7 questions on the use of English and/or Spanish in daily activities (5). Participants reported language use for usual activities such as reading, watching television, and talking to friends and family members. Responses were recorded on a 5-point Likert scale, with 1 being "only Spanish" and 5 being "only English." A corresponding acculturation scale that ranged from 0 to 100 was constructed with 0 representing the use of Spanish only, and 100 indicating the use of English only (15). Participants with a higher acculturation score indicated being more acculturated to the US culture.

To capture changes in psychosocial factors, depressive symptoms, stress, tangible support, and acculturation, differences in scores between 5 y and baseline (5 y – baseline) were calculated for each participant.

### Assessment of covariates

At baseline, information on age, sex, education, annual household income, and family size was collected by questionnaire. At 5 y, updated information on annual household income and family size was re-collected with the same procedure as the baseline interview. Total annual household income was categorized into quintiles, with 1 representing the lowest and 5 representing the highest income level. Differences in annual household income between 5 y and baseline (5 y – baseline) were calculated and further cut into quintiles.

### Statistical analysis

All statistical analyses were performed in Stata/SE 14.0 (Stata Corporation). Normality of total annual household income, family size, acculturation, depressive symptom score, perceived stress score, tangible social support, and their changes between baseline and 5 y were tested using the Skewness and Kurtosis normality test. Because of the nonnormal distribution of all but a few variables (perceived stress, change in depressive symptoms score, and change in stress score), we applied nonparametric tests to assess differences between food secure and insecure groups, using the Wilcoxon–Man–Whitney test, and within-person differences between baseline and 5 y, using the Wilcoxon signed ranks test.

Multivariable logistic regression models were applied to estimate ORs of food insecurity at 5 y as a function of psychosocial factors and their changes between the baseline and 5-y follow-up visits, adjusting for

age, sex, education, baseline total annual household income, change in total annual household income over 5 y, baseline family size, and change in family size over 5 y. Baseline scores for depressive symptoms, stress, tangible support, acculturation, and their changes between baseline and 5 y, were divided by 10 to estimate ORs of food insecurity at 5 y per 10-unit difference or increase in each of the examined variables.

## Results

In this sample of 517 Puerto Rican adults, the majority were women (70.2%), with mean ± SD age 57.4 ± 7.5 y; most had finished high school or had less education (84.1%). The cumulative incidence of food insecurity at 5 y was 12.6%.

Table 1 presents the characteristics and psychosocial factors at baseline and 5-y follow-up by food insecurity status at 5 y. The distribution of total annual household income was similar at baseline and 5 y, when comparing those food secure and food insecure at 5 y. The mean ± SD family size at baseline was 2.2 ± 1.4 and 2.4 ± 1.2 among food secure and food insecure adults (P = 0.035); corresponding family size decreased to 1.8 ± 1.1 and 2.1 ± 1.1 at 5 y (P = 0.002). At baseline, depressive symptoms and perceived stress scores were higher (P = 0.01 and 0.06, respectively), whereas the tangible support score was lower (P = 0.06) among food insecure, relative to food secure, individuals. Similarly, at 5 y, depression and stress scores were higher in the food insecure, relative to food secure, group (P < 0.001), whereas tangible support scores were comparable in the 2 groups at 5 y (P = 0.21). Acculturation scores were similar at baseline and 5 y between the 2 groups (P = 0.93 at baseline; P = 0.66 at 5 y). Over the 5-y follow-up period, mean ± SD depression score changed by −0.2 ± 12.1 and 1.5 ± 14.0 points in the food secure and food insecure groups, respectively (P = 0.45). Corresponding increases for the stress score were, respectively, 4.3 ± 11.8 and 5.8 ± 11.3 points (P = 0.29). Mean acculturation (food security: −2.7; food insecurity: −1.6) and tangible support scores (food security: −13.1; food insecurity: −6.1) decreased over 5 y in both food secure and food insecure groups, but differences across groups were only significant for tangible support (P = 0.04).

In the multivariable logistic regression model, participants had a 1.78 (95% CI: 1.16, 2.76, P = 0.009) times higher risk of being food insecure at 5 y for each 10-unit increase in depressive symptom score relative to baseline (Table 2). For each 10-unit increase in depressive symptom score and stress score over 5 y, participants had 1.50 (95% CI: 1.07, 2.09, P = 0.017) and 1.59 (95% CI: 1.01, 2.51, P = 0.046) times higher odds of being food insecure at 5 y, respectively. No significant association was found between baseline perceived stress, tangible support, acculturation, or changes in tangible support or acculturation on food insecurity at 5 y.

## Discussion

We examined associations between psychosocial risk factors, including depressive symptoms, perceived stress, tangible social support, acculturation, and their changes over 5 y, with subsequent food insecurity in this cohort of Puerto Rican adults living in Massachusetts. Depressive symptoms at baseline, worsened depressive symptoms, and worsened stress over the 5-y follow-up, were associated with higher risk of food insecurity at 5 y, after adjusting for demographic and socioeconomic factors. No significant associations were identified between

**TABLE 1** Distribution of characteristics and psychosocial factors by food insecurity status at 5 y in 517 Boston Puerto Rican Health Study participants at baseline and 5-y follow-up[1]

| | Baseline | | | 5 y | | | Δ (5-y baseline)[2,3] | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | FS at 5 y (N = 452) | FI at 5 y (N = 65) | P (FS vs. FI)[4] | FS at 5 y (N = 452) | FI at 5 y (N = 65) | P (FS vs. FI)[4] | FS at 5 y (N = 452) | FI at 5 y (N = 65) | P (FS vs. FI)[5] |
| Annual household income, USD[6] | 11,380 [8604, 20,215] | 11,880 [8472, 17,628] | 0.72 | 11,562 [10,714, 16,668] | 12,708 [10,740, 17,700] | 0.29 | 6065 ± 72,036+ | 236 ± 11,527 | 0.72 |
| Family size, n | 2.2 ± 1.4 | 2.4 ± 1.2 | 0.04 | 1.8 ± 1.1 | 2.1 ± 1.1 | 0.002 | −0.4 ± 1.4+ | −0.3 ± 1.2 | 0.40 |
| Acculturation score | 22.2 ± 21.2 | 22.0 ± 21.4 | 0.93 | 19.5 ± 1.3 | 20.3 ± 21.3 | 0.66 | −2.7 ± 15.8+ | −1.6 ± 13.3 | 0.47 |
| Depressive symptoms score | 18.4 ± 12.3 | 22.8 ± 13.5 | 0.01 | 18.2 ± 9.2 | 24.3 ± 9.5 | <0.001 | −0.2 ± 12.1 | 1.5 ± 14.0 | 0.45 |
| Perceived stress score | 22.4 ± 9.1 | 24.7 ± 9.2 | 0.06 | 26.8 ± 7.1 | 30.6 ± 7.7 | <0.001 | 4.3 ± 11.8+ | 5.8 ± 11.3+ | 0.29 |
| Tangible support score | 32.6 ± 20.2 | 27.5 ± 17.2 | 0.06 | 19.6 ± 15.0 | 21.4 ± 14.7 | 0.21 | −13.1 ± 21.4+ | −6.1 ± 20.1+ | 0.04 |

[1] Data are mean ± SD or median [IQR]. FI, food insecurity; FS, food security.
[2] Individual differences of total annual household income, household size, acculturation, depression, stress, and tangible support from baseline to 5 y.
[3] P of individual differences over 5 y were calculated by Wilcoxon signed-rank test. + Depicts the significant individual differences over 5 y at the P = 0.05 level.
[4] P of FS versus FI group differences in total annual household income, household size, acculturation, depression, stress, and tangible support were calculated using Wilcoxon–Man–Whitney tests.
[5] P of FS versus FI group differences in the 5-y change of total annual household income, household size, acculturation, depression, stress, and tangible support were calculated using Wilcoxon–Man–Whitney tests.
[6] Median and IQR were calculated for total annual household income; USD, US dollars.

**TABLE 2** Multivariable associations between psychosocial factors (per 10 point increase in score) and food insecurity at 5-y follow-up in 517 Boston Puerto Rican Health Study participants who were food secure at baseline[1]

| | Food insecurity at 5 y ($n = 517$) | |
| --- | --- | --- |
| | OR (95% CI) | P |
| Depressive symptom score at baseline | 1.78 (1.16, 2.76) | 0.009 |
| Change in depressive symptom score over 5-y follow-up | 1.50 (1.07, 2.09) | 0.017 |
| Stress score at baseline | 1.35 (0.67, 2.69) | 0.40 |
| Change in stress score over 5-y follow-up | 1.59 (1.01, 2.51) | 0.046 |
| Tangible support score at baseline | 0.91 (0.73, 1.14) | 0.41 |
| Change in tangible support score over 5-y follow-up | 1.07 (0.88, 1.32) | 0.45 |
| Acculturation at baseline | 1.01 (0.82, 1.26) | 0.93 |
| Change in acculturation over 5-y follow-up | 1.02 (0.82, 1.26) | 0.88 |

[1]Adjusted for demographic and socioeconomic factors including age, sex, education, household income, change in household income, family size, and change in family size.

acculturation or tangible social support and food insecurity. We identified trajectories of mental health, measured by worsened depressive symptoms and stress over 5 y, as novel risk factors for food insecurity at 5 y, independent of psychosocial factors examined at baseline. Focusing on understudied Hispanic minorities in the USA, our findings add to the current sparse data concerning the dynamic impact of multiple psychosocial factors on future food insecurity risk.

The detrimental impact of poor mental health on future risk of food insecurity, as seen in our study, is in line with results from a recent systematic review, which examined longitudinal associations between emotional wellbeing and food insecurity in 12 predominantly rural low-income populations in the USA (10). Three studies looked at the impact of depression on later food insecurity in general US populations, and all of these showed consistent results: adults with depression at baseline had 2–3 times increased risk of food insecurity at 1–5 y of follow-up (12–14). Among the 3 studies that examined bidirectional relations, all showed that depressive symptomatology at baseline was associated with subsequent food insecurity (21–23). Findings from our study further confirm the depression-food-insecurity relation in this Puerto Rican population. Beyond baseline status, changes in depressive symptoms over time were also associated with the risk of future food insecurity. This is a new finding, not tested in the abovementioned studies. In addition, we found that worsened stress, but not stress at baseline, was an independent risk factor for food insecurity at 5 y. Taken together, our findings indicate that continuous efforts should be considered to improve mental wellbeing in Puerto Rican adults, as the effort may lead to improved food equity and food access. More longitudinal studies are needed to examine the association between dynamic changes in mental health and subsequent food insecurity in the future.

In our study, tangible social support was not found to be a significant predictor for food insecurity over 5 y. However, a few previous studies have identified a protective role of social support. For example, compared to those with low community-level social capital, low-income individuals with higher community-level social capital had 53% (95% CI: 0.28, 0.81) lower odds of experiencing hunger, after accounting for membership in any social, civic, community, and religious organizations, length of time in apartment, household income, education and employment status of adult members, whether the household had children or had elderly members over

65 y, ethnicity, and whether the household was headed by a female with children (24). However, that study did not include depression or stress indicators. The protection of social support to later food insecurity was also seen in a longitudinal study of mothers of young children, whose higher support at baseline was associated with a 15% lower risk of being food insecure at 3 y, compared with mothers with lower support, adjusting for income, self-reported ethnic background, parity, previous parenting stress, and having a major maternal depression episode (25). Because lower social support is likely associated with greater depressive symptoms and stress (26), it is possible that some of the tangible support-food security association in our sample was explained, at least partially, by depression and stress. In addition, cross-sectional data from Latinos with diabetes in the USA (27), as well as other vulnerable populations (28), support the idea that social support may buffer against the negative associations between mental health and food insecurity. Therefore, tangible social support may be more crucial in people who are suffering mental distress, which may help explain the nondifferential influence of tangible support in food insecurity in the overall sample in our study.

Acculturation may play an important role in health among Hispanic and Latino minorities in the USA (29). However, we did not see any association between acculturation, at baseline or change over time, in relation to food insecurity at 5 y, or cross-sectionally at 2 y, as previously examined (5). However, a survey with 200 low-income Puerto Rican women in Hartford, Connecticut, found that speaking only Spanish was associated with 3.15 times (95% CI: 1.06, 9.34) higher risk of food insecurity, compared to those who spoke both English and Spanish (6). One explanation could be the predominant Spanish speaking sample that we have and our participants' small change in language acculturation over time (Table 1). The other explanation could be the complex linkages between low acculturation, increased mental distress (30), and food insecurity (10), which require future studies to further dissect.

There are several strengths in our study. First, the longitudinal design allowed us to assess future food insecure risk in relation to the dynamics of many psychosocial risk factors from baseline to 5-y follow-up. Second, our study is strengthened by the use of validated scales and measurement tools for accessing household food security and a number of psychosocial factors. Third, we controlled for some important time-varying demographic socioeconomic confounders, although residual confounding remains possible. There are also some limitations worth discussing. Self-reported data on psychosocial risk factors may introduce reporting bias, the direction of which is unknown. Depressive symptoms and perceived stress were measured for the past week and the past month, respectively; whereas food insecurity was recalled for the past 12 mo. The differences in recall period may cause measurement errors in assessing "usual" psychosocial factors in relation to the chronic food insecurity status. Unmeasured social or personal factors could affect depressive symptoms and perceived stress, which further influence future food insecurity. The majority of our sample (70.2%) were women and findings may not be generalizable to men, due to known sex differences in perceiving food insecurity and psychosocial experience (31, 32). Because we excluded ∼27% participants who were food insecure at baseline ($n = 255$), our study findings may only be generalizable to Puerto Ricans who share similar characteristics to our analytic sample. Lastly, future studies are warranted to test the potential interaction between psychosocial factors,

which cannot be fully explored in our study given the small sample size.

We found that adverse mental health was significantly associated with future risk of food insecurity in Puerto Ricans living in the USA. In addition to baseline depressive symptoms, the novel risk factors of future food insecurity identified in our study included the worsened trajectory of depressive symptoms and stress, suggesting that continuous efforts are needed to address adverse mental health conditions and to improve the psychosocial environment and food equality in Hispanic communities.

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