

Unemployment and household food hardship in the economic recession

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Abstract

Objective: The present study examined the association between unemployment and household food insecurity during the 2007–2009 economic recession in the USA.

Design: Longitudinal survey of the Survey of Income and Program Participation (SIPP; 2008–2011). Food insecurity was measured by five questions excerpted from an eighteen-item Food Security Scale. Unemployment was measured by a dichotomous indicator, the number of job losses and the total duration of all episodes in the observation period.

Setting: As nationally representative data, the SIPP interviewed respondents in multiple waves with a time interval of four months.

Subjects: The study created two analytic samples including working-age household heads employed at the beginning of the observation period. The size of the two samples was 14 417 and 13 080.

Results: Unemployment was positively associated with food insecurity (OR = 1.55; 95% CI 1.32, 1.83; $P < 0.001$). Similar results were obtained when the analysis controlled for food insecurity status measured before unemployment (OR = 1.54; 95% CI 1.27, 1.88; $P < 0.001$). For households with the same duration of unemployment, one more episode of unemployment increased the odds of food insecurity by 8% (OR = 1.08; 95% CI 1.00, 1.18; $P < 0.001$).

Conclusions: More in-depth understanding of the relationship between unemployment and food insecurity is useful to better identify and serve the at-risk population. Connecting unemployment assistance closely to nutrition assistance could lower the prevalence of food insecurity among unemployed households. Public policy should better account for both episodes and duration of unemployment to reduce food insecurity.

Keywords
Economic recession
Food insecurity
Job loss
Unemployment
SIPP

The unemployment rate in the USA during the latest economic recession increased from 5.0% in December 2007 to 10.0% in October 2009, and remained above 9.0% throughout the whole year of 2010⁽¹⁾. Personal unemployment leads to lost income, which increases the probability of experiencing food insecurity⁽²⁾. Food insecurity indicates households' inability to meet basic food needs and their insufficient access to adequate nutrition⁽³⁾. Food insecurity has been discussed to lead to a series of negative health outcomes across the lifespan^(4,5). Households with food insecurity report greater levels of mental health problems and chronic diseases and lower nutrient intakes^(6–10). Adverse consequence of food insecurity for children are particularly concerning in that food-insecure children are likely to experience physical symptoms such as headaches and stomach aches⁽¹¹⁾, coexistence of obesity⁽¹²⁾, hospitalization⁽¹³⁾, behavioural

problems⁽¹⁴⁾ or lower psychosocial health^(11,15). The findings regarding negative consequences of food insecurity are consistently reported by studies using large-scale national data and small community samples^(5,16,17). Recent statistics present that food insecurity is a national public health concern. The prevalence of household food insecurity rose to a decade-high between 2008 and 2011, and reached 14.9% by 2011⁽¹⁸⁾. The caseload of the Supplemental Nutrition Assistance Program (SNAP; i.e. food stamps) also increased significantly by about 50% between 2007 and 2011⁽¹⁹⁾; nearly one in seven Americans (46.2 million) participated in the SNAP by 2011⁽²⁰⁾.

Literature suggests that economic resources are one of the key determinants associated with the risk of food insecurity, along with racial and ethnic minority status, marital status, home ownership, age and education⁽²¹⁾. Roles of economic resources have been studied using

different economic indicators – for instance, poverty status, liquid assets and unemployment – to account for food insecurity in various ways beyond a simple link between food insecurity and income⁽⁵⁾. The present study focused on the relationship between unemployment and food insecurity, considering the recent economic recession and high unemployment rate. It is widely acknowledged that job loss or unemployment is one of the most important risk factors for household food insecurity^(3,22–24); unemployment mainly affects household food consumption through negative income shock and income volatility. Previous studies using nationally representative data show that the food insecurity rate is associated with the unemployment rate; households with no adult employed are more likely to experience food insecurity^(2,25). However, although unemployment appears a key factor predicting food insecurity, many studies investigate the relationship of food insecurity with poverty and food assistance programmes^(17,21,26) while fewer studies examine the relationship of food insecurity with unemployment with closer attention to the characteristics of unemployment^(2,27). Individual unemployment status is often included as a dichotomous control variable in the research on food insecurity; several studies with unemployment status as a primary independent variable often focus solely on specific sub-populations (e.g. those receiving public assistance or single mothers)^(27,28).

The lack of research on the link between unemployment and food insecurity for the population at large may be based on the assumption that unemployment is an adverse event leading to income loss and negative income shock is the direct cause of food insecurity, but previous literature overlooks specific functions of unemployment in predicting food insecurity. We argue that it is important to understand the association between unemployment and food insecurity since food insecurity results from competing demands for constrained resources⁽²⁹⁾ and multiple measures of unemployment may depict specific pathways from a job loss to food insecurity. More in-depth understanding of the relationship between aspects of unemployment and food insecurity is useful for nutrition and food assistance services to better identify and serve the at-risk populations. A more thorough understanding of this relationship informs important policy implications.

Therefore the present study examined the link between unemployment and food insecurity in the 2007–2009 economic recession using the longitudinal data from the 2008 panel of the Survey of Income and Program Participation (SIPP) in the USA. We focused on sample respondents who were employed at the beginning of the observation period. In addition to a dichotomous indicator of unemployment, we measured unemployment status from multiple aspects, including the number of job losses and the total duration of all episodes of unemployment during the observation period. We aim to contribute to comprehensive understandings of unemployment and

food insecurity and provide generalizable findings by employing the large-scale panel data collected from a nationally representative sample.

Methods

Data and sample

Including continuous series of panels since 1984, the SIPP is a longitudinal household survey operated by the US Census Bureau. The SIPP panel ranges from 2.5 to 4 years, and has a sample size from 14 000 to 36 700 households⁽³⁰⁾. In each panel, the SIPP interviews respondents in multiple waves with a time interval of four months to collect information about their previous four months (i.e. the reference period or reference months of each wave). Since the 1996 panel, the SIPP has included a five-item food insecurity scale in one or two waves of interviews (i.e. Wave 8 in the 1996 and 2001 panels, Wave 5 in the 2004 panel, and Waves 6 and 9 in the 2008 panel).

To examine the research questions discussed above, the present study created two analytic samples from the 2008 panel. The first sample used the data in the first six waves with an observation period from September 2008 to August 2010. We limited the first sample to working-age household heads (aged 16–60 years in Wave 1; n 21 063). The SIPP defines individuals above 15 years as the working-age population, and collects employment information from this population. Following previous literature⁽³¹⁾, we further limited the working-age population to those aged 60 years and below because individuals older than 60 years may have different options (e.g. early retirement) when losing a job. We only included household heads who were employed in the first week of the reference period in Wave 1 (n 15 856) because the research questions are focused on the association between food insecurity and the change of employment status from being employed to unemployed. In addition, household heads who did not complete all six waves' interviews (n 1383) or lived in group quarters (n 46) were excluded; the final analytic sample included 14 417 household heads.

The second sample used the data from Waves 6 to 9 in the 2008 panel with an observation period from May 2010 to August 2011. The purpose of creating this second sample was to conduct comparison analyses with those on the first sample. Since the 2008 SIPP collected the information on food insecurity in both Waves 6 and 9, this second sample allowed the study to estimate the relationship between unemployment and food insecurity by controlling for food insecurity in Wave 6. In the second sample, we included working-age household heads (aged 16–60 years in Wave 6) who were employed in the last week of the reference period in Wave 6 (n 13 847). In addition, household heads who did not complete all four interviews from Waves 6 to 9 (n 736) or lived in group quarters (n 31) were excluded; the second sample had a size of 13 080 household heads.

Measures

Outcome

Collected in Waves 6 and Wave 9, household food insecurity was measured by five questions excerpted from the US Department of Agriculture's eighteen-item Food Security Scale⁽³²⁾. Food insecurity questions inquired about the frequency of particular food consumption behaviours (e.g. could not afford to eat balanced foods, cut the size of meals or skipped meals) in the reference period of four months. Although this particular set of items does not constitute a standard scale of food insecurity, a previous assessment using the Rasch measurement model suggests that it is a reasonably reliable measure of food insecurity⁽³³⁾. Previous studies have constructed food insecurity scores based on this five-item scale⁽³⁴⁾. According to participants' responses to these five questions, households reporting 'often true' or 'sometimes true' on at least two questions were considered food insecure (food insecurity = 1).

Independent variables

The SIPP recorded weekly employment status of individuals in the observation period (from September 2008 to August 2010 for the first sample (104 or 105 weeks depending on the interview time of sample respondents) and from May 2010 to August 2011 (69 or 70 weeks) for the second sample). The weekly employment status included the following categories: (i) 'With job, working'; (ii) 'With job, absent without pay but not on layoff'; (iii) 'With job, absent without pay and on layoff'; (iv) 'No job, looking for work or on layoff'; and (v) 'No job, not looking for work and not on layoff'. Those reporting the third or fourth category were coded as '1' on the dichotomous indicator of unemployment (unemployment = 1), and those reporting other categories were coded as '0' (unemployment = 0). Respondents reporting the fifth category (i.e. 'No job, not looking for work and not on layoff') were considered to be out of the labour force instead of being unemployed; they may have retired from work, returned to school or have disability conditions not allowing for work. We created a dichotomous indicator of being out of the labour force separately and included it in the analysis as a control variable; those without a job and not looking for work were coded as '1' on this indicator and others were coded as '0'.

Based on the weekly information, the study created three variables to measure different aspects of unemployment status during the observation period. The first one is a dummy variable indicating whether household heads experienced unemployment or not during the observation period (yes = 1, no = 0). The second one counts the episodes of job losses during the observation period; the episode variable is top-coded at 5 because only a small proportion of respondents had more than five layoffs (0.87%). The third variable measures the total duration of all episodes of unemployment (number of weeks).

Control variables

The study included several demographic characteristics in Wave 1 as control variables, such as household heads' age, gender, race (Non-Hispanic White; Non-Hispanic Black; Hispanic; others), education (high school and below; some college; four-year college and above), marital status (married; others) and citizenship (citizen or not). Several household characteristics were added into analyses as well, including income-to-needs ratio, assets-to-needs ratio, participation in the SNAP, access to social support, household type (couple-headed; male-headed; female-headed), number of household members, number of children living in the household, home ownership (home owners; others) and metro status (metro; others). The metro status variable identifies whether participants lived in one of ninety-three MSA (Metropolitan Statistical Areas) and CMSA (Consolidated Metropolitan Statistical Areas), as defined by the US Office of Management and Budget. Using the average income from four reference months in Wave 1, we created an income-to-needs ratio variable that categorized the sample into three groups: (i) those with average income below 200% of the monthly poverty threshold; (ii) those with average income between 200% and 400% of the monthly threshold; and (iii) those with average income above 400% of the monthly threshold. The monthly poverty threshold is the annual federal poverty line divided by 12. To calculate assets-to-needs ratio, we added up the equities in bank accounts, retirement accounts, stocks, mutual funds and other assets collected in Wave 4. The equities in home, business, vehicle and other real estate were not included because it may not be easy to liquidize these assets during economic hardship. We then compared the value of liquid assets with the monthly poverty threshold and categorized the sample households into two groups using a measure of assets-to-needs ratio: (i) those with liquid assets equal to or below three times the monthly poverty threshold; and (ii) those with liquid assets above three times the monthly threshold. The first category indicates that households do not have sufficient liquid assets to cover household minimum consumption for three months; the literature on asset poverty generally defines the first group of households as being asset-poor⁽³⁵⁾. The scale of access to social support was created from three survey questions included in the wave when the information on food insecurity was collected. These questions asked, when needed, whether respondents' households can have all of the help (3), most of the help (2), very little of the help (1) or no help (0) from their family living nearby, from friends and from a social agency or a church, respectively. The sum of these three questions, ranging from 0 to 9, is defined as respondents' access to social support. A higher value indicates a higher level of social support available for sample respondents. As discussed above, an indicator of whether sample respondents have been out of the labour force during the observation period was also included in

analyses. Our analyses also controlled for state fixed effects, which used one state as a reference group and then added other states' dummy indicators in models.

Statistical analyses

Analyses for the first sample

Since food insecurity is dichotomous, a series of logit models was conducted in the statistical software package STATA version 13.1 to examine the proposed research questions. First, the regression of the outcome measure *v.* each of the independent variables, respectively, was performed, along with control variables (models 1–3 in Table 2). We also ran a logit model using both the episodes and the duration of unemployment as predictors (model 4 in Table 2).

Analyses for the second sample

We repeated a specific analysis (model 1 in Table 2) on the second sample to predict respondents' food insecurity in Wave 9 and added their food insecurity in Wave 6 as a control variable. That is, the association between a dichotomous measure of unemployment and food insecurity was estimated in logit models with lagged dependent variables in Wave 6. The analyses on the second sample may provide more accurate estimates because the lagged dependent variable can be considered a proxy or instrument that takes into account unobserved confounders affecting both food insecurity and employment status.

We had two sets of supplemental tests. First, a household may contain more than one family in SIPP; the first supplemental test limited the samples to the households only including a primary family. The second one repeated the analyses discussed above to sample respondents with income-to-needs ratio below 2. Overall, the supplemental tests did not have results substantively different from those in the main analyses. All analyses were adjusted using the longitudinal household weight variable provided by the SIPP.

Results

Sample characteristics

As shown in the first column of Table 1, the mean age of household heads included the first sample was 42.2 (SD 10.6) years at Wave 1 and about half of these respondents were male (53%). The majority of sample respondents were non-Hispanic White (71%), nearly three-quarters had at least some college experiences and more than half (56%) were married. In terms of household characteristics, nearly two-thirds were led by couples, slightly higher than the reported marital rate. The average household size was 2.7 (SD 1.4) and the mean number of children living in the household was 0.9 (SD 1.2). Nearly 70% of sample respondents were home owners.

Table 1 Descriptive statistics of sample characteristics, Survey of Income and Program Participation (SIPP), 2008–2011

Variable	Mean, SD or percentage	
	First sample	Second sample
Demographic characteristics		
Age (years)		
Mean	42.2	42.2
SD	10.6	10.6
Male (%)	53.0	53.3
Race (%)		
Non-Hispanic White	70.5	69.3
Non-Hispanic Black	11.1	11.5
Hispanic	12.4	13.2
Others	6.0	6.1
Education (%)		
High school or below	26.2	27.4
Some college	37.2	36.0
Bachelor or above	36.6	36.6
Married (%)	56.0	54.6
Citizens (%)	93.2	93.0
Household type (%)		
Couple-headed	64.8	67.8
Male-headed	6.1	6.9
Female-headed	29.1	29.3
Household size		
Mean	2.7	2.8
SD	1.4	1.5
Number of children		
Mean	0.9	1.0
SD	1.2	1.2
Home owners (%)	68.8	66.9
Residence: metro (%)	81.5	82.0
Monthly income (\$US)		
Mean	6586.6	6194.8
SD	5690.3	5493.4
Income-to-needs ratio		
Below 2	20.1	24.3
2 to 4	32.2	32.5
Above 4	46.9	43.3
Liquid assets* (\$US)		
Mean	97 071.0	87 645.3
SD	657 734.2	686 148.4
Assets-to-needs ratio: below 3 (%)	45.2	44.9
Recipient of SNAP† (%)	7.3	5.8
Access to social support‡		
Mean	5.3	5.2
SD	2.5	2.4
Outcome variable‡		
Food insecurity (%)	9.7	9.7
Independent variables‡		
Unemployed (%)	17.8	11.1
Episodes of unemployment		
Mean	0.3	0.1
SD	0.8	0.5
Total duration of unemployment (weeks)		
Mean	4.0	1.5
SD	12.5	5.9
Out of the labour force (%)	12.0	7.2
Sample size	14 417	13 080

SNAP, Supplemental Nutrition Assistance Program.

If not mentioned otherwise, all variables were collected in Wave 1.

*Variables were collected in Wave 4.

†Variables were collected in Wave 6 for sample 1 and Wave 9 for sample 2.

‡Variables were collected in Waves 1 to 6 for sample 1 and in Waves 6 to 9 for sample 2.

Nearly 10% of participants had food insecurity at Wave 6. Nearly 18% of household heads experienced job loss during the observation period. The mean episodes of

unemployment was 0.3 (SD 0.8) in the whole sample, and was 1.7 (SD 1.1) among those with unemployment experiences. The mean duration of all episodes of unemployment was 4.0 (SD 12.5) weeks for the whole sample; if limiting the sample to those with unemployment experiences, the mean duration was 22.6 (SD 21.3) weeks. About one out of eight household heads had been out of the labour force and half of them also reported unemployment experiences.

Nearly 50% of sample households had an average monthly income four times higher than the monthly poverty threshold in Wave 1, 30% had income between two and four times the poverty threshold and 20% had average monthly income below two times the poverty threshold. Regarding liquid assets, nearly 50% had liquid assets insufficient to live at the federal poverty level for three months. About 7% of households in the sample were recipients of SNAP. The mean access to social support reported by households in the sample was 5.3 (SD 2.5). As shown in the second column of Table 1, descriptive statistics of these variables for the second sample were similar to those of the first sample.

Table 2 lists demographic characteristics of the unemployed household heads in the first sample by food insecurity. Nearly 15% of the unemployed heads reported food insecurity. It is clear that the unemployed heads experiencing food insecurity had a more disadvantaged socio-economic background than those without food insecurity and lower education, income and likelihood to own a house, but a higher probability to receive nutrition assistance.

Unemployment and food insecurity

Table 3 demonstrates the relationships between different aspects of unemployment and food insecurity in the first sample. In model 1, the odds of food insecurity for those with unemployment experiences were about 1.6 times higher than for those without unemployment experiences (OR = 1.55; 95% CI 1.32, 1.83; $P < 0.001$). The estimated marginal effect of unemployment in model 1 was about 3.1 percentage points: when all other control variables were held at their means, the change from being employed to unemployed increased the probability of food insecurity from 6.1% to 9.2%. Model 2 used the number of job losses to replace the dichotomous measure and showed that one more episode of unemployment increased the odds of food insecurity by about 20% (OR = 1.20; 95% CI 1.12, 1.28; $P < 0.001$). Results of model 3 with the duration of unemployment as a predictor of food insecurity suggested that a one-week increase in unemployment duration raised the odds of food insecurity by about 1% (OR = 1.01; 95% CI 1.01, 1.02; $P < 0.001$).

Model 4 used both the episodes and duration of unemployment to predict food insecurity because the number of job losses may be confounded with the

Table 2 Sample characteristics of the unemployed household heads by food insecurity status, Survey of Income and Program Participation (SIPP), 2008–2010

Variable	Mean, sd or percentage	
	Food insecure	Food secure
Demographic characteristics		
Age (years)		
Mean	38.3	40.7
SD	12.0	12.4
Male (%)	43.0	48.4
Race (%)		
Non-Hispanic White	52.4	67.8
Non-Hispanic Black	16.6	13.1
Hispanic	23.3	12.9
Others	7.8	6.3
Education (%)		
High school or below	45.9	27.7
Some college	40.7	39.9
Bachelor or above	13.5	32.4
Married (%)	36.0	52.1
Citizens (%)	88.3	92.1
Household type (%)		
Couple-headed	35.6	50.3
Male-headed	26.4	22.3
Female-headed	37.9	27.3
Household size		
Mean	2.7	2.6
SD	1.5	1.4
Number of children		
Mean	1.0	0.8
SD	1.3	1.2
Home owners (%)	36.4	59.7
Residence: metro (%)	83.4	81.2
Monthly income (\$US)		
Mean	3568.1	5840.3
SD	3613.2	5565.4
Income-to-needs ratio (%)		
Below 2	54.5	30.4
2 to 4	29.3	28.8
Above 4	16.2	40.1
Liquid assets* (\$US)		
Mean	702.3	71 426.0
SD	71 304.7	206 192.9
Assets-to-needs ratio: below 3 (%)	81.2	44.1
Recipient of SNAP† (%)	32.3	14.1
Access to social support‡ (%)		
Mean	4.4	5.4
SD	2.3	2.5

SNAP, Supplemental Nutrition Assistance Program.

If not mentioned otherwise, all variables were collected in Wave 1.

*Variables were collected in Wave 4.

†Variables were collected in Wave 6 for sample 1 and in Wave 9 for sample 2.

duration measure in the analysis. Both the number of job losses and the duration of unemployment were still statistically significant, while inclusion of the duration measure reduced the odds ratio of the episodes of unemployment (from 1.20 in model 2 to 1.08 in model 4). For household heads with the same duration of unemployment, one more episode of unemployment increased the odds of food insecurity by 8% (OR = 1.08; 95% CI 1.00, 1.18; $P < 0.001$).

Other variables included in Table 3 had expected results. Income-to-needs ratio, assets-to-needs ratio and access to social support were all negative predictors of food

Table 3 Logit regression results for the first sample: unemployment and food insecurity (*n* 14 417), Survey of Income and Program Participation (SIPP), 2008–2010

Variable	Food insecurity							
	Model 1		Model 2		Model 3		Model 4	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Unemployed	1.55***	1.32, 1.83						
Episodes of unemployment			1.20***	1.12, 1.28			1.08*	1.00, 1.18
Duration/weeks of being unemployed					1.01***	1.01, 1.02	1.01***	1.01, 1.02
Income-to-needs ratio (reference: below 2)								
2 to 4	0.73***	0.62, 0.86	0.73***	0.62, 0.85	0.72***	0.61, 0.84	0.72***	0.61, 0.84
Above 4	0.48***	0.39, 0.59	0.48***	0.39, 0.59	0.47***	0.39, 0.58	0.48***	0.39, 0.59
Assets-to-needs ratio: 3 and above	0.58***	0.49, 0.68	0.57***	0.49, 0.68	0.58***	0.50, 0.69	0.59***	0.50, 0.69
SNAP recipient	1.43***	1.16, 1.76	1.46***	1.18, 1.80	1.38**	1.13, 1.70	1.38**	1.13, 1.69
Access to social support	0.83***	0.80, 0.85	0.83***	0.80, 0.85	0.83***	0.80, 0.85	0.83***	0.80, 0.85

SNAP, Supplemental Nutrition Assistance Program.

Analyses also controlled for the demographic variables listed in Table 1. The results on these demographic variables are not reported. Models 1 to 4 are logit analyses using different measures of unemployment. Model 1 performs the regression of food insecurity *v.* the dummy indicator of unemployment (whether household heads experienced unemployment or not during the observation period); model 2 does the same *v.* the number of episodes of unemployment; model 3 does the same *v.* the total duration of all episodes of unemployment (number of weeks); model 4 uses both the episodes and the duration of unemployment as predictors.

P* < 0.05, *P* < 0.01, ****P* < 0.001.

Table 4 Logit regression results with lagged dependent variable for sample 2: unemployment and food insecurity (*n* 13 080), Survey of Income and Program Participation (SIPP), 2008–2011

Variable	Food insecurity	
	OR	95 % CI
Unemployed	1.54***	1.27, 1.88
Income-to-needs ratio (reference: below 2)		
2 to 4	0.80*	0.67, 0.95
Above 4	0.45***	0.36, 0.57
Assets-to-needs ratio (reference: below 3)		
3–24	0.85	0.69, 1.04
Above 24	0.63***	0.51, 0.79
SNAP recipient	1.49***	1.16, 1.92
Access to social support	0.81***	0.78, 0.83
Food insecurity in Wave 6	5.00***	4.21, 5.94

SNAP, Supplemental Nutrition Assistance Program.

This logit analysis used food insecurity measured in Wave 9 as the dependent variable and controlled for food insecurity measured in Wave 6. Since food insecurity in Wave 6 preceded the one in Wave 9, it was considered a lagged dependent variable. Analyses also controlled for the demographic variables listed in Table 1. The results on these demographic variables are not reported.

P* < 0.05, **P* < 0.001.

insecurity, with odds ratios smaller than 1. Consistent with previous literature⁽³⁶⁾, SNAP participation was a positive predictor of outcome measures, due to the selection into the SNAP by households with food insecurity.

Unemployment and food insecurity in analyses with lagged dependent variables

All the analyses above are correlation-based, and the estimated relationship between unemployment and food insecurity could be biased by omitting unobserved confounders that affect both food insecurity and employment status. Table 4 presents the results of lagged-dependent-variable analyses to predict respondents' food insecurity at Wave 9 on the second sample. Consistent with model 1 in

Table 3, the odds ratio of unemployment was still statistically significant. The odds of food insecurity for those with unemployment experiences was about 1.5 times higher than for those without unemployment experiences (OR = 1.54; 95 % CI 1.27, 1.88; *P* < 0.001); the estimated marginal effect of unemployment on food insecurity was about 3.4 percentage points.

Discussion

The present study examined the change of employment status among working-age household heads in the 2008 panel of SIPP and its association with food insecurity in the recent economic recession. In addition to the dummy measure of unemployment, we examined other characteristics of unemployment, such as the number of job loss episodes and the total duration of all episodes of unemployment.

During September 2008 to August 2010, nearly 20 % of sample respondents had unemployment experiences. This rate cannot be directly compared with the national unemployment rate for the population aged 16 years and over (e.g. 6.1 % in September 2008 and 9.5 % in August 2010)⁽¹⁾, as it cumulates all unemployment experiences of sample respondents during the observation period. At the end of this observation period, 10 % experienced food insecurity. The food insecurity rate is lower than the national household food insecurity rate in 2010 (14.5 %) probably because of the selection criteria of the sample (e.g. being employed at Wave 1).

As expected, unemployment was positively related to the probability of food insecurity. This finding is consistent with national data reporting that household food insecurity is positively associated with the national unemployment rate⁽²⁾. The estimated marginal effect shows that

household heads experiencing job loss were 33% more likely to report food insecurity in model 1 of Table 3. The association between unemployment and food insecurity held even in the lagged-dependent-variable analyses (Table 4). After controlling for food insecurity in Wave 6, the estimated marginal effect shows that household heads experiencing unemployment between Waves 7 and 9 were about 30% more likely to report food insecurity. Negative income shocks caused by unemployment of household heads clearly seem to affect household food insecurity.

The present study broadens the understandings of the relationship between unemployment and food insecurity by expanding findings from the previous studies that use a binary indicator of unemployment. Other characteristics of unemployment measured in the present study were also associated with the likelihood of experiencing food insecurity: namely, both the episodes and duration of unemployment increase the risk of food insecurity. In particular, with the same duration of unemployment in the observation period, one more episode of unemployment increased the odds of food insecurity by 8% (model 4 of Table 3). One previous study⁽²³⁾ also suggests that episodes of unemployment are related to food insecurity. Our results (Table 3) consistently show supportive evidence that multiple episodes of unemployment (i.e. transitions between employment and unemployment) not only increase the amount of time in unemployment, but also impose additional risk of food insecurity. For example, unemployment as a stressor may create a high level of distress and affect family relationships and interactions negatively^(37,38). Each episode of unemployment also increases the risk of poverty and social exclusion from personal networks and institutions, and therefore may increase the risk of food insecurity^(39,40). These could be the reason why, with the same duration of unemployment, those experiencing multiple job losses are more vulnerable to food insecurity than their counterparts.

Limitations

We note that our study has some limitations. First, our empirical findings mainly show correlational association. Using observational data, we may not claim the causal impacts of unemployment on food insecurity. Second, the dynamics of change in employment status over the observation period could be more complicated than what we measured in the study; for instance, by types of employment (e.g. full-time, part-time) or occupation. Yet the study did not fully capture other possibilities regarding change in employment status. We did not investigate the change of employment status experienced by other household members as well. In addition, some important predictors that are tied to both food insecurity and unemployment, such as mental health status and disability status, were not included in analyses. It should also be noted that individual unemployment status aggregated from the longitudinal information may suffer from seam

bias in the SIPP, which indicates that the tendency of a disproportionate number of changes often occurs between waves in longitudinal panel surveys⁽⁴¹⁾.

Policy implications

The results of the present study have public policy implications to reduce food insecurity and improve nutritional intake for those experiencing unemployment. First, unemployment is clearly linked to food insecurity and is an indicator of households' needs for food and nutrition assistance for many households, even including those with higher incomes. Access to public assistance can serve to reduce material hardship, including food insecurity⁽⁴²⁾. Connecting unemployment assistance more closely to public food and nutrition assistance, such as the SNAP, could assist to lower the prevalence of food insecurity among unemployed households. For example, applications and eligibility for food assistance and unemployment benefits could be connected to encourage households who apply for unemployment assistance to be screened for public food assistance programme eligibility. Closer linkage of unemployment and food and nutrition assistance may especially benefit higher-income households experiencing food insecurity due to significant income volatility resulting from unemployment, because higher-income households are less likely than lower-income households to be familiar with and seek help from public assistance programmes due to such factors as stigma, unfamiliarity and lack of belief that their family could be eligible⁽⁴³⁾.

Second, reducing application barriers alone is insufficient and other measures to encourage participation are needed⁽⁴⁴⁾. Public food and nutrition assistance policy could also be shaped to respond to income volatility for those with significant assets that cannot be quickly liquidized to cash. This could occur by changing eligibility rules to account for the volatility, the amount of current income, as well as for non-liquid assets. Adding eligibility criteria to account for sudden drops of income through unemployment and allowing for higher value of assets could increase participation by households who were higher-income prior to an episode of unemployment.

Third, public policy could better account for both episodes and duration of unemployment to reduce food insecurity. Those with multiple episodes of unemployment are more vulnerable to food insecurity, which could be a result of the inability of public assistance bureaucracies to respond quickly enough to rapid employment changes for households. To reduce food insecurity, food and nutrition assistance programmes could have more flexible eligibility rules that provide assistance after households resume employment, as well as streamline the application, certification and approval process and expedite the delivery of assistance benefits for past beneficiaries whose employment status changes. Loosening food assistance eligibility rules can assist to reduce the social ills and public health

problems that accompany unemployment, including food insecurity, and increase participation^(45–47).

Conclusions

The present study concludes that while negative income shocks caused by unemployment clearly affect household food insecurity, several factors are important to consider in policy and practice efforts to mitigate food insecurity for households. While the number of episodes and duration of unemployment both increase the risk of food insecurity, the number of episodes is an especially significant risk factor. Similarly important is to consider pre-unemployment income in mitigation efforts – income volatility most affects the risk of higher-income households to food insecurity, while level of income most affects the risk for lower-income households. Finally, access to food assistance programmes plays an invaluable mitigating role in lowering food insecurity risk.

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