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Food and Nutrition Insecurity: Experiences That Differ for Some and Independently Predict Diet-Related Disease, Los Angeles County, 2022

Michelle Sarah Livings [1,*], Wändi Bruine de Bruin [2,3,4,5], Natasha Wasim [6], John P Wilson [6,7,8,9,10,11], Bruce Y Lee [12,13], Kayla de la Haye [2,5,7]

[1] *Center for Research on Child and Family Wellbeing, School of Public and International Affairs, Princeton University, Princeton, NJ, United States;* [2] *Department of Psychology, Dornsife College of Letters, Arts, and Sciences, University of Southern California, Los Angeles, CA, United States;* [3] *Sol Price School of Public Policy, University of Southern California, Los Angeles, CA, United States;* [4] *Schaeffer Center for Health Policy and Economics, University of Southern California, Los Angeles, CA, United States;* [5] *Center for Economic and Social Research, University of Southern California, Los Angeles, CA, United States;* [6] *Department of Population & Public Health Sciences, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States;* [7] *Spatial Sciences Institute, Dornsife College of Letters, Arts, and Sciences, University of Southern California, Los Angeles, CA, United States;* [8] *Department of Sociology, Dornsife College of Letters, Arts, and Sciences, University of Southern California, Los Angeles, CA, United States;* [9] *Department of Civil and Environmental Engineering, Viterbi School of Engineering, University of Southern California, Los Angeles, CA, United States;* [10] *Department of Computer Science, Viterbi School of Engineering, University of Southern California, Los Angeles, CA, United States;* [11] *School of Architecture, University of Southern California, Los Angeles, CA, United States;* [12] *Department of Health Policy and Management, Graduate School of Public Health and Health Policy, City University of New York, NY, United States;* [13] *Center for Advanced Technology and Communication in Health, City University of New York, NY, United States*

A B S T R A C T

Background: National surveillance shows that food insecurity affects ~1 in 10 Americans each year. Recently, experts have advocated for surveillance of nutrition insecurity alongside food insecurity. Nutrition security refers to the nutritional adequacy of accessible food and factors that impact one's ability to meet food preferences.
Objectives: This study presents representative estimates of food insecurity and nutrition insecurity for Los Angeles County, CA, United States; compares predictors of these constructs; and examines whether they independently predict diet-related health outcomes.
Methods: In December 2022, a representative sample of Los Angeles County adults participating in the Understanding America Study (N = 1071) was surveyed about household food insecurity and nutrition insecurity over the past 12 months. Data were analyzed in 2023.
Results: Reported rates were similar for food insecurity (24%) and nutrition insecurity (25%), but the overlap of these subgroups was less than 60%. Logistic regression models indicated that non-Hispanic Asian individuals had higher odds of nutrition insecurity but not food insecurity. Moreover, nutrition insecurity was a stronger predictor of diabetes compared with food insecurity, and both constructs independently predicted poor mental health.
Conclusions: Food and nutrition insecurity affect somewhat different populations. Both constructs are valuable predictors of diet-related health outcomes. Monitoring nutrition insecurity in addition to food insecurity can provide new information about populations with barriers to healthy diets.

Keywords: nutrition insecurity, food insecurity, chronic disease, diabetes, mental health

Introduction

Food insecurity is defined as not having access to enough food to maintain a healthy lifestyle due to limited money or resources and is characterized by reduced food intake [1]. About 1 in 10 residents of the United States experienced food insecurity every year since 2018 [1], a rate that is likely underestimated [2]. The consequences of food insecurity include poor nutrition, increased risk of chronic disease [3], and poor mental health [4].

As millions of residents in the United States experience food insecurity each year despite living in a country with plenty of

Abbreviations: CI, confidence interval; FPL, federal poverty level; L.A., Los Angeles; SNAP, Supplemental Nutrition Assistance Program; Swanson, Gretchen Swanson Center for Nutrition; UAS, Understanding America Study.

* Corresponding author. *E-mail address:* ML3501@princeton.edu (M.S. Livings).

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food, food insecurity research and surveillance is critical [5,6]. However, a limitation in the United States and other high-income countries is the focus on having "enough food" without considering nutrition or diet quality [7]. Nutrition security is a broader construct that captures the nutritional adequacy of accessible food [8]. Some definitions of nutrition security also consider factors that impact the ability to meet one's food preferences, including foods aligned with cultural or religious dietary requirements of individuals, as well as other dietary constraints such as taste preferences and food allergies [9]. Indicators of nutrition insecurity are widely used in low- and middle-income countries where undernutrition and staple food shortages are key public health threats [10,11]. However, although high-income countries typically have sufficient food for their populations [12], people's spatial, financial, and cultural access to nutritious food is often inequitable [13,14]. Because unhealthy diets compromise physical and mental health [15,16], stakeholders across many sectors addressing food and health in high-income countries have advocated that nutrition insecurity be tracked in addition to existing food insecurity surveillance [7, 17].

New nutrition security measures have been developed to accomplish this goal [9,18,19], to complement the surveillance of food insecurity [19]. The Gretchen Swanson Center for Nutrition (henceforth: Swanson) developed a 4-item tool to screen for nutrition insecurity, with three questions asking whether respondents think the foods they are consuming are good for their health and wellbeing, and one question asking about food variety [9]. The Swanson team then selected one of these four items to be used as a single-item screener for nutrition insecurity, which asks: "In the last 12 months, I worried that the food I was able to eat would hurt my health and wellbeing" [9]. This item was selected to be the single-item screener because of its high sensitivity (93%), specificity (78%), and agreement with the 4-item measure (Cohen's $\kappa = 0.66$) [9].

This study examined whether food insecurity and nutrition insecurity were distinct experiences among residents of Los Angeles (L.A.) County, California, a socioeconomically diverse region with 10 million residents. Specifically, we addressed 3 research questions:

1. What are the rates of people experiencing food insecurity, nutrition insecurity, and both, in L.A. County?
2. What sociodemographic factors are associated with experiencing food insecurity and nutrition insecurity?
3. Is nutrition insecurity a significant predictor of diet-related physical and mental health conditions, distinct from food insecurity?

Methods

Study sample

The Understanding America Study (UAS) includes a representative sample of L.A. County adults recruited through random address-based sampling [20]. Internet and computer/tablet access are provided as needed. Participants receive $20 for every 30 minutes of participation in online surveys. The current study focuses on 1071 L.A. County adults who responded to the December 2022 UAS survey wave (fielded from December 5, 2022, to January 4, 2023). Study protocols were approved by the University of Southern California IRB (#UP-22-00041).

Measures

Food insecurity was measured with the United States Household Food Security Survey Module short-form [21]. Per USDA guidance, the self-administered version of this short-form survey includes 5 items, combining two items from the 6-item interviewer-administered version of this scale [21]. Participants indicated, in the last 12 months, *1)* "The food that I bought just didn't last, and I didn't have money to get more," and *2)* "I couldn't afford to eat balanced meals" (often/sometimes = 1, never = 0); *3)* "Did you ever cut the size of your meals or skip meals because there wasn't enough money for food?" (almost every month/some months = 2; only 1 or 2 months = 1; no = 0); *4)* "Did you ever eat less than you felt you should because there wasn't enough money for food?" (yes = 1, no = 0); and *5)* "Were you ever hungry but didn't eat because there wasn't enough money for food?" (yes = 1, no = 0). Consistent with scoring guidelines for this self-administered short-form survey [21], participants with scores of 2 or more across these 5 questions were considered to have experienced food insecurity in 2022.

Nutrition insecurity was measured with a validated 1-item screener from Swanson [9]: "In the last 12 months, I worried that the food I was able to eat would hurt my health and well-being." Responses of "Sometimes," "Often," or "Always" were coded as experiencing nutrition insecurity (1). Responses of "Rarely" or "Never" were coded as not experiencing nutrition insecurity (0). As noted, this item was selected as a 1-item screener of nutrition insecurity based on high sensitivity, specificity, and agreement [9]. We utilized the 1-item screener, rather than the full 4-item measure, out of consideration for UAS respondent burden.

Sociodemographics included household income relative to the federal poverty level (FPL), gender, age category, race and ethnicity, educational attainment, employment status, and number of children in the household. Response options are shown in Table 1. Note that the reference group for the age category is "65 years and over" as older adults often have a lower risk of food insecurity compared with younger adults [22,23], particularly in L.A. County [24,25].

Cardiovascular disease was measured with 1 item: "Has a doctor ever told you that you have cardiovascular disease (e.g., hypertension, heart failure, heart attack)?" (yes/no).

Diabetes was measured with 1 item: "Has a doctor ever told you that you have diabetes?" (yes/no).

Poor mental health was measured with the 4-item Patient Health Questionnaire [26]. Two items in this validated measure assessed depressive symptoms ("Little interest or pleasure in doing things" and "Feeling down, depressed, or hopeless") and 2 items assessed anxiety symptoms ("Feeling nervous, anxious, or on edge" and "Not being able to stop worrying"). Response options for all items ranged from not at all (0) to nearly every day (3). Internal consistency ($\alpha = 0.93$) warranted the computation of overall scores. Summed scores of 6 or more represent potentially problematic symptoms [26]. This measure was included in a different UAS survey fielded from June 22, 2022, to September 4, 2022, and a total of 981 (92%) participants from the analytic sample completed these measures.

TABLE 1
Sociodemographics of L.A. County residents reporting different combinations of food insecurity and nutrition insecurity in the Understanding America Study, December 2022

	All participants ($N = 1071$)	All food insecure ($n = 229$)	All nutrition insecure ($n = 252$)	Food insecure only ($n = 93$)	Nutrition insecure only ($n = 116$)	Both food and nutrition insecure ($n = 136$)	Neither food nor nutrition insecure ($n = 726$)
Characteristic:	% (95% CI)[1]	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Food insecure	23.5 (20.1, 26.8)	229 (100.0)	136 (54.0)	93 (100.0)	0 (0.0)	136 (100.0)	0 (0.0)
Nutrition insecure	24.5 (21.2, 27.8)	136 (59.4)	252 (100.0)	0 (0.0)	116 (100.0)	136 (100.0)	0 (0.0)
Income/poverty category							
<100% FPL	20.2 (17.0, 23.5)	77 (33.6)	63 (25.0)	26 (28.0)	12 (10.3)	51 (37.5)	82 (11.3)
100%–300% FPL	35.2 (31.6, 38.8)	99 (43.2)	99 (39.3)	41 (44.1)	41 (35.3)	58 (42.6)	217 (29.9)
>300% FPL	44.6 (40.9, 48.2)	53 (23.1)	90 (35.7)	26 (28.0)	63 (54.3)	27 (19.9)	427 (58.8)
Gender							
Female	51.1 (47.4, 54.9)	165 (72.1)	168 (66.7)	65 (69.9)	68 (58.6)	100 (73.5)	428 (59.0)
Male	48.9 (45.1, 52.6)	64 (27.9)	84 (33.3)	28 (30.1)	48 (41.4)	36 (26.5)	298 (41.0)
Age category (years)							
18–40	47.2 (43.5, 51.0)	131 (57.2)	129 (51.2)	53 (57.0)	51 (44.0)	78 (57.4)	296 (40.8)
41–64	37.5 (33.9, 41.1)	84 (36.7)	98 (38.9)	30 (32.2)	44 (37.9)	54 (39.7)	309 (42.6)
65+	15.3 (12.7, 17.9)	14 (6.1)	25 (9.9)	10 (10.8)	21 (18.1)	4 (2.9)	121 (16.7)
Race/ethnicity							
Non-Hispanic Black	7.0 (5.1, 8.9)	23 (10.1)	21 (8.4)	10 (10.8)	8 (6.9)	13 (9.6)	57 (7.9)
Hispanic	45.1 (41.3, 48.8)	144 (63.2)	119 (47.4)	64 (68.8)	39 (33.6)	80 (59.3)	277 (38.2)
Non-Hispanic White	29.6 (26.4, 32.9)	33 (14.5)	52 (20.7)	12 (12.9)	31 (26.7)	21 (15.6)	275 (37.9)
Non-Hispanic Asian	15.8 (13.1, 18.6)	20 (8.8)	45 (17.9)	5 (5.4)	30 (25.9)	15 (11.1)	84 (11.6)
Other	2.5 (1.4, 3.5)	8 (3.5)	14 (5.6)	2 (2.2)	8 (6.9)	6 (4.4)	32 (4.4)
Educational attainment							
College degree	31.6 (28.5, 34.8)	47 (20.5)	90 (35.7)	17 (18.3)	60 (51.7)	30 (22.1)	334 (46.0)
Some college or less	68.4 (65.2, 71.5)	182 (79.5)	162 (64.3)	76 (81.7)	56 (48.3)	106 (77.9)	392 (54.0)
Employment status							
Employed	57.9 (54.2, 61.6)	134 (58.5)	159 (63.1)	54 (58.1)	79 (68.1)	80 (58.8)	443 (61.0)
Not employed	42.1 (38.4, 45.8)	95 (41.5)	93 (36.9)	39 (41.9)	37 (31.9)	56 (41.2)	283 (39.0)
Children in household							
Yes	26.4 (23.0, 29.7)	65 (28.4)	71 (28.2)	21 (22.6)	27 (23.3)	44 (32.4)	188 (25.9)
No	73.6 (70.3, 77.0)	164 (71.6)	181 (71.8)	72 (77.4)	89 (76.7)	92 (67.6)	538 (74.1)
Sample size that completed physical health measures in December 2022	$n = 1053$	$n = 227$	$n = 249$	$n = 91$	$n = 113$	n =136	$n = 713$
Reported cardiovascular disease[2]	10.8 (8.5, 13.0)	23 (10.1)	30 (12.0)	11 (12.1)	18 (15.9)	12 (8.8)	80 (11.2)
Reported diabetes[2]	11.5 (9.1, 13.9)	33 (14.5)	36 (14.5)	8 (8.8)	11 (9.7)	25 (18.4)	68 (9.5)
Sample size that completed mental health measures between June and Sept 2022	$n = 981$	$n = 208$	$n = 230$	$n = 83$	$n = 105$	$n = 125$	$n = 668$
Reported poor mental health[3]	13.6 (10.9, 16.2)	66 (31.7)	65 (28.3)	23 (27.7)	22 (21.0)	43 (34.4)	51 (7.6)

Abbreviation: FPL, federal poverty level.
[1] Confidence intervals (CI) are included alongside weighted frequencies corresponding to the full sample; these frequencies are weighted to be representative of the adult population of Los Angeles County, California. All other columns in the table provide unweighted frequencies corresponding to subsamples, as survey weights are not designed for use with subsamples.
[2] Note $n = 1053$ participants completed the questions on cardiovascular disease and diabetes in December 2022.
[3] Note $n = 981$ participants completed the mental health measures between June and September 2022.

Statistical analysis

First, we computed weighted descriptive statistics representing rates of people experiencing food insecurity, nutrition insecurity, and both. Second, we conducted 2 unweighted logistic regression models predicting (A) food insecurity and (B) nutrition insecurity as binary outcomes, including sociodemographics as predictors. We also conducted a related multinomial logistic regression model predicting a 4-category outcome: *1)* food insecure only; *2)* nutrition insecure only; and *3)* both food and nutrition insecure; as compared with *4)* neither food nor nutrition insecure. Third, separate unweighted logistic regression models were specified to predict cardiovascular disease, diabetes, and poor mental health. For each outcome, a series of models were specified while controlling for sociodemographics: the first model included food insecurity as a predictor; the second model included nutrition insecurity as a predictor; and the third model included both food insecurity and nutrition insecurity.

Results

What are the rates of people experiencing food insecurity, nutrition insecurity, and both, in L.A. County?

In 2022, 23.5% of L.A. County adults reported experiencing food insecurity and 24.5% reported experiencing nutrition insecurity. Of those individuals who reported food insecurity,

59.4% also reported nutrition insecurity; of those who reported nutrition insecurity, 54.0% also reported food insecurity. Just over 1 in 10 (13.5%) reported experiencing both food and nutrition insecurity. Table 1 shows the descriptive statistics for the full study sample and for respondents who reported food and/or nutrition insecurity in 2022.

What sociodemographic factors are associated with experiencing food insecurity and nutrition insecurity?

The logistic regression model predicting food insecurity (compared with food security) showed significant associations with income, gender, age category, race and ethnicity, and educational attainment (see Table 2, Model A). Individuals with incomes below 100% of FPL and individuals with incomes between 100% and 300% of FPL had 4.6 times the odds (95% confidence interval [CI]: 2.9, 7.3) and 2.7 times the odds (95% CI: 1.8, 3.9) of reporting food insecurity, respectively, compared with individuals with incomes above 300% of FPL. Female respondents had 1.5 times the odds of reporting food insecurity (95% CI: 1.1, 2.1) compared with male respondents. Individuals between the ages of 18 and 40 years and between the ages of 41 and 64 years had 2.4 times the odds (95% CI: 1.3, 4.7) and 2.2 times the odds (95% CI: 1.1, 4.2), respectively, of reporting food insecurity compared with individuals 65 years and older. Hispanic individuals had 2.0 times the odds of reporting food insecurity (95% CI: 1.2, 3.1) compared with non-Hispanic White individuals. Furthermore, individuals with some college or less education had 2.1 times the odds of reporting food insecurity (95% CI: 1.4, 3.1) compared with individuals with a college degree.

The logistic regression model predicting nutrition insecurity (compared with nutrition security) showed significant associations with income and race and ethnicity (see Table 2, Model B). Individuals with incomes below 100% of FPL and individuals with incomes between 100% and 300% of FPL had 2.7 times the odds (95% CI: 1.7, 4.1) and 1.9 times the odds (95% CI: 1.3, 2.6) of reporting nutrition insecurity, respectively, compared with individuals with incomes above 300% of FPL. Non-Hispanic Asian individuals had 2.2 times the odds of reporting nutrition insecurity (95% CI: 1.4, 3.6), and individuals who identified as non-Hispanic other race had 2.0 times the odds of reporting nutrition insecurity (95% CI: 1.0, 4.1), compared with non-Hispanic White individuals.

A multinomial logistic regression model that predicted whether participants experienced food insecurity only, nutrition insecurity only, or both food and nutrition insecurity (shown in Supplemental Table 1) produced similar results to the models summarized above. One notable difference was that reporting nutrition insecurity only was solely associated with race and ethnicity; non-Hispanic Asian individuals had 3.1 times the odds of belonging to this category (95% CI: 1.8, 5.6) compared with non-Hispanic White individuals. Income was not a significant predictor of reporting nutrition insecurity only.

Is nutrition insecurity a significant predictor of diet-related physical and mental health conditions, distinct from food insecurity?

Nutrition insecurity predicted two out of three diet-related health outcomes, over and above food insecurity. First, the results of logistic regression models showed that neither food nor nutrition insecurity predicted cardiovascular disease (Supplemental Table 2).

Second, in logistic regression models predicting diabetes that included food insecurity and sociodemographics as predictors (Table 3, Model A), individuals who reported food insecurity (compared with food security) had 2.1 times the odds of reporting diabetes (95% CI: 1.3, 3.5). When including nutrition

TABLE 2
Logistic regression results of sociodemographic characteristics predicting food insecurity (Model A) and nutrition insecurity (Model B) among a sample of L.A. County residents, Understanding America Study, December 2022

	Model A Outcome: Food insecure (n = 229) vs. Food secure (n = 842)	Model B Outcome: Nutrition insecure (n = 252) vs. Nutrition secure (n = 819)
	Odds ratio (95% CI)	Odds ratio (95% CI)
Income (ref ≥ 300% of FPL)		
<100% of FPL	4.56 (2.86, 7.27)[1]	2.65 (1.71, 4.10)[1]
100–300% of FPL	2.65 (1.79, 3.91)[1]	1.86 (1.31, 2.63)[1]
Gender (ref = male)		
Female	1.51 (1.07, 2.14)[1]	1.17 (0.86, 1.59)
Age category (ref = 65 years and over)		
18–40	2.42 (1.25, 4.68)[1]	1.37 (0.80, 2.36)
41–64	2.17 (1.13, 4.17)[1]	1.26 (0.74, 2.15)
Race/ethnicity (ref = Non-Hispanic White)		
Non-Hispanic Black	1.46 (0.76, 2.80)	1.17 (0.64, 2.15)
Hispanic	1.96 (1.23, 3.11)[1]	1.22 (0.81, 1.85)
Non-Hispanic Asian	1.12 (0.59, 2.10)	2.22 (1.37, 3.60)[1]
Non-Hispanic other race	1.54 (0.64, 3.72)	2.03 (1.00, 4.09)[1]
Education (ref = college degree)		
Some college or less	2.08 (1.41, 3.07)[1]	1.15 (0.83, 1.61)
Employment (ref = employed)		
Not employed	0.99 (0.69, 1.42)	0.83 (0.59, 1.16)
Children in household (ref = no children in household)	0.86 (0.60, 1.23)	1.04 (0.74, 1.44)

Abbreviations: CI, confidence interval; FPL, federal poverty level.
[1] Statistically significant odds ratios; statistical significance is based on CIs and $p < 0.05$.

TABLE 3
Logistic regression results of nutrition insecurity and/or food insecurity predicting diabetes among a sample of L.A. County residents, Understanding America Study, December 2022

	Outcome Reported diabetes (n =112) vs. did not report diabetes (n = 941)		
	Model A[1]	Model B[2]	Model C[3]
	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
	Unadjusted models		
Reported food insecurity	1.61 (1.04, 2.49)[4]	—	1.37 (0.83, 2.25)
Reported nutrition insecurity	—	1.62 (1.06, 2.48)[4]	1.41 (0.87, 2.28)
	Adjusted Models		
Reported food insecurity	2.13 (1.28, 3.53)[4]	—	1.67 (0.96, 2.92)
Reported nutrition insecurity	—	2.11 (1.32, 3.37)[4]	1.75 (1.05, 2.93)[4]
Income (ref ≥ 300% of FPL)			
<100% of FPL	0.64 (0.31, 1.31)	0.70 (0.35, 1.41)	0.62 (0.30, 1.27)
100%–300% of FPL	1.05 (0.66, 1.68)	1.07 (0.67, 1.70)	1.02 (0.64, 1.63)
Gender (ref = male)			
Female	0.64 (0.42, 0.98)[4]	0.65 (0.42, 0.99)[4]	0.63 (0.41, 0.97)[4]
Age category (ref = 65 years and over)			
18–40	0.11 (0.05, 0.22)[4]	0.11 (0.05, 0.23)[4]	0.10 (0.05, 0.21)[4]
41–64	0.48 (0.28, 0.83)[4]	0.49 (0.28, 0.85)[4]	0.47 (0.27, 0.82)[4]
Race/ethnicity (ref = Non-Hispanic White)			
Non-Hispanic Black	2.89 (1.40, 5.97)[4]	3.06 (1.48, 6.36)[4]	2.98 (1.43, 6.18)[4]
Hispanic	2.32 (1.32, 4.07)[4]	2.54 (1.45, 4.46)[4]	2.42 (1.37, 4.25)[4]
Non-Hispanic Asian	1.05 (0.47, 2.36)	0.94 (0.41, 2.13)	0.95 (0.42, 2.16)
Non-Hispanic other race	2.14 (0.80, 5.73)	2.07 (0.76, 5.58)	2.07 (0.77, 5.60)
Education (ref = college degree)			
Some college or less	1.27 (0.80, 2.02)	1.30 (0.82, 2.06)	1.25 (0.79, 1.99)
Employment (ref = employed)			
Not employed	1.53 (0.95, 2.45)	1.56 (0.97, 2.50)	1.55 (0.96, 2.49)
Children in household (ref = no children in household)	0.99 (0.59, 1.65)	0.94 (0.57, 1.58)	0.96 (0.57, 1.60)

Abbreviation: CI, confidence interval; FPL, federal poverty level.
[1] Model A includes food insecurity as the sole predictor of interest.
[2] Model B includes nutrition insecurity as the sole predictor of interest.
[3] Model C includes both food insecurity and nutrition insecurity as predictors of interest.
[4] Statistically significant odds ratios; statistical significance is based on CIs and $p < 0.05$.

insecurity and sociodemographics as predictors (Table 3, Model B), individuals who reported nutrition insecurity (compared with nutrition security) had 2.1 times the odds of reporting diabetes (95% CI: 1.3, 3.4). When including food insecurity, nutrition insecurity, and sociodemographics as predictors (Table 3, Model C), only nutrition insecurity remained a significant predictor, with individuals reporting nutrition insecurity having 1.8 times the odds of reporting diabetes (95% CI: 1.1, 2.9) compared with those who did not report nutrition insecurity.

Third, in logistic regression models predicting poor mental health that included food insecurity and sociodemographics as predictors (Table 4, Model A), individuals who reported food insecurity (compared with food security) had 4.4 times the odds of reporting poor mental health (95% CI: 2.8, 6.8). When including nutrition insecurity and sociodemographics as predictors (Table 4, Model B), individuals who reported nutrition insecurity (compared with nutrition security) had 3.5 times the odds of reporting poor mental health (95% CI: 2.4, 5.2). When including food insecurity, nutrition insecurity, and sociodemographics as predictors (Table 4, Model C), individuals reporting food insecurity (compared with food security) had 3.0 times the odds of reporting poor mental health (95% CI: 1.9, 4.9), whereas individuals reporting nutrition insecurity (compared with nutrition security) had 2.3 times the odds of reporting poor mental health (95% CI: 1.5, 3.5).

In supplemental models, we combined the non-Hispanic Black and non-Hispanic other race categories into one race and ethnicity category to address potential concerns about the small number of participants in each category. Results of the logistic regression models predicting food insecurity, nutrition insecurity, and the 3 health outcomes (cardiovascular disease, diabetes, and poor mental health), as well as the multinomial logistic regression model, were all robust to this change in coding; these results are included in Supplemental Tables 3–7.

Discussion

This study provided a first look at the overlap of food insecurity and nutrition insecurity in a sample representative of the adult population of L.A. County, a large and diverse urban center in the United States. Reported rates of food and nutrition insecurity in L.A. County were almost equivalent, yet almost half of the individuals who reported nutrition insecurity did not report food insecurity and vice versa.

Furthermore, food insecurity and nutrition insecurity had different predictors. Although lower income was a key risk factor for both food and nutrition insecurity, the race and ethnic groups at risk of food insecurity differed from those at risk of nutrition insecurity. Hispanic individuals were more likely to experience food insecurity but not nutrition insecurity, whereas

TABLE 4
Logistic regression results of food insecurity and/or nutrition insecurity predicting poor mental health among a sample of L.A. County residents, Understanding America Study, December 2022

	Outcome: Poor mental health ($n = 139$) vs. not ($n = 842$)		
	Model A[1]	Model B[2]	Model C[3]
	Odds ratio (95% CI)	Odds ratio (95% CI)	Odds ratio (95% CI)
	Unadjusted models		
Reported food insecurity	4.46 (3.05, 6.51)[4]	—	3.12 (2.03, 4.79)[4]
Reported nutrition insecurity	—	3.60 (2.48, 5.24)[4]	2.17 (1.42, 3.34)[4]
	Adjusted models		
Reported food insecurity	4.38 (2.84, 6.75)[4]	—	3.04 (1.88, 4.91)[4]
Reported nutrition insecurity	—	3.48 (2.35, 5.16)[4]	2.27 (1.46, 3.53)[4]
Income (ref ≥ 300% of FPL)			
<100% of FPL	1.75 (0.99, 3.10)	2.09 (1.20, 3.64)[4]	1.63 (0.92, 2.91)
100%–300% of FPL	1.11 (0.69, 1.78)	1.21 (0.77, 1.92)	1.06 (0.66, 1.70)
Gender (ref = male)			
Female	1.00 (0.67, 1.49)	1.07 (0.72, 1.59)	1.00 (0.67, 1.50)
Age category (ref = 65 years and over)			
18–40	1.24 (0.65, 2.37)	1.45 (0.76, 2.79)	1.24 (0.65, 2.40)
41–64	0.72 (0.38, 1.37)	0.81 (0.42, 1.55)	0.70 (0.36, 1.35)
Race/ethnicity (ref = Non-Hispanic White)			
Non-Hispanic Black	0.70 (0.31, 1.58)	0.72 (0.32, 1.62)	0.71 (0.31, 1.61)
Hispanic	0.71 (0.42, 1.19)	0.78 (0.47, 1.31)	0.72 (0.42, 1.21)
Non-Hispanic Asian	0.87 (0.46, 1.64)	0.65 (0.34, 1.24)	0.74 (0.38, 1.42)
Non-Hispanic other race	0.42 (0.12, 1.49)	0.38 (0.11, 1.35)	0.37 (0.10, 1.33)
Education (ref = college degree)			
Some college or less	0.85 (0.55, 1.32)	1.00 (0.65, 1.54)	0.86 (0.55, 1.34)
Employment (ref = employed)			
Not employed	1.02 (0.66, 1.57)	1.08 (0.70, 1.66)	1.04 (0.67, 1.62)
Children in household (ref = no children in household)	0.72 (0.46, 1.15)	0.70 (0.44, 1.12)	0.70 (0.44, 1.13)

Abbreviations: CI, confidence interval; FPL, federal poverty level.
[1] Model A includes food insecurity as the sole predictor of interest.
[2] Model B includes nutrition insecurity as the sole predictor of interest.
[3] Model C includes both food insecurity and nutrition insecurity as predictors of interest.
[4] Statistically significant odds ratios; statistical significance is based on CIs and $p < 0.05$.

non-Hispanic Asian individuals were more likely to report nutrition insecurity but not food insecurity. These significant differences related to race and ethnicity may be specific to L.A. County, home to 10 million residents with staggering socioeconomic and structural inequalities [27,28], and where Hispanic individuals comprise the largest racial/ethnic group (49% of the county population) [29]. In this study, a larger proportion of Hispanic individuals reported food insecurity but not nutrition insecurity, indicating that they felt they could access foods that would support their health and wellbeing but could not afford enough food in general. Foods that are healthy and culturally relevant for Hispanic residents are likely accessible due to the large Hispanic population and, relatedly, an abundance of outlets selling foods linked to Hispanic and Latino cultures. However, high rates of poverty among Hispanic residents in L.A. County due to historic structural inequalities and racism, and economic challenges linked to immigration, are barriers to food security. Research in L.A. has indicated that small markets such as bodegas, which are often a key source of culturally relevant foods, are economically less accessible because healthy food options are more expensive than in larger grocery stores [30].

Simultaneously, a larger proportion of non-Hispanic Asian individuals reported nutrition insecurity but not food insecurity, indicating that they could afford enough food but felt like they could not access foods that would support their health and wellbeing. These results may speak to the experience of groups with less representation and smaller populations in L.A. County—e.g., the many ethnicities comprising the catchall category of "non-Hispanic Asian," which makes up 16% of the L.A. County population and includes individuals who identify with many nationalities, including Chinese, Taiwanese, Vietnamese, Filipino, Korean, Japanese, Cambodian, Thai, Indonesian, and Sri Lankan. These communities may have less access to healthy foods that are culturally relevant regardless of their income, as stores and markets stocking foods specific to their cultural background may be distributed more sparsely across the >4000 square miles of L.A. County, and may be too far to frequently visit.

Additionally, younger adults had higher odds of reporting nutrition insecurity coupled with food insecurity, compared with adults 65 years and older. Adults under 65 years were also at higher risk for food insecurity generally, as has been previously documented [31]. Younger adults may not only face more financial barriers to acquiring sufficient food, but their lifestyles—often involving employment, higher education, and caring for children or other family members—may additionally make it difficult for them to access foods that support their health and wellbeing. Furthermore, younger adults—particularly college students—may be unaware whether they are eligible for

food assistance such as the Supplemental Nutrition Assistance Program (SNAP) [32]. However, adults 65 years and older, albeit often on fixed incomes [33], may have more stable budgets and lifestyles with more narrow responsibilities, making accessing sufficient food, and healthy foods, more feasible.

Results pertaining to our final research question show that nutrition insecurity is a stronger predictor of diabetes compared with food insecurity. This is notable because the association between food insecurity and diabetes is well known [34]. Specifically, being food insecure makes diabetes management and diet maintenance more difficult, and is related to other risk factors for type 2 diabetes [35]. Our results suggest that the relationship between food insecurity and diabetes may proceed via a nutritional pathway [36], and indeed, perhaps nutrition insecurity is driving the diet maintenance challenges experienced by individuals with diabetes [35]. Note, however, that this is a cross-sectional analysis, and thus the opposite directionality is also plausible, such that individuals with diabetes may have an increased likelihood of reporting nutrition insecurity if they were attributing their diabetes to their diet or were aware that their dietary choices played a role in their development of diabetes. Our findings also show that both food and nutrition insecurity predict poor mental health, aligning with prior literature demonstrating that food insecurity is a risk factor for depression, anxiety, and stress [4]. This may also point to "food and mood" mechanisms where poor nutrition, arising from experiencing nutrition insecurity, compromises mental health [37]. This role of nutrition insecurity as a predictor of both physical and mental health conditions reiterates the importance of nutrition insecurity surveillance in the public health realm. Future work should continue exploring the possible associations of nutrition insecurity with diet-related diseases and mental health outcomes, with a particular focus on how these experiences play a role in nutrition and related health disparities.

The findings of this study reinforce the need to monitor both food and nutrition insecurity, because they are distinct constructs: food and nutrition insecurity are experienced by somewhat different populations, and they independently predict diet-related health outcomes [38]. The UAS [20], the data source for this study, has recently incorporated surveillance of both food and nutrition insecurity into their nationally representative panel surveys, and ideally other public health surveillance tools will do the same. These data are needed to inform interventions and policies that can address unacceptably high rates of both food and nutrition insecurity, as well as diet-related disease. It is especially critical to document details of populations and regions most at risk so limited resources can be optimally allocated. For example, a new 10-year Strategic Action Plan from the L.A. County Food Equity Roundtable aims to strengthen the food system to reduce food and nutrition insecurity in specific priority populations [39]. Data from the surveillance of food and nutrition insecurity in L.A. County are being used by local policymakers, community-based organizations, and funders to prioritize their activities throughout the county to address populations at risk for hunger and food insecurity and to address inequalities in access to nutritious foods [39].

Additional policy implications and recommendations involve the importance of interventions that combat both food and nutrition insecurity. SNAP, the main United States government-funded food assistance program, has proven effective in helping households overcome food insecurity [40]. However, some individuals and families receiving SNAP benefits remain food insecure [41], and it is thus far unknown if SNAP is effective at alleviating nutrition insecurity. Our first recommendation is, therefore, to examine whether major food assistance programs also help to reduce recipients' risk for nutrition insecurity and to study strategies that may make them more effective in doing so. For example, California's "Market Match" program, in which recipients receive a 1:1 match of SNAP benefits when they purchase produce at farmers' markets [42], increases recipients' overall SNAP benefits, and may specifically contribute to nutrition security by incentivizing the purchase of fruits and vegetables. Furthermore, "food is medicine" programs, where patients access healthy food via their health care provider [43], have the potential to promote healthy food consumption [44,45] and may decrease both food and nutrition insecurity. Overall, more research is needed in terms of interventions that may successfully alleviate nutrition insecurity. This research should not focus exclusively on individual and household factors relevant to food and nutrition security but also on social and structural influences, such as the spatial, financial, and cultural accessibility of healthy foods, to understand how these should be addressed in interventions and policies.

Limitations

Although this study provides the first representative estimates of nutrition insecurity in L.A. County and the first exploration of nutrition insecurity as a health indicator in the United States, there were several limitations. First, although poor mental health was measured within the 12-month window covered by the food and nutrition insecurity measures, these items were not included on the same survey. This is a limitation as some participants did not complete both measures, thus the sample size was smaller for models investigating these mental health outcomes. A second limitation was that the diet-related physical health items were self-reported and not obtained from health records. Although these specific items have not been validated in a study with UAS data, single-item self-reported measures of chronic conditions are widely used in other surveys, including the Behavioral Risk Factor Surveillance System, and have been found to be reasonably accurate, as compared with medical records, in other research [46]. A third limitation was that the item assessing diabetes diagnosis did not distinguish between type 1 or type 2 diabetes, and so it was not possible to specifically estimate the relationship between nutrition insecurity and these two types of diabetes. Nonetheless, the proportion of L.A. County adults who self-reported having diabetes was 11.5% (95% CI: 9.1, 13.9) in the 2022 UAS surveys—the data used in this study—and 11.4% (95% CI: 10.6, 12.3) in the 2023 L.A. County Health Survey, emphasizing the robustness of this self-reported data despite potential ambiguity in how the condition was defined [47]. A fourth limitation is that we used the 1-item screener for nutrition insecurity, rather than the full 4-item measure. However, this item was selected from the 4-item measure for use as a 1-item screener due to its high sensitivity, specificity, and agreement [9].

A fifth limitation is that the nutrition insecurity screener does not define "foods that hurt my health and wellbeing."

This decision was made by the designers of the measure because foods that comprise healthy or unhealthy dietary patterns can vary between individuals [9] (e.g., grains may be perceived as harmful to health for people with gluten allergies). However, this lack of a definition of "foods that hurt my health and wellbeing" may also introduce subjectivity in how people respond. An alternative 2-item measure of nutrition insecurity developed by Tufts University, Kaiser Permanente, and the L.A. County Department of Public Health does provide a definition of "healthy foods," and then asks one question about how hard it was to get and eat healthy foods in the last 12 months and one question about numerous barriers that limited respondents' ability to get and eat healthy foods [19]. We recommend that future work should explicitly compare responses to nutrition insecurity measures where "healthy" and/or "unhealthy" foods are defined versus not defined, using mixed methods to explore participant perceptions of foods that are beneficial or harmful to health. Moreover, it would be useful to examine whether there are differences in responses to these questions based on demographics, including gender [9], race, ethnicity, age, and health or disease status.

In conclusion, this research using a new measure of nutrition insecurity [9,18] suggests that surveillance of nutrition insecurity will provide a different, more detailed picture of food access and who is at risk of poor nutrition. Given that diet-related diseases are the leading cause of death in the United States [48], incorporating nutrition insecurity surveillance alongside traditional food insecurity surveillance will be informative for researchers as well as policymakers. We must learn more about the potential effects of nutrition insecurity and strive to find solutions so that all people have equitable access to sufficient, healthy food.

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Author contributions

The authors' responsibilities were as follows – MSL, WBdB, NW, JPW, KdlH: designed research; MSL: analyzed data; MSL, WBdB, NW, JPW, BYL, KdlH: wrote the article; MSL, WBdB, KdlH: had primary responsibility for final content; and all authors: read and approved the final manuscript.

Conflict of interest

The authors report no conflicts of interest.

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Data availability

Data described in the manuscript will be made available upon request pending application and approval at https://uasdata.usc.edu/index.php.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tjnut.2024.05.020.

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