


Associations between food insecurity and other social risk factors among U.S. adults



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ABSTRACT

BACKGROUND: Food insecurity (FI) often co-exists with other social risk factors, which makes addressing it particularly challenging. The degree of association between FI and other social risk factors across different levels of income and before and during the COVID-19 pandemic is currently unknown, impeding the ability to design effective interventions for addressing these co-existing social risk factors.

OBJECTIVE: To determine the association between FI and other social risk factors overall and across different levels of income-poverty ratios and before (2019) and during (2020–2021) the pandemic.

DESIGN: We used nationally representative data from the 2019–2021 National Health Interview Survey for our cross-sectional analysis. Social risk factors available in NHIS included difficulties paying for medical bills, difficulties paying for medications, receiving income assistance, receiving rental assistance, and “not working last week”.

SUBJECTS: 93,047 adults (≥ 18 years old).

KEY RESULTS: Individuals with other social risk factors (except receiving income assistance) were more likely to report FI, even after adjusting for income and education inequalities. While poverty leads to a higher prevalence of FI, associations between FI and other social risk factors were stronger among people with higher incomes, which may be related to their ineligibility for social safety net programs. Associations were similar before and during the pandemic, perhaps due to the extensive provision of social safety net programs during the pandemic.

CONCLUSIONS: Future research should explore how access to a variety of social safety net programs may impact the association between social risk factors. With the expiration of most pandemic-related social supports, further research and monitoring are also needed to examine FI in the context of increasing food and housing costs. Our findings may also have implications for the expansion of income-based program eligibility

criteria and screening for social risk factors across all patients and not only low-income people.

KEY WORDS: food insecurity; health policy; poverty; disparities; public health; COVID-19

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INTRODUCTION

Despite nationwide efforts to address food insecurity (FI) during the COVID-19 pandemic, more than 10% of U.S. households reported FI in 2021.¹ FI, defined as a lack of access to adequate food for an active, healthy life,¹ is a social risk factor shaped by conditions in which people are born, grow, live, and age (i.e., social determinants of health).^{2,3} Co-existing social risk factors (e.g., cost-related medication non-adherence, unemployment, transportation or utility insecurity, housing instability^{4–8}) add to the complexity of FI by forcing difficult decisions about the prioritization of basic needs.⁹ For instance, people with FI and housing instability are more likely to skip healthcare appointments due to medical costs¹⁰ and to postpone purchasing needed medications.^{8,11} Among adult patients in the emergency department, those reporting FI were also more likely to report housing instability, unemployment, and medical and medication needs.¹²

Our policy response to these co-occurring social risk factors requires attention to the following. First, while having a low income is considered the main cause of FI,¹³ low-income households have access to several FI programs (e.g., food pantries, Supplemental Nutrition Assistance Programs [SNAP]) which can help meet their food needs and potentially reduce FI rates.^{14–16} They may also be eligible for other social safety net programs (e.g., Medicaid, unemployment compensation) that can support their other social risk factors.¹⁷ However, one-third of households who report FI have an income above 200% of the federal poverty level (FPL),

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which typically surpasses the eligibility threshold for SNAP and other nutrition assistance programs.^{18,19} These households with FI, which are excluded from many public benefits programs, may experience greater negative outcomes when social risk factors are compounded.

Second, the pandemic transformed the federal policy response to FI and other social risk factors. Before the pandemic, nutrition assistance programs were generally characterized as having complicated enrollment processes, limited benefit amounts, and outdated rules that hindered people from accessing the food they need.^{20,21} Further, there was a general lack of support for implementing or expanding effective policies to address other social risk factors, such as unemployment and child care.²⁰ In addition, the pandemic caused economic downturn and disrupted food supply, which increased food demands, while FI and other social programs were limited to meet those demands. As a result, national estimates of FI in the U.S increased more than threefold in the first three months of the pandemic, from 11% in January 2020 to 38% in March 2020.²² However, national FI rates remained stable from 10.5% in 2019 to 10.2% in 2021. This may suggest that the increased access to nutrition assistance programs and strengthened food-related community responses during the pandemic^{20,21,23} helped to prevent surges in FI rates.¹ Moreover, the provision of other financial assistance such as rental assistance, deferred public student loan payment, unemployment benefits, cash payments, and federal medical assistance^{20,24} could have provided financial relief that enabled people with co-occurring social risk factors to put their household resources toward their most urgent, unfilled needs.

To our knowledge, the effect that the pandemic had on associations between FI and other social risk factors has not been investigated in a nationally representative sample, nor across varying levels of income. To address this knowledge gap, we utilized nationally representative survey data to identify associations between FI and other social risk factors overall and across different levels of income-poverty ratios and different periods (pre-pandemic and during the pandemic). We hypothesized that social risk factors would be positively associated with FI, and the strengths of those associations would be stronger among individuals in our higher-income stratum who were likely ineligible for social safety net programs, but would be similar before (2019) and during (2020 and 2021) the pandemic.

METHODS

Data

We used pooled cross-sectional data from 2019 to 2021 provided by the National Health Interview Survey (NHIS).²⁵ NHIS is a face-to-face interview survey of the noninstitutionalized U.S. civilians (50 states + District of Columbia),

administered in both English and Spanish, providing pandemic-era nationally representative data. With the redesign of NHIS's content, structure, and questionnaire in 2019,²⁶ data from prior years was not included in this analysis.

Study Variables

Dependent variable NHIS assesses FI using the U.S. Department of Agriculture's 10-item Household Food Security Survey Module.¹ The 10 items assess the ability of households to afford food over the previous 30 days.¹ We categorized households as food secure and food insecure (see Appendix A).

Independent Variables-Social Risk Factors

The Healthy People 2030 Social Determinants of Health framework informed the selection of our social risk factors.²⁷ This framework categorizes social determinants of health into five categories including healthcare access and quality, economic stability, neighborhood and built environment, social and community context, and education access and quality. Negative aspects of social determinants of health at the individual level are considered social risk factors. NHIS assesses 5 social risk factors in addition to FI that falls within the healthcare access and quality and economic stability categories: difficulties paying for medical bills (in the past 12 months, did you/anyone in the family have problems paying or were unable to pay medical bills), difficulties paying for medications (during the past 12 months, was there any time when you needed prescription medication, but did not get it because of the cost?), receiving income assistance (any public assistance or welfare payments from the state or local welfare office), receiving rental assistance (if you are renting a house/apartment, are you getting help from federal, state, or local government), and "not working last week" (did not work last week). Possible responses to these questions included yes, no, refused, not ascertained, and do not know. Responses other than yes and no were considered as missing data and they were not included in the analysis (missing data was less than 4% for each risk factor). Utilization of health services is considered as an indicator of access to care, which itself is a social determinant of health.²⁸ Therefore, difficulties paying for medical bills and medications were considered social risk factors. Education attainment could also be considered as a social risk factor, however, to be consistent with prior literature, we considered it as sociodemographic information.

Other Independent Variables Based on the literature,^{1,9,12,19,29,30} sociodemographic information and variables that have been linked to FI such as race/ethnicity, disability, education, income (ratio of family income to poverty threshold), and SNAP utilization (receiving SNAP in the

last 12 months) were considered as other independent variables. See Appendix A for definition of other independent variables.

Statistical Analysis

All analyses accounted for the complex survey design and were conducted in R Statistical Software (v4.1.1, R Core Team³¹) and STATA (version 17, StataCorp³²); see Appendix B. We used descriptive statistics for independent variables for the full sample and stratified based on FI status. We then fitted a multivariable logistic regression to the complete cases to identify the associated variables with FI. This model was then extended to include social risk factors. We also investigated the impact of income-poverty ratio and the pandemic on the association between FI and other social risk factors; we stratified our analysis based on the income-poverty ratio (strata: less than 100% FPL to indicate poverty; between 100% and 200% FPL; above 200% FPL, suggesting ineligibility for FI and social safety net programs^{18,19}) and year (strata: 2019 for pre-pandemic and 2020 and 2021 for during pandemic) using subpopulation analysis (i.e., assigning a zero weight to survey respondents outside of the subgroup of interest). Due to possibly unique circumstances in terms of associations between other independent variables and FI within each stratum, we chose to proceed with stratifications instead of using interaction terms. We reported the adjusted odds ratios (aOR) and their 95% confidence interval (CI) for all models. We also reported the adjusted prevalence of FI for our subpopulation analysis using the margins command in STATA.

RESULTS

From 2019 to 2021, 93,047 adults aged 18 and older were interviewed. Table 1 shows the weighted percentage and unweighted numbers of independent variables for the full sample and stratified by FI status. In this sample, 7.6% reported FI, 11.9% were SNAP utilizers, and 18.1% had an income less than 100% FPL. Also, our sample was equally distributed across the years.

Table 2 displays the multivariable model adjusted by independent variables without other social risk factors (Model 1), as well as including other social risk factors (Model 2). Results from Model 2 suggest that there is a significant association between FI and other social risk factors, such that individuals with other social risk factors (except receiving income assistance) were more likely to report FI. Specifically, when participants had difficulties paying for medical bills and medications, they were significantly more likely to report FI compared to participants without those difficulties (aOR 3.03 [95% CI 2.76–3.33] and aOR 3.30 [95% CI 2.92–3.74], respectively).

Consistent with prior research, we found that living in poverty led to higher prevalence of FI. FI rates were 25.73% (95% CI 24.44–27.00), 15.36% (95% CI 14.58–16.16), and 2.76% (95% CI 2.58–2.93) for individuals with an income below 100% FPL, between 100% and 200% FPL, and above 200% FPL, respectively. Figure 1 also illustrates the prevalence of FI among people with other social risk factors across different levels of income-poverty ratios.

While people with a social risk factor and in the lower income-poverty ratio (<100% FPL) had a significantly higher prevalence of FI compared to people with those social risk factors and in a higher income-poverty ratio (Fig. 1), the strength of association between having a social risk factor and reporting FI were stronger among people within our higher-income stratum (Table 3). The multivariable model stratified by income-poverty-ratio in Table 3 indicates that as income increases, associations between difficulties paying for medical bills and medications with FI get stronger. For instance, among people with an income below 100% FPL, those with difficulties paying for medical bills were more likely to report FI compared to those without difficulties paying for medical bills (aOR 2.28 [95% CI 1.91–2.72]). The same association was observed among people with an income between 100% and 200% FPL (aOR 2.56 [95% CI 2.23–2.94]). However, this association was significantly stronger for people with an income above 200% FPL (aOR 4.04 [95% CI 3.39–4.80]). In addition, among people with an income above 200% FPL, those with difficulties paying for medications were more likely to report FI compared to those without difficulties paying for medications (aOR 3.95 [95% CI 3.27–4.77]), and this association was significantly stronger compared to the same association among people with an income between 100% and 200% FPL. We also observed a similar pattern among people receiving rental assistance as those with an income above 200% FPL had a significantly higher aOR compared to those with an income below 100% FPL; 2.78 (95% CI 1.74, 4.43) vs. 1.27 (95% CI 1.06, 1.52). See Appendix C for further insights.

The multivariable model stratified by year in Table 4 indicates that the association (i.e., aOR) between FI and other social risk factors did not significantly change during the pandemic, in 2020 and 2021, compared to 2019. For instance, in all three years, those with difficulties paying for medical bills were more likely to report FI compared to those without difficulties. This observation was also true for those with difficulties paying for medications. However, people who reported receiving income assistance and “not working last week” were significantly associated with FI only in 2021. In addition, the association between FI and receiving rental assistance was only significant in 2019.

Figure 2 illustrates the prevalence rate of FI among those with our selected five social risk factors across different years. The prevalence of FI among those with social risk factors decreased significantly from 2019 to 2021.

Table 1 Descriptive Statistics of the 2019–2021 National Health Interview Survey (NHIS) Data (n = 93,047)

Variable	All (n = 93,047) Weighted % (unweighted n)	Food Insecure (n = 6068) Weighted % (unweighted n)	Food Secure (n = 83,807) Weighted % (unweighted n)
Immigration Status (Ref: U.S. Born)	81.8 (76,365)	76.9 (4917)	82.2 (70,725)
Non-Citizens	8.1 (5527)	13.8 (587)	7.6 (4867)
Naturalized Citizens	10.1 (8532)	9.3 (534)	10.2 (7915)
Income-Poverty ratio (Ref: > 200 FPL)	71.5 (67,644)	26.8 (1571)	75.3 (63,958)
< 100 FPL	10.4 (9267)	35.5 (2233)	8.2 (6582)
100–200 FPL	18.1 (16,136)	37.6 (2264)	16.5 (13,267)
Race (Ref: White)	77.1 (70,352)	62.5 (3619)	78.5 (64,656)
Black	13.0 (10,183)	26.3 (1384)	11.7 (8258)
AIAN	1.9 (1588)	4.8 (257)	1.67 (1262)
Asian	6.4 (5208)	3.9 (186)	6.6 (4803)
Other	1.6 (1186)	2.5 (121)	1.5 (1026)
Hispanic	16.7 (12,066)	25.1 (1243)	15.9 (10,277)
Married	52.0 (42,838)	33.6 (1615)	53.5 (40,919)
Age (Ref: 18–34)	29.3 (19,284)	32.5 (1501)	29.2 (17,131)
35–49	24.2 (21,096)	28.0 (1609)	23.8 (18,754)
50–64	24.7 (24,233)	26.4 (1872)	24.5 (21,555)
65+	21.8 (28,434)	13.0 (1086)	22.4 (26,368)
Female	51.7 (50,408)	58.9 (3740)	51.1 (44,919)
Sexual Minority*	4.1 (3462)	7.0 (414)	3.8 (3022)
Having Health Insurance	91.0 (86,685)	80.5 (5113)	92.0 (78,727)
Education (Ref: No Diploma)	5.5 (5098)	14.3 (889)	4.6 (3930)
GED or High School	19.8 (17,748)	31.9 (1871)	18.6 (15,155)
Some College	30.2 (26,726)	37.6 (2251)	29.6 (23,544)
Bachelor	25.4 (23,966)	11.6 (738)	26.7 (22,516)
Higher Graduate	19.1 (19,258)	4.6 (299)	20.4 (18,469)
Household Size (Ref: 1 member)	15.7 (28,683)	19.7 (2274)	15.3 (25,364)
2	34.4 (32,857)	25.7 (1519)	35.1 (30,253)
3	25.6 (15,430)	25.1 (1084)	25.6 (13,825)
> = 4	24.3 (15,856)	29.4 (1172)	23.9 (14,166)
Disabled**	8.9 (9494)	21.7 (1519)	7.7 (7598)
Region (Ref: West)	23.7 (23,322)	21.2 (1319)	23.9 (21,196)
Northeast	17.6 (15,804)	15.1 (883)	17.7 (14,315)
Midwest	21.0 (20,606)	19.3 (1280)	21.2 (18,808)
South	37.8 (33,315)	44.4 (2586)	37.2 (29,488)
Non-Metro Area	13.9 (14,105)	17.1 (1113)	13.8 (12,601)
Self-Reported Health Status (Ref: Excellent or Very Good)	58.2 (52,986)	33.2 (1830)	60.5 (49,577)
Good	27.5 (26,056)	31.2 (1871)	27.2 (23,254)
Fair or Poor	14.2 (13,950)	35.6 (2362)	12.3 (10,938)
Year (Ref: 2019)	33.2 (31,997)	38.7 (2508)	32.9 (28,599)
2020	33.3 (31,568)	34.7 (1951)	33.2 (28,501)
2021	33.5 (29,482)	26.5 (1609)	33.9 (26,707)
SNAP Utilization	11.9 (9478)	42.3 (2571)	9.5 (6888)
Social Risk Factors			
Difficulties Paying for Medical Bills	12.1 (10,111)	38.4 (2327)	10.0 (7402)
Difficulties Paying for Medications	5.8 (5108)	25.5 (1593)	4.2 (3336)
Receiving Income Assistance	3.2 (2540)	11.4 (723)	2.5 (1814)
Receiving Rental Assistance	2.9 (3523)	11.6 (927)	2.2 (3515)
Not Working Last Week	37.3 (37,650)	52.2 (3375)	36.1 (34,092)

* Sexual minority includes Gay/Lesbian/Something else

** The Washington Group Short Set Composite Disability Indicator

Abbreviations: AIAN American Indian/Alaska Native, GED General Educational Development, SNAP supplemental nutrition assistance program, FPL federal poverty level

Unweighted counts of a variable's categories may not sum up to 93,047, as there are missing values in the data

Table 2 Independent Variables Associated with Food Insecurity Before and After Inclusion of Social Risk Factors

Variable	Model 1 (N = 83,263)	Model 2: Model 1 With Social Risk Factors (N = 82,378)
Immigration Status (Ref: U.S. Born)		
Non-Citizens	1.39*** (1.16, 1.68)	1.59*** (1.30, 1.93)
Naturalized Citizens	1.26** (1.07, 1.48)	1.34** (1.13, 1.58)
Income-Poverty ratio (Ref: > 200 FPL)		
< 100 FPL	4.22*** (3.68, 4.84)	4.06*** (3.52, 4.67)
100–200 FPL	3.33*** (2.99, 3.72)	3.00*** (2.67, 3.35)
Race (Ref: White)		
Black	1.64*** (1.48, 1.82)	1.62*** (1.45, 1.80)
AIAN	1.69*** (1.28, 2.25)	1.77** (1.26, 2.50)
Asian	0.84 (0.66, 1.06)	0.93 (0.72, 1.18)
Other	1.63** (1.21, 2.20)	1.61** (1.19, 2.19)
Hispanic	0.95 (0.81, 1.12)	1.01 (0.86, 1.19)
Married	0.86** (0.78, 0.95)	0.81*** (0.73, 0.89)
Age (Ref: 18–34)		
35–49	1.11 (0.98, 1.25)	1.07 (0.95, 1.22)
50–64	0.87* (0.76, 0.98)	0.83** (0.73, 0.94)
65+	0.39*** (0.34, 0.46)	0.42*** (0.35, 0.49)
Female	1.16*** (1.07, 1.26)	1.04 (0.96, 1.13)
Sexual Minority	1.57*** (1.33, 1.86)	1.44*** (1.21, 1.70)
Having Health Insurance	0.61*** (0.53, 0.70)	0.81** (0.70, 0.93)
Education (Ref: No Diploma)		
GED or High School	0.97 (0.84, 1.12)	0.94 (0.81, 1.08)
Some College	1.01 (0.87, 1.18)	0.92 (0.79, 1.07)
Bachelor	0.62*** (0.52, 0.74)	0.58*** (0.49, 0.70)
Higher Graduate	0.41*** (0.33, 0.52)	0.40*** (0.32, 0.49)
Household Size (Ref: 1 member)		
2	0.88* (0.79, 0.97)	0.88* (0.79, 0.98)
3	0.94 (0.83, 1.07)	0.92 (0.81, 1.05)
>=4	0.78** (0.68, 0.90)	0.79** (0.68, 0.92)
Disabled	1.83*** (1.64, 2.05)	1.52*** (1.34, 1.71)
Region (Ref: West)		
Northeast	0.97 (0.83, 1.12)	0.96 (0.81, 1.12)
Midwest	1.03 (0.90, 1.18)	0.96 (0.83, 1.11)
South	1.02 (0.90, 1.17)	0.93 (0.81, 1.08)
Non-Metro Area	0.99 (0.88, 1.12)	1.01 (0.89, 1.15)
Self-Reported Health Status (Ref: Excellent or Very Good)		
Good	1.59*** (1.44, 1.76)	1.41*** (1.27, 1.56)
Fair or Poor	2.64*** (2.35, 2.95)	1.82*** (1.61, 2.05)
Year (Ref: 2019)		
2020	0.93 (0.84, 1.02)	0.98 (0.88, 1.09)
2021	0.69*** (0.62, 0.76)	0.75*** (0.67, 0.83)
SNAP Utilization	2.20*** (1.98, 2.45)	2.08*** (1.86, 2.34)
Social Risk Factors		
Difficulties Paying for Medical Bills		3.03*** (2.76, 3.33)
Difficulties Paying for Medications		3.30*** (2.92, 3.74)
Receiving Income Assistance		1.16 (0.97, 1.38)
Receiving Rental Assistance		1.23** (1.06, 1.41)
Not Working Last Week		1.24*** (1.11, 1.38)

*, **, *** significant at 5%, 1%, and 0.1% level, respectively

DISCUSSION

FI co-exist with other social risk factors, making it particularly complex to address.⁹ While the associations between these co-occurring social risk factors have been investigated in different sub-populations, less is known about how these associations vary across different levels of income and before and during the COVID-19 pandemic.

Our multivariable regression model showed that among people with difficulties paying for medical bills and

medications, the adjusted odds of FI were more than three times that of individuals without those difficulties (Table 2). People receiving rental assistance and reporting “not working last week” were also more likely to report FI compared with people without those social risk factors. While lack of income is a major risk factor for FI and other social risk factors, these results suggest that reducing income disparities, while necessary, may not be sufficient to reduce the burden of FI among those with other social risk factors (considering

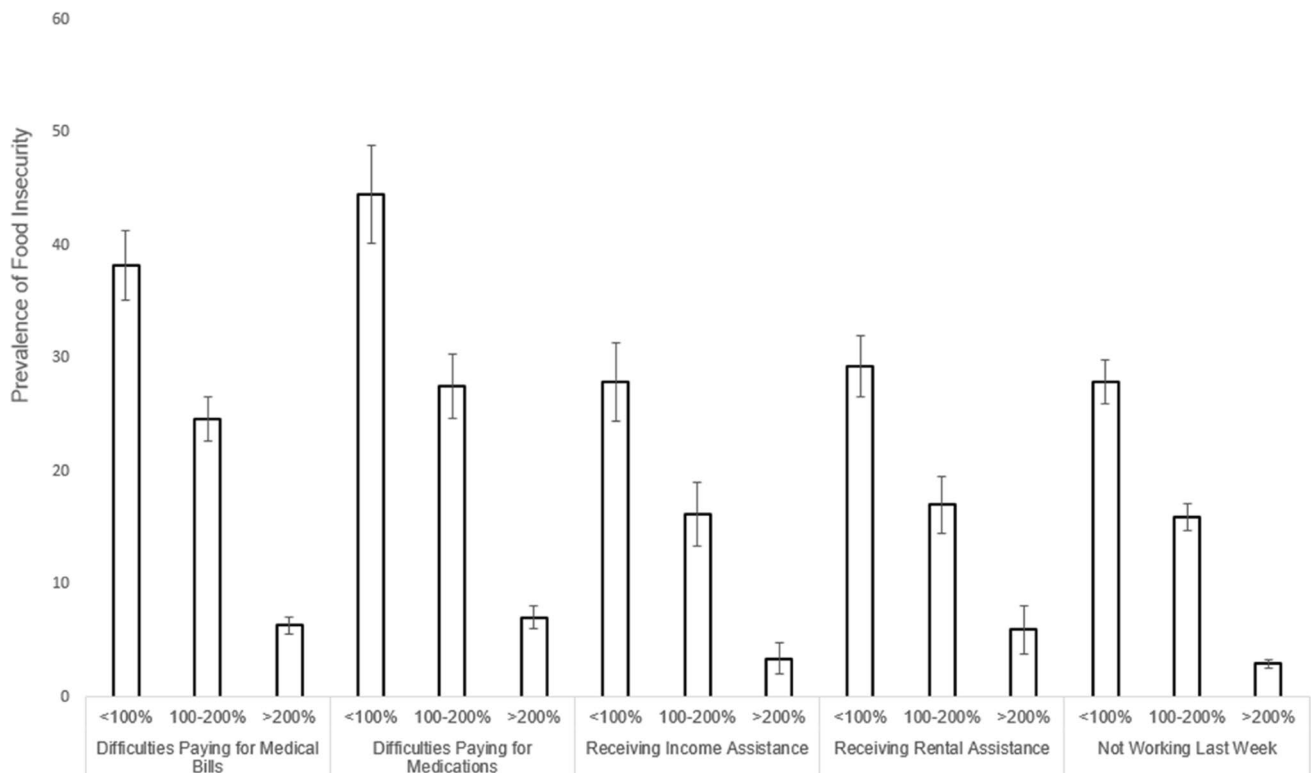


Fig. 1 Adjusted prevalence of food insecurity among people with social risk factors stratified by the income-poverty ratio – error bars indicate the 95% confidence interval.

Table 3 Social Risk Factors Associated with Food Insecurity Stratified by the Income-Poverty Ratio

Variable	Income Below 100% FPL (n = 7541)	Income Between 100% and 200% FPL (n = 13,597)	Income Above 200% FPL (n = 61,240)
Difficulties Paying for Medical Bills	2.28*** (1.91, 2.72)	2.56*** (2.23, 2.94)	4.04*** (3.39, 4.80)
Difficulties Paying for Medications	2.97*** (2.39, 3.70)	2.71*** (2.25, 3.26)	3.95*** (3.27, 4.77)
Receiving Income Assistance	1.14 (0.90, 1.44)	1.09 (0.84, 1.42)	1.38 (0.83, 2.29)
Receiving Rental Assistance	1.27** (1.06, 1.52)	1.17 (0.93, 1.47)	2.78*** (1.74, 4.43)
Not Working Last Week	1.35** (1.11, 1.65)	1.11 (0.94, 1.30)	1.20 (0.99, 1.45)

The model adjusted for other independent variables. Full table is reported in Appendix D

*, **, *** significant at 5%, 1%, and 0.1% level, respectively

Table 4 Social Risk Factors Associated with Food Insecurity Stratified by Year

Variable	2019 (n = 28,498)	2020 (n = 27,975)	2021 (n = 25,905)
Difficulties Paying for Medical Bills	3.13*** (2.69, 3.64)	2.89*** (2.46, 3.39)	3.11*** (2.59, 3.73)
Difficulties Paying for Medications	3.27*** (2.74, 3.92)	3.51*** (2.84, 4.34)	3.14*** (2.46, 4.02)
Receiving Income Assistance	1.04 (0.79, 1.36)	1.08 (0.79, 1.48)	1.38* (1.00, 1.91)
Receiving Rental Assistance	1.36** (1.09, 1.70)	1.20 (0.91, 1.59)	1.09 (0.83, 1.43)
Not Working Last Week	1.09 (0.92, 1.29)	1.20 (0.98, 1.47)	1.51*** (1.27, 1.79)

The model adjusted for other independent variables. Full table is reported in Appendix D

*, **, *** significant at 5%, 1%, and 0.1% level, respectively

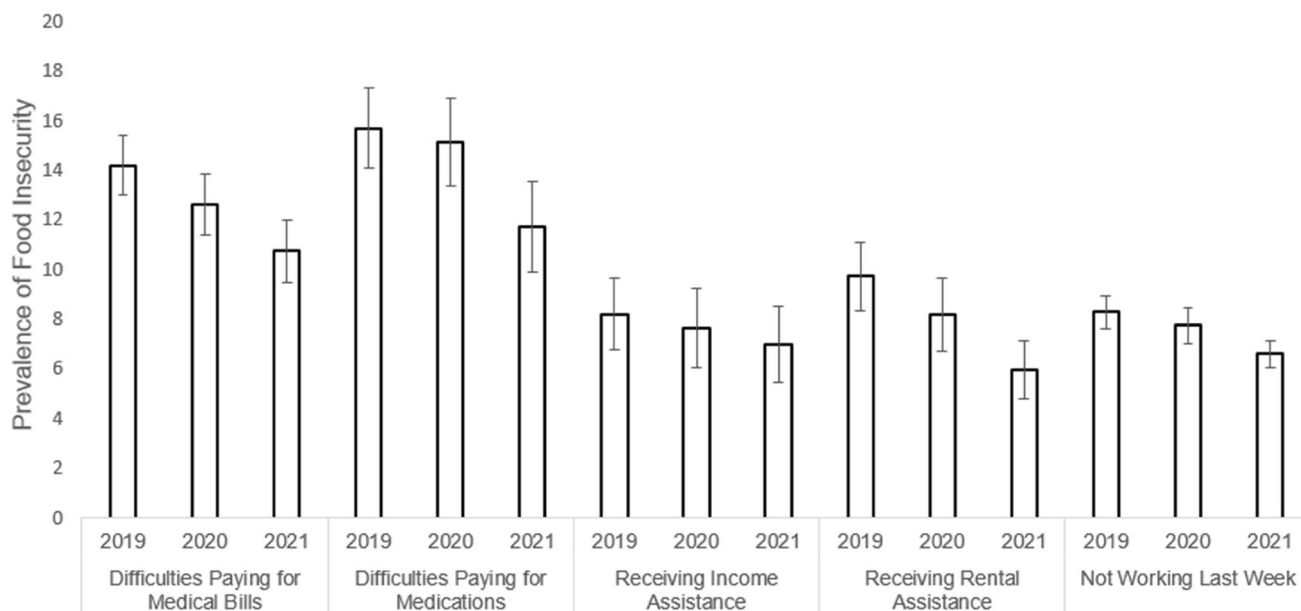


Fig. 2 Adjusted prevalence of food insecurity among people with social risk factors stratified by year – error bars indicate the 95% confidence interval.

the significant aOR for social risk factors in Table 2). This could be because people who are dealing with several social risk factors must prioritize their expenses to address only a few of those whether they are in poverty or have more financial resources. Thus, there are likely to be other factors other than lack of income such as social support, spread of information about FI programs, and access to other FI and social safety net programs that could better predict the co-occurring social risk factors. This finding calls for further research as these variables are not available in NHIS.

Another major finding of our study was that the association between FI and other social risk factors increased with income level (Table 3). While individuals living in poverty who had other social risk factors experienced the highest prevalence of FI (Fig. 1), the association between FI and other social risk factors, measured by aOR, were stronger among people within our higher-income stratum (Table 3). For example, the impact of difficulties paying for medical bills and medications and receiving rental assistance on FI were higher for individuals with incomes above 200% FPL than those with incomes between 100% and 200% FPL and below 100% FPL. These differences could be due to the exclusion of higher-income groups from eligibility for many FI and social safety net programs such as food pantries, National School Lunch Program, and Children’s Health Insurance Program.

Provision of additional support could be the key to controlling FI rates. Despite the disruptive economic and social impact of the pandemic, official national estimates of the prevalence of FI in the U.S. did not increase in 2020 (remaining at 10.5%, similar to 2019), and decreased in 2021 (to 10.2%).¹ In response to the pandemic, there was a surge

of federal and state assistance for FI and other social risk factors^{20,21,23,24} including a nationwide eviction moratorium and enhanced unemployment benefits,³³ which exceeded average wages in the majority of states.³⁴ These pandemic-related public and private assistance programs may explain why FI decreased in 2021. In fact, our analysis demonstrated that the association between FI and other social risk factors did not substantively change in the years 2019, 2020, and 2021 (Table 4). Individuals reporting difficulties paying for medical bills and medications had three times the adjusted odds of FI compared to individuals without difficulties paying for medical bills and medications in all three years. However, receiving rental assistance and FI were statistically insignificant only in 2019, and the associations between FI and receiving income assistance and “not working last week” were significant only in 2021. In addition, the provision of public and private assistance programs could have caused significant decreases in adjusted prevalence of FI among those with difficulties paying for medical bills and medications, receiving rental assistance, and “not working last week” from 2019 to 2021 (Fig. 2).

LIMITATIONS

Several limitations are pertinent to our study. First, important social risk factors (e.g., lack of transportation, housing instability, utility insecurity) are not included in the NHIS questionnaire and our social risk factors mainly cover two categories of our conceptual framework—healthcare access and quality and economic stability. We utilized NHIS’s “receiving rental assistance” as a proxy for housing instability risk factor and the NHIS’s “not working last week” as a proxy

for unemployment risk factor. The latter, however, might not reflect the true unemployment rate as NHIS only asks about working status in the last week. This variable might also include people who were unable to work because they were retired or disabled. However, the inclusion of “receiving income assistance” could have improved the accuracy of this proxy for unemployment. Second, the language barrier and utilization of charitable food assistance programs (e.g., food pantries, soup kitchens) are not assessed by NHIS. Third, the publicly available NHIS data does not provide state-level identifiers (e.g., state policies) that might impact FI. NHIS also does not assess factors attributable to shutdowns during the pandemic but incorporating the year of the survey into our analysis could reflect pandemic-era policies. Fourth, the analysis was conducted on complete cases and we did not impute any missing information as the rate of missing data was less than 12%, which poses minimal bias on results.³⁵ Finally, our data is restricted to adults because NHIS only administers the adult-referenced items in the Food Security Survey Module.

CONCLUSION

Our analysis showed that while reducing income disparities is necessary it may not be sufficient to reduce the burden of FI among those with other social risk factors. Our findings call for future research to investigate whether unobserved factors such as social support, spread of information about FI programs, and access to other FI and social safety net programs could impact the association between FI and other social risk factors. Furthermore, despite the disruptive economic and societal impact of the pandemic, the associations between FI and other social risk factors were similar before and during the pandemic. This could be due to the broad provision of financial support and expanding the eligibility criteria for several FI and social safety net programs. With the expiration of most pandemic-related services, further research and monitoring are needed to examine FI in the context of increasing food and housing costs. Our findings may also have implications for the expansion of income-based program eligibility criteria. For healthcare systems, our results also draw attention to the importance of screening for social risk factors across all patients and not only low-income people.

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