Food Insecurity Disparities Among Immigrants in the U.S.

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Introduction: Food insecurity negatively impacts public health and costs the U.S. healthcare system $53 billion annually. Immigrants are at higher risk of food insecurity. We sought to (1) characterize the prevalence of food insecurity among immigrants (i.e., noncitizens and naturalized citizens) and U.S.-born citizens and (2) determine whether Supplemental Nutrition Assistance Program utilization and income—poverty ratio levels impact the relationship between immigration status and food insecurity.

Methods: Multivariable logistic regression models were used to determine the odds of food insecurity (dependent variables) using nationally representative data from the 2019—2020 National Health Interview Survey. Independent variables included immigration status, Supplemental Nutrition Assistance Program utilization, income—poverty ratio, and other important demographics. AORs with their 95% CIs are reported. Analysis was conducted in 2022.

Results: After controlling for independent variables, noncitizens had 1.28 (95% CI=1.02, 1.61) times higher odds of food insecurity than U.S.-born citizens. There was no food insecurity disparity between naturalized citizens and U.S.-born citizens. However, the association between immigration status and food insecurity varied significantly at different levels of Supplemental Nutrition Assistance Program utilization and income—poverty ratio. There were no food insecurity disparities between immigrants and U.S.-born citizens when they utilized the Supplemental Nutrition Assistance Program and when they had an income below 200% federal poverty level. Noncitizens who did not utilize the Supplemental Nutrition Assistance Program or those with an income above 200% federal poverty level were more likely to report food insecurity than their U.S.-born counterparts (AOR=1.32, 95% CI=1.01, 1.73 and AOR=1.88, 95% CI=1.24, 2.86, respectively). Moreover, naturalized citizens with an income above 200% federal poverty level were also more likely to report food insecurity than their U.S.-born counterparts (AOR=1.61, 95% CI=1.21, 2.14).

Conclusions: Supplemental Nutrition Assistance Program utilization may likely eliminate food insecurity disparities among immigrants and U.S.-born citizens. However, among non—Supplemental Nutrition Assistance Program utilizers, significant food insecurity disparities remained between noncitizens and U.S.-born citizens after adjusting for independent variables. In addition,

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among individuals with incomes above 200% federal poverty level, significant food insecurity disparities were observed between immigrants and U.S.-born citizens. More research is needed to further understand the role that fear of deportation, ineligibility or lack of awareness about eligibility for the Supplemental Nutrition Assistance Program, and other factors such as structural racism play in food insecurity disparities between immigrants and U.S.-born citizens.

INTRODUCTION

Food insecurity (FI) is the lack of access to adequate food for an active, healthy life.[1] In 2020, 10.5% of U.S. households were food insecure at some point during the year.[2] Low-income households, households with children, and populations that experience health disparities such as racial and ethnic minorities are more likely to report FI.[1] In addition, FI negatively impacts population health because it is a key contributor to disparities in health conditions such as hypertension, asthma, obesity, and diabetes.[3−7] FI also costs the U.S. healthcare system $53 billion annually.[8]

However, immigrants are at higher risk of FI.[9−11] Higher risk may be because of income instability during periods of economic uncertainty (such as that seen during the coronavirus disease 2019 [COVID-19] pandemic[12]) as well as low enrollment into safety net and federal nutrition programs, either because of ineligibility, fear of enrollment,[11,13,14] or lack of awareness.[11,13] Immigrants are also offered fewer educational and employment opportunities owing to anti-immigrant attitudes, racism, and discrimination,[9,15] which increase income instability. In 2021, 45.2 million immigrants (i.e., noncitizens and naturalized citizens), equivalent to 13.6% of the total U.S. population, lived in the U.S.[16] It is also estimated that in 2022, more than 11 million undocumented immigrants lived in the U.S.[17] FI estimates among different samples of immigrants vary, with most estimates ranging between 20% and 68%.[11] Thus, addressing FI among immigrants in the U.S. is critical to reducing health disparities and costs associated with FI.

Federal nutrition assistance programs are designed to improve food security. The largest 3 programs are the Supplemental Nutrition Assistance Program (SNAP); the National School Lunch Program (NSLP); and the Special Supplemental Program for Women, Infants, and Children (WIC).[2] Whereas WIC and NSLP have no immigration restrictions,[18] SNAP is available only to qualified noncitizens (e.g., green card holders, asylees, refugees) who meet additional conditions such as having 5 years of residency.[14,19] This ineligibility impacts noncitizens' ability to meet their food needs, raising their risk of FI. Furthermore, even eligible immigrants are less likely to enroll in SNAP than eligible U.S. citizens[13] owing to fear of deportation or hampering their naturalization process, language barriers, lack of knowledge about their eligibility, and unwillingness to enroll owing to limited benefits.[11,13,14] However, naturalized citizens are eligible to enroll in SNAP similarly to U.S.-born citizens, and it has been shown that they experience FI at a similar or even a lower rate than U.S.-born citizens.[20] Naturalized citizens are also more likely to obtain a higher degree and receive a higher income than noncitizens,[21] which might lead to different FI outcomes.

Although a few studies have explored the impact of immigration status on FI,[13,20,22,23] none have used a recent nationally representative sample to characterize differences in FI among immigrants and U.S.-born citizens or to determine whether SNAP utilization and different levels of income−poverty ratio impact the relationship between immigration status and FI. As such, the purpose of this study was to answer these questions, with the hypothesis that noncitizens are more likely to be food insecure than U.S.-born individuals, but naturalized citizens have an FI rate similar to that of U.S.-born individuals. We also hypothesized that the association between FI and immigration status could vary by SNAP utilization and at different levels of income−poverty ratio. Superficially, we hypothesized that there might be FI disparities between immigrants and U.S.-born citizens when they do not utilize SNAP or when they have limited incomes.

METHODS

This study was a secondary analysis of deidentified publicly available data and did not require IRB approval. All the analysis was conducted in late 2022.

Study Population

Pooled cross-sectional data from the 2019−2020 National Health Interview Survey (NHIS)[24] were used for the analysis. NHIS is an in-person health survey of

the non-institutionalized U.S. population residing within the 50 states and the District of Columbia conducted by the U.S. Census Bureau. NHIS is administered in both English and Spanish and oversamples Black, Hispanic, and Asian households to increase the precision of estimates for these groups. We used NHIS's sample adult interviews for our analysis. NHIS randomly selects 1 adult from each household after a brief interview that identifies who lives in the household. Information is collected from that individual on behalf of his/her/their household.[24] We did not have any exclusion criteria, and the only inclusion criterion is explained in the outcome variable section. Our sample included 63,565 adults (31,997 in 2019 and 31,568 in 2020). During 2020, NHIS collected data through a combination of in-person and telephone interviews because of the pandemic, and consequently, the response rate declined slightly; however, they still provided detailed, pandemic-era, nationally representative data. NHIS has also been used in multiple other studies of immigration research.[14,25−27]

Measures

Outcome variable. FI is measured using the U.S. Department of Agriculture (USDA)'s 10-item Household Food Security Survey Module,[2] incorporated into NHIS. The items in the module assess limits in the household's food access over the previous 30 days related to lack of money (see questions in Appendix A, available online). Affirmative responses are summed to determine food security status, according to USDA scoring instructions, with 3 or more affirmative responses considered FI (this includes the USDA categories of *low food secure*, 3−5 affirmative responses, and *very low food secure*, 6 or more affirmative responses).[2] Only adults (aged ≥18 years) were included in the analysis because NHIS only uses the adult-referenced items in the Food Security Survey Module (see Appendix A, available online, for more information).

Main independent variable. In NHIS, immigration status is determined using the following questions: (1) *Were you born in the U.S. or a U.S. territory?* and (2) *Are you a citizen of the U.S.?* On the basis of responses and similar to previous literature,[28,29] participants were categorized as born in the U.S., naturalized citizens, or noncitizens. Noncitizens and naturalized citizens are foreign-born populations, but noncitizens do not have citizenship status as naturalized citizens. In addition, although undocumented immigrants might be represented in our study under the noncitizen category, NHIS, similar to other national health surveys, does not collect information on immigrants' legal status and does not report any information on undocumented immigrants.[28,30] It is estimated that among the 2000 −2018 NHIS's foreign-born participants, more than 14% were undocumented.[30]

Other independent variables. Potential variables were categorized according to Andersen's model of health service use[31] into predisposing factors (race, ethnicity, education, marital status, sex, age), enabling factors (region, metropolitan/nonmetropolitan area, disability status, health insurance, employment, income, number of household members, and number of children aged <18 years), health status, and service utilization. Predisposing factors are the general characteristics of the population and exist before the onset of a problem such as FI.[31] Enabling factors are those that facilitate or impede access to resources.[31] Although there is no consensus on whether disability status, unemployment, number of household members, and number of children aged <18 years should be considered as predisposing or enabling factors, in the analyses, they were considered as enabling factors because they can impede access to services. For income, the ratio of family income to poverty threshold was used (variable RATCAT_A in the NHIS data). We then categorized households into those with an income below 100% federal poverty level (FPL), identifying low-income households living in poverty; those with income between 100% and 200% FPL, identifying low-income households that could be still eligible for many safety-net programs (e.g., SNAP, WIC, Medicare, Medicaid); and those with income above 200% FPL, identifying households that might have fewer income barriers to address their needs but are most likely ineligible for safety-net programs. Although eligibility for safety-net programs varies across states, the 200% cut off point could differentiate low-income households from higher-income households[32] that are most likely ineligible for these programs.[33] For service utilization, SNAP utilization in the past 12 months was used (*At any time in the last 12 months did you/any family members living here receive food stamp benefits?*). See Appendix A (available online) for questions related to each variable.

Statistical Analysis

The analysis accounted for complex survey design, including 2-year sampling weights, to calculate the prevalence of FI among immigrants (noncitizens and naturalized citizens) and U.S.-born citizens according to SNAP utilization and income−poverty ratio. Percentages were calculated with weighted data to be nationally representative of the U.S. population. Cross-tabulations were used to report bivariate distributions of FI,

immigration status, SNAP utilization, and income−poverty ratio. A multivariable logistic regression model was fitted to complete cases to identify the association between immigration status and FI by only adjusting for the year of the survey (Model 1). Considering that the amount of missing data was <9%, the complete case analysis will not pose bias on the final results, and the missing data could be ignored.[34] To identify the key correlates of FI disparities among immigrants, other independent variables were added to Model 1 in a stepwise approach. In Model 2, we added predisposing factors. In Model 3, we added SNAP utilization as service utilization. In Model 4, we added health status, and in the full model, we added enabling factors. Finally, the full model was stratified by SNAP utilization and income−poverty ratio separately. Examining these stratified results is important because income is the main eligibility requirement for SNAP enrollment,[35] and immigrants and U.S.-born citizens may have different levels of income as well as access to food assistance programs.[11,13] Also for each model, we evaluated the multicollinearity among independent variables and found that none of them were correlated. Analyses were conducted in Stata (17, Stata-Corp[36]) by accounting for complex survey design and replicated in R Statistical Software (Version 4.1.1, R Core Team[37]) using the survey package. Stata codes are available in Appendix B (available online).

RESULTS

Table 1 shows the weighted percentages of FI and independent variables for all the adult participants and also stratified on the basis of immigration status. A total of 63,565 adults were interviewed by NHIS in 2019−2020 (31,997 in 2019 and 31,568 in 2020), yielding a weighted sample of 251,484,306. This included 52,559 U.S.-born citizens (81.8%), 5,664 naturalized citizens (9.9%), and 3,738 noncitizens (8.3%). These percentages compare with U.S. Census Bureau estimates of 6.8% naturalized citizens and 6.6% noncitizens in 2020.[38]

An estimated 8.1% of respondents reported living in a food-insecure household in the past 30 days, 11.4% reported utilizing SNAP in the last 12 months, and 10.6% reported an income below 100% FPL. Comparing the characteristics of U.S.-born citizens with those of immigrant adults, immigrants were more likely to be of low income, Hispanic, married, and living in a crowded household. However, noncitizens were more likely to be uninsured, Hispanic, lower educated, and living in a more crowded household than naturalized citizens.

A total of 13.5% of noncitizens (95% CI=11.9%, 15.1%) and 7.4% (95% CI=6.4%, 8.3%) of naturalized citizens reported FI, compared with 7.7% (95% CI=7.3%, 8.0%) of U.S.-born citizens (Appendix C, available online, and Table 1). In unadjusted analysis, U.S.-born citizens who utilized SNAP had higher rates of FI than naturalized citizens who utilized SNAP (31.4%, 95% CI=29.6%, 33.2% vs 23.4%, 95% CI=19.1%, 27.7%) (Figure 1A and Appendix C, available online, and Table 2). In addition, noncitizens who did not utilize SNAP had significantly higher FI rates than naturalized citizens and U.S.-born citizens who utilized SNAP (10.4%, 95% CI=8.8%, 12.0% vs 5.3%, 95% CI=4.4%, 6.2% and 4.7%, 95% CI=4.4%, 5.0%, respectively) (Figure 1A and Appendix C, available online, and Table 2).

Stratification analysis shows that the impact of immigration status on FI is significantly modified at different levels of SNAP utilization and income−poverty ratios. In other words, the degree to which immigration status is associated with FI is significantly impacted by whether a respondent is receiving SNAP benefits and what their income is, even after adjusting for other independent variables. For instance, the multivariable model stratified by SNAP utilization shown in Table 3 indicates that noncitizens who did not utilize SNAP were 1.32 (95% CI=1.01, 1.73) times more likely to report FI than U.S.-born citizens who did not utilize SNAP. However, no FI disparities were observed between immigrants and U.S.-born citizens when they utilized SNAP.

Noncitizens with an income above 200% FPL had significantly higher FI rates than U.S.-born citizens with the same amount of income, and naturalized citizens with an income between 100% and 200% FPL had significantly lower FI rates than their U.S.-born counterparts (Figure 1B and Appendix C, available online, and Table 3).

After adjusting for the year of interview and immigration status, FI prevalence was not significantly different between the U.S.-born and naturalized citizens; however, noncitizens were significantly more likely to report FI than U.S.-born citizens (AOR=1.88, 95% CI=1.63, 2.18) (Model 1 in Table 2). The observed association was similar even after the stepwise addition of predisposing factors (AOR=1.52, 95% CI=1.25, 1.86) (Model 2), SNAP utilization (AOR =1.65, 95% CI=1.33, 2.04) (Model 3), and health status (AOR=1.70, 95% CI=1.36, 2.12) (Model 4). As Model 2 indicates, predisposing factors do not fully explain disparities in reports of FI among noncitizen immigrants compared with those among U.S.-born citizens. In addition, adjusting for SNAP utilization and health status in Models 3 and 4 does not attenuate the relationship between immigration status and FI among

Table 1. Characteristics of Adult Participants in the 2019—2020 National Health Interview Survey (N=63,565)

| Variable	Full sample (N=63,565) Weighted % (unweighted *n*)	U.S.-born citizens (*n*=52,559) Weighted % (unweighted n)	Naturalized citizens (*n*=5,664) Weighted % (unweighted n)	Noncitizens (*n*=3,738) Weighted % (unweighted n)
Food insecure	8.1 (4,459)	7.7 (3,654)	7.4 (373)	13.5 (409)
Immigration status (ref: U.S.-born citizens)	81.8 (52,559)			
Naturalized citizens	9.9 (5,664)			
Noncitizens	8.3 (3,738)			
Race (ref: White)	77.1 (48.404)	81.8 (43,154)	48.4 (2,627)	60.38 (1,627)
Black	13.0 (6,901)	13.5 (5,817)	13.5 (591)	8.6 (231)
AIAN	2.0 (1,087)	2.1 (1,007)	0.5 (30)	1.5 (26)
Asian	6.4 (3,377)	1.6 (729)	35.0 (1,598)	28.13 (905)
Other	1.5 (751)	1.4 (559)	2.5 (128)	1.36 (43)
Hispanic	16.6 (7,985)	9.5 (3,874)	34.3 (1,776)	63.0 (2,017)
Education (ref: <high school diploma)	12.1 (5,416)	8.8 (3,443)	16.7 (711)	37.2 (1,052)
GED or high school	27.9 (15,687)	28.7 (13,282)	23.3 (1,137)	24.4 (823)
Some college	30.7 (18,492)	33.2 (16,259)	24.6 (1,301)	14.8 (519)
Bachelor	18.3 (14,358)	18.6 (11,954)	20.5 (1,408)	13.1 (679)
Higher graduate	10.9 (9,284)	10.6 (7,415)	14.9 (1,083)	10.4 (609)
Married	52.1 (29,425)	49.7 (23,924)	65.6 (3,241)	59.1 (2,113)
Female	51.7 (34,306)	51.5 (28,300)	54.4 (3,239)	50.2 (1,899)
Age, years	47.9 (0.1)	48.0 (0.1)	52.4 (0.3)	42.1 (0.3)
Sexual minority	3.6 (2,114)	4.0 (1,915)	1.8 (123)	1.4 (65)
SNAP utilizer	11.4 (6,160)	11.0 (5,054)	11.5 (593)	15.2 (489)
Health status (ref: excellent or very good)	58.0 (36,224)	58.7 (29,923)	57.2 (3,267)	54.9 (2,222)
Good	27.4 (17,706)	27.0 (14.637)	28.8 (1,595)	30.7 (1,033)
Fair or poor	14.5 (9,593)	14.4 (7,970)	14.0 (799)	14.4 (481)
Region (ref: West)	23.6 (15,673)	21.1 (11,832)	33.6 (2,024)	35.9 (1,397)
Northeast	17.7 (11,029)	16.9 (8,838)	24.7 (1,283)	16.4 (596)
Midwest	21.0 (14,279)	23.4 (12,940)	10.8 (618)	11.3 (467)
South	37.8 (22,584)	38.6 (18,949)	31.9 (1,739)	36.3 (1,278)
Nonmetropolitan resident	14.2 (9,832)	16.6 (9,260)	2.9 (191)	5.6 (209)
Disabled	8.9 (6,482)	9.5 (5,670)	7.7 (469)	4.2 (164)
Having health insurance	90.8 (59,203)	92.8 (49,630)	93.9 (5,369)	69.6 (2,782)
Employed	62.9 (36,216)	62.4 (30,061)	62.9 (3,433)	67.8 (2,549)
Income—poverty ratio (ref: >200 FPL)	71.0 (46,184)	74.0 (39,182)	68.6 (3,987)	47.0 (1,963)
<100 FPL	10.6 (6,372)	9.3 (4,744)	9.9 (623)	22.3 (760)
100—200 FPL	18.4 (11,009)	16.7 (8,633)	21.5 (1,054)	30.7 (1,015)
Household size (ref: ≥3)	50.2 (21,267)	46.9 (16,191)	57.6 (2,327)	72.9 (2,173)
1	15.5 (19,574)	16.6 (16,919)	12.6 (1,494)	7.6 (666)
2	34.3 (22,503)	36.4 (19,279)	29.7 (1,814)	19.4 (878)
Children aged <18 years (ref: 0)	66.3 (46,485)	69.1 (39,609)	63.0 (3,872)	43.5 (1,873)
1	14.7 (7,123)	13.8 (5,494)	15.8 (471)	21.5 (695)
2	11.7 (6,152)	10.6 (4,625)	13.4 (669)	19.9 (679)
≥3	7.3 (3,584)	6.5 (2,661)	7.7 (353)	15.0 (470)
Year 2020 (ref: 2019)	50.1 (31,568)	50.3 (26,231)	50.6 (2,839)	48.9 (1,772)

AIAN, American Indian/Alaska Native; FPL, federal poverty level; SNAP, Supplemental Nutrition Assistance Program.
Note: For age, mean and SE are reported. Sexual minority includes gay/lesbian/something else. Unweighted counts of a variable's categories may not sum up to 63,565 because there are missing values in the data.

Panel A
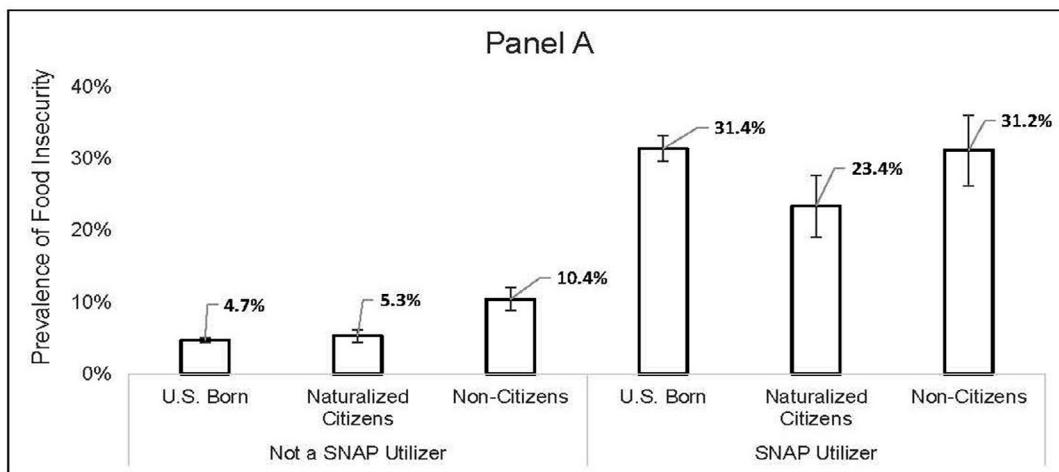
	Not a SNAP Utilizer			SNAP Utilizer		
		Naturalized			Naturalized	
	U.S. Born	Citizens	Non-Citizens	U.S. Born	Citizens	Non-Citizens
	4.7%	5.3%	10.4%	31.4%	23.4%	31.2%
Lower 95% CI	4.45%	4.45%	8.83%	29.65%	19.08%	26.26%
Upper 95% CI	5.00%	6.22%	12.04%	33.18%	27.73%	36.11%
Lower bar	0.27%	0.89%	1.61%	1.76%	4.33%	4.93%
Upper bar	0.28%	0.88%	1.60%	1.77%	4.32%	4.92%

Panel B
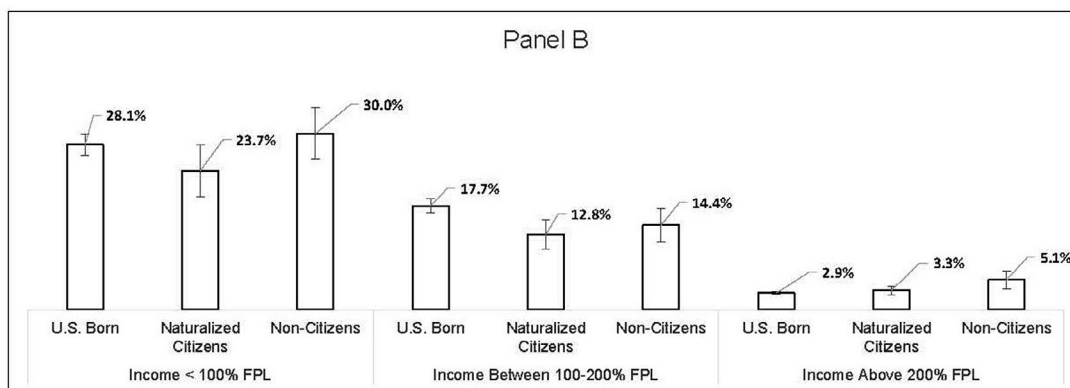
	Income < 100% FPL			Income Between 100-200% FPL			Income Above 200% FPL		
		Naturalized	Non-		Naturalized	Non-		Naturalized	Non-
	U.S. Born	Citizens	Citizens	U.S. Born	Citizens	Citizens	U.S. Born	Citizens	Citizens
Main Probability	28.1%	23.7%	30.0%	17.7%	12.8%	14.4%	2.9%	3.3%	5.1%
Lower 95% CI	26.32%	19.27%	25.60%	16.55%	10.31%	11.62%	2.61%	2.56%	3.65%
Upper 95% CI	29.91%	28.02%	34.33%	18.84%	15.29%	17.24%	3.11%	4.08%	6.55%
Lower bar	1.79%	4.38%	4.37%	1.14%	2.49%	2.81%	0.25%	0.76%	1.45%
Upper bar	1.80%	4.37%	4.36%	1.15%	2.49%	2.81%	0.25%	0.76%	1.45%

Figure 1. Unadjusted prevalence of food insecurity among U.S.-born citizens and immigrants by (A) SNAP utilization and (B) income−poverty ratio levels reported by NHIS, after accounting for complex survey design. The 95% Cls are represented by vertical bars
NHIS, National Health Interview Survey; SNAP, Supplemental Nutrition Assistance Program.

Table 2. Food Insecurity and Its Association With Immigration Status After Multivariable Logistic Regression Adjustment

Variable	Model 1	Model 2, inclusion of predisposing factors	Model 3, inclusion of SNAP utilization	Model 4, inclusion of health status	Full model, inclusion of enabling factors
Immigration status (ref: U.S.-born citizens)					
Naturalized citizens	0.96 (0.83, 1.11)	1.04 (0.88, 1.23)	1.09 (0.91, 1.30)	1.17 (0.97, 1.40)	1.11 (0.92, 1.34)
Noncitizens	**1.88 (1.63, 2.18)*****	**1.52 (1.25, 1.86)*****	**1.65 (1.33, 2.04)*****	**1.70 (1.36, 2.12)*****	**1.28 (1.02, 1.61)***
Year 2020 (ref: 2019)	**0.9 (0.82, 0.99)***	**0.89 (0.81, 0.98)***	**0.86 (0.78, 0.95)****	**0.89 (0.80, 0.98)***	0.93 (0.84, 1.03)
Race (ref: White)					
Black		**2.33 (2.09, 2.61)*****	**1.78 (1.58, 2.01)*****	**1.75 (1.55, 1.97)*****	**1.62 (1.42, 1.83)*****
AIAN		**2.65 (2.13, 3.30)*****	**2.14 (1.70, 2.69)*****	**1.97 (1.56, 2.5)*****	**1.7 (1.33, 2.17)*****
Asian		0.83 (0.64, 1.08)	0.78 (0.6, 1.03)	0.8 (0.61, 1.06)	0.85 (0.65, 1.12)
Other		**1.76 (1.27, 2.44)*****	**1.54 (1.09, 2.17)***	**1.60 (1.13, 2.27)****	**1.73 (1.17, 2.55)****
Hispanic		**1.20 (1.02, 1.41)***	1.10 (0.93, 1.29)	1.10 (0.93, 1.3)	1.01 (0.85, 1.21)
Education (ref: no diploma)					
GED or high school		**0.51 (0.45, 0.58)*****	**0.66 (0.58, 0.76)*****	**0.73 (0.63, 0.84)*****	**0.85 (0.74, 0.99)***
Some college		**0.4 (0.34, 0.45)*****	**0.58 (0.51, 0.67)*****	**0.68 (0.58, 0.78)*****	0.87 (0.75, 1.02)
Bachelor		**0.16 (0.14, 0.19)*****	**0.28 (0.23, 0.33)*****	**0.36 (0.3, 0.43)*****	**0.55 (0.46, 0.67)*****
Higher graduate		**0.09 (0.07, 0.12)*****	**0.16 (0.12, 0.20)*****	**0.21 (0.16, 0.28)*****	**0.37 (0.28, 0.49)*****
Married		**0.57 (0.52, 0.63)*****	**0.67 (0.61, 0.75)*****	**0.71 (0.64, 0.79)*****	0.92 (0.82, 1.05)
Female		**1.48 (1.35, 1.62)*****	**1.28 (1.16, 1.40)*****	**1.29 (1.18, 1.42)*****	**1.24 (1.13, 1.37)*****
Age, years		**0.99 (0.99, 1.00)*****	**1.00 (0.99, 1.00)*****	**0.99 (0.98, 0.99)*****	**0.98 (0.98, 0.99)*****
Sexual minority		**1.69 (1.40, 2.05)*****	**1.58 (1.29, 1.92)*****	**1.44 (1.18, 1.77)*****	**1.43 (1.15, 1.77)****
SNAP utilizer			**5.04 (4.52, 5.61)*****	**4.13 (3.7, 4.61)*****	**2.53 (2.23, 2.87)*****
Health status (ref: excellent or very good)					
Good				**1.85 (1.65, 2.07)*****	**1.69 (1.50, 1.90)*****
Fair or poor				**3.87 (3.43, 4.38)*****	**2.90 (2.53, 3.32)*****
Region (ref: West)					
Northeast					1.03 (0.87, 1.23)
Midwest					1.12 (0.96, 1.30)
South					1.09 (0.98, 1.26)
Nonmetropolitan resident					0.95 (0.83, 1.08)
Disabled					**1.74 (1.52, 1.98)*****
Having health insurance					**0.6 (0.51, 0.70)*****
Employed					1.08 (0.96, 1.22)
Income−poverty ratio (ref: >200% FPL)					
<100% FPL					**4.15 (3.53, 4.87)*****
100%−200% FPL					**3.37 (2.95, 3.84)*****
Household size (ref: ≥3)					
1					**1.19 (1.01, 1.41)***
2					0.97 (0.83, 1.13)
Children aged <18 years (ref: 0)					
1					0.99 (0.83, 1.17)
2					0.83 (0.68, 1.02)
≥3					0.94 (0.74, 1.19)

AIAN, American Indian/Alaska Native; FPL, federal poverty level; SNAP, Supplemental Nutrition Assistance Program.
Note: Boldface indicates statistical significance (*p<0.05, **p<0.01, and ***p<0.001).
Numbers reported in the table are AORs with their 95% CIs. Sexual minority includes gay/lesbian/something else.

noncitizens compared with those born in U.S. However, the AOR for noncitizens decreased substantially after including enabling factors (AOR=1.28, 95% CI=1.02, 1.61) (full model), although it was still statistically significant. Naturalized citizens did not have statistically significant differences in FI relative to U.S.-born

citizens across all models. It is noteworthy to mention that adding independent variables improved the model fit at each step. In addition, among the enabling factors, income−poverty ratio followed by health insurance had the most substantial impact on the relationship between noncitizen immigration status and FI (enabling factors

Table 3. Food Insecurity and Its Association With Immigration Status Stratified by SNAP Utilization and Income−Poverty Ratio

Variable	Stratified by SNAP		Stratified by income		
	SNAP yes (*n*=5,433)	SNAP no (*n*=51,488)	Income below 100% FPL (*n*=5,264)	Income between 100% and 200% FPL (*n*=9,389)	Income above 200% FPL (*n*=42,268)
Immigration status (ref: U.S.-born citizens)					
Naturalized citizens	0.78 (0.56, 1.08)	1.21 (0.98, 1.49)	0.95 (0.67, 1.35)	0.78 (0.58, 1.05)	**1.61 (1.21, 2.14)****
Noncitizens	1.04 (0.71, 1.53)	**1.32 (1.01, 1.73)***	1.36 (0.97, 1.91)	0.90 (0.62, 1.30)	**1.88 (1.24, 2.86)****
Race (ref: White)					
Black	0.98 (0.80, 1.19)	**2.17 (1.86, 2.52)*****	1.14 (0.93, 1.40)	**1.47 (1.19, 1.80)*****	**2.40 (1.95, 2.96)*****
AIAN	1.35 (0.94, 1.93)	**1.90 (1.37, 2.65)*****	**1.79 (1.19, 2.69)****	1.43 (0.94, 2.17)	1.66 (0.99, 2.79)
Asian	0.84 (0.49, 1.44)	0.87 (0.63, 1.20)	0.84 (0.53, 1.33)	0.89 (0.57, 1.39)	0.68 (0.39, 1.17)
Other	1.43 (0.78, 2.62)	**1.78 (1.13, 2.78)***	0.88 (0.44, 1.79)	**2.07 (1.16, 3.69)***	**2.22 (1.26, 3.91)****
Hispanic	0.85 (0.64, 1.14)	1.12 (0.91, 1.38)	1.01 (0.75, 1.37)	0.85 (0.64, 1.14)	1.29 (0.97, 1.72)
Education (ref: no diploma)					
GED or high school	0.83 (0.67, 1.02)	0.87 (0.71, 1.07)	0.91 (0.73, 1.14)	**0.75 (0.60, 0.94)***	0.93 (0.67, 1.31)
Some college	0.88 (0.71, 1.09)	0.88 (0.73, 1.08)	0.88 (0.70, 1.10)	0.90 (0.71, 1.14)	0.81 (0.58, 1.15)
Bachelor	**0.64 (0.46, 0.88)****	**0.57 (0.45, 0.72)*****	**0.51 (0.36, 0.73)*****	**0.71 (0.52, 0.98)***	**0.51 (0.35, 0.74)*****
Higher graduate	**0.48 (0.29, 0.79)****	**0.38 (0.28, 0.53)*****	**0.42 (0.24, 0.74)****	**0.62 (0.39, 0.99)***	**0.33 (0.21, 0.51)*****
Married	1.20 (0.99, 1.47)	**0.81 (0.70, 0.95)****	1.06 (0.84, 1.33)	0.99 (0.83, 1.19)	0.88 (0.71, 1.10)
Female	**1.25 (1.05, 1.47)***	**1.29 (1.15, 1.45)*****	1.14 (0.96, 1.36)	**1.34 (1.14, 1.58)*****	**1.29 (1.09, 1.52)****
Age	**0.99 (0.98, 0.99)*****	**0.98 (0.98, 0.99)*****	**0.99 (0.87, 1.00)****	**0.98 (0.98, 0.99)*****	**0.98 (0.97, 0.99)*****
Sexual minority	**1.45 (1.02, 2.06)***	**1.33 (1.01, 1.74)***	1.45 (0.96, 2.20)	1.08 (0.77, 1.52)	**1.66 (1.19, 2.34)****
SNAP utilizer			**2.20 (1.82, 2.66)*****	**2.33 (1.96, 2.78)*****	**4.10 (3.08, 5.44)*****
Health status (ref: excellent or very good)					
Good	1.13 (0.91, 1.39)	**1.98 (1.72, 2.29)*****	1.22 (0.97, 1.53)	**1.78 (1.45, 2.18)*****	**2.00 (1.65, 2.41)*****
Fair or poor	**1.90 (1.55, 2.34)*****	**3.48 (2.93, 4.14)*****	**2.18 (1.72, 2.75)*****	**3.09 (2.48, 3.85)*****	**3.04 (2.37, 3.91)*****
Region (ref: West)					
Northeast	0.93 (0.70, 1.23)	1.14 (0.93, 1.41)	1.03 (0.76, 1.40)	0.97 (0.72, 1.29)	1.19 (0.90, 1.58)
Midwest	1.21 (0.95, 1.55)	1.10 (0.91, 1.32)	1.06 (0.80, 1.40)	**1.35 (1.06, 1.71)***	0.98 (0.74, 1.28)
South	1.10 (0.88, 1.37)	1.12 (0.94, 1.33)	1.14 (0.88, 1.49)	0.98 (0.78, 1.22)	1.22 (0.96, 1.54)
Nonmetropolitan resident	**0.75 (0.61, 0.93)****	1.09 (0.92, 1.29)	0.86 (0.70, 1.06)	0.88 (0.73, 1.07)	1.08 (0.82, 1.42)
Disabled	**1.66 (1.37, 2.01)*****	**1.69 (1.41, 2.04)*****	**1.60 (1.31, 1.95)*****	**1.49 (1.22, 1.84)*****	**2.37 (1.77, 3.18)*****
Having health insurance	0.80 (0.60, 1.06)	**0.54 (0.45, 0.64)*****	0.78 (0.61, 1.00)	**0.62 (0.50, 0.78)*****	**0.45 (0.35, 0.59)*****
Employed	0.89 (0.73, 1.09)	**1.22 (1.05, 1.41)****	0.89 (0.71, 1.12)	**1.22 (1.01, 1.48)***	1.18 (0.95, 1.46)
Income−poverty ratio (ref: >200% FPL)					
<100% FPL	**2.58 (1.92, 3.46)*****	**4.48 (3.72, 5.38)*****			
100%−200% FPL	**1.94 (1.44, 2.60)*****	**3.45 (3.00, 3.97)*****			
Household size (ref: ≥3)					
1	1.01 (0.75, 1.35)	**1.26 (1.03, 1.55)***	0.96 (0.71, 1.31)	0.98 (0.74, 1.28)	**1.74 (1.30, 2.32)*****
2	1.08 (0.83, 1.41)	0.98 (0.81−, 1.18)	0.93 (0.70, 1.25)	0.91 (0.71, 1.17)	1.12 (0.87, 1.44)
Children aged <18 years (ref: 0)					
1	0.89 (0.67, 1.19)	1.01 (0.82, 1.25)	0.99 (0.72, 1.37)	**0.82 (0.62, 1.09)***	1.16 (0.86, 1.57)
2	0.73 (0.51, 1.03)	0.93 (0.72, 1.87)	0.89 (0.60, 1.32)	0.66 (0.47, 0.93)	1.14 (0.82 1.58)
≥3	**0.68 (0.47, 0.99)***	**1.41 (1.06, 1.87)***	0.80 (0.54, 1.18)	0.86 (0.60, 1.23)	**1.65 (1.07, 2.54)***
Year 2020 (ref: 2019)	0.93 (0.78, 1.09)	0.93 (0.82, 1.05)	1.04 (0.87, 1.24)	1.03 (0.88, 1.21)	**0.75 (0.63, 0.89)****

AIAN, American Indian/Alaska Native; FPL, federal poverty level; SNAP, Supplemental Nutrition Assistance Program.
Note: Boldface indicates statistical significance (*p<0.05, **p<0.01, and ***p<0.001).
Numbers reported in the table are AORs with their 95% CIs. Sexual minority includes gay/lesbian/something else.

were added one by one to identify which changed the AOR of immigrants more).

In addition, the multivariable model stratified by income−poverty ratio shown in Table 3 indicates that immigrants with an income above 200% FPL were more

likely to report FI than their U.S.-born counterparts. Noncitizens and naturalized citizens were 1.88 (95% CI=1.24, 2.86) and 1.61 (95% CI=1.21, 2.14) times more likely to report FI than U.S.-born citizens within the same income level. However, for those with an income

below 200% FPL, there was no FI disparity between immigrants and U.S.-born citizens.

Some other important findings were that having a higher education (e.g., bachelor's degree and higher degree) were negatively associated with FI, whereas having poor/fair health and disability were positively associated with FI across all stratified analysis. In addition, there were no significant associations between FI and being Hispanic or being Asian.

DISCUSSION

More than 13% of the U.S. population are immigrants, and they are driving U.S. population growth.[39] Addressing FI among immigrants could be a critical step to improve public health in the U.S. Immigrants (i.e., noncitizens and naturalized citizens) are at higher risk of FI and have decreased access to and eligibility for federal nutrition assistance programs and other safety-net programs that could help address FI.[10] Although higher education and insurance coverage may protect against FI, immigrants are also less likely than U.S.-born citizens to have educational opportunities[9,15] and are more likely to be uninsured.[40] Income instability and reduced employment opportunities for immigrants[9] also contribute to higher FI rates. In this study, even after adjusting for a wide range of independent variables, disparities in FI rates between noncitizens and U.S.-born citizens remained, suggesting that being a noncitizen is an important risk factor for FI independent of other factors. For such reasons, it has been argued that immigration should be considered a social determinant of health[41] because being an immigrant can directly impact behavioral choices (i.e., using food safety-net resources).

Unadjusted results from this study show that noncitizens who did not utilize SNAP had higher FI rates than U.S.-born and naturalized citizens who did not utilize SNAP. However, FI rates were similar among noncitizens and their U.S.-born counterparts when they utilized SNAP. Considering this finding and the fact that SNAP reduces the rates of FI by roughly 30%,[42] we could assume that SNAP utilization may have a critical impact on reducing FI disparities by immigration status. In addition, besides being associated with FI,[2] low income is one of the primary criteria for SNAP eligibility;[35] thus, low income could help explain disparities in FI rates among immigrants.

Therefore, it was imperative to explore the multivariable regression−adjusted association between immigration status and FI after controlling for important independent variables ([Table 2]). In line with our hypothesis, noncitizens still were more likely to report FI than U.S.-born citizens, meaning that even after addressing disparities in income and other socioeconomic factors, FI disparities still existed between noncitizens and U.S.-born citizens. This finding may suggest that other unobserved variables may better explain FI disparities between noncitizens and U.S.-born citizens. For instance, anti-immigrant policies such as the public charge rule as well as fear of arrest and deportation[9,43,44] may have contributed to this disparity. These policies may exert their impact on FI by increasing the risk of social isolation or fear of using nonfederal food assistance programs (or avoidance of driving to grocery stores).[43] In addition, naturalized citizens had FI rates similar to those of U.S.-born citizens after adjusting for other independent variables.

We also explored the association between FI and immigration status at different levels of SNAP utilization and income−poverty ratios ([Table 3]). SNAP utilization could reduce disparities between immigrants and U.S.-born citizens, as suggested by nonsignificant AORs between these groups when they utilized SNAP. Among individuals who did not utilize SNAP, noncitizens were more likely to report FI than U.S.-born citizens. This finding suggests that as long as noncitizens are ineligible to enroll in SNAP or avoid using SNAP, increasing SNAP benefits (i.e., its amount) cannot address FI disparities between noncitizens and U.S.-born citizens who do not use SNAP. For example, under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, undocumented immigrants and many documented immigrants are ineligible for federally funded benefits programs. Furthermore, those who are eligible for benefits may not enroll in and benefit from SNAP owing to fear of deportation, lack of awareness about eligibility, and language barriers.[11,13,14,22] In a subanalysis not reported in this study, among noncitizens who did not utilize SNAP and were food insecure, more than 78% (equating to more than 1.3 million people) had incomes <200% FPL, suggesting that they could be eligible for SNAP enrollment and utilization.

Contrary to our hypothesis, among respondents with incomes below 200% FPL, there was no statistically significant FI disparity among immigrants and U.S.-born citizens, maybe because they go through similar experiences when income resources are limited. However, among those with incomes above 200% FPL (who should have fewer income barriers in addressing their food needs), both noncitizens and naturalized citizens were significantly more likely to report FI than U.S.-born citizens. This could be due to the availability of extensive social networks to U.S.-born individuals. This finding might also shed light on structural racism and discrimination against immigrants. Although racism causes disparities in the SES of a household, racism is

also independently linked to FI once SES is accounted for.[9] Naturalized citizens, despite their U.S. citizenship, are also seen as less than equal to U.S.-born individuals because mistrust and discrimination against them have been shown in various anti-immigrant policies.[45] Other immigration-related experiences such as disruptive life events and deportation can also impact FI directly.[9] Moreover, living in a disadvantaged neighborhood with poor access to transportation, healthcare, and secure housing may substantially increase the risk of FI irrespective of household characteristics.[9,46,47]

Limitations

These analyses are subject to limitations. It is unclear from previous research whether NHIS responses are systematically biased with respect to immigration status or the degree to which noncitizens differentially participate in the survey. After the 2019 revision, NHIS no longer provides data on the country or region of origin for immigrants. These factors may be associated with FI experiences in the U.S. but are unaccounted for. Mismeasurement was also likely for some variables: NHIS does not include an assessment of language barriers or the utilization of charitable food assistance programs such as food pantries. Moreover, NHIS only distinguishes those who were born to U.S. citizen parents outside of the U.S. from naturalized citizens in their restricted data set, to which we had no access. The analysis also lacks consideration of mixed-status households. In addition, FI prevalence estimates in NHIS differ from official USDA estimates from the Current Population Survey; this discrepancy may arise from different sampling frames, differential survey responses, and NHIS's administration of only the adult-referenced items in the Food Security Survey Module. In addition, owing to limited available data on WIC and NSLP, participation in these programs was not included in the analyses. Finally, data included the year 2020, during which the COVID-19 pandemic and widespread policy changes to address its economic impact may have yielded some of the observed relationships.

CONCLUSIONS

In this research, the association between immigration status and FI was explored. Utilizing SNAP and addressing income inequalities may be necessary and critical in reducing FI disparities between immigrants and U.S.-born citizens. However, being a noncitizen is independently associated with FI, even after adjusting for other independent variables. Naturalized citizens seem to have FI experiences similar to those of U.S.-born individuals

because they are eligible for safety-net programs owing to their citizenship status. Different levels of SNAP utilization and income—poverty ratios seem to explain much of the variation in the FI disparities between immigrants and U.S.-born citizens. FI disparities between immigrants and U.S.-born individuals may be eliminated if they utilize SNAP. However, there are still many noncitizens who do not use SNAP, possibly owing to fear of deportation or stigma. In addition, consistent with previous research, low income is highly associated with FI. However, among individuals with incomes above 200% FPL, immigrants were more likely to report FI than U.S.-born citizens, which could be due to structural factors such as racism or living in disadvantaged neighborhoods. Future research should evaluate the impact of these factors on FI disparities between immigrants and U.S.-born citizens.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.focus.2023.100113.

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