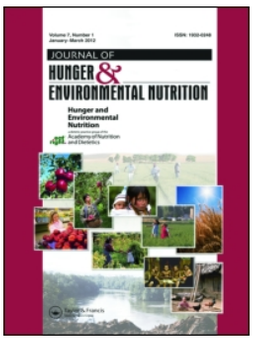

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Using Andersen's Behavioral Model to Predict Participation in the Supplemental Nutrition Assistance Program (SNAP) Among US Adults

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ABSTRACT

Using the 2013 Current Population Survey, this article examines predictors of Supplemental Nutrition Assistance Program (SNAP) participation using an adapted version of Andersen's behavioral model of service use. All variables were found to be significant. We created a risk index, an index counting the number of predictive characteristics an individual possessed, to calculate predicted probabilities of SNAP participation. For each additional risk factor an individual possessed, the predicted probability increased on average by 0.09. Those possessing 10 or more risk factors had the highest predicted probability (74%) of SNAP participation. This research confirms known predictors of SNAP participation. The risk index demonstrates that it is possible to predict SNAP participation not by which factors an individual possesses but how many.

KEYWORDS

SNAP; Current Population Survey; Andersen's behavioral model; food insecurity

Introduction

Each year, food insecurity, or the limited access to adequate food due to a lack of money or other resources, affects millions of US households despite billions of dollars in federal food and nutrition assistance program funding.[1–3] An estimated 14.3% of Americans were food insecure sometime during 2013. The US government addresses food insecurity for individuals and families primarily through a federal program called the Supplemental Nutrition Assistance Program (SNAP), formerly known as food stamps.[4,5] SNAP is the federal government's first line of defense against hunger and aims to improve nutrition.[1] In 2014, the US Department of Agriculture (USDA) reported that 46.5 million people (14.6% of the total population) participated in SNAP and the average monthly benefit in Fiscal Year 2014 was $257 per month.[6]

To qualify for SNAP, federal guidelines require that a household have a gross monthly income of less than 130% of the federal poverty level (FPL), less than 100% of the FPL in net monthly income, and hold less than $2000 in assets. Disabled individuals or individuals over the age of 60 only need to meet the net income test and individuals already receiving assistance through

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other federal programs (such as Temporary Assistance for Needy Families, General Assistance, or Supplemental Security Income) automatically qualify to receive SNAP benefits. All eligible individuals must also meet non-income-based criteria including being a US citizen or eligible noncitizen and actively seeking work or registration in employment training programs.[7] If the employment requirements are not met, benefits will be limited to 3 months every 3 years.[4] Eligibility is less strict in some states due to the enactment of the American Recovery and Reinvestment Act in the wake of the Great Recession; other states maintain stricter eligibility requirements.[8]

Participation in SNAP enhances the purchasing power of participants' limited incomes and allows for increased intake of calories. Assistance with food expenses, whether through SNAP, the Special Supplemental Nutrition Program for Women, Infants and Children, or free and reduced-cost meals for children in public school, frees up dollars that can be used to cover other household expenses such as housing, utility bills, and medical care. Studies show the ability of SNAP to increase food security for participants while decreasing both depth and severity of poverty among adults and especially among children.[6,9]

The relationship between food insecurity and SNAP is strong, but our ability to measure short- and long-term effects is limited by a number of factors.[10] Identifying the impact of SNAP participation on food insecurity is limited by temporal ordering of outcomes measurement (months or years after beginning to receive SNAP benefits or after participants have left the program), the population measured (low versus very low food secure, for example), and the length of the study design (studies often use cross-sectional as opposed to longitudinal methods). Additionally, many studies of SNAP participation are conducted at the state or regional level, therefore making it hard to generalize to national populations. For these reasons, it is difficult to isolate the effects that SNAP has on ameliorating food insecurity.[11]

Cross-sectional studies have identified a strong association between rates of SNAP participation and rates of food insecurity because most food insecure families self-select into the program.[10,12] Some longitudinal studies, on the other hand, show that ending participation in SNAP increases food insecurity, but there are few of these kinds of studies.[13] A 2010 study using a 2-year panel sample from the Current Population Survey (CPS) Food Security Supplement (FSS) by Nord and Coleman-Jensen uncovered that those who had recently left SNAP were more likely to be food insecure when compared to households who remained in the program.[13] Research isolating the effects of SNAP participation is growing and, on the whole, reveals that SNAP generally decreases food insecurity.[9] How much SNAP participation decreases food insecurity and which factors are related to this decrease remains an important gap in the literature.[11,14]

There are a number of predictors of SNAP participation and food insecurity that have been established in previous studies. Poverty status is the strongest predictor of both food insecurity and SNAP participation (to be eligible to receive SNAP, gross monthly income must be below 130% of the FPL), but research has identified other attributes that make individuals more likely to participate in SNAP. Participation rates are higher for the young (25–49), those with less than a college degree, white non-Hispanic households, and female-headed households. Poor households with income below 100% of the FPL and households with children or with a disabled member also participate at higher rates than households not containing these qualities.[6,9,15] Those living in the Midwest and in metropolitan areas enroll in SNAP at higher rates than their regional counterparts due to the difference in eligibility requirements and program policies across US regions and the availability of social service resources provided within metropolitan regions.[16,17]

In order to understand the multiple factors that predict SNAP utilization, it is useful to use a well-established model to understand types of factors that are related to SNAP participation. The Andersen behavioral model has been used here as a theoretical framework to think about the relationship between food insecurity and SNAP participation. The Andersen behavioral model identifies 3 domains that predict service use: predisposing factors, enabling factors, and need factors. Predisposing factors consist of the structural factors in place in society that make an individual more likely to be in a position to need SNAP benefits. Predisposing factors include sociodemographic factors like race/ethnicity, gender, household income, number of children in the household, marital status, and age. Enabling factors impede or enable the use of SNAP benefits and include factors like the region of the country (where eligibility requirements and state policies may differ), metropolitan versus rural areas, and the educational level or employment status of potential participants. Need factors include subjective (self-described food insecurity) and objective (USDA-defined food insecurity) measures of need for SNAP benefits. It is not enough to simply be food insecure as defined by the USDA. Andersen's model sheds light on the impact that a subjectively defined level of food insecurity may have on a household's propensity to seek out benefits. The use of the Anderson behavioral model to predict SNAP participation contributes to our understanding because it allows for an examination of multiple factors beyond the simple demographic characteristics common to many studies of SNAP participation.

The Andersen behavioral model[18] was originally developed to examine the factors that contribute to the utilization of health services,[19] assess equality to access of health care,[20] and aid in the development of policies to promote equal health services access.[21] A recent meta-analysis

identified the use of the Andersen model in 328 different studies between 1998 and 2011 and found that variations of this model utilized an extensive variety of variables to study health services use within vulnerable populations. We identified one study to date that utilizes the Andersen model to predict social services: a 2008 study used the model to guide prediction of food stamp use among older adults and found that the Andersen behavioral model explained 28% of the variation in food stamp use.[22] This research highlights the flexibility of the model to explore service utilization, in this case the utilization of SNAP.[23]

Previous research on SNAP participation has been limited in some important ways. First, studies of SNAP participation focus mainly on demographically describing participants or the effects of SNAP on participants or only predict SNAP participation using previously confirmed sociodemographic characteristics in different variations.[11,24–26] There is little research that considers the cumulative effects of certain sociodemographic characteristics on SNAP participation (for example, the odds of SNAP participation for a black, unmarried woman with children). Instead, the focus tends to be on measuring the effects one at a time to understand how each is related. Second, much of the literature lacks a theoretical framework in which to situate analyses of factors that are known to predict SNAP participation. Few studies have utilized such a framework and none have used the Anderson behavioral model to examine the relationship between factors related to food security.[27,28]

Third, studies describing detailed characteristics of SNAP participants are done less frequently and focus on regional populations. A 2014 study of Los Angeles County residents eligible for SNAP benefits examined a number of individual and neighborhood factors predicting SNAP participation, but their results cannot be generalized past Los Angeles County.

This study proposes to fill these gaps in the literature in 3 ways that will extend our knowledge of this important topic. First, this study examines the impact of known individual demographic factors on SNAP participation and then aggregates those factors into a single index that predicts SNAP participation in a more multidimensional way than these factors can predict individually. Second, this study uses a modified Andersen behavioral model to examine the factors confirmed to be related to SNAP participation. The use of the modified model as an overarching theoretical framework also moves this analysis beyond demographic description by testing the collective predictive power of additional factors that are predicted here to affect SNAP participation. Third, this analysis enlists the most recently available national data on food security that is generalizable to the US population.

Method

Data

The current research uses the 2013 FSS of the CPS (also known as the December Food Security Supplement) conducted by the Census Bureau for the US Department of Agriculture. The CPS is the most widely used data set for studying national rates of food insecurity and SNAP usage and is the major source of USDA statistics on food security. The CPS is a complex, probability sample. Each December since 1995, the CPS has collected data on food insecurity in the Food Security Supplement from US households.

The CPS FSS is a robust data set conducted by the US Census Bureau for the US Department of Agriculture. The methodology used by the CPS is thorough and the data collected can be generalized to the US population. The purpose of the CPS FSS is to collect data on the rate of food insecurity and its economic consequences including the rate of food assistance program utilization and household food expenditure. Additionally, the food security supplement asks the 18-item USDA food security module questions for all those who say that they run short on food and/or who do not have enough of the kinds of food they want to eat in their household.

Sample

The 2013 FSS data file includes records from 53 896 households each represented by a single reference person. A reference person is one adult respondent from each household who answers questions about the typical experiences and behaviors of all other members of the household.[1] Of the total reference persons (n = 27 654), we included here the 10 479 cases with valid data on SNAP participation in our analysis. In order to be asked about their participation in SNAP, they had to pass the "common screen," 2 questions to determine whether the respondent will be asked more detailed questions about their household food security situation. The remainder of the sample of reference persons (n = 17 175) were considered food secure by the CPS because they did not pass the common screen and, thus, were not asked more detailed questions about their food security situation or about their participation in SNAP. Though it is possible that this method excludes some food insecure households and even some households containing current SNAP participants, the literature shows that there is a strong association between those who answer affirmatively to the screening questions (i.e., "passed") and their likelihood of utilizing SNAP.[11] For this reason, those who do not pass the common screen questions are assumed to be fully food secure and not likely SNAP participants.

For those who pass the common screen questions and are, in turn, labeled food insecure at some level, the survey launches into the USDA's Core Food Security Module and more detailed questions on coping with food insecurity,

including receipt of SNAP benefits, are asked. In this way, we confirm that we are only missing data on respondents who are food secure (according to the USDA's definition) and simultaneously participating in SNAP, an unlikely though not impossible combination. Given the setup of the skip logic of the questionnaire, we can only analyze data on the 10 479 respondents asked about SNAP receipt in the 12 months prior to data collection in December 2013.

All data were weighted using the food security supplemental weights as recommended by CPS FSS technical documentation to produce nationally representative estimates of the US adult population as has been done in previous studies using these data.[2,29]

Variables

Predisposing factors

There are 7 predisposing factors included in this analysis. Individual predisposing factors include age, gender, and income level. Race and ethnicity are used as measures of social structure. Two measures of family structure, marital status and the number of one's own children under 18, are included in the predisposing category as well. Age is measured using 4 categories: under 35, 36–49, 50–59, and 60 and up. Gender includes male and female categories. Income is composed of 7 categories: under $20 000, $20–39 999, $40–49 999, $50–59 999, $60–69 999, $70–74 499, and $75 000+. Race is divided into white, black, and other and ethnicity is measured as Hispanic and non-Hispanic. Marital status is measured dichotomously as married or not married and the number of one's own children in the household ranges from 0 to 4 or more. Although any children under 18 not legally claimed by the respondent are not counted in this variable, we believe that the number of one's *own* children in the household under 18 is a more stable measure of the daily burden that legally guarded children place on household food security. In addition, the CPS FSS asks only about one's own children and not details of children not legally part of the household.

Enabling factors

For Andersen, community and personal enabling resources contribute to the ability to access and utilize health services.[20] Enabling resources are measured here using employment status, one measure of social structure (education level), and 2 measures of community type (region and metropolitan residence). Education includes 4 categories (less than high school, high school degree, some college, 4-year degree or higher). Employment status categories include employed, unemployed, retired, disabled, or not in labor force. Region includes Northeast, Midwest, South, and West. Metropolitan residence is dichotomized into categories of metropolitan and nonmetropolitan.

Need factors

According to Andersen, need must be identified and defined in order for use to take place. To account for need in the model, there are 2 measurements included. The first is a subjective measurement of perceived need that identifies whether individuals feel that (1) they have enough of the kinds of food they want to eat, (2) they have enough but not always the *kinds* of food they like to eat, or simply (3) sometimes or often they do not have enough to eat. This is also the first question in the USDA's food security measurement and is used in the CPS as part of the criteria with which to determine who is asked the full battery of questions in the USDA Core Food Security Module (CFSM). The criteria for being asked the full CFSM include if an individual is below 185% of the poverty line, reports running short on money for food, or reports that the household does not have enough to eat.

To measure evaluated need, the CPS sums each affirmative response to the USDA's 18 items of the CFSM. Households with more than 2 food insecure conditions reported are labeled as food insecure (any level). From the raw score, the USDA most often labels households using 3 food security status categories: food secure, low food secure, or very low food secure. These are the 3 categories used in this analysis.

Risk index

A risk index was created to measure the combined effect of the individual factors known to predict SNAP participation. The index measures the risk associated with 13 variables determined to affect SNAP participation through multivariate analyses. The presence of any of these 13 factors was determined a risk because they were significant predictors of SNAP participation, which is indicative of the risk that a household is food insecure and will participate in a food and nutrition program reserved for those in need. To create the index, 13 factors from the modified Andersen behavioral model were analyzed using a logistic regression model to determine their ability to predict SNAP participation. Each of the 13 factors were significant ($p < 0.001$) in predicting SNAP participation in the logistic regression model. For each of the following 13 factors, respondents are assigned a 0 (if they do not have the attribute) or a 1 (if they have the attribute): female, under 60, non-white, Hispanic, unmarried, has at least 1 own child under 18 in household, family income under $20 000, residence outside the West, nonmetropolitan residence, less than college education, unemployed, perceived need, and evaluated need. The index minimum is 0, meaning that the respondent had none of the risk characteristics, and the maximum is 13, which means that the respondent had all of the risk characteristics. Due to low frequencies, the index was recoded so that those with 0 to 2 risk factors were coded together and individuals with 10 or more risk factors were top coded.

Analytic strategy

This study utilizes multivariate logistic regression analyses to predict the odds of SNAP participation controlling for predisposing, enabling, and need factors. We also stratified the logistic regression model by predisposing, enabling, and need factors to examine their ability to predict SNAP separately. Another logistic model including only the risk index was run. Within the logistic regression models, we obtained the predicted probabilities (using the EMMEANS command in SPSS [IBM SPSS Statistics for Windows, Version 23.0, 2015. IBM Corp., Armonk, NY]) of participating in SNAP by various predisposing, enabling, and need factors.

Results

The weighted descriptive statistics in Table 1 show differences in the demographic characteristics of SNAP users versus the general population. Higher rates of SNAP usage appear among women, blacks, and Hispanics than among the general population, as has been shown in the literature on SNAP participation and as was predicted. SNAP participants have lower rates of married status with more than twice as many married individuals within the total sample than within the SNAP participant sample. SNAP participants are younger and have children living in the household more frequently, and over half report a family income of less than $20 000 compared to just 14% of the general population. They live in the south most often, but there is almost no difference in the rate of metropolitan living among SNAP and non-SNAP users. They are significantly less educated and rates of unemployment are substantially higher for SNAP users. As was expected, rates of perceived and evaluated need of food are much higher for those using SNAP, with 20% claiming that they sometimes or often do not have enough of the kinds of food they like to eat compared to just 4.5% of the general population, and over half (54%) are categorized as having low or very low food security compared to just 13.9% in the total sample.

Table 2 shows the results of the logistic regression analyses. We found that the strongest predictors of SNAP usage follow the literature identically. According to the full model (model 1, Table 2), the model and all predictors in the model were significant at the $p < 0.001$ level. The following predisposing factors within the behavioral model had the greatest odds of being SNAP users: females (odds ratio [OR] = 1.28) compared to males, those under 35 (OR = 1.83) compared to those above 60, blacks (OR = 1.75) compared to whites, Hispanics (OR = 1.12) compared with non-Hispanics, those not married (OR = 2.18) compared to married individuals, those with 4 or more children (OR = 3.21) compared to 0 children, and those with yearly family income below $20 000 (OR = 9.76) compared to the most affluent group of $75 000+. Among the enabling factors,

Table 1. Weighted frequencies for total sample and SNAP users.[a]

Variables	Total sample (%)	SNAP recipient (%)
SNAP participation	29.0	100
Predisposing		
Age		
Under 35	22.6	41.9
35–49	28.9	30.4
50–59	20.9	14.5
60 and up	27.6	13.2
Female	49.3	70.2
Race		
White, non-Hispanic	79.9	64.5
Black, non-Hispanic	12.1	28.6
Other	8.0	6.9
Hispanic	14.8	27.1
Married	74.1	37.5
Number of children		
0	57.6	36.7
1	17.8	20.7
2	16.0	21.6
3	6.0	13.4
4+	2.6	7.6
Family income		
Less than $20 000	14.4	56.3
$20 000–$39 999	11.0	21.9
$40 000–$49 999	10.9	10.6
$50 000–$59 999	8.7	4.4
$60 000–$69 999	8.4	2.3
$70 000–$74 999	10.4	2.4
$75 000+	36.1	2.0
Enabling		
Region		
Northeast	17.8	15.5
Midwest	21.4	19.7
South	38.2	44.1
West	22.6	20.7
Metropolitan	84.4	82.0
Education		
Less than high school	11.0	27.8
High school degree	27.8	35.9
Some college	28.5	30.3
College degree (4 year)	32.7	6.0
Employed	62.9	43.7
Need		
Perceived		
Enough of the kinds of food we want to eat	75.8	36.2
Enough but not always the kind of food we want to eat	19.7	43.8
Sometimes or often not enough to eat	4.5	20.0
Evaluated		
Fully or marginally food secure	86.1	46.0
Low food secure	9.3	33.7
Very low food secure	4.6	20.3
Risk index		
0–2	11.3	0.1
3	15.8	0.7

(*Continued*)

Table 1. (Continued).

Variables	Total sample (%)	SNAP recipient (%)
4	19.8	2.2
5	17.1	5.7
6	12.2	10.4
7	9.5	17.6
8	6.8	21.4
9	4.3	14.6
10+	3.3	5.7
N	81 113 091	8 878 535

[a]SNAP indicates Supplemental Nutrition Assistance Program. All data are weighted using the Food Security Supplement household weight.
Source: 2013 Current Population Survey Food Security Supplement.

living outside the West, living in a nonmetropolitan area (OR = 1.04) compared to living in a metropolitan area, having less than a high school degree (OR = 2.49) compared to having a college degree, and being disabled (OR = 2.92) compared to being employed made up the enabling characteristics with the highest odds of SNAP usage. Finally, as was predicted, those with the highest perceived and evaluated need for food had the highest odds of SNAP participation compared to their lower perceived need and food secure counterparts.

In model 2 of Table 2, the risk index proved to significantly predict SNAP participation (OR = 1.83, $p < 0.001$). Because the index includes dummy-coded versions of the 13 independent variables in model 1, model 2 includes only the risk index to avoid multicollinearity with the other predictor variables in model 1.

After the risk index was confirmed to be a significant predictor of SNAP participation in the model 2 logistic regression, predicted probabilities were calculated for each of the 9 values of the index from 0 to 2 factors to 10 or more factors. Figure 1 displays the predicted probabilities of SNAP participation for each value of the index. The calculated predicted probability values increase from a predicted probability value of 0.02 for those with 0 to 2 risk factors up to 0.74 for those with the 10 or more risk factors. With each additional risk factor there is an average increase of 0.09. For this index, the predicted probabilities can be interpreted such that 2% of individuals with 0, 1, or 2 risk factors are predicted to use SNAP, and 74% of those possessing 10 or more risk factors are predicted to use SNAP.

Discussion

This study contributes to our base of knowledge related to predicting SNAP participation in several important ways. It illustrates that aggregating confirmed predictors of SNAP participation into a single risk index results in a more multidimensional prediction of SNAP participation than these factors can predict individually. This study also extends the use of the Andersen behavioral model to focus on predictive factors beyond demographics and

Table 2. Weighted logistic regression of SNAP participation.[a]

	Odds ratio	95% Confidence interval	Odds ratio	95% Confidence interval
N = 81 113 091	Model 1[b]		Model 2[b]	
Predisposing				
Male	—		—	
Female	1.28	(1.27, 1.28)	—	
Age				
Under 35	1.83	(1.83, 1.84)	—	
36–49	1.50	(1.50, 1.51)	—	
50–59	1.28	(1.27, 1.28)	—	
60+	—		—	
Race				
White	—		—	
Black	1.75	(1.75, 1.76)	—	
Other	1.15	(1.15, 1.16)	—	
Hispanic	1.12	(1.11, 1.12)	—	
Non-Hispanic	—		—	
Marital status				
Married	—		—	
Not married	2.18	(2.17, 2.18)	—	
Number of children				
0	—		—	
1	1.19	(1.18, 1.19)	—	
2	1.69	(1.69, 1.70)	—	
3	2.82	(2.81, 2.83)	—	
4+	3.21	(3.19, 3.22)	—	
Family income				
Less than $20 000	9.76	(9.71, 9.82)	—	
$20 000–29 999	4.10	(4.07, 4.12)	—	
$30 000–39 999	2.79	(2.78, 2.81)	—	
$40 000–49 999	1.93	(1.92, 1.94)	—	
$50 000–59 999	1.54	(1.53, 1.55)	—	
$60 000–74 999	2.01	(1.99, 2.02)	—	
$75 000+	—		—	
Enabling				
Region				
Northeast	1.22	(1.22, 1.22)	—	
Midwest	1.12	(1.11, 1.12)	—	
South	1.09	(1.08, 1.09)	—	
West	—		—	
Metropolitan	—		—	
Nonmetropolitan	1.04	(1.03, 1.04)	—	
Education				
Less than high school	2.49	(2.48, 2.50)	—	
High school degree	1.85	(1.85, 1.86)	—	
Some college	1.92	(1.91, 1.93)	—	
4-year degree or higher	—		—	
Employment				
Employed	—		—	
Unemployed	2.23	(2.22, 2.24)	—	
Retired	1.12	(1.11, 1.12)	—	
Disabled	2.92	(2.91, 2.93)	—	
Not in labor force	1.61	(1.61, 1.62)	—	
Need				
Food security (perceived)				
Enough of the kinds of food we want to eat	—		—	

(*Continued*)

Table 2. (Continued).

N = 81 113 091	Odds ratio	95% Confidence interval	Odds ratio	95% Confidence interval
	Model 1[b]		Model 2[b]	
Predisposing				
Enough but not always the kinds of food we want to eat	1.28	(1.28, 1.29)	—	
Sometimes or often not enough to eat	1.46	(1.45, 1.46)	—	
Food security (evaluated)				
High or marginal food security	—		—	
Low food security	1.96	(1.96, 1.97)	—	
Very low food security	2.10	(2.09, 2.11)	—	
Risk index			1.83	(1.83, 1.83)
Nagelkerke R^2	0.39		0.29	
Intercept	−0.88		−0.89	

[a]SNAP indicates Supplemental Nutrition Assistance Program. All data are weighted using the Food Security Supplement household weight.
[b]All variables in model 1 and model 2 were significant ($p < 0.001$).
Source: 2013 Current Population Survey Food Security Supplement.

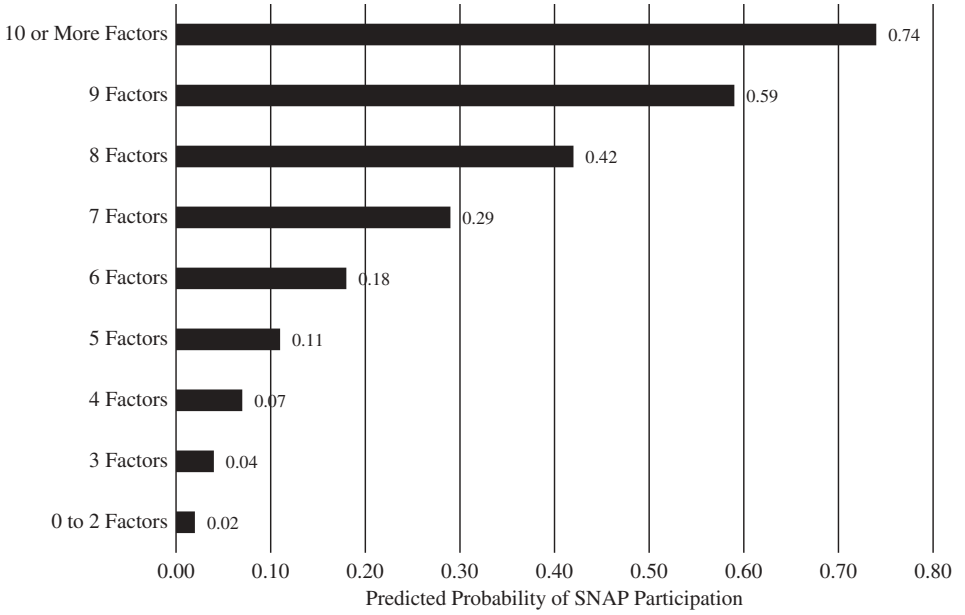

Figure 1. Predicted probabilities of SNAP participation by risk factors.

highlights the predictive power of subjective need, a factor that has not been used to predict SNAP participation prior to this study. Finally, by using a nationally representative sample, the results can be generalized to the US population.

Our results confirm previous research that women, minorities, the young, Hispanics, unmarried, and poor individuals are more likely to participate in SNAP and those with the highest need for food seek food assistance. This research also adds to the discussion that it is not just objectively evaluated need (measured with the USDA's widely used CFSM) that increases odds of SNAP participation. The literature is prolific on the strength of USDA-defined food security status in predicting SNAP participation. This research demonstrates that it is also higher perceived food need that leads to higher rates of SNAP participation. Those with perceived need have indicated they feel that they have enough but not always the kinds of food they want to eat or simply sometimes or often not enough to eat. This is the only question in the CFSM that does not ask about food shortage as a function of income. For this reason, it is helpful to know that perceived household food shortage is predictive of SNAP participation alongside its stronger objectively measured food security status that focuses on food security as a function of income.

This study demonstrates the value of using an adapted version of Andersen's behavioral model for predicting SNAP participation. The model provided a framework to understand the relationship between multiple factors and SNAP participation, an expansion to the often demographic focused framework of other research on SNAP use. We found that all 3 factors (predisposing, enabling, and need) contribute to an individual's likelihood of using SNAP. The model shows that every factor in each category was a significant predictor at the same significance level ($p < 0.001$). Still, each category had one factor that stood out as the strongest predictor. For predisposing factors, we found that income was the strongest predictor of SNAP use, within both this category and the entire model. Under the enabling category, we found that disabled status was the strongest predictor. Finally, as is well documented in the literature, evaluated need for food was the strongest predictor of SNAP participation within the category of need. Our adapted version of Andersen's model highlights, first, that there are a variety of factors in different spheres of an individual's life (some controllable, some not) that help predict his or her odds of SNAP usage. An individual's ability to access resources, economic circumstances, household structure, and measured need are contributing factors to his or her propensity to participate in SNAP. Understanding this ties what much of the literature on who participates in SNAP is already saying together.

Most important, this research demonstrates that by using the risk index, it is possible to predict SNAP participation not by knowing necessarily which factors an individual possesses but how many. The results of the analysis show that increases in the number of risk factors an individual possesses, regardless of which factor it is, increase the likelihood that an individual will use SNAP. This approach to predicting SNAP participation goes beyond individual characteristics and has not been seen in any other studies to date. We believe that it allows

for a more complete exploration of the complex reasons behind an individual's participation in SNAP. We suggest that this index be used as a summary indicator in addition to the analysis of the risk factors individually. What the index contributes is the ability to evaluate the consolidated and additive effect of having multiple risk factors, enabling the use of a more holistic and continuous measurement in predicting SNAP participation.

The risk index developed in this study helps to evaluate the "joint and additive influence of multiple risk factors"[30] from multiple aspects of an individual's life, enabling the examination of the interplay of factors. The index could be used in practice as an adjunct to a food security questionnaire to understand who is at greater risk for needing SNAP benefits. The index can be used as a continuous measurement or by creating a cutoff point (we suggest 9 or more risk factors, which guarantees predicted probabilities above 50%) to indicate strong predicted likelihood of SNAP participation, no matter which 9 of the 13 factors are present.

In practice, this index may be useful to policy makers or emergency food agencies attempting to research which households are most likely to use SNAP, not necessarily interested in the exact sociodemographic makeup of the households. Using an index such as this one contributes to understanding that factors such as race and income do not act alone but together increase odds that SNAP will be needed in a household in a way that goes beyond looking at the factors on their own (as a traditional logistic regression model does) or the interaction of these factors (as are commonly analyzed as interaction terms). This index then may be most useful to applied researchers interested in knowing basic odds of SNAP participation based on the index score each household receives.

Although the data set focuses on macrolevel household characteristics known to affect SNAP usage, we have seen limited studies that utilize such a large, nationally representative sample as the CPS. Additionally, this study contributes detailed descriptions of the individuals using SNAP that vary from the unidimensional descriptions often used in SNAP participation analyses where individual characteristics are described as though they exist independent of other characteristics that we know interact with them.

Limitations

Some limitations to this study should be addressed. The sample used in this analysis was limited by its inability to include those who were screened out (those who were fully food secure but may have participated in SNAP). In addition, the data set may include self-reporting errors as evidenced by some studies that found high rates of underreporting among program participants. These data issues should be addressed in further studies but were beyond the scope of this article. Next, the CPS FSS does not allow for the inclusion of

family and community-level variables that may provide insight into health (i.e., nutrition) beliefs, social support, and other factors we know to be related to SNAP participation and are also factors included in Andersen's original behavioral model. The adapted behavioral model used here could be more robust if these other variables were included. For future studies, appending additional CPS supplements or use of a different data set altogether could allow for the inclusion of more variables true to the original Andersen model, allowing for a better test of the model for predicting the use of social service benefits. Future studies could also test the strength of the modified version of the Andersen model used here to predict SNAP participation by stratifying samples by gender or age. Analysis of the predictive power of predisposing, enabling, or need factors alone to predict SNAP participation would also be useful in determining the reasons some choose not participate.

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