



UNIVERSITY OF KENTUCKY
CENTER FOR POVERTY RESEARCH

Discussion Paper Series DP 2022 - 04

ISSN: 1936-9379

A comprehensive evaluation of the impact of SNAP on the health of seniors

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December 2022

Preferred citation:

Marton, et al. (2022, Dec.). A comprehensive evaluation of the impact of SNAP on the health of seniors. *University of Kentucky Center for Poverty Research Discussion Paper Series, DP2022-04*, Retrieved [Date] from <http://ukcpr.org/research>.

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This project was supported with a grant from the University of Kentucky Center for Poverty Research through funding by the U.S. Department of Agriculture, Food and Nutrition Service, Contract Number 12319818C0010. The findings and conclusions in this report are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy. The opinions and conclusions expressed herein are solely those of the author(s) and should not be construed as representing the opinions of the UKCPR. The authors would like to thank Craig Gundersen and Jim Ziliak for their valuable comments, and Alex McGlothlin for excellent research assistance.

Abstract

Senior participation in the Supplemental Nutrition Assistance Program (SNAP) has traditionally been lower than other groups, with historical estimates below 50 percent. We examine the relationship between state SNAP policy changes occurring over the 2001-2014 period and SNAP participation as well the relationship between SNAP participation and a variety of health-related outcomes for senior and non-senior households. Data from three separate sources, the 2001-2014 December Current Population Survey Food Security Supplement (CPS-FSS), the 2002-2014 Health and Retirement Study (HRS), and the 2001-2014 National Health Interview Survey (NHIS), are used to conduct our analyses. We construct simulated eligibility variables (SEVs) and SNAP policy indices to capture differences in state SNAP generosity. In both our CPS-FSS and our HRS samples, we find that eligibility expansions lead to increases in non-senior SNAP participation with some evidence of smaller increases in senior participation. Overall, seniors and non-seniors appear to respond differently to various policies, but this difference is not consequential enough to explain the large participation disparity between the two groups. We also find that SNAP participation is associated with worse health-related outcomes for all samples in all three datasets, which is likely due to negative selection into program participation. The signs of these relationships reverse when we use our SEVs as instruments for SNAP participation. However, these coefficient estimates are not statistically significant and the strength of the SEV as an instrument for senior SNAP participation depends on the dataset and sample used, as well as whether or not we use sampling weights.

Executive Summary

A sizeable literature has examined participation in the Supplemental Nutrition Assistance Program (SNAP) (Currie, 2006; Nicoll, 2015; Gray and Cunyngnam, 2015) as well as its effects on both food security (Gundersen and Ziliak, 2018; Gundersen et al., 2019) and related health outcomes (Currie, 2003; Bitler, 2015). However, relatively little attention has been paid to these issues as they pertain specifically to seniors. This report employs multiple sources of data and explores the use of new methodological approaches to attempt to fill this void.

Seniors have historically participated in SNAP at relatively low rates. In fiscal year 2018, 82 percent of eligible individuals of all ages participated in SNAP, but only 48 percent of eligible seniors (60 years and older) (Cunyngham, 2021). Despite this low participation rate, there is a persistent need for nutrition assistance among millions of seniors. In 2016, 13.6 percent of seniors in the United States were marginally food insecure, 7.7 percent were food insecure (defined as having low or very low food security), and 2.9 percent had very low food security (Ziliak and Gundersen, 2018). Existing research suggests that seniors are particularly vulnerable to food insecurity and may experience severe health consequences (Leroux et al., 2020). Relative to food secure seniors, food insecure seniors have lower nutrient intakes and are at a higher risk of a wide variety of adverse health conditions, including diabetes, depression, activities of daily living (ADL) limitations, high blood pressure, congestive heart failure, heart attack, and asthma (Gundersen and Ziliak, 2017). Given projections of growth in the number of older Americans and their share of the total population, addressing food insecurity and its health consequences among seniors will likely continue to pose a significant challenge (Gundersen and Ziliak, 2018).

Although SNAP is a federal program, states have the latitude to implement a number of policies in its administration for several decades. These policies can increase SNAP eligibility by

loosening the income and asset restrictions on households – and often do so more generously for households with seniors than without. Alternately, they can introduce or remove aspects of program administration that influence transaction costs or stigma, or they can increase awareness via outreach. Ultimately, these policies may substantially impact SNAP participation.

We use information on policy changes occurring during the 2001-2014 period to construct several measures of policy generosity, including individual indicators for how long each policy was in place in a given state and year, indices representing how many favorable policies were in place, and measures of simulated eligibility representing the extent of eligibility expansions. We define senior and non-senior household samples and policy measures relevant to each. While individual policies have been previously examined, we are the first to investigate the roles of various state SNAP policy variables in influencing senior household participation.

We start by using data from the December Current Population Survey Food Security Supplement (CPS-FSS) to examine the relationship between SNAP policy changes and SNAP participation as well as the relationship between SNAP participation and household food insecurity and food expenditures. We compare estimates for the full sample to those for a restricted sample of respondents aged 60 and older. Next, we use restricted use data between 2002 and 2014 from the Health and Retirement Study (HRS) to again consider the relationship between SNAP policy changes and SNAP participation. This is possible because the restricted use HRS includes state identifiers. The HRS also allows us to explore how SNAP influences a wide range of seniors' health-related outcomes, including a global self-assessment of physical health, body mass index, risky behaviors such as smoking and drinking, and health care utilization. Finally, we supplement our HRS health-related analysis by considering similar outcomes from an alternate data source, the National Health Interview Survey (NHIS). While the

HRS only allows us to compare seniors (60 years and older) to near-seniors (51 to 59 years) due to its focus on older individuals, we can compare seniors to all other adults in the NHIS.

We explore the feasibility of applying two recent methodological innovations in the broader SNAP literature to our analysis focusing on seniors. First, one can potentially address the issue of endogeneity from the non-random nature of SNAP participation using a novel instrumental variables strategy that exploits cross-state, over-time variation in a number of state policies related to SNAP eligibility (Jones, 2020). Second, one can potentially address the well-known phenomenon of measurement error in survey-based SNAP participation measures by implementing a recently developed two-step estimator that jointly models both true SNAP participation status and the probability of misreporting (Denteh, 2017; Nguimkeu et al., 2019).

We find that eligibility expansions lead to increases in non-senior participation with some evidence of smaller increases in senior participation in both our CPS-FSS and our HRS samples. Overall, seniors and non-seniors appear to respond differently to various policies, but this difference is not significant enough to explain the large disparity in participation typically observed between the two groups. We also find that SNAP participation is associated with worse health-related outcomes for all samples in all three datasets, which is likely due to negative selection into program participation. This includes measures of food insecurity from the CPS-FSS, measures of self-assessed health, obesity, drinking and smoking in the HRS and the NHIS, and measures of health care access and utilization in the NHIS and HRS respectively. The signs of these relationships flip when we use our SEVs as instruments for SNAP participation. However, these coefficient estimates are not statistically significant and the strength of the SEV as an instrument for senior SNAP participation depends on the dataset and sample used, as well as on the inclusion or exclusion of sampling weights.

Introduction

A sizeable literature has examined participation in the Supplemental Nutrition Assistance Program (SNAP) program (Currie, 2006; Nicoll, 2015; Gray and Cunyningham, 2015) as well as its effects on both food security (Gundersen and Ziliak, 2018; Gundersen et al., 2019) and related health outcomes (Currie, 2003; Bitler, 2015). However, relatively little attention has been paid to these issues as they pertain specifically to seniors. This report employs multiple sources of data and explores the use of new methodological approaches to attempt to fill this void in the literature by focusing on seniors.

Seniors have historically participated in SNAP at relatively low rates. From fiscal year 2010 to 2017, the percentage of eligible individuals of all ages participating in SNAP increased from 72 percent to 84 percent. The percentage of eligible seniors (60 years and older) was only 33 percent in fiscal year 2010, increasing to 48 percent by 2017 (Vigil, 2019). Despite the increase in the senior participation rate, it remains low, and there is a persistent need for nutrition assistance among millions of seniors. In 2016, 13.6 percent of seniors in the United States were marginally food insecure, 7.7 percent were food insecure (defined as having low or very low food security), and 2.9 percent had very low food security (Ziliak and Gundersen, 2018). Existing research suggests that seniors are particularly vulnerable to food insecurity and may experience severe health consequences (Leroux et al., 2020). Relative to food secure seniors, food insecure seniors have lower nutrient intakes and are at a higher risk of a wide variety of adverse health conditions, including diabetes, depression, activities of daily living (ADL) limitations, high blood pressure, congestive heart failure, heart attack, and asthma (Gundersen and Ziliak, 2017). Given projections of growth in the number of older Americans and their share of the total population, addressing food insecurity and its health consequences among seniors

will likely continue to pose a significant challenge to policymakers in the future (Gundersen and Ziliak, 2018).

Although SNAP is a federal program, states have had the latitude to implement a number of policies in its administration, especially in the period following the passage of the Personal Responsibility and Work Opportunity Act in 1996. These policies may affect SNAP participation in one of several ways, including extending SNAP eligibility to more households, increasing or reducing the transaction costs or stigma associated with participation, and providing information to potentially eligible nonparticipants. We obtain detailed information on several state SNAP policies covering the period from 2001 to 2014 from the United States Department of Agriculture (USDA), Economic Research Service (ERS) SNAP Policy Database (2018), various FNS and other reports (Aussenberg and Falk, 2019; Horng and Dean, 2002; Laird and Trippe, 2014; Cronquist et al. 2019; Trippe and Gillooly, 2010), state SNAP policy manuals/reports, and direct contact with state SNAP administrators.

We use this institutional information to construct several measures of policy generosity, including individual indicators for how long each policy was in place in a given state and year, indices representing how many policies expected to increase participation were in place, and measures of simulated eligibility representing the collective extent of eligibility expansions. We define senior and non-senior household samples and versions of these policy measure relevant to each. While individual policies have been examined in previous studies, this paper is the first to investigate the role of various state SNAP policy variables and new aggregations of the same in senior household participation decisions.

We start with analysis of data from the December Current Population Survey Food Security Supplement (CPS-FSS) (Flood et al., 2020) to examine the relationship between SNAP

policy changes and SNAP participation as well as the relationship between SNAP participation and household food insecurity and food expenditures. We compare estimates for the full sample to those for a restricted sample of respondents aged 60 and older. Next, we use restricted use data between 2002 and 2014 from the Health and Retirement Study (HRS) to again consider the relationship between SNAP policy changes and SNAP participation. This is possible because the restricted use HRS includes state identifiers. The HRS also allows us to explore how SNAP influences a wide range of seniors' health-related outcomes, including a global self-assessment of physical health, body mass index, risky behaviors such as smoking and drinking, and health care utilization. Finally, we supplement our HRS health-related analysis by considering similar outcomes from an alternate data source, the National Health Interview Survey (NHIS). While the HRS only allows us to compare seniors to near-seniors (51 to 59 years) due to its focus on older individuals, we can compare seniors to all other adults (under 60 years) in the NHIS.

We explore the feasibility of applying two recent methodological innovations in the broader SNAP literature to our analysis focusing on seniors. First, one can potentially address the issue of endogeneity from the non-random nature of SNAP participation through the use of a novel instrumental variables strategy that exploits cross-state, over-time variation in a number of state policies related to SNAP eligibility (Jones, 2020). Second, one can potentially address the well-known phenomenon of measurement error in survey-based SNAP participation measures by implementing a recently developed two-step estimator that jointly models both true SNAP participation status and the probability of misreporting (Denteh, 2017; Nguimkeu et al., 2019).

We find that eligibility expansions lead to increases in non-senior participation with some evidence of smaller increases in senior participation in both our CPS-FSS and our HRS samples. Overall, seniors and non-seniors appear to respond differently to various policies, but this

difference is not significant enough to explain the large disparity in participation typically observed between the two groups. We also find that SNAP participation is associated with worse health-related outcomes for all samples in all three datasets, which is likely due to negative selection into program participation. This includes measures of food insecurity from the CPS-FSS, measures of self-assessed health, obesity, drinking and smoking in the HRS and the NHIS, and measures of health care access and utilization in the NHIS and HRS respectively. The signs of these relationships flip when we use our SEVs as instruments for SNAP participation. However, these coefficient estimates are not statistically significant and the strength of the SEV as an instrument for senior SNAP participation depends on the dataset and sample used, as well as on the inclusion or exclusion of sampling weights in our analysis.

Background Literature

In this section, we briefly review the literature on SNAP participation and as well as the challenges to identifying the impact of SNAP on food security and health. We conclude with a discussion of the SNAP literature as it pertains to seniors.

SNAP Participation

There is a large literature on the determinants of the take up of transfer programs, including multiple comprehensive reviews (Currie, 2006; Nicoll, 2015). Categories of determinants typically include transaction cost levels, information availability, and perceptions of stigma (Daponte et al., 1999; Currie, 2006). These participation determinants may be influenced by programmatic features, as well as household characteristics such as age or immigration status. Evaluating the relative impact of these different determinants requires accurate information about eligibility and take up, both of which are often subject to measurement error (Meyer et al., 2015). In this section, we review the literature on the determinants of SNAP participation with a

special focus on seniors, whose participation has traditionally been lower than that of non-seniors (Haider et al., 2003; Currie, 2006; Nicoll, 2015).

Programmatic features of SNAP have been shown to generally influence SNAP participation through increases in generosity (Nicoll, 2015), expansions in eligibility (Jones, 2020), reductions in transaction costs (Currie, 2006), and increases in outreach (Ratcliffe et al., 2008). As an example of the relationship between program generosity and participation, Nord and Prell (2011) find that SNAP participation increased as a result of increases in benefits due to the American Recovery and Reinvestment Act of 2009. In terms of the relationship between eligibility expansions and enrollment, Capps et al. (2004) find that expanding eligibility to immigrants led to an increase in SNAP enrollment. Ganong and Liebman (2018) find that SNAP policy changes meant to reduce transaction costs, such as longer time intervals between recertification periods and simplified income change reporting, increased SNAP enrollment between 2001 and 2007. Dickert-Conlin et al. (2021) find that SNAP policies affecting eligibility and the costs of participation increased the SNAP caseload over the last two decades. Finally, Bartlett et al. (2004) find that increases in outreach spending increase awareness of eligibility, which could lead to subsequent enrollment increases.

Several studies have investigated the role of “stigma” in welfare participation, as some eligible individuals may view participating in a means-tested transfer program such as SNAP as an outward sign of personal failure (Nicoll, 2015). These studies find different results that depend partly on the definition of stigma being used. Ranney and Kushman (1987) find potentially large impact of stigma on SNAP participation. On the other hand, Bartlett et al. (2004) reported feelings of stigma among SNAP non-participants, but neither those feelings nor prior perceptions about eligibility was found to be associated with whether households would

apply for benefits if they were told they were eligible.

Challenges to Identifying the Impact of SNAP on Food Security and Health

As the largest nutrition assistance program in the United States, SNAP provides benefits to millions of eligible low-income households with the intention of reducing food insecurity and consequently promoting healthy living (Gundersen et al., 2019). Many studies evaluate the effectiveness of the program in meeting these goals for recipients of all ages using non-causal methods, and a growing body of studies aim to use causal approaches to estimate the effects of SNAP on food security and health (Gundersen and Ziliak, 2018). However, identifying causal effects is difficult because of endogeneity resulting from both non-random participation and measurement error. Considerable ambiguity therefore remains as to the causal effects of SNAP on both the population at large and seniors in particular.

The first threat to identification is the non-random selection of households into the SNAP program. Conditional on being eligible, the decision to participate is correlated with numerous characteristics of households that simultaneously influence food insecurity and other nutrition-related outcomes. As such, participants tend to differ from income-eligible nonparticipants in ways that the researcher does not observe. Specifically, there is evidence that SNAP participants are, on average, negatively selected, exhibiting low nutrient and calorie intake, higher overweight and obesity prevalence, and higher food insecurity relative to eligible nonparticipants (Currie 2003; Cole and Fox 2008; Bitler, 2015; Condon et al., 2015).

A second challenge in evaluating SNAP's causal effects arises from using survey-based measures that are subject to misclassification. An increasing number of studies have documented that participation measures are not only misreported but that the resulting biases from such measurement errors may be more severe than just an attenuation bias – the estimated treatment

effects may be wrongly signed (Kreider, 2010; Kreider et al., 2012; Almada et al., 2016; Nguimkeu et al., 2019). The extent of misclassification varies by survey and time period. Also, participants who report not receiving benefits (false negatives) tend to be more prevalent, having been estimated to range between 20 and 30 percent in the 2001 and 2005 panels of the Survey of Income and Program Participation (SIPP), 35 percent in the 2001 American Community Survey (ACS), and up to 50 percent in the 2002-2005 Annual Social and Economic Supplement of the March CPS (Meyer et al., 2018).

Studies that do not account for these sources of endogeneity often estimate negative associations between participation and food security despite SNAP also being consistently associated with higher expenditures on food (Gregory et al., 2015). Studies using instrumental variables (IV) methods, which often exploit variation from SNAP policy changes, include Gundersen and Oliveira (2001), Huffman and Jensen (2003), Borjas (2004), Yen et al. (2008), Mykerezzi and Mills (2010), Ratcliffe et al. (2011), Shaefer and Gutierrez (2012), Greenhalgh-Stanley and Fitzpatrick (2013), and Han (2016). These studies are more likely than the associational ones to find evidence that SNAP either improves food security or has no statistically significant effect. However, none of these papers account for misreporting of SNAP participation. Gundersen and Kreider (2009) and Kreider et al. (2012) account for both endogenous participation and misreporting using partial identification bounding methods, showing that SNAP significantly improves food security under relatively weak assumptions.

Other studies have asked whether the positive association between SNAP and obesity is causal. Gibson (2003) and Baum (2011) show that the positive association persists in fixed effects models. Studies using instrumental variables or other quasi-experimental methods find mixed results, with Meyerhoefer and Pylypchuk (2008) finding that SNAP increases obesity and

Fan (2010), Kreider et al. (2012), Denteh (2017), Almada and Tchernis (2018), and Nguimkeu et al. (2019) finding either null or negative effects.

Several studies have examined the impacts of SNAP participation on other health-related outcomes. Currie and Moretti (2008), Almond et al. (2011), and Hoynes et al. (2016) exploit variation from the rollout of the Food Stamp Program in the 1960s and 1970s and find that the advent of the program led to increases in birth weight for children exposed in utero and positive long run health effects for people exposed in early childhood. Yen et al. (2012) use SNAP program office distance as an instrument to estimate that SNAP participation has a negative effect on self-assessed health in Tennessee. Gregory and Deb (2015) use state-level SNAP policy variables as instruments to estimate that SNAP participation improves self-assessed health, increases checkups, and reduces sick days in bed, emergency care, and diagnostic office-based and outpatient visits. Kreider et al. (2012) find that effects on self-assessed health are sensitive to the assumptions used to narrow their bounds.

SNAP and Seniors

Turning our attention to seniors, Haider et al. (2003) uses data primarily from the 1998 wave of the Health and Retirement Survey to do a comprehensive examination of the determinants of SNAP participation of individuals aged 50 and older. They consider whether the differences in SNAP participation by age can be explained by the usual set of suspects described above, including mismeasurement of eligibility and a host of behavioral factors that might influence how responsive seniors are to SNAP policy changes. These behavioral factors include imperfect information about eligibility (Issar, 2010), beliefs that the expected benefit of SNAP participation is low (Daponte et al., 1999), the cost of applying and renewing coverage is high, or that participation is associated with some sort of stigma (Nicoll, 2015). It could also be the case

that seniors do not perceive a personal need for SNAP benefits. Haider et al. (2003) find that measurement error in eligibility does not explain the differentially low take up of SNAP among seniors. Their results also suggest that behavioral factors only account for a modest fraction of the relatively lower take up rate among seniors. They find suggestive evidence that eligible seniors who do not enroll appear to be less needy along several dimensions relative to those who do.

Other papers have also examined different aspects of the age gradient in SNAP participation. Cunnyngham (2010) presents descriptive evidence suggesting that the characteristics of the elderly SNAP eligible population often appear to vary from those of the elderly SNAP-participating population. Further, the characteristics of both populations frequently varied by state and also occasionally over time. This variation appeared to be related to state SNAP eligibility policies as well as state demographics and economic climates. Lim (2011) finds that low participation rates among seniors are more likely associated with age effects than cohort effects. Wu (2009) found that lower average benefit levels, lack of information about SNAP eligibility, and a preference for other types of nutrition assistance contribute to low elderly SNAP participation. This lower participation rate did not negatively affect elderly nutritional well-being on average. According to focus group results described in Gabor et al. (2002), elderly SNAP nonparticipation was associated with stigma, the belief that the benefits would not be worth the effort, and perceptions of an overly complicated and intrusive application process. Finally, Wilde and Dagata (2002) found that seniors also reported difficulties with transportation and the use of electronic benefit transfer cards.

As senior participation in SNAP differs from other groups, we may expect that relationships between participation in SNAP, food security, and health outcomes for seniors may

also differ. In particular, many health-related outcomes and behaviors for seniors are shaped over decades, and short-term receipt of SNAP may be less likely to influence them than for younger recipients. Butler and Raymond (1996) examine the roles of selecting into the Food Stamp Program and food stamp income on nutrient intake of a sample of seniors from the Supplemental Security Income (SSI)/Elderly Food Stamp Cashout Project of 1980-1981. They find evidence that selecting into the program is strongly correlated with attaining adequate nutrition and that food stamp income negatively impacts nutrition, although nutrient intake generally does not decrease below seniors' recommended daily allowance. Fitzpatrick et al. (2016) find that senior SNAP recipients living in food deserts are at higher risk of reporting food insufficiency and receiving subsidized meals than those with closer food store access. Greenhalgh-Stanley and Fitzpatrick (2013) use policy instruments and find that SNAP participation results in higher levels of some types of health care and a higher incidence of food insufficiency. Ranney and Gomez (2010) find a negative relationship between food insufficiency and health, a positive relationship between income and health, and weak evidence of a negative relationship between the probability of receiving food stamps and health. Nicholas (2011) also finds that senior food stamp recipients are no more likely than similar eligible non-recipients to have lower blood sugar levels, diabetes hospitalizations, outpatient utilization, or Medicare spending.

Unlike the previous literature, we focus specifically on differential responses of SNAP participation to SNAP policies (using the CPS-FSS and the HRS) and then examine the relationship between SNAP participation and health-related outcomes (using the CPS-FSS, the HRS, and the NHIS) for different age groups. The closest participation paper in the previous literature is Haider et al. (2003). The biggest differences include the fact we analyze the comprehensive set of state SNAP policies that have been implemented over the past two

decades, as well as the broader age range of the non-senior households we compare to senior households in the CPS-FSS. We also construct multiple policy indices and simulated eligibility variables to reflect differences in SNAP generosity by state over time separately for households in different age ranges.

Data

In this section we separately describe the three datasets we use in this analysis, the CPS-FSS, the HRS, and the NHIS. We also summarize institutional information on changes in SNAP policies over time and provide a description of how we use this policy variation to construct our measures of SNAP policy generosity.

Current Population Survey-Food Security Supplement

First, we use data from the CPS-FSS between 2001 and 2014 to examine the effect of SNAP policy changes on SNAP participation, as well as on household food insecurity and food expenditures, comparing estimates for the full sample to those for a restricted sample of respondents aged 60 and older. The CPS-FSS is a supplement to the CPS monthly labor force survey of roughly 50,000 households, administered since 1995 (Flood et al., 2020). About 30-35 percent of these households have at least one senior. The CPS-FSS serves as the main instrument for measuring national and state-level food insecurity in the United States based on its 18-item food security module that asks questions regarding various degrees of food-related hardships.

We use as outcomes self-reported SNAP participation; the count of affirmative responses to the food security module; indicators for marginal, low, or very low food security (one or more affirmative responses); low or very low food security, which is also termed food insecurity (three or more); and very low food security (eight or more, or six in households without children). Another outcome is weekly spending on food from all sources, including grocery stores,

restaurants, and other sources, which will shed light on the most likely mechanism through which SNAP improves food security. Spending is adjusted to 2010 dollar values.

We restrict the sample in several ways. We exclude households living in Alaska and Hawaii due to differences in state benefit formulas complicating analyses employing the SEV. We exclude households living in California due to the likely impact on senior SNAP participation from the state's SSI "cashout" policy during the sample period – in which SSI recipients were excluded from SNAP. We restrict the sample to low-income households with income at or below 185 percent of the federal poverty level (FPL) – a cutoff provided in the CPS-FSS. The CPS-FSS screens out households with higher income than this limit and also indicating no food hardship from questions about SNAP. Because we require information on household SNAP participation, we impose this gross income cutoff on our sample. Our sample therefore includes most households eligible for SNAP based on gross income, but not all: Households with seniors are not subject to a gross income limit under the federal eligibility criteria, and several states increase the limit up to 200 percent FPL through broad-based categorical eligibility expansions (described below). Finally, we exclude households with any missing characteristics used as controls.

The full CPS-FSS analysis sample includes 170,929 households. We define two additional subsamples: a "senior" sample of households with respondents aged 60 or older and a "non-senior" sample of households with respondents aged 59 or younger. The senior sample makes up about 34 percent of the full sample, and the non-senior sample makes up about 66 percent. Households with any senior present account for about 37 percent of the full sample, so the senior sample includes the majority of these households. Control variables for our analysis include household respondent characteristics including age, gender, race/ethnicity, marital status,

educational attainment, and employment status as well as household/family characteristics including household size, presence of children, and family income.

Table CPS-1 provides summary statistics for our full CPS-FSS sample of households, as well as stratified by senior vs. non-senior households. About 23 percent of the full sample reported receiving SNAP benefits in the past year. Only 14 percent of senior households received benefits, about half the percentage of non-senior households that did (28 percent). Senior households are more likely to be food secure. Only 16 percent in the sample are food insecure, compared to 34 percent of non-senior households. Additionally, senior households spend less on food per week, which makes sense given their smaller average size. The senior and non-senior samples differ in other noticeable ways. Predictably, the average age of senior respondents is higher. Senior respondents are more frequently female, white, native-born, widowed, less educated, and not in the labor force. Senior households are also on average smaller, more likely to contain just one member, and much less likely to include children. Table CPS-1 also shows the average value of the policy variables and policy summary measures described above.

Health and Retirement Study

Next, we use restricted-access panel data from the HRS to examine the dynamic effects of SNAP policy changes on SNAP participation and the health of seniors and near-seniors as they age. The HRS is a nationally representative longitudinal survey of individuals aged 51-61 in 1992 drawn from a multistage probability sample frame. The HRS has since interviewed participants biennially through 2018, adding a new cohort of individuals aged 50 and over every six years. We utilize data from the 2002 – 2014 waves of the HRS partly because of the minimal variation in the state SNAP policy variables in the pre-2002 period.¹ The HRS includes SNAP

¹ We also wanted to ensure a consistent sample period between the three samples / datasets utilized in this report.

participation since the date of the respondent's last interview, along with the necessary demographic and economic controls.

We apply three main sample restrictions. First, the unit of analysis is at the household level, where we select the household as the financial/family respondent in the core HRS files. There are 127,412 households in the 2002-2014 waves of the HRS. Second, we restrict the sample to low-income households with income up to 250 percent of the FPL – a cutoff provided in the HRS – to capture households that are more likely to be eligible for SNAP conditional on eligibility expansions. We also use a higher income cutoff than in the analyses using the CPS data because lower cutoffs greatly reduce the HRS sample size. This restriction yields 38,362 households. Finally, we exclude households with missing information on the control variables and any outcome variables, yielding the final analysis sample of 35,296. We also define a "senior" sample of households with respondents aged 60 or more. Seniors make up 77 percent of the full analysis sample.

The HRS has a wide range of health-related information that allows us to create three sets of dependent variables. The "health" category includes a measure of self-reported health status, which ranges from "excellent" to "poor" on a five-point scale. We define a binary variable capturing self-reported health as being at least "good" based on this five-point scale measure. For the "health behavior" category, we construct variables for body mass index (BMI), obese ($BMI \geq 30$), and severely obese ($BMI \geq 35$).² SNAP's impacts on body weight are potentially more important for health if we find any effects on severe obesity. The health behavior category also includes an indicator of current smoking status and the number of alcoholic beverages consumed per day. The "health care utilization" category includes an indicator of having any doctor visits,

² Body mass index is defined as weight in kilograms divided by height in meters squared.

an indicator for any inpatient hospitalization, the number of inpatient hospitalizations, an indicator for any overnight nursing home stay, the number of nursing home stays, and an indicator of any outpatient surgery.³

Table HRS-1 presents descriptive statistics (means and standard deviations) for the full and senior samples. The SNAP participation rate for the full sample is 19 percent, while it is 15 percent for the senior sample. These senior SNAP participation rates are consistent with the well-known historically lower participation for the elderly relative to other demographic groups during the sample period (e.g., Haider et al., 2003).

The senior respondents in the HRS are an average of 74 years old and live in households of an average size of 1.8. About 68 percent of the seniors in the sample are female, 30 percent are married, 23 percent are black, and 71 percent are white. Also, about 38 percent of the seniors have a high school degree, while 91 percent are not in the labor force. Finally, the HRS permits us to capture critical functional limitations of the sample that we use as additional controls to capture the physical or mental costs of taking up SNAP. The variables include the sum of activities of daily living (ADL), the sum of instrumental activities of daily living (IADL), and a measure of cognitive function as the number of words correctly recalled immediately or delayed. The sum of ADLs measure summarizes five activities that the respondent reports having "some difficulty" performing: bathing, dressing, eating, getting in and out of bed, and walking across a room. About 76 percent of seniors report having no difficulty with the five ADLs, while about 12 percent report having some difficulty with one of the five ADLs. Similarly, the sum of the IADLs variable summarizes the following five activities that the respondent had difficulty performing: using the phone, managing money, taking medications, shopping for groceries, and

³ The health care utilization variables are measured with respect to the date of the last interview or within the previous two years for new respondents.

preparing hot meals. Again, most of the seniors (79 percent) report having no difficulty with any of the five IADLs, while about 11 percent report having some difficulty with one of the five IADLs.

National Health Interview Survey

Finally, we supplement our HRS health-related analysis by considering similar outcomes from an alternate data source, the NHIS. While we use the NHIS and HRS to answer the same general types of questions, the relative strengths of the two datasets mean that analyzing them both will yield a more complete picture of the impact of SNAP on seniors than either would separately. Since the NHIS includes all ages, it enables us to compare the effects on seniors to those on other age groups, which is not possible with the HRS. On the other hand, the two datasets contain somewhat different variables; for instance, the HRS contains more detailed information on ADLs/IADLs while the NHIS contains richer information on health conditions and health care utilization. Note our NHIS analyses are based on the public-use files since it was not feasible to get access to the Research Data Center (RDC) in a timely manner.

The NHIS is an annual, cross-sectional survey of households developed by the CDC's National Center for Health Statistics (NCHS) and administered by the U.S. Census Bureau since 1957, with the goal of providing information on the health status and healthcare utilization of the U.S. population over time. The NHIS typically includes responses for about 35,000 households containing approximately 87,500 individuals per year. In each family sampled, one adult and one child (if present) are semi-randomly selected for a more detailed individual survey that provides in-depth information about health conditions, health behaviors, and healthcare utilization. Our full sample analysis uses the Sample Adult File which contains 25,000 to 30,000 adults per year in recent years, while our analysis of seniors utilizes the 35 percent of these adults who are at

least 60 years old. We use the 2001-2014 surveys of the NHIS. The NHIS includes information on whether the respondent lived in a household where at least one person (it is not revealed who) received SNAP benefits as well as the demographic and economic control variables discussed above.

We apply two main sample restrictions. First, the unit of analysis is adult respondents. There are over 950,000 adult (18 and older) respondents to the survey in the 2001-2014 NHIS. Second, we restrict the sample to respondents living in low-income households with income up to 200 percent of the FPL – a cutoff provided in the NHIS – to examine households that are more likely to be eligible for SNAP. This restriction yields 252,563 respondents, of which 53,995 are 60 and older.

From the NHIS we examine three different sets of health-related outcomes related to health behaviors, health care access, and health status. For health behaviors, we analyze the effect of SNAP on the respondent's current smoking status, the number of cigarettes per day the respondent smoked if they were daily smokers, the number of cigarettes per day the respondent smoked if they were current smokers, the frequency they drank in the past week, the frequency they drank in the past year, and how many drinks the respondent had each time they drank.

For health care access, we analyze the effect of SNAP on whether or not in the past 12 months the respondent needed but could not afford mental health care, needed but could not afford dental care, needed but could not afford eyeglasses, saw/talked to a mental health professional, saw/talked to an eye doctor, saw/talked to a therapist (PT/OT), saw/talked to an OB/GYN, saw/talked to a medical specialist, saw/talked to a general doctor, was in a hospital overnight, delayed medical care delayed due to cost, or if any family member need and did not get medical care due to cost.

Finally, for health, we analyze the effect of SNAP on whether the respondent's general health is about the same or improved compared to a year ago, their current health status (good or bad), BMI, if they need help with instrumental activities of daily living (IADL), have an activity limitation from depression, anxiety, or an emotional problem, or have a limitation of activity by chronic condition.

Table NHIS-1 presents descriptive statistics for the full, non-senior, and senior samples. About 29.2 percent of the full sample lived in a household with someone that received SNAP, in the non-senior sample 31.5 percent lived in a household with someone that received SNAP, and in the senior sample 20.9 percent lived in a household with someone that received SNAP benefits.

The average age in the non-senior sample in the NHIS is 35 years, compared to 72 years in the senior sample. About 55 percent of the non-senior sample is female, 19 percent is black, 38 percent is Hispanic, 42 percent married, 17 percent live in a single person household, and about 58 percent are employed. Meanwhile, the senior sample is about 61 percent female, 19 percent black, 20 percent Hispanic, 41 percent married, 43 percent live in a single person household, and about 13 percent are employed.

There are also some noteworthy contrasts in the outcome variables between the two samples. About 83 percent of non-senior adults report being in good health, compared to about 60 percent of the seniors, and about 4 percent of the non-senior adults report they need help with instrumental activities of daily living (IADL), compared to about 17 percent of the seniors. About 24 percent of the non-seniors report limitations from depression/anxiety/emotional problems compared to about 8 percent of the seniors, while seniors are almost three times as likely to report limitations from a chronic condition. Seniors are less likely to be current

smokers, but they generally smoke similar amounts of cigarettes conditional on being a current smoker. Seniors tended to drink about as often as non-seniors, but drank fewer total drinks on occasions that they consumed alcohol. Finally, adults were more likely to respond that they did not obtain medical care due to cost, while seniors were in general more likely to see medical professionals in the past year.

SNAP Policy Changes Over Time

Although SNAP is a federal program, states have been given the latitude to implement a number of policies over the past several decades that may affect households' propensity to participate. Here, we consider policies in use at some point during the 2001-2014 period; not all of these policies are still used or allowable. Following Stacy et al. (2018), we classify these policies as primarily impacting one of four factors affecting the participation decision: eligibility to receive benefits; transaction costs involved in applying, enrolling, or maintaining benefits; stigma associated with participation; and outreach spreading information related to eligibility criteria and how to receive benefits. We gather information on policies affecting eligibility, transaction costs, and stigma from the USDA, Economic Research Service's (ERS) SNAP Policy Database (2018) and additional information on a policy affecting outreach from ERS's SNAP Policy Index (2020). Unless otherwise specified, we construct yearly policy measures for each policy described below representing the percentage of the year that policy was in place.

Some state policies may increase SNAP participation by extending eligibility to previously ineligible households who would otherwise participate. Households are typically eligible for SNAP if they meet a gross income test of 130 percent of the FPL (households with senior or disabled members need not meet the gross income test), a net income test of 100 percent of the FPL, and a countable resource test of \$2,250 (households with senior or disabled

members may have up to \$3,500 in countable resources) or if all members are determined to be categorically eligible through their participation in Temporary Assistance for Needy Families (TANF), SSI, or state General Assistance programs. In the period following the passage of PRWORA in 1996, states have been allowed to expand SNAP eligibility in various ways. First, states can implement broad-based categorical eligibility (BBCE) expansions (USDA FNS, 2018; Aussenberg and Falk, 2019). Through BBCE, households can be made eligible for SNAP if the state offers a non-cash TANF-funded or state Maintenance of Effort (MOE)-funded benefit for which the household qualifies. States can offer these relatively inexpensive benefits to households with gross income above 130 percent FPL (up to 200 percent FPL) and countable resources above the federal limit. Therefore, through BBCE, states can effectively loosen some combination of the SNAP income and asset limits applied to households that are not categorically eligible, either for all households or for different types of households (e.g., those with senior or disabled members, those with dependent children).⁴ Second, states can align their vehicle valuation rules to those rules used in TANF-funded programs to exclude one or more

⁴ Non-cash benefits qualifying households for categorical SNAP eligibility do not technically alter the federal eligibility criteria; instead, they extend categorical eligibility to additional households that would be eligible for a SNAP benefit based on their net income but are not due to having too high of gross income or countable resources. By assigning eligibility criteria to qualifying non-cash benefits looser than those in the federal gross income, net income, and asset tests, states implementing BBCE effectively “loosen” these criteria. States may not use BBCE to restrict eligibility; any household that is eligible according to the federal gross income, net income, and asset tests or that is categorically eligible through all members receiving TANF, SSI, or state General Assistance programs cannot be made ineligible through BBCE. Households with gross income above 200 percent FPL cannot be made eligible through receipt of a qualifying non-cash benefit, effectively limiting the extent to which BBCE expansions can loosen the gross income limit. To receive a qualifying non-cash benefit, households with senior and disabled members typically must have gross income below a certain level, unlike the federal gross income test which they are exempt from. Non-cash benefits frequently do not take household assets into account, meaning that households qualifying through BBCE in one of these states may have any amount of countable resources, and the asset limit is effectively eliminated. Non-cash benefits typically do not take net income into account, meaning that some households qualifying for a BBCE-associated non-cash benefit based on gross income would receive a \$0 benefit according to the federal benefit formula due to having net income above 100 percent FPL. These households are not eligible for SNAP in practice, and we do not consider them eligible in our analyses, with two exceptions: First, households with 1 or 2 members qualify for a minimum benefit that varies over the 2001-2014 period even if their benefit is calculated as below the minimum allotment. Second, households with net income above 100 percent FPL could still be calculated to be eligible for a non-zero benefit from 2009 to 2013 when SNAP maximum allotments were temporarily increased according to the American Recovery and Reinvestment Act.

vehicles from the resource test. Last, states can expand eligibility to additional legal noncitizens eligible for SNAP or similar state- funded food assistance.⁵ The SNAP Policy Database (2018) provides separate information on whether states extended eligibility to all legal noncitizen adults and/or all seniors (age 65+), which we incorporate separately in analyses of the full/non-senior or senior samples, respectively.

Policies reducing transaction costs may increase SNAP participation by making it easier for households to apply for SNAP, enroll in SNAP, and/or maintain SNAP benefits. States can alter their policies affecting how SNAP is administered in several ways affecting transaction costs. First, states can use simplified reporting, which reduces requirements for households with earnings to report changes in their circumstances. Second, states can allow households to submit SNAP applications online instead of requiring in-person application. Third, states can operate SNAP call centers to perform one or more of several administrative functions and/or complement in-person administration. Fourth, states can conduct interviews over the phone instead of requiring in-person interviews at recertification (without having to document household hardship requiring recertification over the phone). Fifth, states can operate a Combined Application Project, streamlining the SNAP application process for SSI recipients. Sixth, states can change how frequently households must recertify to continue receiving SNAP. The SNAP Policy Database (2018) provides monthly information on the proportions of SNAP units of various type with recertification periods of 1-6 months.⁶ We separately construct the

⁵ PRWORA made most immigrants ineligible for SNAP benefits. The 2002 Farm Bill restored SNAP eligibility to most legal immigrants, including those living in the United States for five years or longer, children, and those receiving disability-related assistance or benefits. During the 2001 to 2014 period, states were allowed to expand eligibility further to other legal noncitizens who would not otherwise be eligible for SNAP or state-funded food assistance.

⁶ For context, the typical certification period length before a household needs to be recertified is 12 months, or 24 months for households with only senior or disabled members. The SNAP Policy Database provides historical information covering our period for the proportion of households estimated to have certification periods of 1-3 months, 4-6 months, 7-12 months, or longer than 12 months. We combine the proportions with periods of 1-3

monthly proportion of SNAP units with “short” recertification periods of 6 months or less for SNAP units with earnings and for senior SNAP units and use the annual average of these monthly proportions in analyses of the full/non-senior or senior samples, respectively.

Policies increasing the stigma of SNAP participation may disincentivize and decrease participation. We consider only one such policy: whether states require fingerprinting of SNAP applicants. Policies raising awareness of SNAP may increase participation among eligible nonparticipants who previously were unaware of the program or thought themselves ineligible. We consider only one such policy: whether states had federally funded TV or radio ad campaigns intended to raise awareness of SNAP among eligible nonparticipants.⁷

SNAP policy summary measures

Several studies construct index measures of state SNAP policies to summarize overall policy generosity (e.g., Ganong and Liebman, 2018; Dickert-Conlin et al., 2021). We follow Stacy et al. (2018) most closely in constructing a total policy index as the sum of the 11 policy variables described in the above section:

$$Policy\ Index_{st} = \sum_{i=1}^{11} Policy_{ist} \quad (1)$$

where s indicates state, t indicates year, and i indicates a policy contributing to the index. Each policy variable $Policy_{ist}$ is an annual average of a monthly indicator equal to 1 if a policy is in place in a given month and therefore represents the percentage of the year that a policy was in place (except for the policy variable indicating the proportion of SNAP units with a recertification period of 6 months or less, though that variable also ranges from 0 to 1). Two

months and 4-6 months to create the proportion with certification periods of 1-6 months separately for SNAP units with earnings and for senior SNAP units.

⁷ Note that there are other state SNAP policies that we do not consider in this report due to data limitations. Not all of the policies described in this section are allowed today, including the fingerprinting of SNAP applicants and the federal funding of ads to raise awareness of SNAP.

policies likely to decrease SNAP participation – proportion of SNAP units with short recertification periods and fingerprinting requirements – enter the index as $(1 - Policy_{ist})$ so that a value of 1 indicates no short recertification periods or fingerprinting requirements. The total policy index ranges from 0 to 11, with 0 representing the fewest policies in place likely to increase SNAP participation and 11 representing the most.

Additionally, we construct corresponding sub-indices for policies primarily affecting eligibility, transaction costs, stigma, or outreach. These are constructed as the total policy index above, but each summarize fewer policies primarily impacting each of these four factors as identified in the previous section. The eligibility index ranges from 0 to 3, the transaction costs index ranges from 0 to 6, and the stigma and outreach indices each range from 0 to 1 (each only containing information about one policy).

The total, eligibility, and transaction costs indices each contain policy variables that are more applicable to non-senior households: the proportion of SNAP units with earnings with short recertification periods and/or the state making legal noncitizen adults (18-64) eligible for SNAP or similar state-funded food assistance. For these indices, we also construct senior versions swapping in senior-relevant versions of these variables: the proportion of senior SNAP units with short recertification periods and/or the state making legal noncitizen seniors (65+) eligible for SNAP or similar state-funded food assistance. We designate these as “non-senior” or “senior” versions of these indices, respectively, and use the non-senior indices in analyses of the full and non-senior samples and the senior indices in analyses of the senior sample.

Figure 1 illustrates state variation in the non-senior version of the total policy index across three years spanning the sample period. States tend to adopt more SNAP policies over time expected to increase participation, though there is substantial variation in when these

policies are adopted. Appendix Figure 1 illustrates similar variation in the senior version of the total index as well as the non-senior and senior versions of the four policy subindices.

Several of the policies described above operate in more complex ways in practice than binary indicators or a policy index can capture. In particular, state policies effectively expanding SNAP eligibility do so in differing but interacting ways. States can alter how vehicles are applied to the countable resource test as described above if the rule they transition to is less restrictive than the federal minimum. States can also use BBCE to expand categorical eligibility to households if they qualify for a non-cash TANF/MOE- funded benefit, effectively extending eligibility to households with higher gross income or assets than the federal gross income test or asset test would allow. The extent to which the gross income and asset limits are effectively altered through BBCE significantly varies between states over the sample period. Some states' BBCE expansions also target different subcategories of households – like those with senior or disabled members – in different ways. In particular, many states' BBCE policies expanded eligibility for households with seniors more than for households without during the 2001-2014 period by either waiving the asset limit only for senior/disabled households with gross income under a certain limit or by waiving the asset limit for all households but additionally allowing senior/disabled households to have higher gross income than households without senior/disabled members. Some states have implemented an additional policy not described above: standard medical expense deductions (SMEDs) for households with senior or disabled members. In the absence of a SMED, these households are allowed a deduction of out-of-pocket medical expenses exceeding \$35 to determine their net income (other households do not receive this deduction). SMEDs allow households to deduct a standard amount in place of their actual spending exceeding \$35 to determine their net income (they may still deduct their actual

spending less \$35 if that amount is higher than the SMED). Senior/disabled households with relatively low out-of-pocket medical expenses can therefore have higher deductions than they otherwise would in states with SMEDs, which translates to lower net income. In limited cases, this can make some senior/disabled households eligible for SNAP that otherwise would not be. Variation in the extent to which eligibility is altered along these various dimensions, the combination of ways in which it is altered, and the groups targeted means that the nature of SNAP eligibility expansion in any given state and year can differ greatly from others that have similar policies in place.

We obtain detailed information on state policies related to SNAP eligibility and benefit determination from 2001 to 2014 from the USDASNAP Policy Database (2018), various FNS and other reports (Aussenberg and Falk, 2019; Horng and Dean, 2002; Laird and Trippe, 2014; Cronquist et al., 2019; Trippe and Gillooly, 2010), state SNAP policy manuals/reports, and direct contact with state SNAP administrators.

We follow previous studies on the effects of Medicaid (e.g., Cutler and Gruber, 1996; Currie and Gruber, 1996) and SNAP (e.g., Han 2016; Han, 2020) by constructing a measure of simulated eligibility for SNAP which we term a simulated eligibility variable (SEV). We compute the proportion of a random national sample that would be eligible to receive SNAP benefits in each state in each year based on the various state policies pertaining to eligibility discussed above (BBCE, vehicle exemption, standard medical expenses deduction):

$$SEV_{st} = \frac{\# \text{ individuals simulated as eligible in state } s \text{ and year } t}{\text{Total \# individuals}} \quad (2)$$

A higher proportion simulated as eligible in a state and year indicates a more generous policy set and should predict a subsequently higher likelihood of SNAP participation. The point of using a constant national sample rather than a time-varying sample from each state is to prevent changes

over time in the characteristics of a state's population from confounding the estimates. In other words, the identifying variation comes only from plausibly exogenous changes in state policies related to the generosity of the SNAP program, as opposed to endogenous changes in, say, state economic conditions. This simulated eligibility approach is preferable to simply including each policy variable separately because it consolidates relevant eligibility policy information into a *simulated eligibility rate* that is more predictive of individuals' participation probabilities.

For the constant national sample, we pool all available waves of the Survey of Income and Program Participation (SIPP) from 1996 to 2013, which together contain around 340,000 household-year observations. The SIPP provides information on household size, income, assets, expenses, and other characteristics like member age and disabilities necessary to determine SNAP eligibility. Household financial variables are adjusted for inflation to each year before application of the combined eligibility criteria in each state and year resulting from the policies described above. In analyses of the full sample, we use an SEV calculated using the full sample of individuals in SIPP households following Jones (2020). Additionally, we are the first to use the simulated eligibility method to study the SNAP participation of senior households as opposed to non-senior households, so we also construct new versions of the SEV specific to each group. Specifically, the non-senior SEV is the proportion simulated as eligible of a sample of about 230,000 SIPP households with respondents under age 60, and the senior SEV is the proportion simulated as eligible of a sample of about 110,000 SIPP households with respondents age 60 or older. These subsample-specific SEVs more accurately represent the eligibility policy variation relevant to non-seniors or seniors.

Figure 2 illustrates state variation in the full-sample version of the SEV across three years spanning the sample period. The SEV tends to increase or stay constant over time as most states

only expand SNAP eligibility during the sample period, although a few states reverse expansions or change their policies such that the SEV falls. There is also a slight decline in the SEV in later years in many states due to the 2013 expiration of the ARRA temporary benefit increase, which made some higher-income SIPP households lose eligibility. Appendix Figure 2 illustrates similar variation in the non-senior and senior versions of the SEV. Much like the federal SNAP eligibility criteria, state eligibility expansions tend to be more generous for seniors than non-senior households, as represented by the higher values of the senior SEV.

Methods

In this section we first describe the methodology used to estimate the relationship between SNAP policy changes and SNAP participation using the CPS-FSS and the HRS. Next, we describe our approach to estimating the relationship between SNAP participation and health-related outcomes using the CPS-FSS, the HRS, and the NHIS. Here, we also discuss the possibility of using the initial SNAP participation analysis as a potential first stage of an IV analysis of health-related outcomes. While we describe these methods generically without reference to specific datasets for the most part, we do include mentions of any major deviations driven by the specifics of the datasets.

SNAP Participation Outcome (CPS-FSS and HRS datasets)

We start our empirical analysis by exploring the relationship between the SNAP participation of senior households relative to non-senior households and state SNAP policy changes related to eligibility, transaction costs, stigma, and outreach. There are two reasons for investigating how state SNAP policies affect participation. First, we would like to know which combination of state policies are correlated with participation to gain insights into the well-documented incomplete program take-up. Such insights can be useful for informing SNAP

policy debates regarding policy changes to encourage participation and suggest useful avenues for future research. Second, based on our findings regarding the strength of these state policies in predicting participation, these state SNAP policies can serve as potential instruments in IV designs used in estimating SNAP's causal impacts, especially for seniors.

To accomplish this, we estimate linear probability models of the form:

$$SNAP_{ist} = \beta_0 + \beta_1 Policy_{st} + \beta_2 X_{ist} + \theta_s + \tau_t + \varepsilon_{ist}, \quad (3)$$

where $SNAP_{ist}$ is an indicator for self-reported receipt of SNAP benefits in the past year for household i in state s and year t , $Policy_{st}$ is a vector of one or more of the aforementioned state policy variables or summary measures, X_{ist} is a vector of the aforementioned control variables, θ_s is a vector of state fixed effects, τ_t is a vector of year fixed effects, and ε_{ist} is the error term. We cluster robust standard errors by state in all regressions. While our main regressions are unweighted, we refer the reader to the Appendix for the weighted versions of the results.

We are interested in estimating β_1 , which ideally represents the average treatment effects of various state policies on low-income household SNAP participation. Because we are interested in how β_1 differs between senior and non-senior households, we estimate equation (3) for each of three samples separately from the CPS-FSS: the full sample including all households, the non-senior sample including the households with respondents aged under 60, and the senior sample including households with respondents aged 60 or older. For the HRS, we only estimate equation (3) for the full (or near-seniors) and senior subsamples. We then present and compare the estimates of β_1 side by side to determine whether senior households respond differently to state SNAP policies.

To determine which individual policies or broader types of policies affect SNAP participation, we estimate models including different sets of policy variables in $Policy_{st}$. When

applicable, we include the corresponding subsample-specific versions of policy variables in \mathbf{Policy}_{st} as described in the data section in analyses using the full, non-senior, or senior subsamples. The first policy set includes the eleven individual variables described in the data section. Each of these variables range from 0 to 1. The remaining sets use summary policy measures on differing scales, so we standardize those measures. Our estimates of β_1 in these regressions represent the effect of a standard deviation increase in the relevant variable, allowing easier comparison between summary measures. The second policy set includes the total policy index described in the data section. The third set includes four sub-indices for policies primarily impacting eligibility, transaction costs, stigma, and outreach constructed analogously to the total policy index. The fourth set includes the SEV described in the data section. The fifth set mirrors the third set but with the SEV included in place of the eligibility policy sub-index.

In estimating equation (3) where SNAP participation is the dependent variable, we do not address SNAP's misreporting partly because the consequences of measurement error in binary choice models may be less severe and methods to address those are an active area of research (e.g., Meyer and Mittag, 2017).

Health-related Outcomes (all datasets)

In this section, we start with a brief discussion of the theoretical relationship between SNAP and health-related outcomes. We then describe some recent methodological innovations in the broader SNAP literature (Jones, 2020; Denteh, 2017; Nguimkeu et al., 2019) that may be able to address two challenges associated with estimating the causal effect of SNAP on the health-related outcomes of seniors. The first is the non-random nature of SNAP participation (Jones, 2020). The second is high rate of misclassification of survey-based participation measures (Meyer et al., 2015; Nguimkeu et al., 2019).

We hypothesize that the causal effect of SNAP is to increase food expenditures, thereby improving food insecurity and at least some other aspects of health in general. The causal effect on obesity is theoretically ambiguous, as food subsidies could either increase food intake across-the-board or induce a shift from inexpensive calorie-dense foods to more expensive but healthier options. SNAP could also affect other health behaviors, such as smoking and drinking, in either direction since the causal effect of income on these behaviors appears to vary across contexts (Adams et al., 2012; Averett and Wang, 2013; Kenkel et al., 2014; Apouey and Clark, 2015; Cowan et al., 2015). SNAP’s effect on health care utilization is also theoretically ambiguous; demand for care could decrease because of improved health or increase through income effects. It is possible that the effect of SNAP receipt on the health-related outcomes or behaviors of seniors may differ from its effect on non-seniors, especially as short-term SNAP receipt may be less likely to affect health outcomes shaped over longer periods of time. Our framework allows us to examine differential relationships for seniors and non-seniors.

For each health-related outcome in each dataset, we will begin with a naïve regression model specification given by:

$$Y_{ist} = \alpha_0 + \alpha_1 SNAP_{ist} + \alpha_2 \mathbf{X}_{ist} + \theta_s + \tau_t + \varepsilon_{ist}, \quad (4)$$

where Y_{ist} denotes the outcome for household i in state s in year t , $SNAP_{ist}$ is the self-reported indicator for SNAP participation for household i in state s in year t , \mathbf{X}_{ist} is a vector of the aforementioned control variables, θ_s and τ_t are fixed effects for state and year, and ε_{it} is the error term. Standard errors are heteroskedasticity-robust in all three datasets and clustered by state in the CPS-FSS and HRS analysis. For the NHIS, we do not have state information since we only use the public-use files. In the presentation of our results, we will first present naïve OLS estimates of α_1 for all the three datasets.

However, since households are negatively selected in the SNAP program, as suggested by prior research, then the naïve OLS estimate of α_1 will understate any favorable impacts of SNAP. We attempt to address this endogenous selection issue using our simulated eligibility variable (SEV) given by equation (2) and described in detail in the previous section of the report. The second stage regression in the IV analysis is given by:

$$Y_{ist} = \alpha_0 + \alpha_1 \widehat{SNAP}_{ist} + \alpha_2 X_{ist} + \theta_s + \tau_t + \varepsilon_{ist}, \quad (5)$$

where \widehat{SNAP}_{ist} are the fitted values from a first stage regression given by equation (3) with the variable $Policy_{st}$ being the SEV and all other parameters are as defined above. The success of this IV analysis depends on the strength of the SEV as an instrument for participation, which we will first demonstrate.

Finally, while using the SEV in an IV analysis addresses endogeneity from (true) SNAP participation, it does not solve endogenous SNAP misreporting. We note that Nguimkeu et al.'s (2019) recently developed misreporting framework is a promising approach that can be incorporated with our simulated eligibility variable to address both the endogeneity of participation and misreporting. As with our usual IV analysis above, Nguimkeu et al.'s (2019) methodology also depends on the strength of the SEV as an instrumental variable for participation. In addition, their approach also requires using survey-specific interview/interviewer characteristics as predictors of misreporting. For instance, all our datasets contain interview mode variables (face-to-face vs. telephone). The HRS also has indicators for proxy interviews and the presence of and help from third parties during the interview.

Results

In this section we present our results separately by the primary dataset used in the analysis. Our CPS-FSS and HSR analysis examine both the relationship between SNAP policy

changes and SNAP participation and the relationship between SNAP policy changes and health-related outcomes. Our NHIS analysis focuses solely on the relationship between SNAP policy changes and health-related outcomes.

Current Population Survey Food Security Supplement

Table CPS-2 reports estimates from equation (3) above regressing household SNAP participation on a set of eleven individual state SNAP policy variables for each of the analysis samples. The senior sample regression uses alternate versions of two variables more relevant to the senior population. Ten of these policy variables represents the percentage of a year a state had the policy in place. The remaining variable indicates the annual average proportion of SNAP units with short recertification periods. Each policy variable ranges from zero to one, with one indicating that the relevant policy was in place all year or that all SNAP units had a short recertification period during the year. The policy variables are categorized as primarily targeting eligibility, transaction costs, stigma, or outreach. Nine of the policies included are expected to have a positive impact on SNAP participation by either increasing eligibility, reducing transaction costs, reducing stigma, or increasing awareness, and we therefore expect their estimated coefficients to be positively signed. The remaining policy variables expected to have a negative impact on SNAP participation include the proportion of SNAP units with earnings or with senior members with short recertification periods and the indicator that a state requires applicants be fingerprinted, and we therefore expect these estimated coefficients to be negatively signed.

For most policy variables we consider, we find no evidence of effects on SNAP participation among the full, non-senior, or senior samples. We do find evidence that shorter recertification periods of six months or less for SNAP units with earnings reduce the probability

of household SNAP participation. Our estimates indicate that households in either the full or non-senior sample are about 2.1 percentage points less likely to have received benefits in the last year, respectively, in states in which all households with earnings are subject to a short recertification period. The corresponding point estimate for senior SNAP units is larger but not statistically significant. Households in either the full or non-senior sample living in states with applicant fingerprinting requirements are also less likely to participate in SNAP by about 2.9 percentage points. The corresponding point estimate for the senior sample indicates a similar reduction for seniors, though it is not statistically significant. We find evidence that senior households are about 1.3 percentage points more likely to participate if their state streamlines the SNAP application process for SSI recipients through a Combined Application Project (CAP). The corresponding point estimate for the non-senior sample indicates a similar reduction for non-seniors, though it is not statistically significant.

The first three columns of Table CPS-3 report the results from regressions of household SNAP participation on a total policy index for each of the analysis samples. The last three columns report results from regressions using the four policy subindices in place of the total index. The construction of these indices is described in the data section. The senior sample regression uses alternate versions of the total, eligibility, and transaction costs indices that take into account alternate policy variables more relevant to the senior population. Higher values of the indices indicate that a state has implemented more policies expected to increase eligibility, reduce transaction costs, reduce stigma, and/or increase awareness, or that it has refrained from implementing policies expected to do the opposite. We therefore expect the estimated coefficients on the total and subindices to be positively signed. In all regressions, we standardize the indices, meaning that the estimated coefficients represent the impact of a one standard

deviation increase in the index.

We find evidence that a higher total policy index score increases the probability of SNAP participation among the full and non-senior samples by about 1.1 and 1.2 percentage points, respectively. Among the senior sample, we find no evidence of an effect, as the estimated coefficient on the total index is much closer to zero and statistically insignificant. None of the estimated coefficients on the four subindices are statistically significant for any sample. Still, the point estimates are generally positive as expected, with the exception of the outreach subindex for the non-senior sample and the eligibility subindex for the senior sample.

Table CPS-4 reports the results for each analysis sample from regressions of household SNAP participation on the SEV corresponding to each sample. The construction of the SEVs is described in the data section. Higher values of the SEV indicate that a state has implemented more policies expected to increase eligibility of the relevant household sample. We therefore expect the estimated coefficients to be positive. In all regressions, we standardize the SEV, meaning that the estimated coefficients represent the impact of a one standard deviation increase in the SEV.

We find evidence that more generous state eligibility expansions collectively increase SNAP participation among non-senior and senior households. We find that a standard deviation increase in the non-senior sample SEV increases the probability that a non-senior household received SNAP benefits by about 1.5 percentage points. Among senior households, a similar increase in the senior sample SEV increases the probability but not to the same extent – about 1.0 percentage point. Among the full sample, the probability increases by about 1.3 percentage points. Notably, the F statistics reported for each specification indicate that the SEV is a strong instrument for non-senior SNAP participation (F-statistic of 21.6), but not for senior SNAP

participation (5.3).

Table CPS-5 reports the results from regressions structured like those in the last three columns of Table CPS-3 using the four policy subindices as the independent variables of interest, but with each sample's corresponding SEV substituted in for the eligibility policy subindex. The SEV and subindices are standardized, and we expect the estimated coefficients on these measures to be positive.

Again, we find evidence that more generous state eligibility expansions increase SNAP participation among non-senior and senior households. The point estimates indicate increases in the probability of SNAP participation of 1.5 and 1.0 percentage points, respectively. These are comparable to the estimates reported in Table CPS-4. We find little evidence that other policy types collectively increase SNAP participation, except for the stigma subindex. Our estimate for the non-senior sample indicates that a standard deviation increase in the stigma subindex increases the probability of participation for non-senior households by about 0.8 percentage points. The corresponding point estimate for the senior sample is of similar size but statistically insignificant.

Unfortunately, the fact that we do not find a strong relationship between SNAP policies and SNAP participation among seniors in the CPS-FSS reduces our confidence that we can successfully address the challenge of participation endogeneity among seniors using the SEV or other sets of policy measures as instruments (Jones, 2020). Further, since that IV does not work well, then it would not make sense to layer on top of that a second instrument to address measurement error (Denteh, 2017; Nguimkeu et al., 2019).

Given these concerns, we proceed by only estimating naïve models using OLS relating SNAP participation with health-related outcomes as specified by equation (4) above. Note that,

for the HRS data, we will present IV results using the SEV as an instrument for SNAP participation as described by equation (5) above since we find evidence for a stronger relationship between the SEV and senior SNAP participation. However, due to the generally weak first stage for the senior sample in the SEV IV analysis, we do not report results that also include a second instrument to address measurement error following Nguimkeu et al. (2019) for neither the CPS nor the HRS datasets.

Table CPS-6 presents the naïve OLS results of the effects of SNAP participation on the four food security outcomes and weekly food spending outcome. As expected and due to the adverse selection into the program, the results show that SNAP participation is associated with worse food security outcomes for both the non-senior and senior samples. Specifically, SNAP receipt predicts 1.4 more affirmative responses for non-senior households and 1.3 for senior households. Non-senior households receiving SNAP are 23.3 percentage points more likely to report any affirmative responses, 20.2 percentage points more likely to be classified as food insecure, and 10.4 percentage points more likely to be classified as having very low food security. In comparison, senior households receiving SNAP are 27.3 percentage points more likely to report any affirmative responses, 20.5 percentage points more likely to be classified as food insecure, and 10.1 percentage points more likely to be classified as very low food secure. SNAP receipt predicts increased weekly food spending of \$10.18 among non-senior households, but we find no association between food spending and SNAP among senior households.

Health and Retirement Study

As with our analysis using the CPS, we begin by presenting results from linear probability models specified by equation (3) of SNAP participation on various groups of state SNAP policy variables and a standard set of control variables reported in Table HRS-1. Table

HRS-2 reports the regression results for the set of eleven SNAP policy variables grouped into four categories: eligibility, transaction costs, stigma, or outreach. Again, the two SNAP policies we expect to affect participation negatively are the proportion of SNAP units with earnings with short certification periods and the indicator that a state requires fingerprinting of SNAP applicants. The remaining nine policies are expected to impact participation positively. Like the CPS sample, the results in Table HRS-2 do not provide evidence that the state-level policies affect participation significantly. The only coefficient that is statistically significant for both samples is the state policy allowing online applications. However, the results are in an unexpected direction where allowing online SNAP application reduces the probability of participation by about 2.5 and 1.8 percentage points for seniors and the full sample, respectively. If states implementing online SNAP applications reduce (but not eliminate) the face-to-face availability of caseworkers, this could reduce senior participation if seniors prefer in-person services (Mishra, et al., 2014). Unsurprisingly, the F statistics for the test of joint significance of the 11 policies are low: 1.9 and for the full and senior samples, respectively.

Given our finding that the individual policies do not generally affect participation, we turn to two ways of aggregating the policy variables. Recall that we create a total SNAP policy index and four thematic policy variables in the areas of eligibility, transaction costs, stigma, and awareness creation (outreach). The first two columns of Table HRS-3 present the results from regression of SNAP participation on the Total SPI for both samples, while the remaining columns report results using the subindices. Again, we standardize all the policy indices for ease of interpretation. Table HRS-3 shows that none of the policy indices are statistically significant predictors of SNAP participation. Only the eligibility index is positively related to the likelihood of participation for both the full and senior samples. The F statistic of the joint test of

significance is less than one in all cases, indicating that the policy indices have little predictive power in the HRS sample.

We now turn to a different approach of measuring how SNAP eligibility rules can affect participation. Table HRS-4 presents the results of SNAP participation models using the simulated eligibility variable defined previously. As described above, we expect the SEV to be more predictive of households' participation decisions because, unlike the policy indices, the SEV relies on plausibly exogenous changes in state SNAP policies since it is based on a constant national sample. Again, we standardize the SEV in the regressions. The estimated coefficients represent the change in the probability of participation resulting from a unit standard deviation change in the SEV. The results show that an increase in the generosity of the state's SNAP eligibility policies positively impacts the probability of participation for seniors. Specifically, a one standard deviation increase in the SEV increases the probability of SNAP participation by 1.4 percentage points for the full sample and 1.2 percentage points for seniors. Although these estimated coefficients are not economically different from those obtained from the larger CPS analysis sample, they are statistically significant, suggesting that the SEV meaningfully predicts household SNAP participation decisions, all else equal. The F statistics of the test of significance are 30.3 and 12.8 for the full and senior samples, respectively, supporting the SEV's predictive strength.

We conduct one additional exercise that leverages the SEV with the other non-eligibility policy indices presented above in the last two columns of Table HRS-3. We ran the same regressions as reported in Table HRS-3 but replacing the eligibility index with the SEV. Table HRS-5 reports the results of this analysis. The results show that the estimated effect of the SEV on the probability of participation is essentially unchanged for both the full and senior samples.

Again, we find no evidence that the other subindices have a significant effect on household participation decisions.

Thus, unlike in the CPS-FSS analysis of senior SNAP participation, here we find that in the HRS analysis the SEV is a strong predictor of participation. While previous studies have utilized one or more state SNAP policies in IV approaches to study the impacts of SNAP, such instruments have frequently been found to be weak. The unique way in which the SEV combines information about different SNAP policies may help to overcome this issue in certain samples. Support for the SEV first stage using the senior sample in the HRS is why we opted to conduct SEV IV analysis only for the HRS sample. Accordingly, we use the SEV to instrument for SNAP participation in estimating SNAP's effects on various HRS senior health outcomes identified in Table HRS-1.

Before discussing the SEV IV results, we first present the naïve OLS results of the effects of SNAP participation on senior health outcomes in the HRS as we did for the CPS-FSS. As expected and due to the adverse selection into the program, the results in Table HRS-6 show that SNAP is associated with worse outcomes across all health and risky health behavior outcomes for both the full and senior samples. Specifically, SNAP reduces the probability of reporting health status as at least “good” by 8.6 percentage points, increases BMI by 0.48 units, and increases the probability of being obese and severely obese by 3.8 and 2.8 percentage points, respectively, for seniors. Also, we find that SNAP increases the likelihood of being a current cigarette smoker by 4 percentage points but has no impact on the number of alcoholic beverages per day.

Panel B of Table HRS-7 continues to present associational results for health care utilization outcomes for seniors. The OLS results show that SNAP increases the probability of

any doctor visits by 2.9 percentage points, the likelihood of inpatient hospitalization by 5.1 percentage points, and the number of inpatient hospital stays by 0.16. However, we find no statistically significant association between SNAP and the probability of any overnight nursing homestays, the number of nursing homestays and the probability of any outpatient surgery. The results are qualitatively similar for the full sample.

We now turn to the IV results of the SNAP's impacts on senior health using the SEV as an instrument for participation. As demonstrated above, the SEV is a strong predictor of senior SNAP participation in the HRS sample. The SEV also likely satisfies the second exclusion restriction required for a valid instrumental variable. The fact that the SEV is computed as the share of a common (random) national sample that would be eligible to receive SNAP benefits in each state in each year suggests that it only likely affects the health outcomes we examine through its effect on program participation.

Tables HRS-8 and HRS-9 present the IV estimates of the impacts of SNAP on senior health outcomes. All the IV estimates are not statistically significant. However, the direction/sign of the estimated coefficients for both panels of Table 8 are in the expected direction, and opposite to the corresponding naïve OLS results in Table 6 except for the probability of being obese. A similar pattern of results holds for most of the IV estimates in Table 9 vis-a-vis the naïve OLS results in Table 7. Put together, HRS analysis results suggest that the simulated eligibility variable may be a promising strategy for estimating the causal impacts of SNAP participation.

National Health Interview Survey

Our analysis of the NHIS differs from that in the CPS and HRS because of the lack of state identifiers in the public-use NHIS data. Thus, we are unable to incorporate our simulated

eligibility variable in the analysis of the SNAP's impact on the health-related outcomes. Instead, we present associational evidence of the effect of living in a household where at least one member of the family receives SNAP benefits on a battery of health-related outcomes. The mechanism may either be direct because the respondent themselves receives SNAP or may be an indirect spillover effect from living with someone who receives benefits.

Results for outcomes related to health care access are in Tables NHIS-2 and NHIS-3. Consistent with recipients being negatively selected into the program, SNAP participation is positively associated with needing but not being able to afford mental health care, dental care, and eyeglasses, and delaying medical care or living with someone that delayed medical care for both non-seniors and seniors. The effect of SNAP participation on seeing or talking to mental health professionals, therapists, seeing a medical specialist, and seeing a general doctor was also positive and statistically significant for both groups, with larger effects among the senior sample, suggesting that SNAP participation may be associated with increased access to health care in both groups. However, this association could also stem from greater health issues in this sample of adults, which our analysis of health status suggests.

Table NHIS-4 presents results for health status. Both senior and non-senior participants were more likely to report being in worse health compared to last year and currently being in bad health. These effects in the senior sample (-0.0668 and -0.132 respectively) were roughly double that of the non-senior sample. There were no significant effects on BMI, needing help with instrumental activities of daily living, and having activity limitations from depression/anxiety/emotional problems in the senior sample. However, SNAP participation was positively and significantly associated with all three of these outcomes in the non-senior sample. One striking difference we notice in these results and the health care access results is the

prevalent mental health issues and interaction with mental health professionals among the non-elderly compared to the elderly, among those living in a household that participates in SNAP.

Finally, Table NHIS-5 presents results for health behaviors, although sample sizes were small in the senior sample that responded to these questions and are generally imprecisely estimated. Non-seniors who received SNAP benefits were associated with positive and statistically significant increases in smoking, but negative and statistically significant decreases in frequency of drinking (though positive increases in the amount of alcohol consumed on occasions they did drink).

Discussion

We examine the impact of a variety of state SNAP policies and policy summary measures on the probability of SNAP participation among households with senior or non-senior respondents over the 2001-2014 period. Overall, our findings suggest that senior and non-senior households responded to some state SNAP policies primarily influencing transaction costs and stigma, though they tended to respond in different ways. Short recertification periods – which increase the time and travel costs to households of staying on SNAP – reduced SNAP participation on average among non-senior households. The same is true of fingerprinting requirements, which may have increased the hassle costs and stigma associated with applying for SNAP. State operation of a CAP increased SNAP participation on average among senior households, which makes sense given that CAPs streamline the SNAP application process for SSI recipients and that members of low-income senior households are more likely to qualify for SSI based on age or disability than non-senior households. Unexpectedly, we find that the operation of SNAP call centers reduced senior household SNAP participation on average. Call centers would be expected to reduce the costs of participating in SNAP by allowing households

to avoid in-person trips otherwise needed to gather information or meet program requirements to participate in SNAP, or at least have no impact given that states must still offer face-to-face services in administering the program. Therefore, the negatively signed estimate is unexpected – especially for senior households for whom travel may be more difficult than non-seniors. It could be the case that states operating call centers reduce their spending on in-person services, which may increase transaction costs for seniors if they prefer face-to-face services to calling (Mishra et al., 2014). We find no evidence in any specification of an impact of outreach efforts involving radio or TV advertising.

Further, we find evidence that eligibility expansions increased SNAP participation – especially for non-senior households. The way in which we incorporate state SNAP eligibility policies in our models matters. When we include binary indicators for BBCE expansions or vehicle exemption rules or an eligibility index measure adding these indicators together, we find no evidence that they increased SNAP participation. However, when we regress household SNAP participation on the SEV, which contains information on the combined extent of state eligibility expansions, we find strong evidence that eligibility expansions increased non-senior SNAP participation. However, senior SNAP participation did not increase to the same extent when states expand eligibility, suggesting that eligibility is a less important factor for senior households. This makes sense given the historically lower take-up rates of eligible seniors compared to eligible non-seniors (Vigil, 2019).

Our findings are of interest to policymakers and researchers interested in the factors explaining low senior SNAP participation and take up rates relative to non-seniors. Seniors appear to respond to different policies than non-seniors and respond less strongly to policies like the expansion of SNAP eligibility that are important to determining non-senior participation. We

do not identify a strong policy lever that seems to consistently increase senior SNAP participation, though we find some evidence suggesting that expanding senior household eligibility and CAPs may do so.

Additionally, our findings may be relevant for researchers interested in using SNAP policy instruments in instrumental variables (IV) frameworks. Several studies have employed state-level policies as instruments for SNAP participation but have frequently had difficulty obtaining precise estimates (e.g., Meyerhoefer and Pylypchuk, 2008; Yen et al., 2008; Ratcliffe et al., 2011; Almada et al., 2016; Denteh, 2017). Tables CPS-2 through CPS-5 include F-statistics for the policy variables in each regression to show those variables' potential as instruments for SNAP participation. Only one specification meets the common rule of thumb that the first stage F-statistic exceed 10: the model using only the SEV, and only for the non-senior household sample. Our findings show that the validity of policy instruments likely depends on the sample used and that simulated eligibility variables can potentially be used in instrumental variable estimation strategies in SNAP program evaluation studies.

Conclusion

Seniors have historically participated in SNAP at relatively low rates. In fiscal year 2018, 82 percent of eligible individuals of all ages participated in SNAP, but only 48 percent of eligible seniors (60 years and older) did so (Cunyngham, 2021). Despite this, senior participation in SNAP and the impact of participation in on the health-related outcomes of seniors are relatively under- studied topics in the literature. This report attempts to fill this void in the literature through the use multiple sources of data (CPS-FSS, HRS, and the NHIS) and new methodological approaches to compare seniors' experience with SNAP to that of non-seniors.

We leverage SNAP policy changes during the 2001-2014 period to construct several

measures of policy generosity, including individual indicators for how long each policy was in place in a given state and year, indices representing how many favorable policies were in place, and measures of simulated eligibility representing the extent of eligibility expansions. We define senior and non-senior household samples and versions of these policy measure relevant to each. While individual policies have been examined in previous studies, we are the first to investigate the role of a various state SNAP policy variables and new aggregations of the same in senior household participation decisions.

We first use data from the CPS-FSS to examine the relationship between SNAP policy changes and SNAP participation as well as the relationship between SNAP participation and household food insecurity and food expenditures. Next, we use restricted use data from the HRS to again consider the relationship between SNAP policy changes and SNAP participation. The HRS also allows us to explore how SNAP influences a wide range of seniors' health-related outcomes, including a global self-assessment of physical health, body mass index, risky behaviors such as smoking and drinking, and health care utilization. Finally, we supplement our HRS health-related analysis by considering similar outcomes from an alternate data source, the National Health Interview Survey (NHIS). While the HRS only allows us to compare seniors to near-seniors due to its focus on older individuals, we can compare seniors to all other adults in the NHIS.

We find that eligibility expansions lead to increases in non-senior participation with some evidence of smaller increases in senior participation in both our CPS-FSS and our HRS samples. Overall, seniors and non-seniors appear to respond differently to various policies, but this difference is not significant enough to explain the large disparity in participation typically observed between the two groups. We also find that SNAP participation is associated with worse

health-related outcomes for all samples in all three datasets, which is likely due to negative selection into program participation. This includes measures of food insecurity from the CPS-FSS, measures of self-assessed health, obesity, drinking and smoking in the HRS and the NHIS, and measures of health care access and utilization in the NHIS and HRS respectively. The signs of these relationships flip when we use our SEVs as instruments for SNAP participation. However, these coefficient estimates are not statistically significant and the strength of the SEV as an instrument for senior SNAP participation depends on the dataset and sample used, as well as on the inclusion or exclusion of sampling weights in our analysis.

These results suggest the need for further qualitative research to better understand this differential policy response of seniors and inquire other possible policies that may have a stronger influence on their participation. In addition, more quantitative research is needed to further explore the promise of our SEV as a potential instrument for senior SNAP participation.

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Figure 1. Total policy index, non-senior version

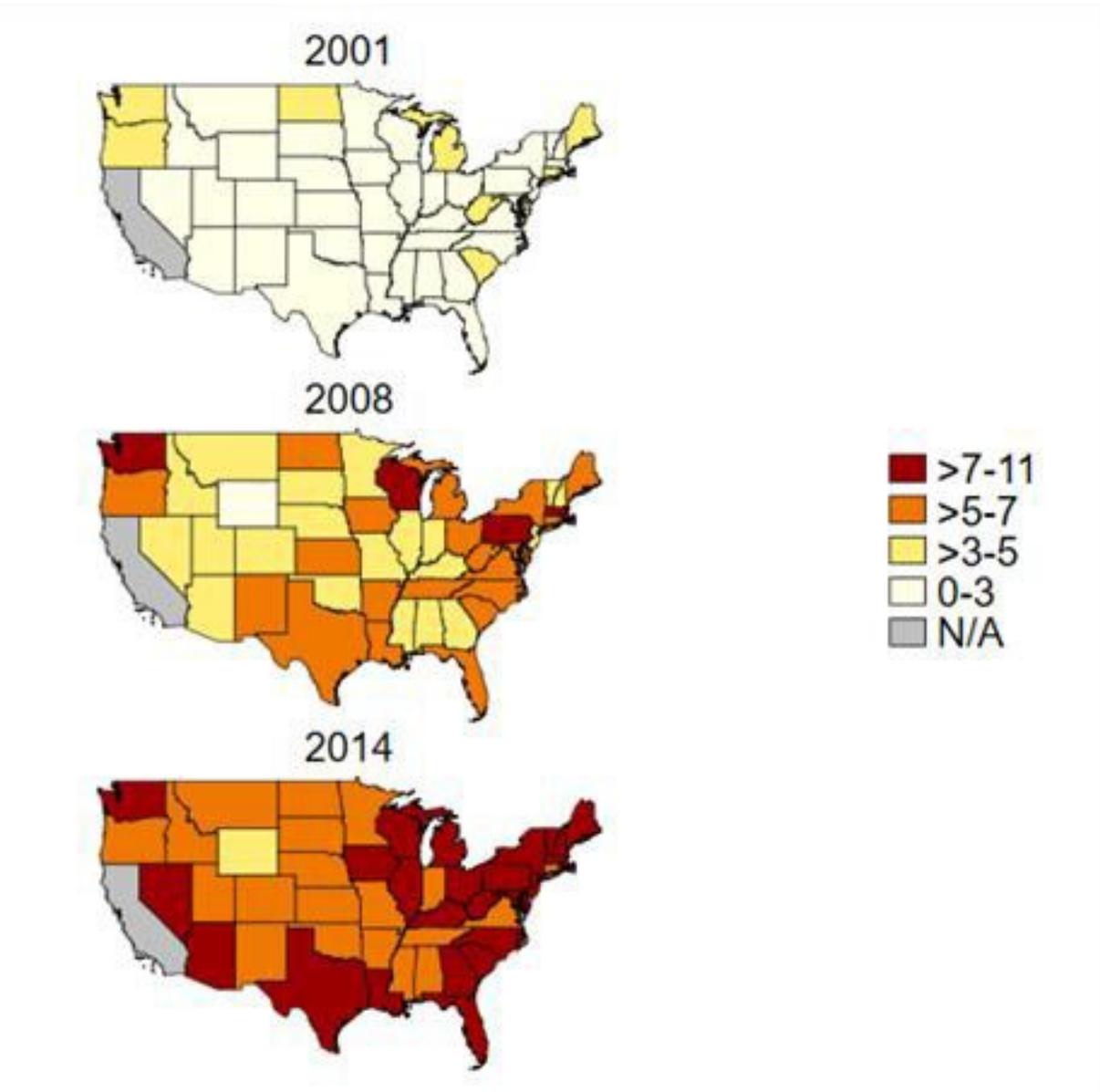


Figure 2. Simulated eligibility variable, full sample version

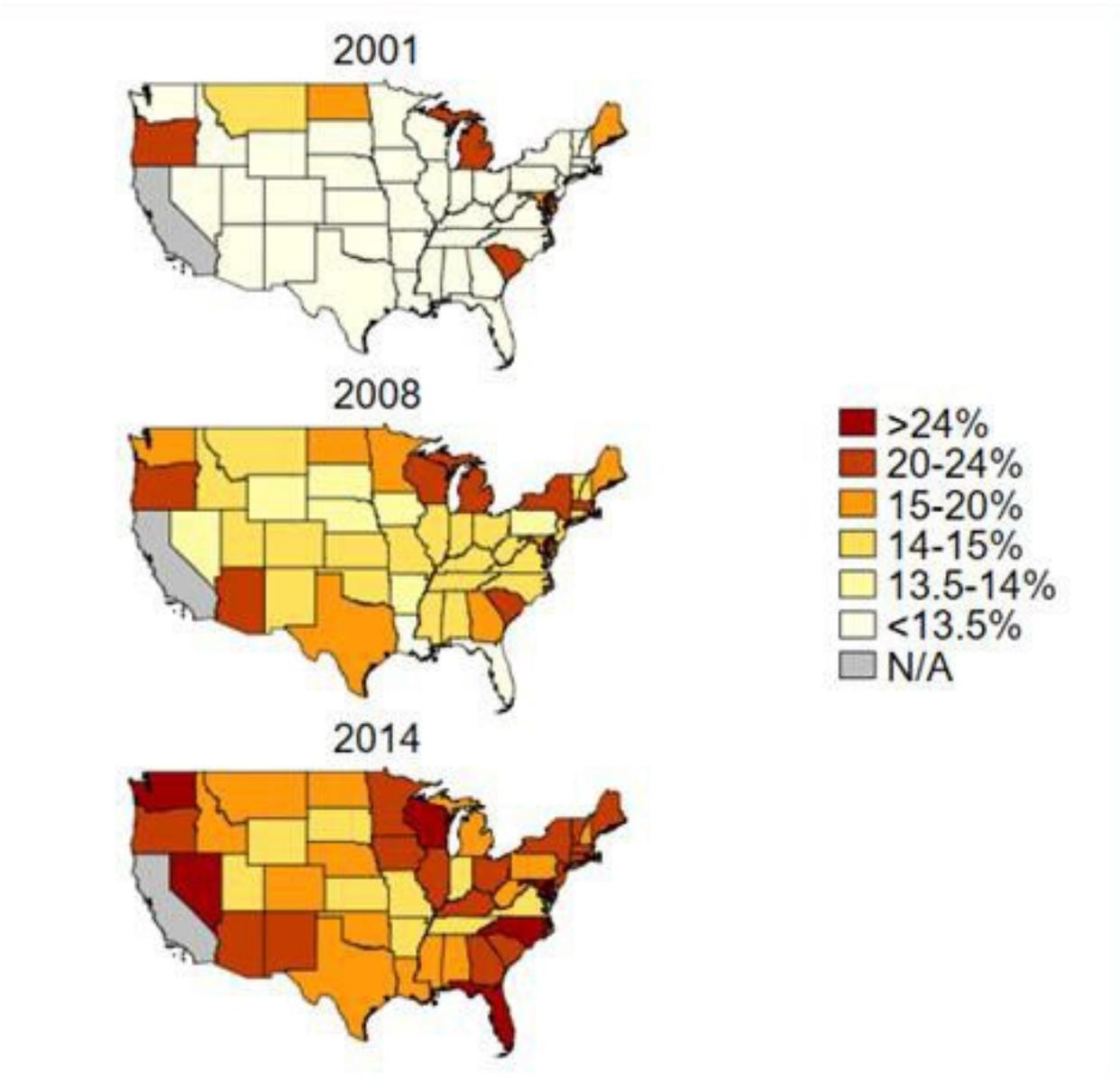


Table CPS-1. Summary statistics by household sample

	Sample		
	Full	Non-senior	Senior
Received SNAP in the past year	0.233	0.282	0.140
	(0.423)	(0.450)	(0.347)
Food security outcomes			
Affirmative responses	1.870	2.327	0.998
	(2.927)	(3.194)	(2.072)
Marginal, low, or very low food security	0.440	0.521	0.287
	(0.496)	(0.500)	(0.452)
Low or very low food security	0.276	0.339	0.157
	(0.447)	(0.473)	(0.363)
Very low food security	0.108	0.133	0.0606
	(0.311)	(0.340)	(0.239)
Food spending per week (inflation-adjusted \$)	99.45	114.3	70.38
	(86.43)	(92.47)	(63.86)
State SNAP policies: Eligibility			
Uses BBCE	0.462	0.463	0.461
	(0.489)	(0.489)	(0.489)
Excludes one or more vehicles from asset test	0.786	0.780	0.795
	(0.396)	(0.400)	(0.388)
All legal noncitizen adults (18-64) SNAP eligible	0.0906	0.0874	0.0966
	(0.284)	(0.279)	(0.292)
All legal noncitizen seniors (65+) SNAP eligible	0.118	0.114	0.125
	(0.320)	(0.315)	(0.328)
State SNAP policies: Transaction Costs			
Simplified reporting for households with earnings	0.811	0.813	0.806
	(0.374)	(0.372)	(0.378)

Allows online statewide SNAP applications	0.377	0.373	0.383
	(0.472)	(0.472)	(0.474)
Operates call centers statewide	0.297	0.297	0.298
	(0.446)	(0.446)	(0.446)
Telephone recertification in at least part of state	0.476	0.478	0.472
	(0.485)	(0.484)	(0.485)
Combined Application Project for SSI recipients	0.288	0.289	0.287
	(0.448)	(0.448)	(0.447)
% with earnings with 1-6 month recertification	0.530	0.537	0.516
	(0.418)	(0.418)	(0.419)
% seniors with 1-6 month recertification	0.0763	0.0773	0.0743
	(0.0861)	(0.0855)	(0.0870)
State SNAP policies: Stigma			
Requires fingerprinting of applicants statewide	0.0828	0.0902	0.0689
	(0.273)	(0.283)	(0.250)
State SNAP policies: Outreach			
Federally funded TV or radio outreach	0.107	0.108	0.105
	(0.152)	(0.152)	(0.152)
SNAP policy indices			
Total, non-senior (0 to 11)	5.082	5.062	5.119
	(2.071)	(2.061)	(2.090)
Total, senior (0 to 11)	6.537	6.524	6.561
	(2.015)	(2.005)	(2.035)
Eligibility, non-senior (0 to 3)	1.339	1.331	1.353
	(0.727)	(0.721)	(0.737)
Eligibility, senior (0 to 3)	1.366	1.357	1.381
	(0.738)	(0.732)	(0.748)
Transaction costs, non-senior (0 to 6)	2.719	2.714	2.730

	(1.611)	(1.600)	(1.631)
Transaction costs, senior (0 to 6)	3.173	3.173	3.172
	(1.550)	(1.542)	(1.565)
Simulated eligibility variables			
All households	0.175	0.175	0.175
	(0.0415)	(0.0413)	(0.0419)
Senior households	0.186	0.185	0.186
	(0.0716)	(0.0712)	(0.0723)
Non-senior households	0.172	0.172	0.172
	(0.0345)	(0.0343)	(0.0347)
Household characteristics			
Respondent: Age (Years)	50.17	38.41	72.63
	(19.23)	(11.44)	(7.606)
Respondent: Female	0.579	0.561	0.612
	(0.494)	(0.496)	(0.487)
Respondent: Black, non-Hispanic	0.150	0.165	0.122
	(0.357)	(0.371)	(0.327)
Respondent: American Indian or Alaska Native, non-Hispanic	0.0152	0.0174	0.0110
	(0.122)	(0.131)	(0.104)
Respondent: Asian or Pacific Islander, non- Hispanic	0.0195	0.0248	0.00955
	(0.138)	(0.155)	(0.0973)
Respondent: Other race, non-Hispanic	0.0129	0.0145	0.00981
	(0.113)	(0.119)	(0.0985)
Respondent: Hispanic	0.129	0.166	0.0605
	(0.336)	(0.372)	(0.239)
Respondent: Foreign-born	0.137	0.165	0.0839
	(0.344)	(0.371)	(0.277)

Respondent: Married	0.364 (0.481)	0.385 (0.487)	0.323 (0.468)
Respondent: Divorced	0.185 (0.389)	0.188 (0.391)	0.180 (0.384)
Respondent: Widowed	0.160 (0.366)	0.0297 (0.170)	0.408 (0.491)
Respondent: Separated	0.0443 (0.206)	0.0562 (0.230)	0.0215 (0.145)
Respondent: High school degree	0.569 (0.495)	0.590 (0.492)	0.527 (0.499)
Respondent: Associate's degree	0.0774 (0.267)	0.0900 (0.286)	0.0533 (0.225)
Respondent: Bachelor's degree	0.0797 (0.271)	0.0921 (0.289)	0.0560 (0.230)
Respondent: Advanced degree	0.0259 (0.159)	0.0259 (0.159)	0.0259 (0.159)
Respondent: Employed	0.455 (0.498)	0.621 (0.485)	0.137 (0.343)
Respondent: Unemployed	0.0627 (0.242)	0.0871 (0.282)	0.0163 (0.127)
Household: Number of people	2.552 (1.650)	3.032 (1.724)	1.636 (0.983)
Household: Single person household	0.341 (0.474)	0.226 (0.418)	0.560 (0.496)
Household: Children in household	0.386 (0.487)	0.558 (0.497)	0.0573 (0.232)
Family income: Under \$5,000	0.0857 (0.280)	0.106 (0.308)	0.0462 (0.210)

Family income: \$5,000-7,499	0.0715 (0.258)	0.0710 (0.257)	0.0724 (0.259)
Family income: \$7,500-9,999	0.0860 (0.280)	0.0728 (0.260)	0.111 (0.314)
Family income: \$10,000-12,499	0.111 (0.315)	0.0905 (0.287)	0.151 (0.358)
Family income: \$12,500-14,999	0.101 (0.302)	0.0801 (0.272)	0.142 (0.349)
Family income: \$15,000-19,999	0.155 (0.362)	0.133 (0.340)	0.196 (0.397)
Family income: \$20,000-24,999	0.153 (0.360)	0.144 (0.351)	0.171 (0.376)
Family income: \$25,000-29,999	0.0942 (0.292)	0.105 (0.306)	0.0743 (0.262)
Family income: \$30,000-34,999	0.0537 (0.225)	0.0717 (0.258)	0.0194 (0.138)
Family income: \$35,000-39,999	0.0323 (0.177)	0.0458 (0.209)	0.00637 (0.0795)
Family income: \$40,000-49,999	0.0383 (0.192)	0.0551 (0.228)	0.00645 (0.0801)
Family income: \$50,000-59,999	0.0132 (0.114)	0.0190 (0.136)	0.00235 (0.0484)
Family income: \$60,000-74,999	0.00383 (0.0618)	0.00543 (0.0735)	0.000783 (0.0280)
Family income: \$75,000-99,999	0.000725 (0.0269)	0.000998 (0.0316)	0.000204 (0.0143)
Number of households	170,929	112,184	58,745

Source: Current Population Survey Food Security Supplement (CPS-FSS) 2001-2014, USDA SNAP Policy Database (2018), USDA SNAP Policy Index (2020), author calculation

Note: Analysis samples include households with income less than 185% of the federal poverty level. Full sample includes all such households, non-senior sample includes households with respondents aged under 60, and senior sample includes households with respondents aged 60 or older. Variables range from 0 to 1 and represent binary indicators, annual averages of binary indicators, or annual averages of proportions unless otherwise specified. Stigma and outreach indices are excluded but range from 0 to 1 as they only summarize one policy each.

Table CPS-2. Regression of SNAP participation on state SNAP policies by household sample

	Sample		
	Full	Non-senior	Senior
Primarily impacting eligibility			
Uses BBCE	0.00881 (0.00653)	0.0105 (0.00730)	0.00411 (0.00771)
Excludes one or more vehicles from asset test	-0.00199 (0.00856)	0.00331 (0.0107)	-0.0124 (0.00986)
All legal noncitizen adults (18-64) SNAP eligible	-0.00295 (0.0191)	0.00390 (0.0248)	
All legal noncitizen seniors (65+) SNAP eligible			-0.0133 (0.0145)
Primarily impacting transaction costs			
Simplified reporting for households with earnings	0.00647 (0.00685)	0.00969 (0.00854)	-0.00388 (0.00879)
Allows online statewide SNAP applications	0.00448 (0.00624)	-0.0000285 (0.00715)	0.0115 (0.00741)
Operates call centers statewide	-0.00473 (0.00613)	-0.00236 (0.00660)	-0.0110 (0.00710)
Telephone recertification in at least part of state	-0.00378 (0.00536)	-0.00316 (0.00694)	-0.00452 (0.00611)
Combined Application Project for SSI recipients	0.0123 (0.00748)	0.0120 (0.00921)	0.0128* (0.00725)
% with earnings with 1-6 month recertification	-0.0210** (0.00789)	-0.0214** (0.00845)	
% seniors with 1-6 month recertification			-0.0406 (0.0373)

Primarily impacting stigma			
Fingerprinting of applicants statewide	-0.0294*	-0.0290**	-0.0291
	(0.0151)	(0.0111)	(0.0300)
Primarily impacting outreach			
Federally funded TV or radio outreach	0.00757	-0.00292	0.0224
	(0.0157)	(0.0176)	(0.0185)
Adjusted R²	0.258	0.267	0.196
N	170,929	112,184	58,745
F-statistic	2.526	3.309	2.231

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: +=p<0.10, ++=p<0.05, and +++=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Policy measures range from 0 to 1 and represent the percentage of the year a policy was in place or the annual average proportion of the SNAP population.

Table CPS-3. Regression of SNAP participation on state SNAP policy indices by household sample

	Total policy index			Policy subindices		
	Sample					
	Full	Non-senior	Senior	Full	Non-senior	Senior
Policy indices						
Total, non-senior	0.0107** (0.00499)	0.0120**+ (0.00522)				
Total, senior			0.00245+ (0.00568)			
Eligibility, non-senior				0.00237 (0.00428)	0.00525 (0.00478)	
Transaction costs, non-senior				0.00730 (0.00464)	0.00706 (0.00520)	
Eligibility, senior						-0.00349 (0.00540)
Transaction costs, senior						0.00271 (0.00469)
Stigma				0.00756 (0.00613)	0.00738 (0.00443)	0.00833 (0.0102)
Outreach				0.000767 (0.00231)	-0.000850 (0.00265)	0.00345 (0.00273)
Adjusted R²	0.257	0.267	0.195	0.257	0.267	0.195
N	170,929	112,184	58,745	170,929	112,184	58,745
F-statistic	4.589	5.306	0.187	1.582	2.103	1.121

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: +=p<0.10, ++=p<0.05, and +++=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and

corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the index.

Table CPS-4. Regression of SNAP participation on simulated eligibility variable by household sample

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.0133*** (0.00368)		
SEV, non-senior		0.0152*** (0.00328)	
SEV, senior			0.0104** (0.00450)
Adjusted R²	0.258	0.267	0.196
N	170,929	112,184	58,745
F-statistic	13.09	21.59	5.314

Note: Asterisks indicate the following: *= $p < 0.10$, **= $p < 0.05$, and ***= $p < 0.01$. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: += $p < 0.10$, ++= $p < 0.05$, and +++= $p < 0.01$. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV.

Table CPS-5. Regression of SNAP participation on simulated eligibility variable and non-eligibility state SNAP policy subindices by household sample

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.0130*** (0.00343)		
SEV, non-senior		0.0153*** (0.00324)	
SEV, senior			0.00994** (0.00423)
Policy indices			
Transaction costs, non-senior	0.00564 (0.00426)	0.00499 (0.00488)	
Transaction costs, senior			0.00228 (0.00457)
Stigma	0.00765 (0.00462)	0.00824** (0.00378)	0.00713 (0.00775)
Outreach	0.000956 (0.00232)	-0.00103+ (0.00256)	0.00399+ (0.00276)
Adjusted R²	0.258	0.267	0.196
N	170,929	112,184	58,745
F-statistic	5.480	7.558	2.873

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: +=p<0.10, ++=p<0.05, and +++=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages,

respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables and policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV or index.

Table CPS-6. Regression of food security outcomes on SNAP participation by household sample

	Affirmative response count	Marginal, low, or very low food security	Low or very low food security	Very low food security	Food spending
Panel A: Full sample					
SNAP participation	1.448*** (0.0328)	0.255*** (0.00478)	0.215*** (0.00443)	0.112*** (0.00328)	7.938*** (0.769)
Panel B: Non-senior sample					
SNAP participation	1.393***+ (0.0396)	0.233***+++ (0.00556)	0.202*** (0.00561)	0.104*** (0.00391)	10.18***+++ (0.903)
Panel C: Senior sample					
SNAP participation	1.271***+ (0.0425)	0.273***+++ (0.00868)	0.205*** (0.00712)	0.101*** (0.00524)	-0.183+++ (0.765)
Dep var mean (full)	1.870	0.440	0.276	0.108	99.45
Dep var mean (non-senior)	2.327	0.521	0.339	0.133	114.3
Dep var mean (senior)	0.998	0.287	0.157	0.0606	70.38
N (full)	167,251	167,251	167,251	167,251	164,051
N (non-senior)	109,729	109,729	109,729	109,729	108,507
N (senior)	57,522	57,522	57,522	57,522	55,544

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: +=p<0.10, ++=p<0.05, and +++=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample, indicated by the panel, and corresponding food security or spending outcome, indicated by the column. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185%

of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older.

Table HRS-1. Summary statistics by household sample

	Full sample	Senior sample
<i>Dependent variables</i>		
Self-reported health at least good	0.57 (0.49)	0.58 (0.49)
Body mass index (BMI)	28.47 (6.63)	27.89 (6.20)
Obese	0.34 (0.47)	0.31 (0.46)
Severely obese	0.14 (0.35)	0.12 (0.32)
Currently smoke	0.19 (0.39)	0.15 (0.35)
Number of drinks per day	0.57 (1.47)	0.45 (1.18)
Any doctor visits (since last interview)	0.90 (0.30)	0.91 (0.28)
Any inpatient hospitalization (since last interview)	0.31 (0.46)	0.32 (0.47)
Number of inpatient hospital stays (since last interview)	0.60 (1.49)	0.61 (1.41)
Any nursing home stay (since last interview)	0.03 (0.18)	0.04 (0.20)
Number of nursing home stays (since last interview)	0.05 (0.56)	0.05 (0.30)
Any outpatient surgery (since last interview)	0.18 (0.38)	0.19 (0.39)
Received SNAP (since last interview)	0.19	0.15

	(0.39)	(0.36)
<i>Household Characteristics</i>		
Age (years)	69.57	73.69
	(11.11)	(8.84)
Female	0.67	0.68
	(0.47)	(0.47)
Black	0.26	0.23
	(0.44)	(0.42)
White	0.66	0.71
	(0.47)	(0.45)
Other race	0.08	0.06
	(0.27)	(0.23)
Married	0.32	0.30
	(0.47)	(0.46)
Formerly married	0.60	0.65
	(0.49)	(0.48)
Household size	2.02	1.86
	(1.40)	(1.24)
Less than high school	0.35	0.36
	(0.48)	(0.48)
High school degree	0.38	0.38
	(0.48)	(0.49)
Some college	0.19	0.17
	(0.39)	(0.38)
College degree	0.06	0.05
	(0.23)	(0.22)
Graduate degree or more	0.03	0.03
	(0.16)	(0.16)

Not in the labor force	0.82	0.91
	(0.38)	(0.28)
Employed	0.15	0.07
	(0.36)	(0.26)
Unemployed	0.03	0.01
	(0.17)	(0.12)
Household income (\$)	16,086.80	15,888.27
	(9,223.71)	(8,020.12)
Net value of housing (primary residence, \$)	66,425.99	74,335.71
	(128,722.03)	(134,441.00)
Net value of non-housing financial wealth (\$)	28,259.48	34,263.79
	(161,929.69)	(175,109.41)

Number of Activities of Daily Living (ADLs) where respondent reports some difficulty (percent)

Zero ADLs	75.72	75.78
One ADL	11.57	11.84
Two ADLs	5.79	5.71
Three ADLs	3.55	3.42
Four ADLs	2.34	2.24
Five ADLs	1.04	1.01

Number of Instrumental Activities of Daily Living (IADLs) where respondent reports some difficulty (percent)

Zero IADLs	78.64	79.10
One IADL	11.56	11.22
Two IADLs	5.48	5.36
Three IADLs	2.41	2.33
Four IADLs	1.27	1.30
Five IADLs	0.63	0.68
Number of words correctly recalled immediately or delayed	8.61	8.34

(0-20)

(3.46) (3.47)

Simulated Eligibility Variables (SEV)

Full sample SEV 19.77 19.42
(7.47) (7.42)

Senior sample SEV 18.12 17.91
(4.24) (4.24)

State SNAP policies: Eligibility

State uses BBCE for all SNAP applicants 0.53 0.51
(0.49) (0.49)

State excludes one or more vehicles from asset test 0.80 0.79
(0.40) (0.40)

All legal noncitizen adults (18-64) are eligible for SNAP or state food assistance 0.13 0.13
(0.34) (0.33)

All legal noncitizen seniors (65+) are eligible for SNAP or state food assistance 0.15 0.15
(0.36) (0.35)

State SNAP policies: Transaction Costs

State uses simplified reporting options for households with earnings 0.83 0.82
(0.37) (0.37)

State allows online SNAP application 0.48 0.46
(0.49) (0.49)

State operates call centers 0.32 0.32
(0.45) (0.45)

State granted a waiver to use telephone interview at recertification in at least part of state 0.58 0.55
(0.48) (0.49)

State uses a Combined Application Program for SSI applicants	0.40	0.39
	(0.49)	(0.48)
Proportion of SNAP units with earnings with 1–6-month recertification period	0.53	0.54
	(0.43)	(0.43)
Proportion of elderly SNAP units with 1–6-month recertification period	0.08	0.08
	(0.08)	(0.08)
<i>State SNAP policies: Stigma</i>		
Requires fingerprinting of applicants statewide	0.17	0.17
	(0.38)	(0.37)
<i>State SNAP policies: Outreach</i>		
State has federally funded TV or radio ad outreach campaign	0.14	0.14
	(0.17)	(0.17)
<i>State SNAP policy indices</i>		
Total index, non-senior (0 to 11)	5.52	5.40
	(2.04)	(2.06)
Total index, senior (0 to 11)	6.98	6.86
	(2.00)	(2.03)
Eligibility index, non-senior (0 to 3)	1.46	1.42
	(0.75)	(0.75)
Eligibility index, senior (0 to 3)	1.48	1.44
	(0.75)	(0.75)
Transaction costs index, non-senior (0 to 6)	3.09	3.00
	(1.59)	(1.61)
Transaction costs index, senior (0 to 6)	3.54	3.46
	(1.58)	(1.60)

Number of households	34,030	26,515
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Source: Health and Retirement Survey 2002-2014, USDA SNAP Policy Database (2018), USDA SNAP Policy Index (2020), author calculation.

Notes: The unit of analysis is the household. Analysis samples include households with income up to 250% of the federal poverty level. The full sample includes all such households while the senior sample includes households with respondents aged 60 or older. The stigma and outreach indices (not shown under the *State SNAP Policy Indices* panel) summarize the single stigma and outreach SNAP policy variables, respectively. Descriptive statistics are weighted.

Table HRS-2. Regression of SNAP participation on state SNAP policies by household sample

	Full sample	Senior sample
<i>Primarily impacting eligibility</i>		
State uses BBCE for all SNAP applicants	0.0114 (0.0123)	0.0181 (0.0111)
State excludes one or more vehicles from asset test	0.00168 (0.0108)	0.000560 (0.0115)
All legal noncitizen adults (18-64) are eligible for SNAP or state food assistance	-0.0306 (0.0247)	
All legal noncitizen seniors (65+) are eligible for SNAP or state food assistance		-0.00973 (0.0236)
<i>Primarily impacting transaction costs</i>		
State uses simplified reporting options for households with earnings	0.00545 (0.0107)	0.000203 (0.0101)
State allows online SNAP application	-0.0178* (0.00950)	-0.0247** (0.0107)
State operates call centers	0.00115 (0.0104)	0.00390 (0.00923)
State granted a waiver to use telephone interview at recertification in at least part of state	-0.00326 (0.00695)	0.000266 (0.00654)
State uses a Combined Application Program for SSI applicants	0.0175 (0.0108)	0.0165* (0.00970)
Proportion of SNAP units with earnings with 1-6 recertification period	0.00485	

	(0.00878)	
Proportion of elderly SNAP units with 1–6-month recertification period		-0.0363
		(0.0535)
<i>Primarily impacting stigma</i>		
State requires fingerprinting of SNAP applicants	0.00411	0.00731
	(0.00891)	(0.00899)
<i>Primarily impacting outreach</i>		
State has federally funded TV or radio ad outreach campaign	-0.00571	-0.00420
	(0.0267)	(0.0204)
<hr/>		
Adjusted R ²	0.171	0.137
Number of households	34,030	26,515
F-statistic for test of joint significance of SNAP policy variables	1.998	1.407

Notes: Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Policy measures range from 0 to 1 and represent the percentage of the year a policy was in place or the annual average proportion of the SNAP population.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-3. Regression of SNAP participation on state SNAP policy indices by household

	Total Policy Index		Policy subindices	
	Full sample	Senior sample	Full sample	Senior sample
Total index, full	-0.000594 (0.00580)			
Total index, senior		-0.000462 (0.00512)		
Eligibility, full			0.00407 (0.00698)	
Transactions cost index, full			-0.00108 (0.00529)	
Stigma index, full			-0.00281 (0.00398)	
Outreach index, full			-0.00193 (0.00437)	
Eligibility, senior				0.00695 (0.00619)
Transactions cost index, senior				-0.000878 (0.00395)
Stigma index, senior				-0.00361 (0.00484)
Outreach index, senior				-0.00146 (0.00328)
Adjusted R ²	0.171	0.137	0.171	0.137
Number of households	34,030	26,515	34,030	26,515
F-statistic	0.0105	0.00815	0.430	0.719

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a set of coefficients from a separate regression model using a different analysis sample (full or

senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the index on the probability of SNAP participation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-4. Regression of SNAP participation on simulated eligibility variable by household sample

	Full sample	Senior sample
<i>Simulated eligibility variables</i>		
SEV, full sample	0.0149*** (0.00271)	
SEV, senior		0.0119*** (0.00334)
Adjusted R ²	0.171	0.137
Number of households	34,030	26,515
F-statistic	30.30	12.76

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a set of coefficients from a separate regression model using a different analysis sample (full or senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Simulated eligibility variables are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV on the probability of SNAP participation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-5. Regression of SNAP participation on simulated eligibility variable and non-eligibility state SNAP policy subindices by household sample

	Full sample	Senior sample
<i>Simulated eligibility variables</i>		
SEV, full sample	0.0153*** (0.00307)	
SEV, senior		0.0125*** (0.00358)
<i>Policy indices</i>		
Transactions cost index, full	-0.00243 (0.00453)	
Transactions cost index, senior		-0.00243 (0.00453)
Stigma index, full	-0.00395 (0.00469)	-0.00528 (0.00461)
Outreach index, full	-0.000234 (0.00335)	-0.000187 (0.00278)
Adjusted R ²	0.171	0.140
Number of households	34,030	26,515
F-statistic	6.497	3.408

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a set of coefficients from a separate regression model using a different analysis sample (full or senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Simulated eligibility variables and policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV or index on the probability of SNAP participation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-6. OLS regression results of the impacts of SNAP participation on health outcomes

	Self-reported health at least good	Body mass index	Obese	Severely obese	Currently smoke	Number of drinks per day
Panel A: Full sample (N=34,030)						
SNAP participation	-0.0760***	0.367*	0.0219	0.0215**	0.0608***	0.0249
	(0.0105)	(0.194)	(0.0132)	(0.0103)	(0.00676)	(0.0379)
Panel B: Senior sample (N=26,515)						
SNAP participation	-0.0864***	0.478***	0.0383***	0.0282***	0.0397***	-0.0323
	(0.0122)	(0.186)	(0.0132)	(0.00992)	(0.00792)	(0.0364)
Dep var mean (full)	0.572	28.47	0.342	0.142	0.188	0.570
Dep var mean (senior)	0.583	27.89	0.309	0.116	0.146	0.448

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-7. OLS regression results of the impacts of SNAP participation on health care utilization

	Any doctor visits	Any inpatient hospitalization	Number of inpatient hospital stays	Any nursing home stay	Number of nursing home stays	Any outpatient surgery
Panel A: Full sample (N=34,030)						
SNAP participation	0.0293*** (0.00472)	0.0512*** (0.00972)	0.165*** (0.0370)	0.00339 (0.00285)	0.0167 (0.0149)	0.00727 (0.00490)
Panel B: Senior sample (N=26,515)						
SNAP participation	0.0291*** (0.00512)	0.0555*** (0.0129)	0.184*** (0.0474)	0.00427 (0.00423)	0.00455 (0.00590)	0.0117 (0.00824)
Dep var mean (full)	0.897	0.307	0.596	0.0342	0.0459	0.180
Dep var mean (senior)	0.913	0.323	0.606	0.0403	0.0511	0.187

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-8. Instrumental Variable (IV) estimation results of the impacts of SNAP participation on health outcomes

	Self-reported health at least good	Body mass index	Obese	Severely obese	Currently smoke	Number of drinks per day
Panel A: Full sample (N=34,030)						
SNAP participation	0.0155	-2.155	0.0938	-0.289	-0.251	-0.664
	(0.352)	(3.881)	(0.285)	(0.226)	(0.315)	(0.751)
Panel B: Senior sample (N=26,515)						
SNAP participation	0.0500	-1.340	0.299	-0.186	-0.189	0.154
	(0.426)	(5.345)	(0.373)	(0.233)	(0.244)	(0.942)
Dep var mean (full)	0.572	28.47	0.342	0.142	0.188	0.570
Dep var mean (senior)	0.583	27.89	0.309	0.116	0.146	0.448

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample). The instrumental variable is the sample-specific simulated eligibility variable (SEV), with corresponding first stage results reported in Table 4.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table HRS-9. Instrumental Variable (IV) estimation results of the impacts of SNAP participation on health care utilization

	Any doctor visits	Any inpatient hospitalization	Number of inpatient hospital stays	Any nursing home stay	Number of nursing home stays	Any outpatient surgery
Panel A: Full sample (N=34,030)						
SNAP participation	0.261 (0.388)	-0.00949 (0.349)	-1.129 (1.291)	0.0265 (0.117)	-0.129 (0.219)	0.234 (0.178)
Panel B: Senior sample (N=26,515)						
SNAP participation	0.373 (0.486)	0.348 (0.418)	-0.414 (1.375)	0.116 (0.153)	0.102 (0.243)	-0.0397 (0.257)
Dep var mean (full)	0.897	0.307	0.596	0.0342	0.0459	0.180
Dep var mean (senior)	0.913	0.323	0.606	0.0403	0.0511	0.187

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample). The instrumental variable is the sample-specific simulated eligibility variable (SEV), with corresponding first stage results reported in Table 4.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table NHIS-1. Summary statistics by respondent

	Full sample	Non-senior sample	Senior sample
<i>Dependent variables</i>			
Health Status			
Health status compared to 1 year ago	0.870 (0.336)	0.887 (0.317)	0.824 (0.381)
Current Health Status,	0.778 (0.416)	0.826 (0.379)	0.601 (0.490)
Body mass index	27.89 (6.691)	27.94 (6.865)	27.76 (6.186)
Needs help with instrumental activities of daily living (IADL)	0.0673 (0.251)	0.0387 (0.193)	0.173 (0.378)
Activity limitation from: Depression/anxiety/emotional problem	0.169 (0.375)	0.242 (0.428)	0.0779 (0.268)
Limitation of activity by chronic condition	0.223 (0.416)	0.157 (0.364)	0.466 (0.499)
Health Behaviors			
Currently Smokes	0.260 (0.439)	0.296 (0.456)	0.160 (0.366)
Number cigarettes per day (daily smokers)	15.06 (9.616)	14.88 (9.472)	15.93 (10.26)
Number cigarettes per day (current smokers)	12.93 (9.886)	12.70 (9.758)	14.15 (10.44)
Frequency drank alcohol in past year: Days per week	0.822 (1.655)	0.832 (1.578)	0.791 (1.880)

Frequency drank alcohol in past year: Days in past year	46.12 (84.46)	47.10 (80.08)	43.00 (96.96)
Average number of drinks on days drank	2.961 (3.346)	3.149 (3.376)	2.015 (3.017)

Health Care Access

Needed but couldn't afford mental health care, past 12 months	0.0464 (0.210)	0.0568 (0.231)	0.0175 (0.131)
Needed but couldn't afford dental care, past 12 months	0.225 (0.418)	0.256 (0.437)	0.139 (0.346)
Needed but couldn't afford eyeglasses, past 12 months	0.138 (0.345)	0.150 (0.357)	0.106 (0.308)
Saw/talked to mental health professional, past 12 months	0.0956 (0.294)	0.109 (0.311)	0.0594 (0.236)
Saw/talked to eye doctor, past 12 months	0.296 (0.457)	0.231 (0.422)	0.477 (0.499)
Saw/talked to therapist (PT/OT), past 12 months	0.0817 (0.274)	0.0660 (0.248)	0.125 (0.331)
Saw/talked to OB/GYN, past 12 months	0.334 (0.472)	0.403 (0.490)	0.160 (0.366)
Saw/talked to medical specialist, past 12 months	0.229 (0.420)	0.176 (0.381)	0.374 (0.484)
Saw/talked to general doctor, past 12 months	0.625 (0.484)	0.555 (0.497)	0.817 (0.386)

Was in a hospital overnight in past 12 months	0.112 (0.316)	0.0925 (0.290)	0.185 (0.389)
Medical care delayed due to cost, past 12 months	0.162 (0.368)	0.176 (0.381)	0.109 (0.311)
Any family member need and not get medical care (due to cost), past 12 months	0.219 (0.413)	0.241 (0.428)	0.136 (0.343)
Household Respondent Characteristics			
Received SNAP	0.292 (0.455)	0.315 (0.465)	0.209 (0.407)
Age	43.203 (18.546)	35.447 (11.787)	71.725 (7.955)
Female	0.566 (0.496)	0.553 (0.497)	0.613 (0.487)
Asian or Pacific Islander	0.049 (0.216)	0.049 (0.215)	0.050 (0.218)
Black/African American	0.189 (0.392)	0.190 (0.392)	0.187 (0.390)
Hispanic	0.337 (0.473)	0.375 (0.484)	0.195 (0.396)
Native American/Alaskan Native	0.009 (0.097)	0.010 (0.100)	0.008 (0.087)
Other or Multiple Race	0.004 (0.063)	0.004 (0.067)	0.002 (0.049)
Divorced	0.124 (0.330)	0.114 (0.318)	0.163 (0.369)
Married	0.416 (0.493)	0.416 (0.493)	0.413 (0.492)

Separated	0.046	0.050	0.034
	(0.210)	(0.218)	(0.180)
Widowed	0.082	0.018	0.318
	(0.274)	(0.131)	(0.466)
Family Size	3.244	3.570	2.045
	(1.965)	(1.964)	(1.433)
Single Household	0.224	0.169	0.428
	(0.417)	(0.374)	(0.495)
Children in Household	0.485	0.563	0.200
	(0.500)	(0.496)	(0.400)
Advanced Degree	0.020	0.019	0.023
	(0.140)	(0.137)	(0.149)
Bachelor's Degree	0.064	0.067	0.052
	(0.245)	(0.250)	(0.222)
High School or Equivalent	0.316	0.317	0.313
	(0.465)	(0.465)	(0.464)
Some College	0.250	0.272	0.167
	(0.433)	(0.445)	(0.373)
Employed	0.480	0.576	0.126
	(0.500)	(0.494)	(0.332)
Unemployed	0.081	0.099	0.016
	(0.273)	(0.299)	(0.126)
\$5000 to \$9999	0.171	0.168	0.224
	(0.377)	(0.374)	(0.417)
\$10000 to \$14999	0.212	0.211	0.228
	(0.409)	(0.408)	(0.420)
\$15000 to \$19999	0.169	0.171	0.142
	(0.375)	(0.376)	(0.349)

\$20000 to \$24999	0.126 (0.332)	0.128 (0.334)	0.094 (0.291)
\$25000 to \$34999	0.105 (0.307)	0.109 (0.311)	0.047 (0.212)
\$35000 to \$44999	0.033 (0.180)	0.035 (0.183)	0.013 (0.113)
\$45000 to \$54999	0.009 (0.096)	0.010 (0.097)	0.004 (0.066)
\$55000 to \$64999	0.002 (0.048)	0.002 (0.048)	0.002 (0.049)
\$65000 to \$74999	0.001 (0.030)	0.001 (0.030)	0.000 (0.012)
\$75000 and over	0.002 (0.046)	0.002 (0.045)	0.003 (0.050)

Number of households	252,563	198,568	53,995
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Source: National Health Interview Survey (2001-2014)

Notes: The unit of analysis is the respondent. Analysis samples include households with income up to 200% of the federal poverty level. The full sample includes all respondents 18 and older, the non-senior sample includes respondents aged 18-59, while the senior sample includes

respondents with respondents aged 60 or older.

Table NHIS-2. OLS regression results of health care access in past 12 months on SNAP participation for full sample

	Needed but couldn't afford mental health care	Needed but couldn't afford dental care	Needed but couldn't afford eyeglasses	Saw/talked to mental health professional	Saw/talked to eye doctor	Saw/talked to therapist (PT/OT)
Panel A: Full sample						
SNAP participation	0.0264*** (0.00264)	0.0873*** (0.00492)	0.0606*** (0.00407)	0.0380*** (0.00296)	0.00194 (0.00441)	0.0154*** (0.00256)
N	59384	59387	59368	59324	59320	59318
Panel B: Non-senior sample						
SNAP participation	0.0258*** (0.00271)	0.0854*** (0.00504)	0.0573*** (0.00413)	0.0370*** (0.00304)	0.00358 (0.00448)	0.0144*** (0.00256)
N	55215	55220	55201	55155	55153	55149
Panel C: Senior sample						
SNAP participation	0.0228** (0.0113)	0.0541** (0.0215)	0.0673*** (0.0205)	0.0404*** (0.0132)	0.0370 (0.0242)	0.0380** (0.0162)
N	4169	4167	4167	4169	4167	4169
Dep var mean (full)	0.0464	0.225	0.138	0.0956	0.296	0.0817
Dep var mean (non-senior)	0.0568	0.256	0.15	0.109	0.231	0.066
Dep var mean (senior)	0.0175	0.139	0.106	0.0594	0.477	0.125

Notes: Standard errors appear in parentheses and are heteroscedasticity robust. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table X, and year fixed effects.

Analysis samples include only households with an annual income less than 200% of the federal poverty level for respondents of all ages 18 and above (Panel A: full sample), respondents ages 18-59 (Panel B: non-senior sample) and respondents aged 60 or older (Panel C: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table NHIS-3. OLS regression results of health care access in past 12 months on SNAP participation for full sample

	Saw/talked to OB/GYN	Saw/talked to medical specialist	Saw/talked to general doctor	Was in a hospital overnight	Medical care delayed due to cost	Any family member need and not get medical care (due to cost)
Panel A: Full sample						
SNAP participation	0.0271*** (0.00655)	0.0279*** (0.00381)	0.0409*** (0.00521)	0.0203*** (0.00212)	0.0388*** (0.00299)	0.0695*** (0.00339)
N	33413	59295	59287	111378	111373	111378
Panel B: Non-senior sample						
SNAP participation	0.0275*** (0.00675)	0.0283*** (0.00384)	0.0403*** (0.00538)	0.0198*** (0.00215)	0.0382*** (0.00305)	0.0683*** (0.00345)
N	30931	55128	55118	104706	104700	104705
Panel C: Senior sample						
SNAP participation	0.0204 (0.0260)	0.0397* (0.0226)	0.0982*** (0.0209)	0.0373*** (0.0124)	0.0284* (0.0152)	0.0856*** (0.0169)
N	2482	4167	4169	6672	6673	6673
Dep var mean (full)	0.334	0.229	0.625	0.112	0.162	0.219
Dep var mean (non-senior)	0.403	0.176	0.555	0.0925	0.176	0.241
Dep var mean (senior)	0.16	0.374	0.817	0.185	0.109	0.136

Notes: Standard errors appear in parentheses and are heteroscedasticity robust. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table X, and year fixed effects.

Analysis samples include only households with an annual income less than 200% of the federal poverty level for respondents of all ages 18 and above (Panel A: full sample), respondents ages 18-59 (Panel B: non-senior sample) and respondents aged 60 or older (Panel C: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table NHIS-4. OLS regression results of health status on SNAP participation for full sample

	Health status compared to 1 year ago	Health status (Good or Bad)	Body mass index	Needs help with instrumental activities of daily living (IADL)	Activity limitation from: Depression/anxiety/emotional problem	Limitation of activity by chronic condition
Panel A: Full sample						
SNAP participation	- 0.0376*** (0.00324)	-0.0512*** (0.00258)	1.134*** (0.0722)	0.00866*** (0.000910)	0.0631*** (0.00962)	0.0463*** (0.00212)
N	59711	111379	58236	111400	9362	111295
Panel B: Non-senior sample						
SNAP participation	- 0.0361*** (0.00328)	-0.0487*** (0.00258)	1.148*** (0.0742)	0.00850*** (0.000896)	0.0598*** (0.0106)	0.0439*** (0.00210)
N	55515	104706	54128	104726	7905	104625
Panel C: Senior sample						
SNAP participation	- 0.0459*** (0.0176)	-0.105*** (0.0171)	0.0534 (0.307)	0.0124* (0.00736)	0.0475** (0.0222)	0.105*** (0.0160)
N	4196	6673	4108	6674	1457	6670
Dep var mean (full)	0.87	0.778	27.89	0.0673	0.169	0.223
Dep var mean (non-senior)	0.887	0.826	27.94	0.0387	0.242	0.157
Dep var mean (senior)	0.824	0.601	27.76	0.173	0.0779	0.466

Notes: Standard errors appear in parentheses and are heteroscedasticity robust. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table X, and year fixed effects.

Analysis samples include only households with an annual income less than 200% of the federal poverty level for respondents of all ages 18 and above (Panel A: full sample), respondents ages 18-59 (Panel B: non-senior sample) and respondents aged 60 or older (Panel C: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table NHIS-5. OLS regression results of health care behaviors on SNAP participation for full sample

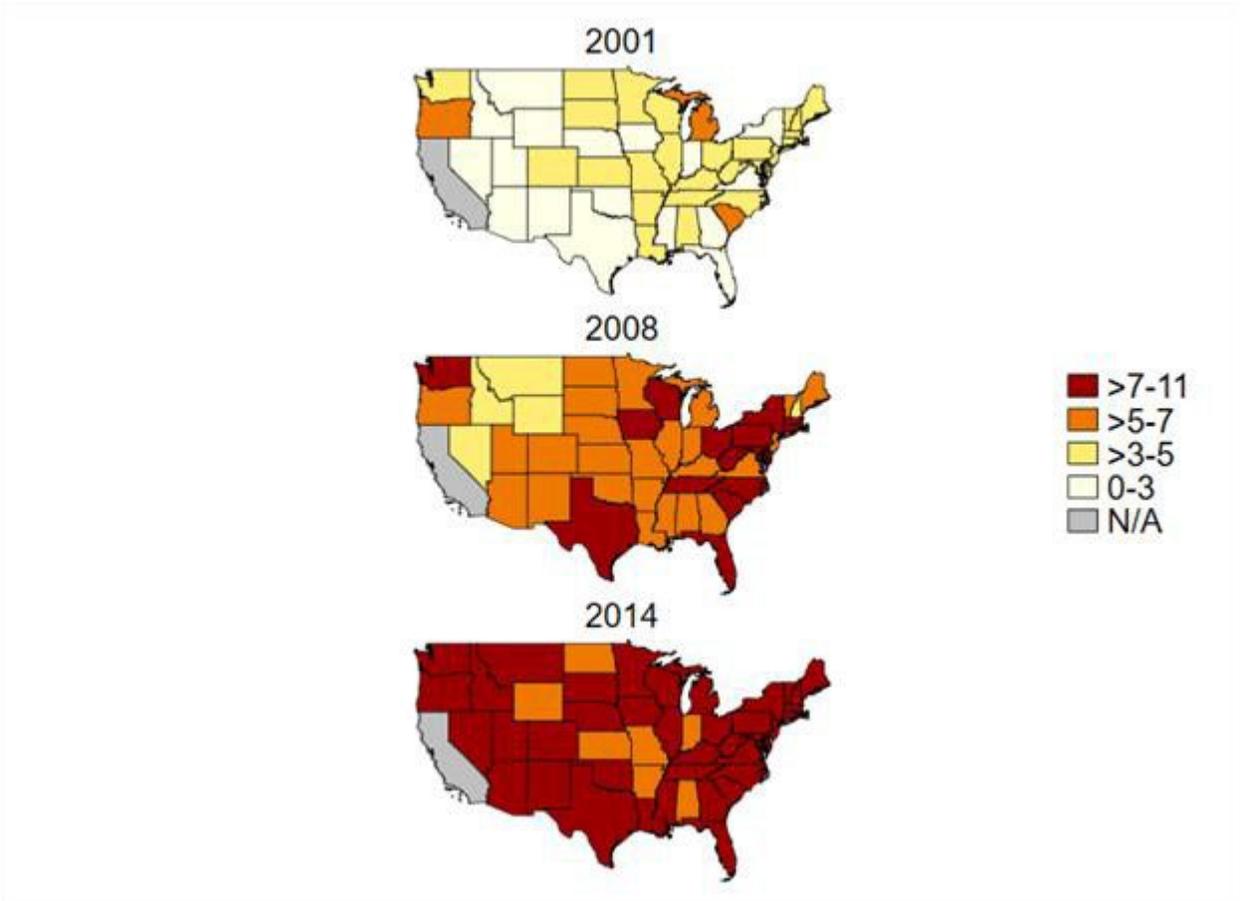
	Currently Smokes	Number cigarettes per day (daily smokers)	Number cigarettes per day (current smokers)	Frequency drank alcohol in past year: Days per week	Frequency drank alcohol in past year: Days in past year	Average number of drinks on days drank
Panel A: Full sample						
SNAP participation	0.119*** (0.00476)	0.634*** (0.174)	0.832*** (0.161)	-0.0381** (0.0185)	-2.227** (0.937)	0.215*** (0.0450)
N	59558	12963	16575	45149	45149	37408
Panel B: Non-senior sample						
SNAP participation	0.118*** (0.00489)	0.618*** (0.175)	0.805*** (0.162)	-0.0504*** (0.0187)	-2.839*** (0.946)	0.215*** (0.0453)
N	55381	12308	15770	42114	42114	35527
Panel C: Senior sample						
SNAP participation	0.0795*** (0.0207)	0.767 (1.220)	0.467 (1.090)	0.117 (0.110)	5.255 (5.654)	0.359* (0.207)
N	4177	655	805	3035	3035	1881
Dep var mean (full)	0.26	15.06	12.93	0.822	46.12	2.961
Dep var mean (non-senior)	0.296	14.88	12.7	0.832	47.1	3.149
Dep var mean (senior)	0.16	15.93	14.15	0.791	43	2.015

Notes: Standard errors appear in parentheses and are heteroscedasticity robust. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table X, and year fixed effects. Analysis samples include only households with an annual income less than 200% of the federal

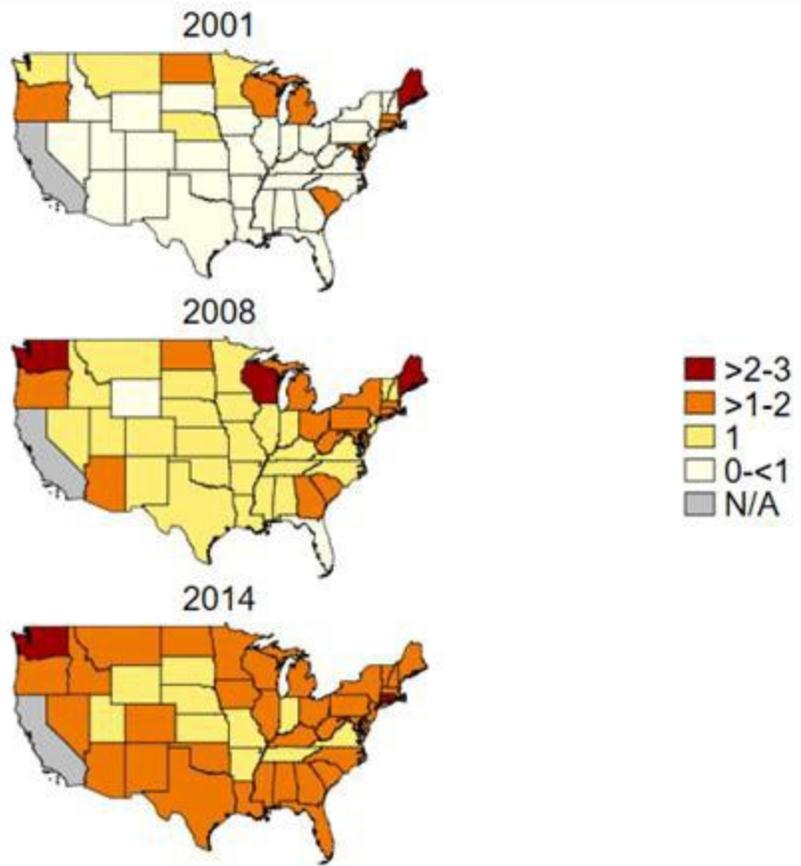
poverty level for respondents of all ages 18 and above (Panel A: full sample), respondents ages 18-59 (Panel B: non-senior sample) and respondents aged 60 or older (Panel C: senior sample). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Figure 1. Additional policy indices by category and age group

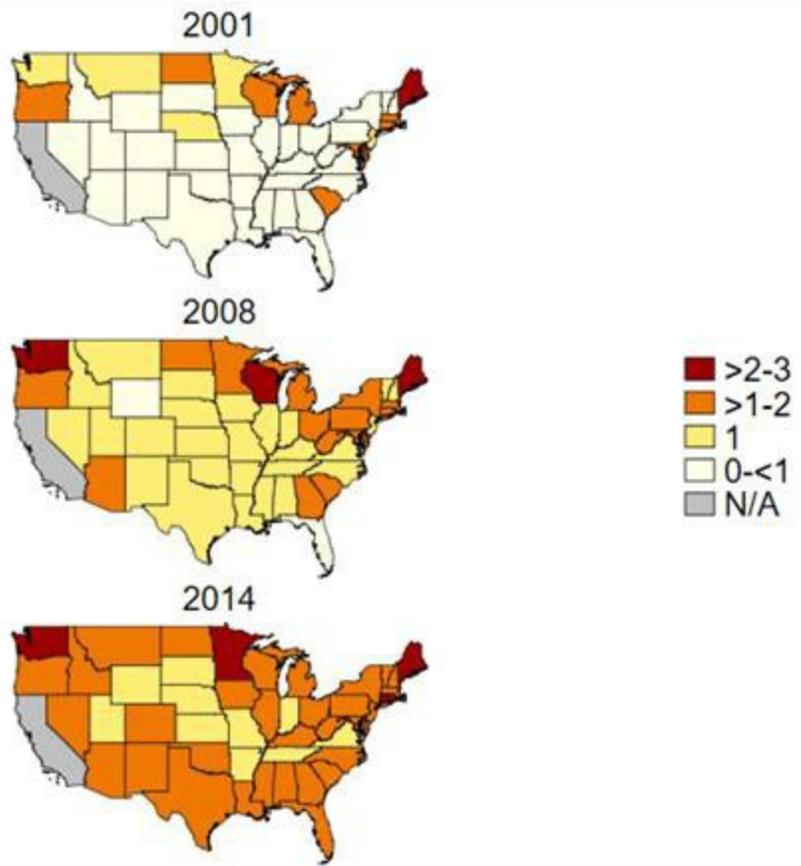
Total index, senior version



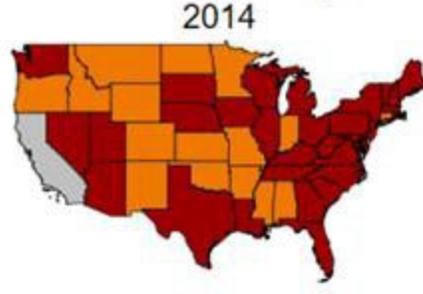
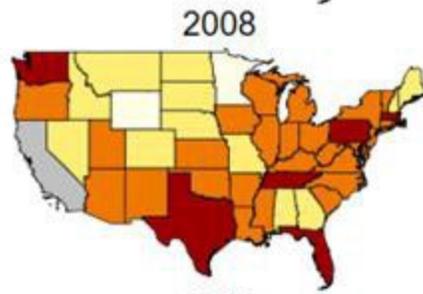
Eligibility index, non-senior version



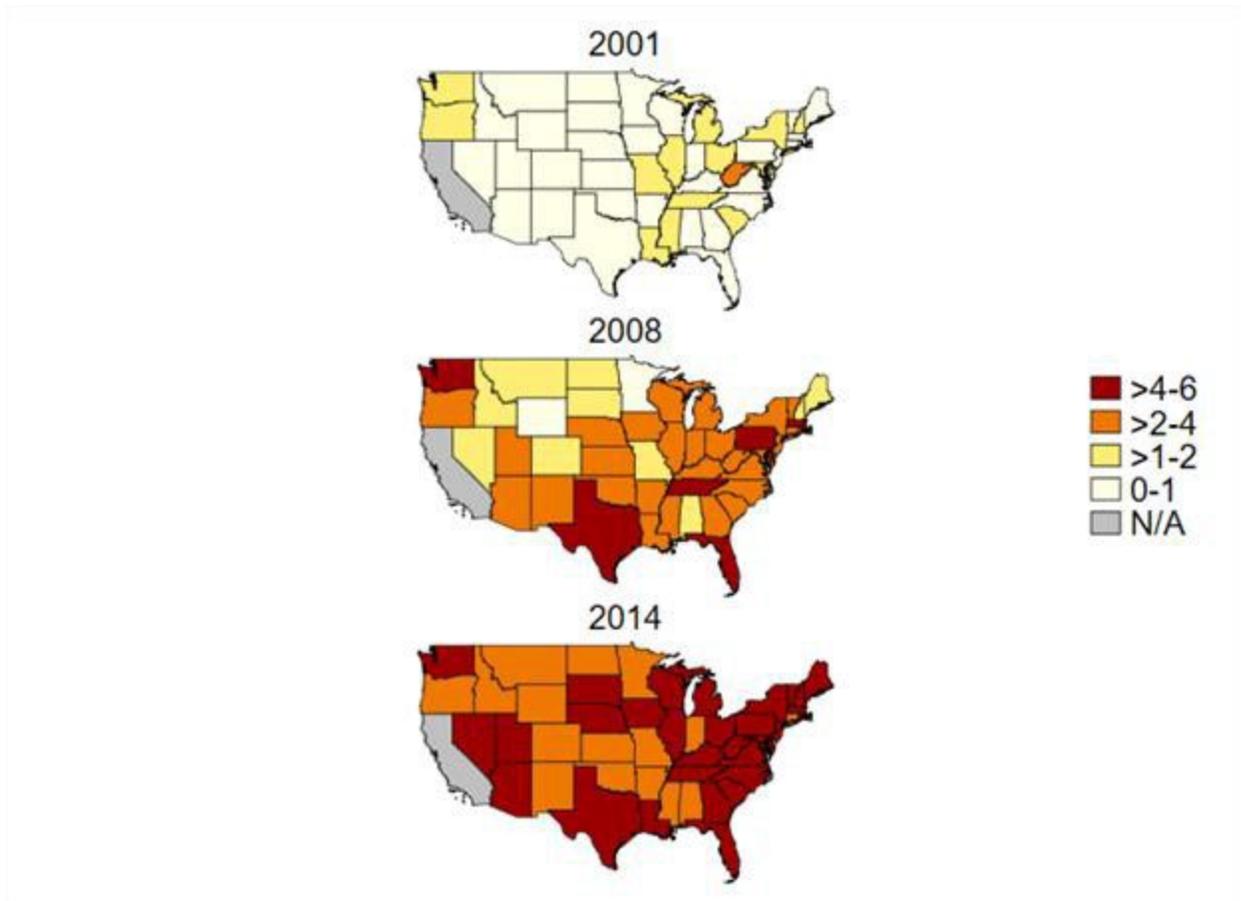
Eligibility index, senior version



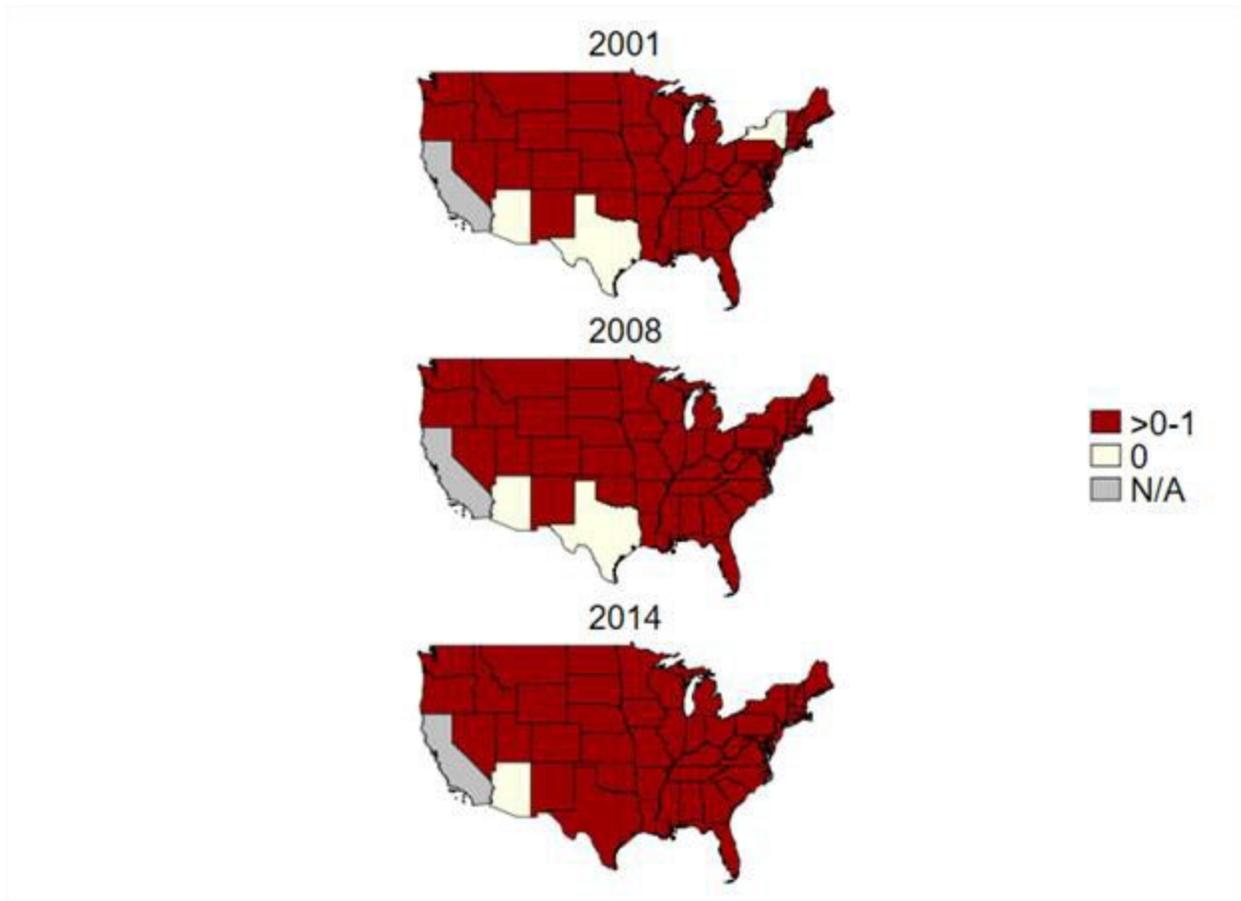
Transaction costs index, non-senior version



Transaction costs index, senior version



Stigma index



Outreach index

2001



2008



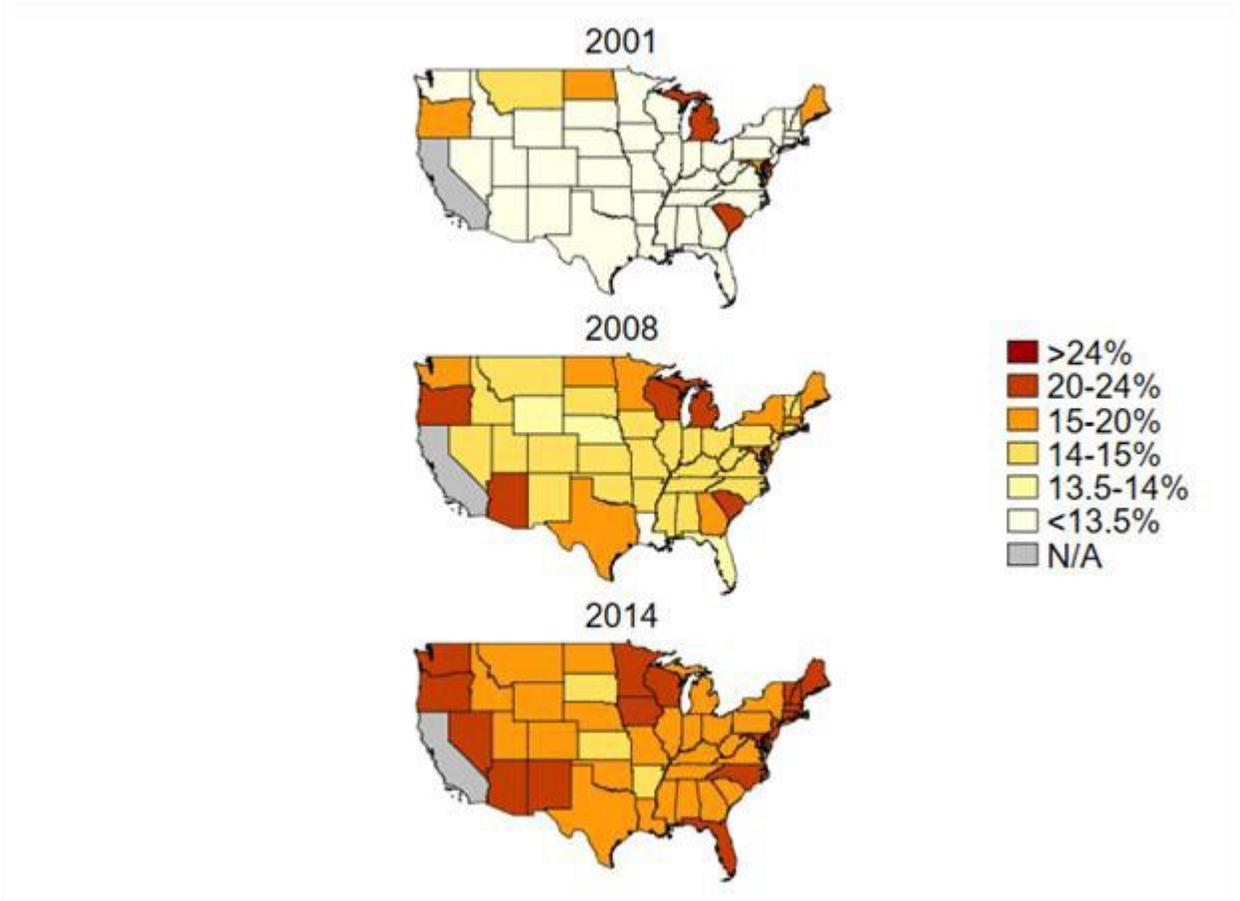
• >0-1
D 0
O N/A

2014



Appendix Figure 2. Additional simulated eligibility variables by age group

Non-senior version



Senior version

2001



2008



2014



- >24%
- 20-24%
- 15-20%
- 14-15%
- 13.5-14%
- <13.5%
- N/A

Appendix Table CPS-1. Summary statistics by household sample, sample weights

	Sample		
	Full	Non-senior	Senior
Received SNAP in the past year	0.249 (0.433)	0.294 (0.456)	0.152 (0.359)
Food security outcomes			
Affirmative responses to food security questionnaire (0 to 18)	1.971 (2.983)	2.380 (3.214)	1.085 (2.155)
Marginal, low, or very low food security	0.460 (0.498)	0.530 (0.499)	0.307 (0.461)
Low or very low food security	0.292 (0.455)	0.348 (0.476)	0.171 (0.376)
Very low food security	0.114 (0.318)	0.136 (0.342)	0.0665 (0.249)
Food spending per week (inflation-adjusted \$)	100.7 (87.13)	113.9 (92.53)	71.31 (64.72)
State SNAP policies: Eligibility			
Uses BBCE	0.505 (0.489)	0.510 (0.489)	0.495 (0.489)
Excludes one or more vehicles from asset test	0.770 (0.408)	0.765 (0.412)	0.782 (0.400)
Makes eligible all legal noncitizen adults (18-64) for SNAP or state food assistance	0.0624 (0.239)	0.0611 (0.237)	0.0652 (0.244)
Makes eligible all legal noncitizen seniors (65+) for SNAP or state food assistance	0.0821 (0.273)	0.0802 (0.270)	0.0864 (0.279)
State SNAP policies: Transaction Costs			

Uses simplified reporting option for households with earnings	0.863 (0.326)	0.866 (0.322)	0.855 (0.333)
Allows households to submit a SNAP application online statewide	0.445 (0.485)	0.443 (0.485)	0.448 (0.485)
Operates call centers statewide	0.349 (0.464)	0.348 (0.464)	0.352 (0.466)
Uses telephone interview at recertification in at least part of state	0.547 (0.483)	0.550 (0.482)	0.539 (0.484)
Operates a Combined Application Project for SSI recipients	0.411 (0.486)	0.412 (0.486)	0.409 (0.486)
Proportion of SNAP units with earnings with 1-6 month recertification periods	0.568 (0.416)	0.575 (0.415)	0.553 (0.417)
Proportion of senior SNAP units with 1-6 month recertification periods	0.0809 (0.0800)	0.0822 (0.0803)	0.0779 (0.0792)
State SNAP policies: Stigma			
Requires fingerprinting of applicants statewide	0.130 (0.332)	0.138 (0.341)	0.111 (0.310)
State SNAP policies: Outreach			
Has federally funded TV or radio ad outreach campaign	0.120 (0.157)	0.121 (0.157)	0.119 (0.156)
SNAP policy indices			
Total, non-senior (0 to 11)	5.374 (2.134)	5.362 (2.122)	5.399 (2.159)

Total, senior (0 to 11)	6.869 (2.058)	6.862 (2.048)	6.882 (2.081)
Eligibility, non-senior (0 to 3)	1.338 (0.706)	1.336 (0.701)	1.342 (0.716)
Eligibility, senior (0 to 3)	1.357 (0.710)	1.355 (0.705)	1.363 (0.720)
Transaction costs, non-senior (0 to 6)	3.046 (1.638)	3.044 (1.627)	3.049 (1.663)
Transaction costs, senior (0 to 6)	3.533 (1.580)	3.537 (1.571)	3.525 (1.599)
Simulated eligibility variables			
All households	0.179 (0.0422)	0.179 (0.0420)	0.178 (0.0427)
Senior households	0.195 (0.0747)	0.195 (0.0743)	0.195 (0.0756)
Non-senior households	0.174 (0.0345)	0.174 (0.0344)	0.174 (0.0348)
Household characteristics			
Respondent: Age (Years)	48.86 (19.06)	38.02 (11.46)	72.39 (7.652)
Respondent: Female	0.578 (0.494)	0.564 (0.496)	0.610 (0.488)
Respondent: Black, non-Hispanic	0.192 (0.394)	0.213 (0.410)	0.145 (0.352)
Respondent: American Indian or Alaska Native, non-Hispanic	0.0102 (0.101)	0.0113 (0.106)	0.00786 (0.0883)
Respondent: Asian or Pacific Islander, non- Hispanic	0.0234	0.0280	0.0134

	(0.151)	(0.165)	(0.115)
Respondent: Other race, non-Hispanic	0.0120	0.0131	0.00979
	(0.109)	(0.114)	(0.0984)
Respondent: Hispanic	0.162	0.196	0.0898
	(0.369)	(0.397)	(0.286)
Respondent: Foreign-born	0.166	0.191	0.112
	(0.372)	(0.393)	(0.315)
Respondent: Married	0.359	0.376	0.323
	(0.480)	(0.484)	(0.468)
Respondent: Divorced	0.177	0.175	0.181
	(0.382)	(0.380)	(0.385)
Respondent: Widowed	0.146	0.0286	0.401
	(0.353)	(0.167)	(0.490)
Respondent: Separated	0.0497	0.0614	0.0244
	(0.217)	(0.240)	(0.154)
Respondent: High school degree	0.563	0.585	0.515
	(0.496)	(0.493)	(0.500)
Respondent: Associate's degree	0.0747	0.0851	0.0522
	(0.263)	(0.279)	(0.222)
Respondent: Bachelor's degree	0.0780	0.0885	0.0553
	(0.268)	(0.284)	(0.229)
Respondent: Advanced degree	0.0258	0.0253	0.0267
	(0.158)	(0.157)	(0.161)
Respondent: Employed	0.460	0.611	0.133
	(0.498)	(0.488)	(0.340)
Respondent: Unemployed	0.0691	0.0930	0.0173
	(0.254)	(0.290)	(0.130)
Household: Number of people	2.604	3.037	1.667

	(1.659)	(1.716)	(1.023)
Household: Single person household	0.327	0.224	0.552
	(0.469)	(0.417)	(0.497)
Household: Children in household	0.405	0.563	0.0641
	(0.491)	(0.496)	(0.245)
Family income: Under \$5,000	0.0926	0.113	0.0488
	(0.290)	(0.316)	(0.215)
Family income: \$5,000-7,499	0.0727	0.0717	0.0750
	(0.260)	(0.258)	(0.263)
Family income: \$7,500-9,999	0.0858	0.0738	0.112
	(0.280)	(0.261)	(0.315)
Family income: \$10,000-12,499	0.109	0.0904	0.149
	(0.311)	(0.287)	(0.356)
Family income: \$12,500-14,999	0.0990	0.0804	0.139
	(0.299)	(0.272)	(0.346)
Family income: \$15,000-19,999	0.150	0.131	0.191
	(0.357)	(0.337)	(0.393)
Family income: \$20,000-24,999	0.150	0.142	0.169
	(0.357)	(0.349)	(0.374)
Family income: \$25,000-29,999	0.0963	0.105	0.0768
	(0.295)	(0.307)	(0.266)
Family income: \$30,000-34,999	0.0551	0.0708	0.0211
	(0.228)	(0.257)	(0.144)
Family income: \$35,000-39,999	0.0327	0.0443	0.00748
	(0.178)	(0.206)	(0.0862)
Family income: \$40,000-49,999	0.0384	0.0529	0.00701
	(0.192)	(0.224)	(0.0834)
Family income: \$50,000-59,999	0.0134	0.0183	0.00276

	(0.115)	(0.134)	(0.0524)
Family income: \$60,000-74,999	0.00392	0.00527	0.000989
	(0.0625)	(0.0724)	(0.0314)
Family income: \$75,000-99,999	0.000827	0.00109	0.000252
	(0.0287)	(0.0330)	(0.0159)
Number of households	170,929	112,184	58,745

Source: Current Population Survey Food Security Supplement (CPS-FSS) 2001-2014, USDA SNAP Policy Database (2018), USDA SNAP Policy Index (2020), author calculation

Note: Analysis samples include households with income less than 185% of the federal poverty level. Full sample includes all such households, non-senior sample includes households with respondents aged under 60, and senior sample includes households with respondents aged 60 or older. Variables range from 0 to 1 and represent binary indicators, annual averages of binary indicators, or annual averages of proportions unless otherwise specified. Stigma and outreach indices are excluded but range from 0 to 1 as they only summarize one policy each. Descriptive statistics are weighted.

Appendix Table CPS-2. Regression of SNAP participation on state SNAP policies by household sample, sample weights

	Sample		
	Full	Non-senior	Senior
Primarily impacting eligibility			
Uses BBCE	0.00231 (0.00639)	0.00319 (0.00717)	0.000470 (0.00710)
Excludes one or more vehicles from asset test	-0.00244 (0.00807)	0.00435 (0.0105)	-0.0143 (0.00887)
Makes eligible all legal noncitizen adults (18-64) for SNAP or state food assistance	-0.00250 (0.0189)	0.00162 (0.0225)	
Makes eligible all legal noncitizen seniors (65+) for SNAP or state food assistance			-0.0150 (0.0135)
Primarily impacting transaction costs			
Uses simplified reporting option for households with earnings	0.00452 (0.00864)	0.00718 (0.0107)	-0.00580 (0.0101)
Allows households to submit a SNAP	0.00346	-0.00189	0.0147

application online statewide	(0.00681)	(0.00741)	(0.00885)
Operates call centers statewide	-0.00532	-0.00137	-0.0175**
	(0.00591)	(0.00625)	(0.00762)
Uses telephone interview at recertification in at least part of state	-0.00992	-0.0101	-0.00723
	(0.00621)	(0.00768)	(0.00538)
Operates a Combined Application Project for SSI recipients	0.0103	0.0107	0.0114*
	(0.00721)	(0.00895)	(0.00655)
Proportion of SNAP units with earnings with 1-6 month recertification periods	-0.0192**	-0.0174**	
	(0.00781)	(0.00852)	
Proportion of senior SNAP units with 1-6 month recertification periods			-0.00582
			(0.0460)
Primarily impacting stigma			
Requires fingerprinting of applicants statewide	-0.0283	-0.0249*	-0.0374
	(0.0169)	(0.0128)	(0.0311)
Primarily impacting outreach			

Has federally funded TV or radio ad outreach campaign	-0.00797 (0.0198)	-0.0120 (0.0211)	-0.00502 (0.0212)
Adjusted R²	0.257	0.266	0.199
N	170,929	112,184	58,745
F-statistic	2.109	1.988	2.445

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects and is weighted by the CPS-FSS household sample weights. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Policy measures range from 0 to 1 and represent the percentage of the year a policy was in place or the annual average proportion of the SNAP population.

Appendix Table CPS-3. Regression of SNAP participation on state SNAP policy indices by household sample, sample weights

	Total policy index			Policy subindices			
	Sample	Full	Non-senior	Senior	Full	Non-senior	Senior
Policy indices							
Total, non-senior	0.00537	0.00608					
	(0.00499)	(0.00513)					
Total, senior			-0.000726				
			(0.00565)				
Eligibility, non-senior				0.000307	0.00292		
				(0.00389)	(0.00454)		
Transaction costs, non-senior				0.00302	0.00241		
				(0.00383)	(0.00426)		
Eligibility, senior						-0.00510	
						(0.00493)	
Transaction costs, senior						-0.000613	
						(0.00405)	
Stigma				0.00701	0.00627	0.00948	
				(0.00598)	(0.00409)	(0.0106)	
Outreach				-0.00153	-0.00206	-0.000790	

				(0.00290)	(0.00316)	(0.00304)
Adjusted R²	0.257	0.266	0.198	0.257	0.266	0.199
N	170,929	112,184	58,745	170,929	112,184	58,745
F-statistic	1.159	1.406	0.0165	0.804	1.128	0.441

Note: Asterisks indicate the following: *= $p < 0.10$, **= $p < 0.05$, and ***= $p < 0.01$. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects and is weighted by the CPS-FSS household sample weights. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the index.

Appendix Table CPS-4A. Regression of SNAP participation on simulated eligibility variable by household sample, sample weights

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.00949** (0.00364)		
SEV, non-senior		0.0117*** (0.00331)	
SEV, senior			0.00750 (0.00461)
Adjusted R²	0.257	0.266	0.199
N	170,929	112,184	58,745
F-statistic	6.814	12.59	2.644

Note: Asterisks indicate the following: *= $p < 0.10$, **= $p < 0.05$, and ***= $p < 0.01$. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects and is weighted by the CPS-FSS household sample weights. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV.

Table CPS-4B. Regression of SNAP participation on simulated eligibility variable by household sample, non-standardized SEV

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.321*** (0.0886)		
SEV, non-senior		0.442***+++ (0.0952)	
SEV, senior			0.145**++++ (0.0629)
Adjusted R²	0.258	0.267	0.196
N	170,929	112,184	58,745
F-statistic	13.09	21.59	5.314

Note: Asterisks indicate the following: *= $p < 0.10$, **= $p < 0.05$, and ***= $p < 0.01$. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: += $p < 0.10$, ++= $p < 0.05$, and +++= $p < 0.01$. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV.

Appendix Table CPS-5A. Regression of SNAP participation on simulated eligibility variable and non-eligibility state SNAP policy subindices by household sample, sample weights

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.00962*** (0.00343)		
SEV, non-senior		0.0122*** (0.00331)	
SEV, senior			0.00699* (0.00409)
Policy indices			
Transaction costs, non-senior	0.000606 (0.00371)	-0.0000123 (0.00416)	
Transaction costs, senior			-0.00256 (0.00459)
Stigma	0.00813 (0.00494)	0.00856** (0.00320)	0.00829 (0.0103)
Outreach	-0.00116 (0.00295)	-0.00166 (0.00306)	-0.000901 (0.00340)
Adjusted R²	0.257	0.266	0.199
N	170,929	112,184	58,745
F-statistic	3.283	4.989	1.298

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects and

is weighted by the CPS-FSS household sample weights. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables and policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV or index.

Appendix Table CPS-5B. Regression of SNAP participation on simulated eligibility variable and non-eligibility state SNAP policy subindices by household sample, non-standardized SEV

	Sample		
	Full	Non-senior	Senior
Simulated eligibility variables			
SEV, full	0.313*** (0.0827)		
SEV, non-senior		0.443***+++ (0.0940)	
SEV, senior			0.139**++++ (0.0591)
Policy indices			
Transaction costs, non-senior	0.00564 (0.00426)	0.00499 (0.00488)	
Transaction costs, senior			0.00228 (0.00457)
Stigma	0.00765 (0.00462)	0.00824** (0.00378)	0.00713 (0.00775)
Outreach	0.000956 (0.00232)	-0.00103+ (0.00256)	0.00399+ (0.00276)
Adjusted R²	0.258	0.267	0.196
N	170,929	112,184	58,745
F-statistic	5.480	7.558	2.873

Note: Asterisks indicate the following: *=p<0.10, **=p<0.05, and ***=p<0.01. Plus signs indicate that the non-senior and senior estimates are statistically different as follows: +=p<0.10, ++=p<0.05, and +++=p<0.01. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and

corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older. Simulated eligibility variables and policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV or index.

Appendix Table CPS-6. Regression of food security outcomes on SNAP participation by household sample, sample weights

	Affirmative response count	Marginal, low, or very low food security	Low or very low food security	Very low food security	Food spending
Panel A: Full sample					
SNAP participation	1.426*** (0.0377)	0.252*** (0.00617)	0.211*** (0.00547)	0.110*** (0.00336)	8.827*** (0.833)
Panel B: Non-senior sample					
SNAP participation	1.361*** (0.0435)	0.230*** (0.00640)	0.196*** (0.00647)	0.102*** (0.00420)	11.21*** (0.895)
Panel C: Senior sample					
SNAP participation	1.300*** (0.0490)	0.277*** (0.00918)	0.214*** (0.00817)	0.103*** (0.00619)	0.330 (0.867)
Dep var mean (full)	1.971	0.460	0.292	0.114	100.7
Dep var mean (non- senior)	2.380	0.530	0.348	0.136	113.9
Dep var mean (senior)	1.085	0.307	0.171	0.0665	71.31
N (full)	167,251	167,251	167,251	167,251	164,051
N (non- senior)	109,729	109,729	109,729	109,729	108,507
N (senior)	57,522	57,522	57,522	57,522	55,544

Note: Asterisks indicate the following: *= $p < 0.10$, **= $p < 0.05$, and ***= $p < 0.01$. Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample, indicated by the panel, and corresponding food security or spending outcome, indicated by the column. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects and is weighted by the CPS-FSS household sample weights. Analysis samples include only households with an annual income less than 185% of the federal poverty level and alternately respondents of all ages, respondents under age 60, or respondents aged 60 or older.

Appendix Table HRS-1. Summary statistics by household sample, sample weights

	Full sample	Senior sample
<i>Dependent variables</i>		
Self-reported health at least good	0.59 (0.49)	0.60 (0.49)
Body mass index (BMI)	28.47 (6.63)	27.89 (6.20)
Obese	28.52 (6.74)	27.88 (6.29)
Severely obese	0.34 (0.48)	0.31 (0.46)
Currently smoke	0.15 (0.36)	0.12 (0.33)
Number of drinks per day	0.21 (0.41)	0.16 (0.36)
Any doctor visits (since last interview)	0.90 (0.30)	0.91 (0.28)
Any inpatient hospitalization (since last interview)	0.30 (0.46)	0.32 (0.47)
Number of inpatient hospital stays (since last interview)	0.60 (1.68)	0.61 (1.54)
Any nursing home stay (since last interview)	0.03 (0.18)	0.04 (0.20)
Number of nursing home stays (since last interview)	0.04 (0.51)	0.05 (0.30)
Any outpatient surgery (since last interview)	0.19 (0.39)	0.20 (0.40)
Received SNAP (since last interview)	0.18	0.15

	(0.39)	(0.35)
<i>Household Characteristics</i>		
Age (years)	68.05	72.96
	(11.22)	(9.02)
Female	0.64	0.66
	(0.48)	(0.47)
Black	0.17	0.15
	(0.37)	(0.36)
White	0.76	0.79
	(0.43)	(0.40)
Other race	0.07	0.06
	(0.26)	(0.23)
Married	0.32	0.29
	(0.47)	(0.45)
Formerly married	0.60	0.64
	(0.49)	(0.48)
Household size	1.98	1.79
	(1.38)	(1.20)
Less than high school	0.30	0.32
	(0.46)	(0.47)
High school degree	0.39	0.40
	(0.49)	(0.49)
Some college	0.21	0.19
	(0.41)	(0.39)
College degree	0.07	0.06
	(0.26)	(0.24)
Graduate degree or more	0.03	0.03
	(0.16)	(0.16)

Not in the labor force	0.80	0.91
	(0.40)	(0.29)
Employed	0.17	0.08
	(0.38)	(0.27)
Unemployed	0.03	0.02
	(0.17)	(0.12)
Household income (\$)	16,500.10	16,181.52
	(9,610.97)	(8,250.63)
Net value of housing (primary residence, \$)	71,327.80	80,488.44
	(145,838.68)	(157,537.63)
Net value of non-housing financial wealth (\$)	32,009.92	39,454.85
	(174,910.50)	(189,074.60)

Number of Activities of Daily Living (ADLs) where respondent reports some difficulty (percent)

Zero ADLs	75.72	75.78
One ADL	11.57	11.84
Two ADLs	5.79	5.71
Three ADLs	3.55	3.42
Four ADLs	2.34	2.24
Five ADLs	1.04	1.01

Number of Instrumental Activities of Daily Living (IADLs) where respondent reports some difficulty (percent)

Zero IADLs	78.64	79.10
One IADL	11.56	11.22
Two IADLs	5.48	5.36
Three IADLs	2.41	2.33
Four IADLs	1.27	1.30
Five IADLs	0.63	0.68
Number of words correctly recalled immediately or delayed	8.61	8.34

(0-20)

(3.46) (3.47)

Simulated Eligibility Variables (SEV)

Full sample SEV 19.70 19.61
(7.41) (7.41)

Senior sample SEV 18.11 18.04
(4.23) (4.24)

State SNAP policies: Eligibility

State uses BBCE for all SNAP applicants 0.53 0.52
(0.49) (0.49)

State excludes one or more vehicles from asset test 0.82 0.81
(0.38) (0.38)

All legal noncitizen adults (18-64) are eligible for SNAP or state food assistance 0.14 0.14
(0.34) (0.34)

All legal noncitizen seniors (65+) are eligible for SNAP or state food assistance 0.16 0.16
(0.36) (0.37)

State SNAP policies: Transaction Costs

State uses simplified reporting options for households with earnings 0.84 0.83
(0.36) (0.37)

State allows online SNAP application 0.48 0.47
(0.49) (0.49)

State operates call centers 0.33 0.32
(0.45) (0.45)

State granted a waiver to use telephone interview at recertification in at least part of state 0.59 0.58
(0.48) (0.48)

State uses a Combined Application Program for SSI applicants	0.39	0.38
	(0.48)	(0.48)
Proportion of SNAP units with earnings with 1–6-month recertification period	0.51	0.51
	(0.43)	(0.43)
Proportion of elderly SNAP units with 1–6-month recertification period	0.07	0.07
	(0.08)	(0.08)
<i>State SNAP policies: Stigma</i>		
Requires fingerprinting of applicants statewide	0.17	0.16
	(0.37)	(0.37)
<i>State SNAP policies: Outreach</i>		
State has federally funded TV or radio ad outreach campaign	0.14	0.14
	(0.17)	(0.17)
<i>State SNAP policy indices</i>		
Total index, non-senior (0 to 11)	5.57	5.52
	(2.02)	(2.03)
Total index, senior (0 to 11)	7.01	6.96
	(1.97)	(1.99)
Eligibility index, non-senior (0 to 3)	1.49	1.47
	(0.74)	(0.74)
Eligibility index, senior (0 to 3)	1.51	1.50
	(0.73)	(0.73)
Transaction costs index, non-senior (0 to 6)	3.11	3.07
	(1.59)	(1.60)
Transaction costs index, senior (0 to 6)	3.55	3.51
	(1.56)	(1.57)

Number of households	34,030	26,515
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Source: Health and Retirement Survey 2002-2014, USDA SNAP Policy Database (2018), USDA SNAP Policy Index (2020), author calculation.

Notes: The unit of analysis is the household. Analysis samples include households with income up to 250% of the federal poverty level. The full sample includes all such households while the senior sample includes households with respondents aged 60 or older. The stigma and outreach indices (not shown under the *State SNAP Policy Indices* panel) summarize the single stigma and outreach SNAP policy variables, respectively. Descriptive statistics are weighted.

Appendix Table HRS-2. Regression of SNAP participation on state SNAP policies by household sample, sample weights

	Full sample	Senior sample
<i>Primarily impacting eligibility</i>		
State uses BBCE for all SNAP applicants	0.0162 (0.0136)	0.0231* (0.0135)
State excludes one or more vehicles from asset test	0.00903 (0.0136)	0.000539 (0.0155)
All legal noncitizen adults (18-64) are eligible for SNAP or state food assistance	-0.0255 (0.0248)	
All legal noncitizen seniors (65+) are eligible for SNAP or state food assistance		0.0161 (0.0246)
<i>Primarily impacting transaction costs</i>		
State uses simplified reporting options for households with earnings	-0.00151 (0.0114)	-0.00202 (0.00948)
State allows online SNAP application	-0.0204* (0.0116)	-0.0317** (0.0132)
State operates call centers	0.00536 (0.0111)	0.0103 (0.0117)
State granted a waiver to use telephone interview at recertification in at least part of state	0.00965 (0.00938)	0.00939 (0.0104)
State uses a Combined Application Program for SSI applicants	0.0194 (0.0141)	0.00448 (0.0118)
Proportion of SNAP units with earnings with 1-6 recertification period	0.00636	

	(0.0126)	
Proportion of elderly SNAP units with 1–6-month recertification period		-0.0983
		(0.0645)
<i>Primarily impacting stigma</i>		
State requires fingerprinting of SNAP applicants	0.0197**	0.0216*
	(0.00846)	(0.0108)
<i>Primarily impacting outreach</i>		
State has federally funded TV or radio ad outreach campaign	0.0222	0.0258
	(0.0332)	(0.0269)
<hr/>		
Adjusted R ²	0.167	0.143
Number of households	34,030	26,515
F-statistic for test of joint significance of SNAP policy variables	2.104	1.320

Notes: Standard errors appear in parentheses and are clustered by state. Each set of coefficients is from a separate regression model using a different analysis sample and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Policy measures range from 0 to 1 and represent the percentage of the year a policy was in place or the annual average proportion of the SNAP population.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-3. Regression of SNAP participation on state SNAP policy indices by household, sample weights

	Total Policy Index		Policy subindices	
	Full sample	Senior sample	Full sample	Senior sample
Total index, full	0.00336 (0.00790)			
Total index, senior		-0.000335 (0.00697)		
Eligibility, full			0.00816 (0.00791)	
Transactions cost index, full			0.00378 (0.00652)	
Stigma index, full			-0.00907*** (0.00328)	
Outreach index, full			0.00283 (0.00522)	
Eligibility, senior				0.0101 (0.00714)
Transactions cost index, senior				-0.000998 (0.00590)
Stigma index, senior				-0.00839* (0.00499)
Outreach index, senior				0.00419 (0.00438)
Adjusted R ²	0.166	0.142	0.166	0.142
Number of households	34,030	26,515	34,030	26,515
F-statistic	0.181	0.00231	2.221	1.521

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a

set of coefficients from a separate regression model using a different analysis sample (full or senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the index on the probability of SNAP participation.

** $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

Appendix Table HRS-4. Regression of SNAP participation on simulated eligibility variable by household sample, sample weights

	Full sample	Senior sample
<i>Simulated eligibility variables</i>		
SEV, full sample	0.0145*** (0.00459)	
SEV, senior		0.00928** (0.00422)
Adjusted R ²	0.169	0.145
Number of households	34,030	26,515
F-statistic	9.913	4.841

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a set of coefficients from a separate regression model using a different analysis sample (full or senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Simulated eligibility variables are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV on the probability of SNAP participation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-5. Regression of SNAP participation on simulated eligibility variable and non-eligibility state SNAP policy subindices by household sample, sample weights

	Full sample	Senior sample
<i>Simulated eligibility variables</i>		
SEV, full sample	0.0162*** (0.00521)	
SEV, senior		0.0116** (0.00441)
<i>Policy indices</i>		
Transactions cost index, full	0.00159 (0.00577)	
Transactions cost index, senior		-0.00352 (0.00610)
Stigma index, full	-0.0102*** (0.00377)	-0.00983** (0.00460)
Outreach index, full	0.00408 (0.00451)	0.00482 (0.00396)
Adjusted R ²	0.167	0.145
Number of households	34,030	26,515
F-statistic	3.388	2.824

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents a set of coefficients from a separate regression model using a different analysis sample (full or senior sample) and corresponding policy measures. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (full sample) and respondents aged 60 or older (senior sample). Simulated eligibility variables and policy indices are standardized such that the coefficient estimates represent the effect of a one standard deviation increase in the SEV or index on the probability of SNAP participation.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-6. OLS regression results of the impacts of SNAP participation on health outcomes, sample weights

	Self-reported health at least good	Body mass index	Obese	Severely obese	Currently smoke	Number of drinks per day
Panel A: Full sample (N=34,030)						
SNAP participation	-0.0830***	0.570*	0.0332*	0.0346**	0.0644***	0.0213
	(0.0123)	(0.296)	(0.0181)	(0.0144)	(0.0104)	(0.0536)
Panel B: Senior sample (N=26,515)						
SNAP participation	-0.0999***	0.782**	0.0524***	0.0429***	0.0364***	-0.0406
	(0.0151)	(0.293)	(0.0178)	(0.0144)	(0.0134)	(0.0469)
Dep var mean (full)	0.572	28.47	0.342	0.142	0.188	0.570
Dep var mean (senior)	0.583	27.89	0.309	0.116	0.146	0.448

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-7. OLS regression results of the impacts of SNAP participation on health care utilization, sample weights

	Any doctor visits	Any inpatient hospitalization	Number of inpatient hospital stays	Any nursing home stay	Number of nursing home stays	Any outpatient surgery
Panel A: Full sample (N=34,030)						
SNAP participation	0.0366*** (0.00446)	0.0636*** (0.0106)	0.284*** (0.0679)	0.00615 (0.00410)	0.0195 (0.0134)	0.00144 (0.00734)
Panel B: Senior sample (N=26,515)						
SNAP participation	0.0422*** (0.00700)	0.0743*** (0.0147)	0.327*** (0.0899)	0.00750 (0.00623)	0.0110 (0.00898)	0.00693 (0.0104)
Dep var mean (full)	0.897	0.307	0.596	0.0342	0.0459	0.180
Dep var mean (senior)	0.913	0.323	0.606	0.0403	0.0511	0.187

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-8. Instrumental Variable (IV) estimation results of the impacts of SNAP participation on health outcomes, sample weights

	Self-reported health at least good	Body mass index	Obese	Severely obese	Currently smoke	Number of drinks per day
Panel A: Full sample (N=34,030)						
SNAP participation	-0.143	-6.220	-0.256	-0.408	-0.221	-0.354
	(0.379)	(6.636)	(0.529)	(0.349)	(0.419)	(0.983)
Panel B: Senior sample (N=26,515)						
SNAP participation	-0.364	-7.021	0.0663	-0.564	0.234	2.182
	(0.640)	(9.514)	(0.734)	(0.450)	(0.559)	(1.664)
Dep var mean (full)	0.572	28.47	0.342	0.142	0.188	0.570
Dep var mean (senior)	0.583	27.89	0.309	0.116	0.146	0.448

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample). The instrumental variable is the sample-specific simulated eligibility variable (SEV), with corresponding first stage results reported in Table 4.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table HRS-9. Instrumental Variable (IV) estimation results of the impacts of SNAP participation on health care utilization, sample weights

	Any doctor visits	Any inpatient hospitalization	Number of inpatient hospital stays	Any nursing home stay	Number of nursing home stays	Any outpatient surgery
Panel A: Full sample (N=34,030)						
SNAP participation	0.224 (0.387)	-0.140 (0.459)	-3.098 (2.204)	0.00424 (0.144)	-0.196 (0.254)	0.354 (0.315)
Panel B: Senior sample (N=26,515)						
SNAP participation	0.348 (0.586)	0.311 (0.669)	-4.386 (3.632)	0.241 (0.243)	0.130 (0.366)	-0.0656 (0.417)
Dep var mean (full)	0.897	0.307	0.596	0.0342	0.0459	0.180
Dep var mean (senior)	0.913	0.323	0.606	0.0403	0.0511	0.187

Notes: Standard errors appear in parentheses and are clustered by state. Each column presents the association of SNAP participation for the specific health outcome from a separate regression model. Each model includes the covariates reported in Table 1, state fixed effects, and year fixed effects. Analysis samples include only households with an annual income less than 250% of the federal poverty level for respondents of all ages (Panel A: full sample) and respondents aged 60 or older (Panel B: senior sample). The instrumental variable is the sample-specific simulated eligibility variable (SEV), with corresponding first stage results reported in Table 4.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$