# THREE ESSAYS ON FOOD INSECURITY, NUTRITIONAL OUTCOMES, AND SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION AMONG SENIORS

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by

ASHLEY E. PRICE

Dr. Colleen Heflin, Dissertation Supervisor

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

THREE ESSAYS ON FOOD INSECURITY, NUTRITIONAL OUTCOMES, AND SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION AMONG SENIORS

presented by Ashley E. Price,

a candidate for the degree of doctor of philosophy,

and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Colleen Heflin

Professor Irma Arteaga

Professor Peter Mueser

Professor Enid Schatz

To Donald Fletcher Price and Louveenia Talbert

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## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

Figure Page

Chapter 2

**THREE ESSAYS ON FOOD INSECURITY, NUTRITIONAL OUTCOMES, AND SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION AMONG SENIORS**

Ashley E. Price

Dr. Colleen Heflin, Dissertation Supervisor

ABSTRACT

As the senior population in the United States grows to be a more significant portion of the American populous, social scientists, public health advocates, policy makers, and health care professor must grapple with how to address the strain senior will place on health systems and social services. Nutrition is a critical component of maintaining good health, managing chronic diseases, and prevention, thus, we must learn more about the senior experiences with nutrition and social programs which address nutrition inadequacy. To contribute to this literature this dissertation uses nationally representative survey data and econometric analysis to understand seniors and nutrition. The first essay focuses on understanding what contributes to seniors' participation Supplemental Nutrition Assistance Program. The second essay looks at the role food security and functional limitations play in seniors' nutritional outcomes. The third chapter explores what drives the higher food insecurity rates among senior women relative to senior men. All three essays highlight potential barriers for seniors having quality nutrition.

# CHAPTER 1: INTRODUCTION

As Baby Boomers, those born between 1946 and 1964, enter older ages we are seeing significant growth in our senior population. In 2015, those 65 and older made up 15 percent of the United States population. Conversely, in 2030 the proportion of the population that are seniors is expected to grow to roughly a fifth of the total population in the United States (Mather, Jacobsen, & Pollard, 2015; Ortman, Velkoff, & Hogan, 2014; US Department of Health and Human Services, Administration on Aging, 2013). Policymakers, scholars, and budget experts have noted that the growth in the population that will be 65 and older, will have significant consequences on federal spending. It is predicted that over the next 25 years, 56 percent of the spending growth of major federal health programs, like Medicare, will be attributed to seniors (Centers for Disease Control and Prevention, 2013; Mirel & Carper, 2014). Therefore, studying the senior population is critically important for social scientists; additionally, the changes in the demographic and economic characteristics of our new senior population make research on this population immediately pertinent.

The increase in the proportion and sheer numbers of seniors is only one set of characteristics that will affect federal, state, and local spending on the senior population. When analyzing the potential financial burden due to health expenditures of the senior population, it important to recognize that the newer generations of older Americans significantly changing the racial and ethnic makeup of those 65 and older. Between 2012 to 2030 the proportion of seniors who are non-Hispanic Whites is expected to drop 7 percent—from roughly 79 percent to 73 percent of the total population—and estimates for 2060 suggest that the proportion which is characterized as non-Hispanic Whites will

drop to 55 percent among older Americans (Ortman, Velkoff & Hogan, 2014). The growth in the proportion of seniors who are Blacks and Hispanic is relevant to public health and health spending as minorities face increased risks of poor health outcomes, like higher rates of chronic disease and comorbidities, relative to White seniors (Centers for Disease Control and Prevention, 2013; Olshanky, et. al, 2012).

Baby boomers are also reshaping senior social and work patterns in the United States, which can contribute to differences in risk of health outcomes. The older population has a rising share of those 65 and older who continue to participate in the labor force as they age (Butrica, Smith, & Iams, 2012). Educational attainment has also increased among the United States senior population. On the other hand, with the racial and ethnic changes in the senior population, there is a growth in the economic disparities across racial and ethnic subgroups among seniors (Department of Health and Human Services, 2016). The marital status of seniors is also changing; more older Americans are divorced than seniors of previous generations (Wu et. al, 2013). Unmarried Baby Boomers face poorer health outcomes and greater economic vulnerabilities than those seniors who are married (Reno & Veghte, 2010).

Additionally, there are new shifts in the geographic characteristics of seniors. While many seniors still migrate and retire in the South there is an emergence in the Midwest, Appalachia, and the Northeast of seniors staying where they lived in their prime ages. With seniors aging in certain regions and their children and other young people moving elsewhere, creates a "graying" of these regions. The most significant growth in the "graying" is taking place in the rural Midwest, which has been strapped for resources and health care infrastructure (Frey, 2010).

The demographic characteristics and shifts affecting the senior population show demographic characteristics and environment can predict and influence economic and health outcomes. The demographic groups among seniors with the most growth are the same demographic characteristics that are associated with poor health outcomes. The growth in chronic disease among the senior population has been startling over the last couple of decades. For example, 77 percent of seniors have at least two chronic diseases, and this population of seniors represents 69 percent of Medicare beneficiaries. The increase in chronic diseases among those 65 and older, has had a significant effect on Medicare spending. Roughly, 93 percent of Medicare spending can be attributed to seniors with at least two chronic diseases (Centers for Disease Control and Prevention, 2014; Centers for Medicare and Medicaid Services, 2015; Mirel & Carper, 2014). Thus, the rising number of seniors in the United States—a group already known to put significant strain on our health care system—coupled with growth within the proportion of seniors with demographic characteristics which predict increased risk of poor health outcomes, makes focusing on ways to prevent disease or to moderate the effect of disease not only a public health issue, but a policy relevant fiscal issue.

For my dissertation, I choose to focus on one potential public health and policy intervention area for addressing the health issues and cost related to the growth and changes in the senior population—nutrition. There is a bountiful amount of literature on geriatric care and chronic disease that indicates nutrition plays a critical for the overall health of seniors. Quality nutritional intake can help reduce the onset and help mediate the effects of chronic diseases among seniors. While there is a significant amount of literature about the nutrition of seniors who are institutionalized, the growth in numbers

seniors and the growing diversity of the senior population call for a further evaluation of the experience of noninstitutionalized seniors.

Two of the most important individuals in my life are seniors—my maternal grandma, Louveenia Talbert, and my paternal grandpa, Donald Price. I had a special connection with my paternal grandpa, who passed away in 2005. I have watched my widowed grandma navigate older age, retirement, and the onset of chronic disease. I have also watched her care for others at the expense of her own health outcomes; I have always been curious about how her role as mother and caregiver has continued as she aged and played a role in her relationship to her own consumption of food. I have seen her utilize nutrition assistance programs at different periods of her life. As a child, I remember walking with my cousins to the closest place to get food in my grandma's low-income neighborhood, a convenience store, to purchase food with food stamps for my grandma. In recent years, my grandma made significant changes to her dietary intake—focusing on quality food that is affordable. I watched the effects of the change in her nutritional intake impact her overall health and her diabetes. Witnessing this experience solidifies for me the importance of this dissertation and the relevance of calling for nutrition to be a line of defense in reducing health cost.

Additionally, as a high schooler, I spent a summer living alone with my grandpa, a longtime retired federal employee with a relatively high economic status. Despite having had an average middle-class socioeconomic status, he faced the issues of frailty and diminished functionality which were exacerbated by chronic kidney issues. These functional issues appeared at times to limit what food intake and preparation he favored. A divorced senior man living alone, my grandpa was solely responsible for his nutritional

intake. Spending time with my grandpa made me think about the unique physical challenges seniors face as they age and deal with new functional limitations. It was reminiscing about my time with my grandpa that reminded me to focus on not just the low-income seniors and scarce resources as limiting the ability for senior to have adequate food, but other barriers to their ability to consume nutritious food—functionality. My grandparents challenged how I thought of about seniors, and as the United States begins to face the effects of a growing senior population who have a higher prevalence chronic disease we must think critically about these components of senior life.

Each chapter of my dissertation investigates a component of the senior population's relationship to nutrition. In chapter one I present an empirical exploration of what makes some seniors over others participate in our largest nutrition assistance program, the Supplemental Nutrition Assistance Program (SNAP). SNAP is our frontline defense against hunger for vulnerable American households, and understanding what leads to participation is critical for identifying ways to aid in the purchasing of quality food for some of our most vulnerable seniors—those in low-income households. I investigate the role of demographic characteristics and the state of residence for seniors with lower income in the utilization of SNAP. I use the Current Population Survey's (CPS) Annual Social and Economic Supplement (ASEC) for analysis of determinants of SNAP participation among seniors, and further use simulations to analyze the relative contributions of demographic characteristics, state economic characteristics, state non-food policies, and state food policies in the change of SNAP participation among seniors from 2003 to 2013. In chapter 1 I find that state food policies contribute to about 46 percent of the change in SNAP participation among seniors. While, state non-food

policies and individual demographic characteristics account for 14 percent and 10 percent of the change in SNAP participation during the decade, respectively.

Next, chapter two examines the effect of functional limitations and food security on seniors meeting nutrient recommendations. Seniors' ability to get the nutrition they need can be hindered by their access to resources for quality food, but seniors also face physical limitations that may impact their nutrition intake. For analysis, I use the National Health and Nutrition Examination Survey pooling years 2007, 2009 and 2011, and examine, with probit estimations, the role of food security, activities of daily living (ADLs), and instrumental activities of daily living (IADLs), as determinants for noninstitutionalized seniors meeting recommended nutritional intakes for eight nutrients. I focus my analysis on eight nutrients, that are critical in mitigating the physiological complications associated with aging—the nutrients include calcium, kilocalories, folate, protein, vitamin a, vitamin b, vitamin c, and zinc. The results of my analysis indicate the likelihood of meeting protein needs is higher for those who are food insecurity and for those with increased limitations in ADLs. Additionally, I find that an increase in the difficulty of an individual completing IADLs showed an increased in the likelihood of meeting most nutrient needs. I conduct further analysis and find that an inability for one to perform the IADL of preparation of one's meals, is driving the positive relationship between IADLs and meeting nutrition needs.

Finally, chapter three explores what contributes to gender differences in food security among seniors. Research on senior gender and well-being finds senior women face worse economic well-being because they are likely to have more of the individual, family, and household predictors of economic strain. Chapter three examines how the

different composition of demographic characteristics of men and women plays a role in senior food insecurity differences by gender. I also search for evidence of unobserved differences in food insecurity by gender possibly related to senior women continuing a mothering role of taking care of others, but not themselves even in their older age. Using, the CPS Food Security Supplement (CPS-FSS), and pooling yeas 2005 to 2015, I use stepwise probit regression and sensitivity analysis to investigate if senior men and women have the same determinants of food insecurity and the magnitude of those effects between the two genders. I find that senior women's increases in food insecurity rates are related to women having higher rates of known predictors for food insecurity, such as lower educational attainment, lower household income, and being widowed. The patterns for predictors of food insecurity among seniors are found to be the same across gender.

The dissertation encompasses three chapter that focuses on how the senior experience and characteristics of seniors may impact the food security status, nutritional outcomes, and SNAP participation for our aging population. Each chapter highlights potential areas or policy windows that can address the nutrition and food needs of seniors. Understanding the complexities and characteristics that impact quality food consumption among seniors is pertinent, as seniors' rates of food insecurity continue to grow over time, and despite dealing with a reduction in their ability to receive quality food seniors are a group not likely to receive assistance. Policy makers and social scientists must find ways to better target the nutrition needs of our senior population, so we can potentially reduce the costs and burden this growing senior population afflicted with higher rates of chronic disease will have on our health care system.

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# CHAPTER 2: SUPPLEMENTATION NUTRITION ASSISTANCE PROGRAM(SNAP) PARTICIPATION AND SHIFTS IN DEMOGRAPHIC CHARACTERISTICS AND STATE RESIDENCY AMONG SENIORS

## Introduction

Every generation leaves its mark on our society. The aging Baby Boomers, the large population born between 1946 and 1964, have had significant and broad economic, political, and social influence in the country at each stage of their lives. It will be important to consider the influence of the large aging Baby Boomer's population impacts on our limited resources (Fey, 2010; Pruncho, 2012). In 2011, the first of the Baby Boomers turned age 65. The size of the senior population is expected to grow over the next two decades: In 2012, 13.7% of the total U.S. population were 65 years of age or older. Projections suggest an increase to 20.3% by 2030 (Ortman, Velkoff & Hogan, 2014) due to both increases in longevity and a decline in fertility (Cherlin, 2010; Centers for Disease Control and Prevention, 2013; Ortman, Velkoff & Hogan, 2014). The demographic composition of the senior population is also changing in that it is more racially and ethnically diverse (Ortman, Velkoff & Hogan, 2014). Geographically, there is a graying of the Midwest, Appalachia, and Northeast due to the decline in migration to these areas and increasing senior population (Frey, 2010, 2015; Kent, Lee, & Mather, 2011). Seniors continue to be a large part of the Southern population.

The growing senior population requires a further look at how this group is affected by social problems, such as food insecurity[1]—defined by the USDA as "the state

[1] Food insecurity is often measured using the Core Food Security Module of the Current Population Survey. For households with children, the questionnaire includes eighteen household food security items. For households without children, there are ten household food security items. Each question is a food insecure behavior strategy or food insecure condition. Respondents answered in a dichotomous manner: either "yes," the household meets the condition or uses the behavior or "no," the household does not meet the condition or use the behavior. Households with zero yes answers are deemed to have high food security. One or two yes answers indicate marginal food security. Three or more yes answers indicate food insecurity. A household meets the criteria for "very low food security" with yes answers to three questions and yes answers to eating less than they felt they should and cutting meal size or skipping meals for three or more months.

of being without reliable access to a sufficient quantity of affordable, nutritious food" (2015)—which is associated with negative health effects (Olson, 1999; Stuff et al., 2004). Due to the high incidence of food insecurity among low-income families and children, most food security research has focused on children, mothers, and family. Therefore, there are gaps in the literature on food insecurity among seniors.

Food insecurity, however, is growing among seniors and affecting their way of life. For example, seniors below the poverty level often restrict food spending to have money for prescription drugs (Bengle, et al., 2010; Kushel et al., 2006; Lee & Frongillo, 2001; Piette, Heisler, & Wagner, 2004; Ziliak & Gundersen, 2014). In 2001, approximately 10% of seniors were marginally food insecure; by 2013, the percentage had risen to approximately 15% or 9.6 million seniors. From 2010 to 2013 alone, the proportion of seniors who were food insecure grew by almost 60%, from 5.5% to 8.7% (Ziliak & Gundersen, 2014). Furthermore, the demographic changes in race and ethnicity among seniors and states seniors live in correlate with higher risk of food insecurity. Blacks and Hispanics are two to three times more likely to be food insecure than Whites. Regionally, the South includes nine out of the ten states with the highest rates of food insecurity, though food insecurity is growing in other regions including the Midwest (Strickhouser, Wright & Donley, 2014). Many researchers, social service providers, and policymakers have looked at social programs and policy to reduce the risk of food insecurity.

Despite the growth in food insecurity among this population, seniors[2] continue to have the lowest take-up rates—rates of participation among eligible—of the

[2] The United States Department of Agriculture(USDA) defines "senior" as an individual 60 years or older (USDA, 2016)

Supplemental Nutrition Assistance Program (SNAP) compared to other age demographics; elderly take-up is 35% and non-elderly take-up is 76% (Cunnyngham, 2010; Eslami et al. 2012; Hoynes & Schanzenbach, 2015; USDA, 2015; Wu, 2009). Seniors have referenced the complex or lengthy application processes and difficulty determining whether they are eligible for a benefit as barriers to participation. Seniors often incorrectly believe they are only eligible for the minimum SNAP benefit (Haider, Schoeni, & Jacknowitz, 2002). Once they are enrolled, they have a slightly higher retention in the program compared to other age groups. This implies that the low take-up is due to low rates of initial participation in the program (Wu 2009). Exploring the lack of SNAP usage among seniors and identifying what demographic groups within eligible seniors are more likely to use SNAP is important to understanding how to implement more effective government services to this growing group. Examining take-up of seniors' use of social programs is a pressing issue; as the senior population in need of these programs grows, they have the potential to put pressure on resources, health services, and programs (Kent, Lee & Mather, 2011).

This paper seeks to answer two research questions: (1) How do demographic characteristics contribute to SNAP household participation among seniors? and (2) How do state characteristics contribute to SNAP household participation among seniors? I have currently found no formal evaluations of changes in demographic characteristics and state residency for seniors as a function of senior SNAP take-up rates. In this paper, I review the literature on the patterns of demographic characteristics and state of residence of seniors and explore how these changing characteristics relate to SNAP participation over time. I go on to review the current literature on SNAP take-up among seniors and

relate it to the broader literature on the changing composition of SNAP recipients over time. I then present an empirical analysis of how state characteristics and policies and demographic characteristics attribute to the change SNAP take-up rates from 2003 to 2013 among the senior population using nationally representative data from the Current Population Survey (CPS). I find that state characteristics have a larger role in the change in SNAP participation among seniors likely to be eligible over time than demographic characteristics. Specifically, state food policy accounts for roughly 50% of the growth in SNAP participation during the ten-year period. Additionally, I find that state economic conditions contributed to SNAP participation by dampening the growth of SNAP participation from 2003 to 2013.

## Background

### Supplemental Nutrition Assistance Program (SNAP) Eligibility for Seniors

SNAP provides in-kind monthly benefits for nutrition assistance to low-income households. SNAP continues to be the nation's largest domestic nutrition assistance program, with over 22 million households in the United States being served by the program in 2014 (USDA Food and Nutrition Service, 2015). As a federally supported entitlement program, administration of SNAP is carried out by the federal government under the USDA through the Food and Nutrition Service (FNS), but implemented at the state level. Federal rules specify that SNAP benefits are allocated at the household level.[3] SNAP eligibility is based on household income and economic resources or by categorical

[3] The USDA defines a household "as individuals who share a residential unit and customarily purchase and prepare food together" (USDA, 2015). Thus, when determining eligibility for a household, those who live together and purchase and prepare food together have their incomes along with other determinants of eligibility combined.

eligibility.[4] There are three tests that a household must meet to be eligible for benefits: the gross monthly income test, net income test, and the asset test.

Gross monthly income[5] is defined as the monthly income of a household before any program deductions are applied. The basic rule is that gross monthly income must be at or below 130% of the federal poverty line to qualify for SNAP benefits.[6] While gross income is considered as one of the tests to determine eligibility, those households with individuals who are seniors or disabled and those categorically eligible do not have to meet the gross monthly income test (USDA Food and Nutrition Service, 2014; USDA, 2015). Net income is defined as the income after the deductions are applied. To be program eligible, a household's net income must be at or below 100% of the federal poverty line for the household's size. There are several basic SNAP deductions that are the same across states.[7] When calculating the monthly net household income, seniors can deduct medical expense over $35.[8] Additionally, excess shelter costs, expenses like utilities that more than half the income after the other deductions, are capped at $517[9], except for households that include a senior who are not subject to this cap (USDA Food and Nutrition Service, 2015). The asset test generally refers to liquid assets when determining eligibility. To pass the asset test, households must have liquid assets of $2,250 or less. Households with a senior or disabled member must have liquid assets of $3,250 or less. Cash or money in a bank account, stocks, or other monies in accounts that

[4] Categorical eligibility is based on federal legislation that allows most households to be eligible for SNAP if they qualify or receive other types of public assistance.
[5] Gross monthly income includes all sources of earned income (amount of income received before payroll taxes are deducted), but does not include noncash income or in-kind benefits from programs like Medicare (USDA Food and Nutrition Service, 2015).
[6] While gross monthly income has a basic rule of at or below 130% of the federal poverty line, most states have adopted broad-based categorical eligibility requirements, which relax this requirement for many households.
[7] For example, the deduction of 20% of earned income and a standard deduction based on household size.
[8] Medical expenses include doctor or hospital bills, doctor approved prescriptions and over-the-counter medications, insurance premium costs, attendant care or nursing home care.
[9] Alaska, Hawaii, and Guam allow for a higher cap

can be easily turned into cash are countable resources at the federal level and across states. Other forms of resources or property such as business property or homes do not count as countable resources. Additionally, if households receive Temporary Assistance for Needy Families (TANF) or Social Security Income (SSI), these resources are not included as countable income. It is important to note that since 2008 many senior's retirement and pension plans are not included as countable resources (USDA Food and Nutrition Service, 2014; USDA, 2015). While gross monthly income[10], net income, and asset test are the main determinates of eligibility and benefits, the federal government does provide states with some flexibility in implementing their programs. This is to allow states to meet the needs of their low-income population policies and therefore implies that SNAP eligibility and benefit qualifications to not be consistent across states.

State waivers can directly impact access and participation in SNAP. State policies can vary regarding reporting methods available, reporting timing requirements, verification methods, recertification periods, and the status change threshold required for recipient reporting. State options, available through the Farm Bills of 2002 and 2008, work to either increase individuals' access (e.g. call centers) or make access more difficult for certain groups (e.g. finger-print analysis). Call centers are intended to increase the availability of services by reducing the need for applicants and recipients to take the time to visit offices for certain services. Additionally, to reduce barriers to participation and streamline delivery, states have the option of utilizing telephone interviews instead of requiring a face to face interview for certification (Castner, et al.., 2012; Dickert-Conlin, Fitzpatrick, & Tiehen, 2010; Hulsey, et.al, 2013; Rowe, 2010;

[10] Seniors are not subject to gross monthly income test.

Keefe, et al.., 2012; Rowe, 2010). States also have the option of using web based application and benefit tools to simplify the application and recertification process (Cody, Nogales, & Martin, 2008). On the other hand, there may be state policies that are barriers to access and, thus, add to the difficulty of applying for SNAP. For example, finger printing of SNAP applicants has been used by states to deter fraud, but research has also shown finger-print analysis can be a barrier to participation. For instance, this extra step adds to stigma associated with participation in the SNAP program. Additionally, it increases difficulty in applying for the program by adding a further step and more time to the process, as it requires visits to offices equipped with the technology (Bartlett, Burstein, & Hamilton, 2004).

**SNAP Participation and Individual Characteristics**

Empirical research on SNAP caseloads have examined macroeconomic conditions, individual household characteristics, as well as, national, state, and local policies and how they affect SNAP participation rates. Individual or household characteristics play an important role in the SNAP participation rates (Acs & Schwabish, 2011; Bhattarai, Duffy, & Raymond, 2005; Grieger & Danziger 2011; Gundersen & Oliveira, 2001; Rank & Hirschl, 2005). Over a third of those aged 20 and 29.7% of those aged 25 will at one point in their lives receive SNAP, and most often SNAP participation is a recurring event in the life course (Grieger & Danzinger, 2011).

Those with low education, households with children, and those who are food insecure are more likely to receive SNAP (Bartlett, et al., 2004; Daponte, 2000; Chaparro, Harrison, & Pebley, 2014; Gundersen & Oliveira,2001; Rank & Hirschl, 2005). Additionally, low-income racial minorities have a higher likelihood of SNAP

participation than low-income Whites (Martin et al., 2003; Purtell, Gershoff, & Aber, 2012). For example, Grieger and Danzinger (2011) estimate close to three times as many Blacks have received SNAP by age 62 as Whites. Research also shows that there is a relationship between SNAP participation and an individual household's participation in other assistance programs (Moffit, 2015). Bhattarai, Duffy, and Raymond (2005) examine characteristics of low-income households that utilized SNAP and food pantries and find, participation in other cash and noncash welfare programs, being a household with children that does not own a home, and shorter application processes all increase the likelihood of participating in SNAP. Finally, prime age adults who participate in SNAP often are members of working low-income households (Acs & Schwabish, 2011; Zedlewski & Rader, 2005).

**SNAP Participation and State Residency**

SNAP participation rates among eligible individuals vary greatly across states. For example, in 2013 Food and Nutrition Services reported state eligible participation rates as high as 100 percent in Maine, and 66 percent in California and Nevada (Food and Nutrition Services, 2016). Literature on SNAP participation that has focused on the effects of state policy implementation on SNAP participation rates has concluded that state program changes intended to remove barriers and the use of categorical eligibility have increased SNAP participation rates (Castner, O'Reilly, Conway, Bardos, & Sama-Miller, 2012; Dean, Pawling, & Rosenbaum, 2008; Hoynes & Schanzebach, 2015; US Food and Nutrition Service, 2010; Hulsey et al., 2013; Keefe et al. 2012; Rowe, 2010; Ziliak, 2013). For example, Currie et al. (2001) examines the roles of state economic characteristics and state policy implementation in the declines in SNAP participation

before welfare reform and shortly after The Personal Responsibility and Work Opportunity Restoration Act of 1996 (PRWORA). They found that state unemployment rates accounted for 20% of the SNAP participation decline, and that state implementation of TANF accounted for 30% of the decline in participation—with the greatest effect in large cities. To further parse out the role of state residency on SNAP participation, Ziliak (2013) uses linear probability modeling and simulations for analysis of the relative contributions of demographic characteristics, state economic characteristics, and state policy to SNAP participation. He finds that from 2000 to 2011 state economic conditions account for almost half of the increase in SNAP participation, and state food policies account for just over a third of the increase in participation. This paper closely follows the methodology used by Ziliak (2013).

**SNAP Participation and Seniors**

Literature focused on seniors and their SNAP participation tends to fall into three categories: measuring participation rates among seniors, participation rate differences by age categories among seniors, and senior SNAP participation rates are low (Cunnyngham, 2010; Eslami, Filion, & Strayer, 2011; Howden & Meyer, 2011; Hoynes & Schanzenbach, 2015; USDA, 2015). Research measuring senior participation rates has found that seniors consistently have low participation, and participation rates among seniors declines as they age (Cunnyngham, 2010; USDA, 2015). States that have a high proportion of eligible seniors living in rural areas have lower senior SNAP take-up rates than those states where more eligible seniors live in urban areas. States in the Northeast like Vermont and Massachusetts have senior SNAP take-up rates in the 60% range, while

states like Wyoming, Arkansas, and Kansas have senior SNAP take-up rates between 24% and 27%(Cunnyngham, 2010; Ziliak, Gundersen, & Haist, 2008; Ziliak, 2013).

Research on low participation rates among seniors has estimated the difference in SNAP participation by age categories and cohorts (Haider, Jacknowtiz, & Schoeni, 2003; Levy, 2008; Geiger, et al, 2014). Research has shown patterns of low take-up and participation in older birth cohorts as they age, which suggests this is not a new phenomenon (Levy, 2008). Even when controlling for misclassification of eligibility and behavioral considerations, such as stigma, food stamp participation declines with age (Haider, Jacknowtiz, & Schoeni, 2003). Research on barriers to SNAP participation among eligible seniors find seniors often cite complicated applications, stigma, costs associated with applying versus actual dollar benefit amounts, and the lack of knowledge of the program as reasons for not participating in the program (Blank & Ruggles, 1996; Daponte, Sanders, & Taylor, 1999; Gabor, Williams, Bellamy, and Hardison, 2002). Low participation rates among seniors has also been explained by low initial rate of adoption, individual lack of knowledge of eligibility, and food assistance from other programs supplementing need (Wu, 2009). Additionally, senior SNAP take-up is correlated with the proportion of the population that are seniors and state economic characteristics and policies (Cunnyngham, 2010). While there is empirical research examining senior SNAP participation, prior research focuses solely on calculating accurate rates of participation or uses small sample qualitative analysis to identify reasons seniors do not participate in SNAP; there is little research examining how observable characteristics contribute to changes in SNAP participation among seniors. This paper contributes to the literature by looking further into the low participation rates of seniors, I exploit the significant changes

in the senior population through the entry of those around the Baby Boomer generation into senior ages to examine what role observable individual demographic characteristics and state policies and state characteristics contribute to SNAP participation among seniors.

## Conceptual Framework

The demographic characteristics of the senior population have been changing over time. Both the rise in diversity among the senior population and the seniors' pattern of state residency can provide an opportunity to examine their differential use of the social program SNAP. Considering, the increases in the racial minorities and the proportions of elderly in certain states correlates with higher rates of food insecurity these characteristics would warrant more research. Given that seniors have lower rates of SNAP participation compared to other age groups and that their rates of food insecurity continue to grow, it is important to identify and examine what characteristics impact the likelihood of SNAP take-up among this population.

### Senior Demographic Shifts and Potential Effects on SNAP Take-up

With advances in medical care and improved quality of life each generation is living longer than their previous generation. Additionally, there is an increase in proportion of seniors in the population because of the declines in fertility. Those aged 85 and older are expected to grow in number from 5.5 million to 19 million from 2010 to 2030 (Olshansky et al., 2012; US Department of Health and Human Services Administration on Aging, 2014). The growing senior population is also changing in racial composition (Ortman & Velkoff, 2014). In 2010, non-Hispanic Whites made up 80% of adults aged 65 years or older, by 2030 that percent will decrease to 71.2% of the

population 65 and older. It is predicted that by 2050 non-Hispanic Whites will make up less than 60% of the population of older Americans—that's a 20% decrease in the portion of non-Hispanic Whites in about forty years. As the share of minorities among senior population increases, there could be a corresponding decline in the economic well-being of this group overall, particularly, if the lower socioeconomic status of Latinos and Blacks is carried into older ages. The racial and ethnic divergence between America's senior population and younger age groups may also create a new kind of generation gap (Centers for Disease Control and Prevention, 2013; Kent, Lee & Mather, 2011; Ortman, Velkoff & Hogan, 2014). The growth in the senior population and the changes in its composition are important in examining SNAP participation among seniors. There is a clear age gradient in SNAP participation among seniors. In 2009, older age categories had lower take-up rates among seniors. Seniors ages 60-64 had 34% take-up rate, those ages 65-69 had 33% take-up, seniors ages 70-74 had 29% take-up, those ages 75-79 had 30% take-up, and those older than 80 years of age had 28% take-up (Leftin, 2011). The demographic shift to a more diverse population is also related to the relationship between the rate of SNAP take-up and race. In 2009 the participation rate by eligible White non-Hispanic senior households was 25%. Conversely, eligible black non-Hispanics senior household participation was 41% and eligible participation by Hispanic senior households 47% (Leftin, 2011; Wu, 2009).

**State Residency and Potential Effects on SNAP Take-up**

The decline in migration among prime aged individuals and the general increase in the proportion of the population that is of senior age, has created a "graying" of certain areas in our country. This graying population shift is taking place, particularly in the

Midwest, Appalachia, and Northeastern states. The South continues to have large numbers of senior individuals. However, the recent movement of younger individuals to the South has offset some of the high proportion of seniors in the Southern region (Frey, 2010, 2015; Kent, Lee, & Mather, 2011). The state seniors live in plays an important role in SNAP uptake rates among the aging. The federal government provides states with some flexibility in implementing their programs by SNAP statutes, regulation, and waivers. Some of these state policies directly affect seniors. (1) Several states have an option called the Supplemental Security Income Combined Application Project (SSI-CAPS), which target seniors and those with disabilities. SSI-CAPS state programs often give seniors who receive SSI a static benefit amount based on whether they have high or low shelter expenses. States can subsequently combine their determination of SNAP benefit with that of the SSI benefit (USDA, Fact Sheet USDA Support for Older Americans, 0202.15, 2015). (2) In some states recipients are required to use the itemized amount of deductions. While, other states use a standard medical deduction amount. These variations in the way that medical deductions are calculated effect the senior's benefit amount and eligibility. (3) States also differ regarding categorical eligibility. It can be argued that the issue of categorical eligibility has limited impact on seniors, as they do not need to meet the gross monthly income test. Conversely, the removal of the asset test still applies to senior. However, it should be noted that seniors often have most of their assets in property or homes that are not considered in asset calculations (Center of Budget and Policy Priorities, 2013; Food and Nutrition Service, 2016). The flexibility between states can influence the take-up of SNAP among seniors. State variation is important because there are high concentrations of seniors in the South and a growing

population and higher proportions of seniors in the Midwest and Northeastern area. Additionally, some states give discretion to county and local offices to make decisions regarding information used to determine eligibility benefit allocation. This causes differences in the effective eligibility criteria within states, which contribute to participation differences within states. This may partially explain the lower participation rates among seniors in rural area versus seniors in urban areas (Food and Nutrition Service, 2016; Ziliak & Gundersen, 2013, 2014).

The rise in diversity and the changes in the state of residence of seniors over time can provide an opportunity to examine their use of social programs such as SNAP, and can allow practitioners to direct outreach to the specific issues that affect the take-up rates of seniors. This paper examines SNAP take-up among senior individuals over time exploring the role demographic characteristics and state residency play in determining the likelihood of taking up SNAP when eligible. My empirical analysis focuses on predictors of SNAP take-up from 2003 to 2013 for those over the age of 60 years.

## Methods

### Data

This paper examines the role demographic and state characteristics play in determining the likelihood of SNAP take-up among eligible seniors over time. I combine data from the Current Population Survey (CPS), the USDA Economic Research Services (ERS) SNAP Policy Database, and the University of Kentucky Center for Poverty (UKCPR) National Welfare Data. To collect individual level statistics, I use the CPS data from years 2003 to 2013. The CPS is a monthly nationally represented survey of about 60,000 households in the United States conducted by the United States Census Bureau.

Households are interviewed about activities in the prior weeks. A household enters the sample and is interviewed for four consecutive months. The household is then not interviewed for eight months. The household then returns to the sample and is interviewed for another four consecutive months.[11] The March CPS Supplement, often referred to as the Annual Social and Economic Supplement (ASEC), includes questions about annual income, employment, noncash benefits, and health insurance data for participants.

I supplement individual level data from the CPS with state level characteristics from the ERS SNAP Policy Database and the UKCPR National Welfare Data for 2003-2013. The ERS SNAP Policy Database provides State-level SNAP policies that relate to eligibility criteria, recertification, reporting, benefit issuance methods, availability of online applications, use of finger print requirements, and coordination with other assistance programs (Economic Research Service, U.S. Department of Agriculture, 2016). The UKCPR National Welfare Data, a publicly available state level panel data covering population, employment, unemployment, welfare, poverty, and politics is also used (University of Kentucky Center for Poverty Research, 2015).

**Measures**

This study focuses on standard individual demographic characteristics (age, gender, race, education, marital status, employment status, household size, the presence of children, and region). Age is included as a series categorical dummy variable identifying ages 60 to 64, ages 65 to 69, ages 70 to 74, ages 75 to 79, ages 80 and older. Four dummy race variables are included: 1) individuals who answer yes to Hispanic

[11] For analysis, I do not keep multiple observations from the same house to avoid double counting in estimation. If there are multiple observations I use the first observation only.

ethnicity are coded as Hispanic; 2) individuals are assigned to White if they identify as White in the race question and not Hispanic in the ethnicity question; 3) individuals are assigned as black if they identify as black in the race question and not Hispanic in the ethnicity question; and 4) individuals are categorized as "other race" if they identify as American Indian or Eskimo, Asian or Pacific Islander, or other race who do not identify as Hispanic. Four levels of education are identified with dummy variables for those who receive less than high school diploma, those who have received a high school diploma or a GED, those with some college but who have not received a four-year college degree, and those who have completed four years of college or more. For marital status, I code married, widowed, divorced, separated, and never married.[12] Employment status is coded to identify the employed, unemployed, and those who are not in the labor market. I create a dummy variable for the presence of a child under 18 in the home. I also include a variable for household size. Finally, household income is included, which is adjusted for inflation[13].

For state-based characteristics, I use variables from the UKCPR Welfare Data and the ERS Policy Database. To capture state non-food policy characteristics, the state minimum wage adjusted for inflation[14] and the state EITC (earned income tax credit) subsidy rate as a percentage of the federal phase-in rate are included. The EITC subsidy rate is expected to incentivize people to join the work force as it rises, thus having a negative correlation with SNAP participation (Williams & Johnson 2011; Ziliak, 2013). Additionally, to address economic conditions, previous year state unemployment

[12] I differentiate divorced and separated due to the potential for a stronger financial commitment for those separated but not divorced.
[13] Adjusted for inflation to buying power in 2013

rate and two years lags prior state unemployment rate are included in keeping with prior literature (Ziliak, 2013). Finally, state median adjusted income is included to further capture state economic conditions.

States have differing SNAP benefit implementation policies, which potentially influence SNAP take-up rates depending on what state one lives. Thus, included are measures for state's maximum SNAP benefit amount for a family of four, if states have simplified reporting, and the sum of the dollar amount of Federal, State, and grants spending for SNAP outreach. Additionally, modernization policies intended to reduce barriers to participation including the use of call centers, phone interviews in lieu of in-person interviews, and online applications are variables utilized. One policy that increases barriers to SNAP, finger-print requirement, is included. Finger-print and modernization variables are coded based on whether the policies implemented statewide, regionally (partial implementation in certain regions or counties in a state) or not at all. Also, included are variables for state food policy that are unique to seniors, including: if states have a Combined Application Project (CAP) and the proportion of senior SNAP households with 13 or more-month recertification periods.

**Analytic Sample and Procedures**

*Table 1* shows weighted[14] descriptive statistics for all those in the sample over the age of 60 and for the analytic sample, those most likely to be SNAP eligible based on income. For the sample of those over the age of 60, the sample size is N=209,118 represented an adjusted population size of 36,584,669. SNAP eligibility for those over the age of 60 differs from standard eligibility criteria in that seniors that have different

[14] CPS Annual Social and Economic Supplement household weights are used in descriptive statistics, because SNAP is a benefit giving at the household level and household income is used for analysis.

asset limits and do not need to meet the gross income tests. Seniors are required to pass the net income test, but not the gross income test. Additionally, seniors and the disabled are subject to asset limits of $1,000 higher than other households. The CPS does not contain data allowing for the calculation of assets. Additionally, since seniors are not required to meet the gross income test, limiting the sample to eligible seniors cannot be done by restricting the sample to those at or below 130% of the federal poverty line. This paper seeks to analyze the extent to which demographic characteristics and state of residence are predictors of whether seniors who are eligible for SNAP choose to participate in the program. Therefore, in this paper to limit the analysis sample to those seniors most likely to be eligible for SNAP an individual must have (1) been identified by the CPS as a reference person, (2) been 60 or older at the time they answer the March CPS (3) and have a gross income below 185% of the federal poverty level. The sample is limited to those identified as the reference person because in CPS interview methodologies the reference person is typically the head of household (owner or renting of home) and SNAP benefits are given at the household level. SNAP rules for seniors apply to individuals 60 and older thus the sample is limited to this demographic. Finally, since the CPS does not contain measures that allow for the identification of net income or assets, seniors' income is limited to below 185% of the federal poverty level. The analytic sample size is then N=66,578 representing a population size of 11,020,854 seniors aged 60 and older.

Table 1. Summary Statistics Comparison of Full Sample and Analytic Sample, CPS-ASEC 2003-2013

| | Full Sample Ages 60+ | Analytic Sample Ages 60+ >185% FPL | Full - Analytic | |
|---|---|---|---|---|
| | Mean | Mean | Diff | Sig |
| SNAP Participation | 5.40% | 14.00% | 8.60% | *** |
| Demographics | | | | |
| Age 60-64 | 26.70% | 21.30% | -5.40% | *** |
| Age 65-69 | 21.10% | 18.30% | -2.80% | *** |
| Age 70-74 | 16.70% | 17.40% | 0.80% | *** |
| Age 75-79 | 14.70% | 16.90% | 2.20% | *** |
| Age 80+ | 20.80% | 26.10% | 5.30% | *** |
| Female | 51.70% | 61.70% | 10.00% | *** |
| Black | 9.40% | 14.50% | 5.10% | *** |
| White | 80.60% | 70.70% | -9.90% | *** |
| Hispanic | 6.10% | 10.20% | 4.10% | *** |
| Other | 3.90% | 4.60% | 0.70% | *** |
| Less than High School | 19.50% | 36.80% | 17.30% | *** |
| High School or GED | 33.50% | 37.20% | 3.70% | *** |
| Some College | 22.70% | 17.90% | -4.80% | *** |
| College | 24.20% | 8.00% | -16.20% | *** |
| Married | 47.90% | 32.10% | -15.80% | *** |
| Widowed | 29.80% | 39.90% | 10.10% | *** |
| Divorced | 14.70% | 17.90% | 3.20% | *** |
| Separated | 1.60% | 2.70% | 1.00% | *** |
| Never Married | 5.90% | 7.40% | 1.40% | *** |
| Child(ren) in the home | 5.00% | 7.20% | 2.20% | *** |
| Household Size | 1.79 | 1.704 | -0.09 | *** |
| Employed | 25.50% | 12.20% | -13.30% | *** |
| Unemployed | 1.50% | 1.70% | 0.20% | *** |
| Not in Labor Market | 73.10% | 86.10% | 13.10% | *** |
| Household Income | $47,229 | $15,418 | -$31,811.0 | *** |
| Geography | | | | |
| Metropolitan | 80.00% | 74.30% | -5.60% | *** |
| Northeast | 19.90% | 19.20% | -0.70% | *** |
| Midwest | 22.90% | 22.50% | -0.50% | *** |
| South | 36.80% | 40.00% | 3.20% | *** |
| West | 20.40% | 18.40% | -2.00% | *** |
| Economy | | | | |
| Unemployment Rate | 6.9 | 7 | 0.1 | *** |
| Unemployment Rate (t-1) | 6.8 | 6.9 | 0.2 | *** |
| Unemployment Rate (t-2) | 6.5 | 6.6 | 0.1 | *** |
| Median Income ($1000) | $43,429 | $42,836 | -$593 | *** |
| Nonfood Policy | | | | |
| Min. Wage (State) | $7.35 | $7.31 | -$0.04 | *** |
| EITC Subsidy Rate | 6.2 | 6.8 | 0.6 | *** |
| Food Policy | | | | |
| Max SNAP Benefit Amount | $577 | $581 | $3 | *** |
| Call Centers Full | 32.60% | 33.00% | 0.40% | ** |
| Call Centers Partial | 24.10% | 22.60% | -1.50% | *** |
| Combined Application Project | 40.40% | 41.40% | 1.00% | *** |
| Phone Initial Interview Full | 36.00% | 37.70% | 1.60% | *** |
| Phone Initial Interview Partial | 4.80% | 4.70% | -0.10% | ** |
| Simplified Reporting | 85.50% | 86.00% | 0.50% | |
| Online Application Full | 44.60% | 45.10% | 0.50% | *** |
| Online Application Partial | 8.80% | 8.00% | -0.90% | ** |
| Fingerprint Full | 18.30% | 17.30% | -1.00% | |
| Fingerprint Partial | 3.40% | 3.50% | 0.10% | ** |
| Proportion of Elderly SNAP units with 13+ months Recertification Periods | 39.60% | 40.10% | 0.50% | *** |
| Outreach ($100,000) | $127 | $128 | $1 | *** |
| Politics | | | | |
| Governor is Democrat | 50.50% | 49.70% | -0.80% | *** |
| Observations | 209,118 | 66,578 | -142,540 | |
| Population Size | 36,584,669 | 11,020,854 | -25,563,815 | |

FPL=Federal Poverty Level

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

All dollar amounts adjusted for inflation set at 2013 levels

Household weights used in descriptive statistics

Using *Table* 1 to compare the analytic sample to the overall sample, we see that the analytic sample includes an 8.4% higher rate of SNAP participation than the sample of all individuals 60 and older. Additionally, the analytic sample is comprised of older individuals and more females than the 60 and older sample. The analytic sample is less White, less educated, and has fewer married individuals and more widowed, divorced, separated, and never married individuals. Furthermore, the analytic sample is made up of fewer employed individuals, and more individuals not in the labor market than the total sample. The analytic sample has a significant difference in the average household income, with an average household income close to $32,000 less than the overall sample. More individuals in the analytics sample live in the South than in the full sample. The differences in characteristics between the analytic sample and sample of all seniors is consistent with the characteristics of those with lower household incomes and seniors in poverty, where senior women, racial minorities, and those not married are at higher risk of poverty (Anzick & Weaver, 2001; Engelhadt & Gruber, 2004; Munnell, 2004; Reno & Veghte, 2010). Given the literature on characteristics of food insecurity, the analytic sample (less White and less educated) is selected to be food insecure and as the literature suggest selected to be eligible for SNAP.

**Analytical Approach**

I use a simple probit model to look at the effect of demographic and state characteristics on SNAP take-up among seniors. I use descriptive statistics to show trends in demographic characteristics and the state of residence of seniors from 2003 to 2013. The aim of my probit regressions is to identify demographic characteristics and state

characteristics as predictors of senior SNAP participation. The empirical equation 1 for the probit regression is as follows:

**(Equation)** $SNAP_{ijt} = \alpha + X_{ijt}\beta_1 + Z_{ijt}\beta_2 + G_{ijt}\beta_3 + F_{ijt}\beta_4 + \varphi_t + \varepsilon_{ijt}$

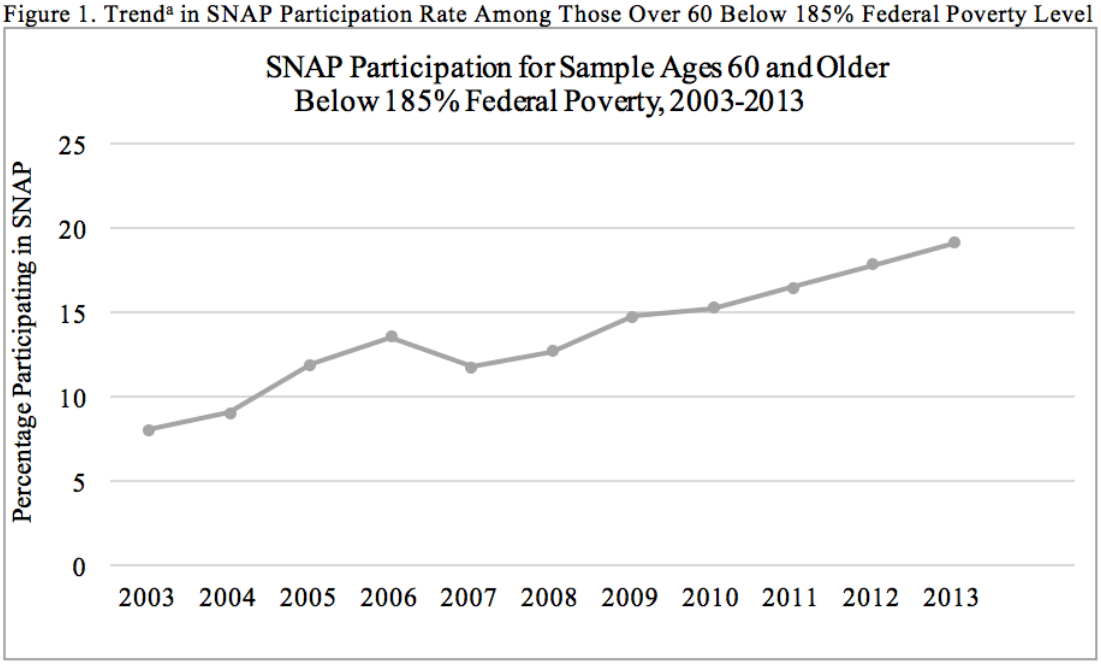
Where $SNAP_{ijt}$ is a dummy variable identifying those receiving SNAP for any senior individual in household *i*, in state *j*, and time *t*, $X_{ijt}$ is a set of indicators for individual and household demographic characteristics at time *t*, $Z_{ijt}$ is a set of indicators for state by year economic variables, $G_{ijt}$ is a set of indicators for state by year non-food policy variables, $F_{ijt}$ is a set of indicators for state by year food policy variables, $\varphi_t$is a set of dummy variables for each year, and $\varepsilon_{ijt}$ is a random error term. While I do use year fixed effects, I do not include state fixed effects, given that the state characteristics are captured in the state based variables. The probit model is weighted using the CPS supplement household weights, given SNAP participation is a household variable and the sample is limited to heads of household. Following an interpretation of the marginal effects of the probit regression, I use the probit model to run a series of counterfactual simulations. I interpret these simulations to summarize the contribution of demographic characteristics, state economic characteristics, and state non-food and food policies, on changes in SNAP participation among seniors from 2003 to 2013.

## Results

### Descriptive Statistics

*Figure 1* shows the pattern of growth in SNAP participation among the analytic sample. There is a steady increase from 2003 to 2013. The steepest increases occur from years 2004 to 2005 (+2.87%) and 208 to 2009 (+2.07%). These steeper increases around 2009 could be the effect of the recession impacting this population, creating more economic burden and less resources.

Figure 1. Trend[a] in SNAP Participation Rate Among Those Over 60 Below 185% Federal Poverty Level




a. SNAP trend descriptive statistics weighted with household weights

*Table 2* shows the change in the demographic characteristics for the weighted analytic sample[15], 60 and older who are below 185% of the federal poverty level, and for those in the analytic sample who are SNAP recipients over the period 2003 to 2013. In 2003, the participation rate was 8.1% for seniors below 185% of the federal poverty

[15] CPS Annual Social and Economic Supplement household weights are used in descriptive statistics.

level, and as shown in *Table 2* there is a statistically significant increase to 19.2% in 2013.

Table 2. Change in Composition of Demographic and Geographic Characteritsics from 2003 to 2013

| | Ages 60+ Below 185% FPL | | | | SNAP Recipients Ages 60+ Below 185% FPL | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean 2003 | Mean 2013 | Δ Change 2013-2003 | Sig | Mean 2003 | Mean 2013 | Δ Change 2013-2003 | Sig |
| SNAP | 8.10% | 19.20% | 11.20% | *** | | | | |
| Demographics | | | | | | | | |
| Age 60-64 | 19.40% | 23.30% | 3.90% | *** | 23.90% | 32.70% | 8.80% | *** |
| Age 65-69 | 17.20% | 19.40% | 2.20% | ** | 19.60% | 23.30% | 3.70% | |
| Age 70-74 | 19.30% | 17.40% | -1.90% | * | 23.80% | 17.40% | -6.40% | ** |
| Age 75-79 | 19.00% | 14.80% | -4.10% | *** | 18.40% | 11.30% | -7.10% | *** |
| Age 80+ | 25.20% | 25.00% | -0.20% | | 14.30% | 15.20% | 0.90% | |
| Female | 59.60% | 60.90% | 1.30% | | 70.00% | 66.20% | -3.80% | |
| Black | 12.40% | 15.50% | 3.10% | *** | 22.30% | 22.50% | 0.20% | |
| White | 76.10% | 67.80% | -8.30% | *** | 55.70% | 54.40% | -1.30% | |
| Hispanic | 8.30% | 11.90% | 3.60% | *** | 17.20% | 17.80% | 0.60% | |
| Other | 3.30% | 4.80% | 1.60% | *** | 4.80% | 5.20% | 0.50% | |
| Less than High School | 41.00% | 30.70% | -10.40% | *** | 61.50% | 43.90% | -17.60% | *** |
| High School or GED | 37.20% | 37.80% | 0.60% | | 21.50% | 28.70% | 7.20% | *** |
| Some College | 15.10% | 21.80% | 6.70% | *** | 11.20% | 19.70% | 8.50% | *** |
| College | 6.60% | 9.70% | 3.10% | *** | 5.80% | 7.70% | 1.90% | |
| Married | 34.20% | 32.70% | -1.50% | | 19.80% | 21.50% | 1.70% | |
| Widowed | 42.50% | 35.00% | -7.50% | *** | 40.20% | 31.10% | -9.00% | *** |
| Divorced | 15.00% | 20.60% | 5.60% | *** | 24.00% | 29.50% | 5.50% | *** |
| Separated | 2.50% | 2.90% | 0.40% | | 7.00% | 4.80% | -2.10% | *** |
| Never Married | 5.90% | 8.90% | 3.00% | *** | 9.10% | 13.10% | 4.00% | |
| Child(ren) in the home | 6.20% | 7.80% | 1.60% | *** | 15.90% | 13.60% | -2.40% | |
| Household Size | 1.662 | 1.787 | 0.126 | *** | 1.847 | 1.926 | 0.078 | |
| Employed | 12.10% | 13.30% | 1.20% | | 4.80% | 9.30% | 4.50% | *** |
| Unemployed | 1.40% | 2.40% | 1.00% | *** | 0.90% | 2.90% | 2.00% | ** |
| Not in Labor Market | 86.50% | 84.30% | -2.20% | *** | 94.30% | 87.80% | -6.50% | *** |
| Household Income | $14,534 | 15,856 | 1,322 | *** | $9,123 | $13,849 | $4,726 | *** |
| Geography | | | | | | | | |
| Metropolitan | 71.50% | 77.40% | 5.90% | *** | 69.60% | 78.20% | 8.50% | *** |
| Northeast | 20.70% | 18.60% | -2.20% | *** | 25.60% | 26.30% | 0.70% | |
| Midwest | 22.60% | 21.70% | -0.90% | *** | 20.00% | 21.30% | 1.30% | |
| South | 39.10% | 40.20% | 1.10% | *** | 41.70% | 38.10% | -3.50% | * |
| West | 17.60% | 19.60% | 2.00% | *** | 12.70% | 14.20% | 1.60% | |
| Observations | 6,401 | 6,914 | 513 | | 594 | 1,418 | 824 | |
| Population Size | 10,056,181 | 12,142,737 | 2,086,556 | | 810,574 | 2,244,030 | 1,433,456 | |

FPL=Federal Poverty Level

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

All dollar amounts adjusted for inflation set at 2013 levels

Household weights used in descriptive statistics

When focusing on demographic changes for the analytic sample and the subsample of SNAP recipients we see in the first two columns of *Table 2* in 2003, those aged 60-64 made up 19.4% of the analytic sample, while those aged 65 to 69 were 17.2%, individuals aged 70 to 74 were 19.3%, those aged 75 to 79 comprised 19%, and those over the age of 80 made up 25.2% of the analytic sample. By 2013, there was a statistically significant increase in the size of the two youngest age groups. This reflects a pattern the literature has described as the beginning of the Baby Boomers population their entering later stages of life and their crowding out of later age groups because of the sheer size of the generation.

The trends in demographic and state characteristics for those in the analytic sample who receive SNAP follow some of the same trends of the total analytic sample, with some significant exceptions (such as differences in geographic distribution). There is a general increase in the percentage of the population that is age 60 to 64. Table 2 shows there was a statistically significant decline in the percent of SNAP recipients who were between the ages of 70 to 74 (-6.4%) and those ages 75 to 79 (-7.1%). The sample of all seniors below 185% of the federal poverty level also had declines, but at lower magnitudes, of age groups 70 to 74 and 75 to 79 of 1.9% and 4.1% respectively. This shows that over time recipients are becoming younger than those who do not take uptake-up SNAP.

Looking at the changes in racial make-up of the analytic sample, *Table 2* shows a statistically significant decline in the proportion of Whites in this demographic group from 2003 to 2013, and a growth in Hispanics. In 2003, 76.1% of the analytic sample was White, and by 2013 this percent declined to 67.8%. This decline is mostly

replaced with Hispanics in this analytic sample. In 2003, Hispanics made up 8.3% of the analytic sample and by 2013, Hispanics made up 11.9% of the analytic sample. There is a small increase in the proportions that identify as other (any race other than Hispanic, White, or Black) from 2003 to 2013 (3.3% and 4.8% respectively). The subsample receiving SNAP is proportionally less White than the analytic sample overall, but there are no statistically significant changes in the racial and ethnic makeup from 2003 to 2013.

*Table 2* shows there was a decrease in the proportion of the sample with less than a high school degree for the analytic sample (-10.4%) and for the SNAP recipients in the sample (-17.6%) from 2003 to 2013. Over time the proportion with less than high school degree makes up consistently the largest education attainment group of SNAP recipients. This is consistent with the literature on education and SNAP participation, that SNAP participants tend to have lower education.

In *Table 2* we see from 2003 to 2013 there is a small decline in the percent of those not in the labor from 86.5% to 84.3%, and a small increase in those unemployed from 1.4% to 2.4%. Household income increased from $14,534 in 2003 to $15,856 in 2013. *Table 2* also presents the geographic distribution of those 60 and older with income below 185% of the federal poverty level. *Table 2* shows that in 2003, 39.1% of the analytic sample is in the South and in 2013, 40.2% live in the south. Over time there is statistically significant growth in the proportion of this analytic sample that lives in the West, increasing by 2% from 2003 to 2013. Finally, there is a nearly 1% decline in the proportion of those in the analytic sample living in the Midwest from 2003 to 2013.

Those in the sample who receive SNAP have more pronounced changes in labor market status and income from 2003 to 2013. For those who receive SNAP there was a

6.5% decrease in those not in the labor market from 2003 to 2013, and a 2% and 4.5% growth in unemployed and employed, respectively. Household income decreased by nearly $4,700. While the sample of all under 185% of federal poverty had these same patters in employment status and household income, the changes for those who receive SNAP were larger. Additionally, *Table 2* shows that the highest proportion of SNAP recipients reside in the South. However, there was a statistically significant decrease in the percent of the SNAP recipients who live in the South from 2003 to 2013.

**Probit Model Estimation**

*Table 3* shows the marginal effects for this probit model for the analytic sample which is restricted to seniors below 185% of the federal poverty level. From 2004 to 2014 there was a growing trend of a greater proportion of SNAP participants among seniors under of the federal poverty level and that pattern continues as the negative association with age continues to decrease with each younger age category. Those 80 and older are just 10.3 percentage points less likely to participate in SNAP relative to those ages 60 to 64. For those ages 75 to 79, they are 6.5 percentage points less likely to participate in SNAP relative to those ages 60 to 64. This is consistent with previous literature that shows younger seniors are more likely to use SNAP. Women age 60 and older and below 185% of the federal poverty level are 2.2 percentage points more likely to participate in SNAP.

Table 3. Marginal Effects of Demographics and Geography on SNAP Participation Among Those 60+ Below 185% Federal Poverty Level

| | | dy/dx | Sig | SE |
|---|---|---|---|---|
| Demographics Characteristics | | | | |
| Age | | | | |
| | Age 60-64 | | | |
| | Age 65-69 | -0.0265 | *** | 0.0043 |
| | Age 70-74 | -0.0457 | *** | 0.0045 |
| | Age 75-79 | -0.0652 | *** | 0.0048 |
| | Age 80+ | -0.103 | *** | 0.0047 |
| Gender | | | | |
| | Female | 0.0215 | *** | 0.0032 |
| Race/Ethnicity | | | | |
| | Black | 0.0541 | *** | 0.0036 |
| | White | | | |
| | Hispanic | 0.0706 | *** | 0.0046 |
| | Other | 0.0452 | *** | 0.0062 |
| Education | | | | |
| | Less than High School | | | |
| | High School or GED | -0.0557 | *** | 0.0034 |
| | Some College | -0.0519 | *** | 0.0042 |
| | College | -0.0652 | *** | 0.0063 |
| Marital Status | | | | |
| | Married | -0.0914 | *** | 0.0058 |
| | Widowed | -0.0279 | *** | 0.0053 |
| | Divorced | 0.0246 | *** | 0.0055 |
| | Separated | 0.0256 | *** | 0.0083 |
| | Never Married | | | |
| Employment Status | | | | |
| | Employed | -0.0655 | *** | 0.0111 |
| | Unemployed | | | |
| | Not in Labor Market | 0.0308 | *** | 0.0104 |
| Household | | | | |
| | Household Size | 0.0502 | *** | 0.0021 |
| | Child(ren) in the home | 0.0502 | *** | 0.0066 |
| | Household Income ($1000) | -0.0079 | *** | 0.0002 |
| Geography | | | | |
| | Nonmetropolitan | 0.0069 | ** | 0.0034 |
| | Northeast | | | |
| | Midwest | -0.0212 | *** | 0.0055 |
| | South | -0.0474 | *** | 0.0055 |
| | West | -0.0494 | *** | 0.0069 |
| State Economy | | | | |
| | Unemployment Rate | -0.0036 | | 0.003 |
| | Unemployment Rate (t-1) | 0.0063 | | 0.0044 |
| | Unemployment Rate (t-2) | -0.0037 | | 0.0031 |
| | Median Income ($1000) | -0.0037 | *** | 0.0004 |
| State Nonfood Policy | | | | |
| | Min. Wage (State) | 0.0119 | *** | 0.0023 |
| | EITC Subsidy Rate | 0.108 | *** | 0.0173 |
| State Food Policy | | | | |
| | Max SNAP Benefit Amount for Family of Four ($100) | 0.0002 | *** | 0.00000 |
| | Call Centers Full | 0.0136 | *** | 0.0042 |
| | Call Centers Partial | 0.0147 | *** | 0.0044 |
| | No Call Centers | | | |
| | Combined Application Project | 0.0105 | *** | 0.0038 |
| | Phone Initial Interview Full | 0.0251 | *** | 0.0054 |
| | Phone Initial Interview Partial | -0.0528 | *** | 0.0144 |
| | No Phone Initial Interview | | | |
| | Simplified Reporting | 0.0471 | *** | 0.006 |
| | Online Application Full | 0.0079 | * | 0.0042 |
| | Online Application Partial | 0.008 | | 0.0072 |
| | No Online Application | | | |
| | Fingerprint Full | -0.0177 | *** | 0.0055 |
| | Fingerprint Partial | 0.009 | | 0.0101 |
| | No Fingerprint | | | |
| | Proportion of Elderly SNAP units with 13+ months Recertification Periods | 0.0004 | | 0.0052 |
| | Outreach ($100,000) | 0.00002 | ** | 0.00001 |
| State Politics | | | | |
| | Governor is Democrat | 0.011 | *** | 0.0033 |
| Observations | | | 64,936 | |
| Population size | | | 11,020,854 | |

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

All dollar amounts adjusted for inflation set at 2013 levels

Model includes year dummy variables

Household weights used in analysis

There is a clear education gradient to SNAP participation; seniors with more education are less likely to participate in SNAP. Seniors who have a high school degree or GED are 5.6 percentage points less likely to participate in SNAP than those with less than high school education. Those with some college are 5.2 percentage points less likely to participate in SNAP. Finally, those with a college degree or higher are 6.5 percentage points less likely to participate in SNAP than those who have less than high school education.

Those with children in the home are 5 percentage points more likely to participate in SNAP. Additionally, as household size increases with every added person there is a 5 percentage point increase in the probability of participating in SNAP. Seniors who are employed are 6.6 percentage points less likely to participate in SNAP than those who are unemployed. Those not in the labor force are more likely to participate than those who are unemployed. Additionally, for every dollar increase in household income households are 7.9 percentage points less likely to participate in SNAP.

Moving to examining the role of location, we see seniors living in non-metropolitan areas are more likely to participate in SNAP than those who live in metropolitan areas. Those living in the Midwest are 2 percentage points less likely to participate in SNAP than those in the Northeast while, those residing in the South and West are 4.7 percentage points and 4.9 percentage points, respectively, less likely to participate in SNAP relative to those in the Northeast.

State characteristics show a relationship to SNAP participation among those 60 and older. While each of the unemployment rate variables shows no marginal effect, state median income has a negative relationship with SNAP participation. State EITC rate has

positive relationship, where increase in state EITC rate increases the likelihood of SNAP participation. The finding of a positive relationship between EITC rate and SNAP participation contrasts with previous literature which has shown that expansion of EITC coincides with many low-income individuals entering the labor force and getting off SNAP (Meyer & Rosenbaum, 2001; Ziliak, 2013). The research on the inverse relationship between ETIC and SNAP participation has primarily seen this relationship among single mothers (Meyer & Rosenbaum, 2001). Seniors, however, have different labor market behaviors than prime aged individuals, which might explain why EITC does not show a negative relationship with SNAP participation when looking at seniors. Finally, for every one-dollar increase in state minimum wage there is a 3.7 percentage point decrease in likely senior SNAP participation.

Turning to the state food policy variables, there is a positive relationship between the average state benefit level and SNAP participation: For every one-dollar increase in average state SNAP benefit level for a family of four there is a 0.02 percentage point increase in the probability of SNAP participation. Living in a state with call centers implemented across their whole state makes one 1.4 percentage points more likely to participation in SNAP relative to states with no call centers. Partial implementation of call centers has a 1.5 percent point increase in being likely to SNAP participation. Similarly, CAPs increase the probability of SNAP participation at the state level by 1.1 percentage points. States with waivers of the face-to-face initial interview have 2.5 percentage points higher levels of SNAP participation however, states with partial implementation of the waiver statewide have a negative marginal effect on participation. Simplified reporting increases the probability of SNAP participation by 4.7

percentage points. Online applications implemented across the full state increase the probability of SNAP participation. The finger-print requirement reduces participation by 1.8 percentage points. Additionally, for every dollar increase in state outreach funds there is a 2 percentage point increase the probability of participation in SNAP. Finally, states having a Democratic Governor increase the probability of SNAP participation by 1.1 percentage points.

**Counterfactual Simulations**

In this section, I use the probit model estimation from *Table 3* to look at what percentage of the overall increase in SNAP participation from 2003 to 2013 among seniors below the 185% federal poverty level is attributed to changes in demographic characteristics, State economic characteristics, State non-food policy, and State food policy are separate from each other over time. To do this, I group variables that fit into each of these categories (demographic characteristics, State economic characteristics, State non-food policy, and State food policy) and fix one group at a time at the values at their 2003 levels while allowing the remaining variables to change over time.

To assess the contribution of changing demographics of the senior population as more people begin entering older age from on the growth in SNAP participation from 2003 to 2013, I fix the demographic variables (race, age category, gender, employment status, marital status, household size, presence of children in the home, and education) at their 2003 levels, and allow variables in State economic characteristics, such as both State non-food and food policy to change over time. From 2003 to 2013 SNAP participation among seniors below 185% of the federal poverty level increased by 11.23% as shown in *Table 2*. Looking at *Table 4* when the demographic variables are

fixed it is predicted that SNAP participation would have increased by 10.15%. This shows that changes in demographic characteristics account for 10.33% or $= 100\times\left(1-\frac{10.07}{11.23}\right)$ of the change in SNAP participation from 2003 to 2013. Changing demographic characteristics explains roughly 10% of the portion of the change in SNAP participation during the 10-year span, as the simulated growth is reduced by just over 1%. While this includes all the demographic characteristics shifting together, age and race are most prominent. Thus, the growth over time in minorities in the sample, a group that is more likely to participate, could explain this change.

Table 4. Counterfactual Simulations of Contributions to Growth of Senior SNAP Participation Among Those under 185% of Federal

Calendar Years 2003-2013

| Actual Change | Demographic Characteristics Fixed at 2003 Levels | | State Economy Fixed at 2003 Levels | | State Non-food Policy Fixed at 2003 Levels | | State Food Policy Fixed at 2003 Levels | |
|---|---|---|---|---|---|---|---|---|
| | Predicted Change | Share due to Demographic Characteristics | Predicted Change | Share due to State Economy | Predicted Change | Share due to State Non-food Policy | Predicted Change | Share due to State Food Policy |
| 11.23 | 10.07 | 10.33 | 11.28 | -0.45 | 9.69 | 13.71 | 6.09 | 45.77 |

All dollar amounts adjusted for inflation set at 2013 levels
Simulation models include year dummy variables
Household weights used in analysis

To isolate the contribution of state economic characteristics (unemployment rate, both one and two-year lagged and state median income) on the growth in senior SNAP participation, State economic characteristics were set at the 2003 level, and demographic characteristics, state non-food and food policy allowed to change over time. As *Table 4*, shows the predicted value was 11.28%; State economic characteristics created -0.45% reductions in the simulated SNAP participation when compared to the actual change of 11.23%. 2003 had lower state unemployment rates, including the two lagged unemployment rates than 2013, but 2003 also saw lower state median income (state median income was $32,720 in 2003 and $44,719 in 2013[16]). While the lower

[16] Adjusted for inflation at 2013 dollar values

unemployment rates would suggest lower participation, an increase in median income would suggest decreases in participation. The negative number suggests the changes in state economies have a dampening impact on SNAP participation growth during this time, but the magnitude is not very large.

State non-food policy makes up a greater portion of change than demographic characteristics, but not more than state economic policies. To isolate the contribution of state non-food policies (minimum wage and EITC subsidy rate) on the growth in SNAP participation for likely eligible seniors from 2003 to 2013, state non-food policies were set at the 2003 level and demographic characteristics, state economic characteristics, and state food policy could change over time. When we hold state non-food policy at the 2003 levels the predicted change in SNAP participation is 9.69%; thus, state non-food policies make up 13.71% of the increase in SNAP participation. State minimum wage increased from $5.48 in 2003 to $7.46 in2013. EITC and minimum wage rates are labor policy levers that can increase labor market participation and literature suggest those participating in the labor market (often the working poor) are more likely to be SNAP participants.

State food policies make up the largest contribution to the change in SNAP participation among the elderly. To isolate state food policies (maximum SNAP benefit amount, the availability of call centers, combined application projects, availability of phone interviews in lieu of face to face for initial interviews, the use of online applications, finger-print requirements for, proportion of senior SNAP units with recertification periods for longer than 12 months, and outreach dollars) contribution on growth in SNAP participation, state non-food policies were set at the 2003 level and

demographic characteristics, state economic characteristics, and state non-food policy were allowed to change over time. When holding state food policies at the 2003 levels the predicted change is 6.04%. Thus, state food policies account for 45.77% of the increase in SNAP participation from 2003 to 2013. *Table 5* shows changes in policies from 2003 to 2013. Policy changes from 2003 to 2013 were mostly policies that reduce barriers to SNAP for the general population. Specific to seniors there is an increase in CAPS and longer recertification periods for seniors.

Table 5. Number of States Implementing Food Policies and Averages for SNAP Spending Across States in 2003 and 2013

| | Number of States Implementing Food Policies and Average SNAP Spending Across States | |
|---|---|---|
| | March 2003 | March 2013 |
| Average Max SNAP Benefit Amount ($100) Across States | 597.2<br>(45.96) | 678.3<br>(58.11) |
| Call Centers in Full State Implementation | 5 | 25 |
| Call Centers Partial State Implementation | 4 | 9 |
| No Call Centers | 42 | 17 |
| Combined Application Project | 4 | 18 |
| Phone Initial Interview in Full State Implementation | 0 | 41 |
| Phone Initial Interview Partial State Implementation | 0 | 2 |
| No Phone Initial Interview | 51 | 8 |
| Simplified Reporting | 23 | 51 |
| Online Application in Full State Implementation | 2 | 38 |
| Online Application Partial State Implementation | 0 | 1 |
| No Online Application | 49 | 12 |
| Fingerprint Requirement in Full State Implementation | 4 | 1 |
| Fingerprint Requirement Partial State Implementation | 1 | 0 |
| No Fingerprint Requirement | 46 | 50 |
| Average Proportion of Elderly SNAP units with 13+ months Recertification Periods Across States | 0.215<br>(0.255) | 0.482<br>(0.366) |
| Average Outreach ($100,000) Across States | 20.9<br>(73.3) | 110.5<br>(231.0) |
| Observations | 51 | 51 |

Table includes 2003 and 2013 averages across all 50 states not simply averages for sample
Standard deviations in paranthesis
All dollar amounts adjusted for inflation to 2013 levels

The simulations show that state food policies have the largest contribution to the growth of SNAP participation from 2003 to 2013. State food policy accounts for nearly 50% of the growth among this population for the elderly. State non-food policy also contributed to SNAP participation growth, as it accounts for close to 14% of the change in participation during this time. Demographic characteristics account for roughly 10% of

the change from 2003 to 2013. State economies, however, had a subduing impact on the SNAP participation growth. This work contributes to the literature by examining how the change in demographic and state characteristics of seniors contributes to SNAP participation growth. It further adds to literature looking to understand the SNAP participation rates among this population.

**Limitations**

This research has some limitations worth noting. Primarily, the CPS does not include enough data on assets to accurately calculate eligibility. Thus, for this paper the sample is defined as those below 185% of the federal poverty level. While referring participation among eligible seniors, the sample could include those not eligible for SNAP because they may not meet the net income requirement. Additionally, there is a large body of research that suggests many survey respondents underreport their participation in the SNAP program because of issues like stigma (Wheaton 2007; Meyer & George, 2011). Thus, research could be biased in making conclusion about the impact of observable characteristics on SNAP participation.

## Discussion

Using probit modeling and simulation analysis on CPS data from 2001 to 2013, this paper seeks to answer two research questions: (1) What is the contribution of changing demographic characteristics on SNAP participation among seniors? and (2) What is the contribution of the state residency distribution in terms of exposure to economic conditions, food and non-food policy characteristics on SNAP participation seniors? The analysis presented demonstrates that state food policies make up 50% of the change in SNAP participation. Additionally, state non-food policy contributes just under

14% to the change in SNAP. Demographic characteristics contribute less than 10% to the change in SNAP participation. State economy characteristics have a dampening impact on participation rates among seniors. This analysis contributes to a growing literature focused on social program participation among the older population.

SNAP is the first line of public policy defense against hunger and food insecurity in the United States. Food insecurity encompasses not only economic well-being, but food insecurity can create behavioral deficiencies and depression in those experiencing food insecurity, and can cause poor health outcomes and lack of nutritional consumption (Cook et al, 2004). SNAP is a social policy that can reduce food insecurity by increasing one's ability to purchase food (Nord & Golla, 2009, Ratchliffe, McKernan, & Zhang, 2011; Wild et al., 2000; Yen et al. 2008). The changing racial composition and geographic movement of seniors are positively correlated with food insecurity. It is vital to reduce food insecurity in the senior population, who are already at risk for adverse general health and have more severe health consequences related to food insecurity than other age groups.

This paper finds the most significant contribution to the growth in SNAP participation among seniors likely to be eligible are state policies. This suggests research should further be targeted towards identifying specific barriers to SNAP participation in which older individuals are experiencing. Policies intended to decrease barriers to participation may in fact be working for the senior population. Modernization tools like call centers, phone interviews, online applications, and simplified reporting can increase overall participation even among this unique population. Additionally, barriers reducing

policies that specifically target seniors, CAPs, and longer recertification periods for seniors may have a positive impact on senior participation.

Additionally, SNAP participation positively effects self-reported poor and decreases the reported number of doctors' visits (Gregory & Deb, 2015). Trying to reduce the risk of negative health for seniors should be a priority for the United States' social programs because of the large numbers of seniors who could be using federally funded health programs. Prevention of adverse health outcomes will be a critical cost saving measure as the proportion of the population that is of senior status is predicted to rise by over a fifth the next decade. For those believing SNAP can be a front-line defense against food insecurity and poor health outcomes for seniors, increasing SNAP participation among this group should include efforts to increase the use of modernization policies and senior specific policies in states.

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# CHAPTER 3: FOOD SECURITY, FUNCTIONAL STATUS, AND MEETING NUTRITIONAL RECOMMEDNATIONS AMONG SENIORS

## Introduction

In 2014, Americans age 65 and older represented 14.5% of the total population in the United States. Between 2004 and 2014 the senior population grew by 10 million—constituting a 28% increase in the senior population, far surpassing the 6.2% growth in the population under the age of 65 (US Department of Health and Human Services, 2016). It is projected that one in every five Americans will be a senior in 2030 (Centers for Disease Control and Prevention, 2013; Ortman, Velkoff & Hogan, 2014).

The coming generation of seniors will be significantly different than those before them—more racially diverse, less likely to be married, and facing declines in their economic well-being and increases in inequality and disparities (Helman, Copeland, & VanDerhei, 2012; McGarry, 2013; Rix, 2011; Johnson & Mermin, 2009). The change in the financial security of seniors coupled with the growing size of the senior population has the potential to strain resources and social services in ways previous cohorts of elderly have never done before (Knickman & Snell, 2002; Sundali, Westerman, & Stedham, 2008). Health care services and their costs are explicitly important for this population (Rice & Fineman, 2004) because the elderly use considerably more health and medical services than the general population due to the increased health risks associated with aging (Kronenfeld, 2004). Additionally, the Baby Boomer generation has a greater potential for poorer health outcomes compared to previous generations, given their higher rates of obesity and the growth in the proportion of racial and ethnic minorities and unmarried individuals, who have increased health risks. To reduce the strain the growing senior population will have on fiscal, health, and human resources in the United States, it

will be critical for public health advocates and policymakers to focus on preventative health measures to.

Maintaining good nutrition is vital for the maintenance of elderly health and prevention, including reducing the risk of both chronic and terminal illnesses and disease (He et al, 2007; Meydani, 2001; Reedy et al, 2014). For example, nutrition plays a crucial role in the morbidity of illnesses' such as cardiovascular disease, cancer, dementia, and Alzheimer's disease (Coombs, Barrocas, & White, 2004; Mann, 2002; Scarmeas, et al., 2008; Shah, 2013; Takashashi et al, 2003). Additionally, poor nutrition can decrease immunity, increase the time needed for recovery from injury or illness, and has been associated with an increase in hospital visits—all functions that already deteriorate with age (Brownie, 2005; Forster et al, 2012; Lesourd, 1997; Sullivan, 1995). Finally, elderly malnutrition leads to increased health costs for individuals and for the health care system—a system that will be further strained with the growth in the aging population. Quality nutritious diets can reduce the health risk seniors already face (Bernstein & Munoz, 2012; Volkert, 2013).

To inform policy and public health decisions that support nutritional health for seniors, it is important to understand the factors that are associated with nutritious diets among seniors. While physiological changes in seniors' body create issues for nutrient intake, they also face the cumulative effect of socioeconomic and behavioral factors (Donini, et al, 2013; Mojon et al, 1999; Morley, 1997; Morley et al, 1997; Palacios & Joshipura, 2014; Shatenstein, 2008; Walls & Steele, 2004; Wellman et al, 1997). Research on nutritional risks among the elderly has examined a variety of socioeconomic and behavioral predictors of nutritional intake, including food insecurity, demographic

characteristics, and functional limitations (Lee & Frongillo, 2001; Bartali et al., 2003; Storey & Anderson, 2014; Stuff, et al., 2004). While there is an expansive body of literature on the nutrient intake for seniors, the research has primarily focused on institutional senior populations (those living in facilities like nursing homes). The proportion of those aged 65 and older, however, who are institutionalized is only 3.8 percent (Congressional Budget Office, 2013). The pattern of seniors' living arrangements and the growing number of seniors, requires more attention be paid to how independent seniors navigate nutrition, health, wellness, and life.

Using data from the 2007 to 2011 panels of the National Health and Nutrition Examination Survey (NHANES), I will answer the following research question: To what extent is the nutritional adequacy for noninstitutionalized American seniors associated with their food security status, activities of daily living (ADLs), and instrumental activities of daily living (IADLs)? In this paper, I will begin by presenting background information on the nutritional needs of the elderly. I will then review the literature on elderly nutrition, as well as, elderly demographic characteristics, food insecurity, ADLs and IADLs, and each predictor's relationship to nutritional outcomes. Next, I will present an empirical analysis of food insecurity, functional status, and demographic characteristics as predictors of nutritional adequacy for the elderly. I conclude with the policy implications of my findings.

## Background

As seniors age, they have an increased risk of malnutrition due to the decrease in body mass, decreased dietary intake and less active lifestyles; consequently, during the aging process, these physiological changes in the body require a diet of nutrient dense

foods (Bernstein & Munoz, 2012; Chernoff, 2013; Nicklett & Kadell, 2013). Seniors require a vitamin rich diet (including vitamin A, vitamin B6, vitamin B12, vitamin C, vitamin D, vitamin E) to address the declines in muscle and bone mass, immune function, heart function, and the body's hormone production (Mithal, et al, 2013; Rolland et al, 2013). Seniors also need foods rich in zinc, iron, folate, riboflavin, calcium, and protein to address issues of slowing metabolisms, increased heart risks, deteriorating sight, and low energy levels (Blumberg, 1997; Deutz et al, 2014; Paddon-Jones et al, 2015; Visvanathan, Newbury, & Chapman, 2014). Therefore, finding what factors predict specific nutritional deficiencies is important for public health professionals, social scientists, and policymakers to effectively address the health of the elderly.

## Literature Review

Empirical research has examined the relationship between senior demographic characteristics and nutritional intake finding racial and ethnic minorities have decreased rates of consumption of the nutrient rich diets needed as individuals' age (Deirelein et al., 2014; Ervin & Kennedy-Stephenson, 2002; Storey & Anderson, 2014; Wolf et al., 1996). For example, Deierlein et al. (2014) find Hispanic and Black elderly have the highest intakes of fats, sodium, and added sugars. Additionally, they find elderly individuals who are married have increased rates of consumption of nutrient rich foods. Black elderly consume the lowest amounts of nutrient-rich foods and have increased consumption of saturated fats and sodium relative to White seniors (Storey & Anderson, 2014). Among seniors, White women are most likely to have nutrient rich diets (Hsiao, et al., 2013). Although there has been a bountiful among of empirical exploration of the differential

nutritional challenges seniors face by demographic groups, there is less literature on the association of senior nutrition and food insecurity.

The literature on the consequences of food insecurity, including the relationship between food insecurity and poor nutrition intake (Champagne et al., 2007; Leung et al, 2014; Morales & Berkowitz, 2016), has often focused on children, women, and low-income family units because of the increased rates of food insecurity among these populations (Hanson & Connor, 2014; Kendall et al., 1996). Even with limited literature on senior food insecurity, food insecurity among seniors continues to grow. From 2001 to 2014, seniors facing the threat of hunger nearly doubled—rising from 7.4% of seniors to 15.8% of seniors (Ziliak & Gundersen, 2015). Among the few studies which have examined the relationship between food insecurity and malnutrition among the aging, Russell et al. (2016) find that food insecure elderly[17] have increased rates of poor diet quality, physical health issues, and mental health issues when compared to food secure elderly. More specifically, elderly individuals who self-report being food insecure have lower intakes of vitamins crucial to the physiological changes associated with aging, including vitamin A, vitamin B6, and vitamin B12 (Lee & Frongillo Jr. 2001; Rose & Oliveira, 1997). Additionally, elderly individuals who are food insecure also have decreased rates of needed micronutrients, protein levels, and antioxidants compared to those who are food secure (Lee & Frongillo Jr. 2001; Lyles, Schafer, & Seligman, 2014). Ziliak and Gundersen (2014) utilized the NHANES from 1999-2010 to examine average nutrition consumption for seniors based on food security status over time. Their work focused on nutrient intakes of energy, protein, vitamin A, vitamin C, thiamin, riboflavin,

[17] Russell et al. (2016), in creation of their binary food insecurity measure identify individuals as food insecure if respondents are marginally food secure, have food insecurity, and have very low food security.

vitamin B6, calcium, phosphorous, magnesium, and iron. The authors compared the means of nutrient intakes between food secure and food insecure seniors, finding food insecure seniors have between 10 and 20 percent lower average nutrient intake than food secure seniors.

Seniors often face an increase in functional limitations as they age; there is a body of literature covering functional limitations and nutrition intake in the elderly finding functional limitations can be a predictor of nutritional intake, and conversely, nutritional intake can be a predictor of functional limitation (An, et al, 2015; Evans et al, 2010; Brewer et al, 2010; Ribeiro, et al., 2016; Shikany et al, 2013; Ziliak, Gundersen, & Haist, 2008). For example, adequate nutrient intake can reduce the effects of functional limitations in the elderly, and conversely, undernutrition can increase risks of physical, mental, and social impairment (Kleinpell et al, 2008; Sharkey et al, 2003). Moreover, as the number of functional limitations increases the risks of poor nutritional intake increase among the elderly (Bartali et al, 2003). Limitations in ADLs and IADLs—two operationalized measures of functional limitations—have been found to affect the food choices of seniors because of limitations in the ability to prepare certain foods. Individuals with functional limitations have decreased intake of calorie-rich, energy-producing food and nutrients needed as people age (An, et al 2015; Sheiham & Steele, 2001). Inability to perform ADLs is associated with chronic undernutrition, dehydration, vitamin B12, deficiency, and bone condition related to deficiency in calcium and/or vitamin D (osteoporosis and osteomalacia) (Amarantos, Martinez & Dwyer, 2001; Arciniegas & Guiterrez, 2014; Axen & Schnoll, 1995; Sheehy, Perry, & Cromwell, 1999). Inabilities in IADLs are less likely to be associated with chronic undernutrition,

but contribute to dehydration and vitamin deficiencies (Amarantos, Martinez & Dwyer, 2001; Arciniegas & Guiterrez, 2014). Empirical research on the relationship between functional limitations and nutritional intake has often focused on hospitalized or institutionalized seniors, where nutritional assessments can be conducted and evaluated alongside clinical or caregiver assessments of functional status (Orsitto, et al., 2009). Recent work on ADLs and IADLs of the noninstitutionalized population includes Lee and Frongillo Jr. (2014), who examine individual ADL and IADL items, as well as, ADL and IADL scores, but do not use nutrient intake as an outcome, but instead use food security status.

There is an obvious gap in the literature regarding senior, nutrition, and functional limitation. First, while there have been empirical analyses of the relationship between each of the individual characteristics separately, there is no known research that takes the role of these into account in a single model. Secondly, there is a large body of literature on predictors of senior nutritional intake, but this literature tends to restrict the populations of interest to the elderly living in nursing homes (Kiesswetter, et al., 2013; Schrader, et al., 2014). Since over 96% of Americans (45.4 million) over the age of 65 in 2014 were community-dwelling or lived in noninstitutionalized settings, there is an important need to look at risks for the noninstitutionalized senior population (Administration of Aging, 2015). Additionally, Ziliak and Gundersen (2003) look at nutrient outcomes for noninstitutional seniors but limit their analysis to a comparison of those who are food secure with those who are food insecure. Ziliak and Gunderson also focus on averages of intakes rather than whether seniors are meeting their dietary recommendations as suggested by gerontologists and nutritionists. In contrast, this paper

examines noninstitutionalized seniors meeting dietary needs rather than intake averages. This current gap in the literature provides an opportunity for this work to contribute to the literature. Given the literature on functional limitations and nutrition intake among seniors, and literature that covers food insecurity and nutrition intake, one would hypothesize that having food insecurity and having more functional limitations would predict a lower likelihood of meeting nutritional requirements.

## Methods

### Data

While controlling for standard demographic characteristics, this paper examines whether food insecurity and functional limitations are predictors for elderly meeting their standard nutritional recommendations. The following is an analysis of nutritional outcomes for those aged 65 years and older. I use data from NHANES combining years 2007-2011. NHANES is a nationally representative series of studies that evaluate the health and nutrition of the US population. In two year cycles, the NHANES collects data on roughly 5,000 people across the country and oversamples low-income adolescents, those 60 and older, African Americans, and Mexican Americans. NHANES includes survey data which collect demographic, socioeconomic, dietary and health-related information from participants. Additionally, the NHANES includes medical and dental information administered by medical personnel in Mobile Examination Centers (MEC), in which they collect a variety of data on health conditions, dietary intake, and physiological measurements of participants. This paper looks at intake and utilizes the NHANES dietary data. Dietary data is provided in three types of information structures: dietary behavior, a 24-hour dietary recall, and a food frequency questionnaire. The

NHANES' inclusion of quality dietary and health data make this dataset the best option for this paper's analysis. The only restriction used to build my analytic sample is the limiting of observations to those over the age of 65. Pooling years 2007 (n=1,556), 2009 (n=1,523), and 2011 (n=1,250) of the NHANES for those aged 65 and older, there are 4,329 observations.

**Measures**

As seniors, functional status becomes important in assessing whether seniors can live independently or need caregiving assistance. The Activities of Daily Living (ADLs) scale, initially developed in the late 1950s, measures physical function activities essential to basic self-care. To assess the effects of treatment of seniors with hip replacements Katz and colleagues (1963) used the measurement of the ADLs bathing, dressing, using the toilet, transferring (physical movement, ambulation, and mobility), continence, and feeding to gauge physical functional limitations (Amarantos, Martinez & Dwyer, 2001; Levin et al., 2003). Over time, more researchers have added physical activities to ADLs under the sets of tasks including dressing, eating, ambulation, transfer/toileting, and hygiene (Kane & Kane, 2000; Rogers & Miller, 1997; Weiner et al., 2000). To add to the understanding and assessment of functional limitations, Lawton and Brody (1969) created the Instrumental Activities of Daily Living (IADLs) to assess seniors' ability to function independently in a community, as they may be able to do basic daily activities but have difficulty with basic psychological or social functions. IADLs often focus on the behavioral competence of cognitive activities and include activities such as management of money, chores, using a phone, and shopping. Lawton and Brody (1970) showed

IADLs could be utilized to develop plans for caregivers (Amarantos, Martinez & Dwyer, 2001; Katz 1983; Schor, Lerner, & Malspeis, 1995).

For the variables of interest, I create IADL and ADL scales using several common questions about functional ability. Over time scholars have added more items to ADL and IADL scales, leading to inconsistent standards of specific items. I utilize the ADL and IADL items most consistently used by previous research to build ADL and IADL scores for analysis. I choose the specific ADL and IADL items identified by Kou and colleagues (2006) as important gauges of general functionality. I also chose individual ADL and IADL items identified by Seeman and colleagues (2010 as important for functional limitation trends among older Americans. Following the use of items by other scholars, I include seven ADL activities: (1) the ability to walk from room to room on the same floor, (2) the ability to walk up ten stairs, (3) the ability to walk a quarter of a mile, (4) the ability to sit up from an armless chair, (5) the ability to get in and out of bed, (6) the ability to dress oneself, and (7) the ability to feed oneself using standard utensils. If an individual indicates they have no difficulty with the task, it is coded zero; if one says they have "some difficulty", "much difficulty", or are "unable to complete the task", they are given a one. A zero is then given to those who have no difficulty completing the tasks. All seven of the ADL items scores are added together to get a total ADL scale score, with a maximum value of seven and a minimum value of zero. The construction of the ADL scores, yields an interpretation of the scores, where a higher score for means one has difficulty with more activities—a higher score is a negative outcome. I use three IADLs items to create an IADL scale, again choosing items which are consistent in the literature evaluating functional limitations. For IADLs, I included three activities: (1) the ability

manage money, (2) the ability to do chores around the home, and (3) the ability to do their own meal preparation. Like in the case of the ADL score creation, a zero is given for the IADL item if the individual identifies they have no difficulty completely a task. If one answers that they have "some difficulty", "much difficulty", or are "unable to complete the task" to the IADL item, then they are given a value of zero. All three items are added together to get the total IADL scale where a maximum value is 3 and a minimum value is zero. Just as for the construction of the ADL scores, the interpretation of the IADL scores is that a higher number indicates increased difficulty with measured tasks.

The food security status of respondents in the NHANES is calculated using the responses to the U.S. Food Security Survey Module (US FSSM), which captures behavior modifications related to meeting household and individual food needs (Bickel G, et al, 2000). In the US FSSM, an adult is classified as food secure if the respondent gives no affirmative answers. A person is defined as being marginally food secure if they provide one or two affirmative answers. Adults are identified as having low food security if an adult respondent gives three to five affirmative answers, and very low food security is defined by answering six to ten affirmative answers (Center for Disease Control and Prevention, 2016). I create a food security dichotomous variable where one indicates either having food insecurity or very low food security and zero is coded for those who self-identify as food insecure or having marginal food insecurity.

This paper focuses on the intake of eight vitamins and nutrients which have been indicated by the geriatric nutrition literature as critical for elderly health: 1) calcium (milligrams), 2) energy (kilocalories), 3) folate (micrograms), 4) protein (grams), 5)

vitamin A (micrograms), 6) vitamin B12 (micrograms), 7) vitamin C (micrograms), and 8) zinc (micrograms). The dietary recall data collected by NHANES, along with data on supplement consumption, are used by the administrators of NHANES to estimate the overall intake of participants. NHANES records two days of total nutrient intakes. For the Day 1 24-hour dietary recall, a dietary interviewer collects dietary consumption during the MEC as recalled by participants. The Day 2 24-hour dietary recall, is collected over the phone three to ten days after the MEC. If an individual is unable to self-report their dietary a proxy will record their information for the participant. When data are available for both days, I take the average of the two daily nutrient amounts; or, if only one day is available, that nutrient total is used for the daily intake. I create a series of dummy variables identifying if an individual meets the daily recommendations for those over the age of 65 as determined by the Food and Nutrition Board Recommendations from The National Academy of Medicine. *Table 1* presents the recommendations for women and men who are seniors.

Table 1. The National Academy of Medicine Daily Recommendations of Intake of Selected Nutrients and Vitamins for those Over the Age of 60

| | Men | Women | All |
|---|---|---|---|
| Calcium (miligrams) | | | 1200 |
| Energy (kilocalories) | 2200 | 1600 | |
| Folate (micrograms) | | | 400 |
| Protein (grams) | 56 | 46 | |
| Vitamin A (micrograms) | 900 | 700 | |
| Vitamin B12 (micrograms) | | | 2.4 |
| Vitamin C (micrograms) | | | 90 |
| Zinc (micrograms) | | | 11 |

The National Academy of Medicine recommends different intake amonts of some nutrients and vitamins for men and women

During NHANES household interviews, participants are asked to self-report standard demographic characteristics (age, gender, race/ethnicity, citizenship status, education level, marital status, household income, region, and employment status). Age is included in my model as a series of dummy variables for ages 65 to 69, ages 70 to 74, ages 75 to 79, and ages 80 and older. Four dichotomous race variables are included: 1)

individuals who answer yes to Mexican-American or other Hispanic are coded as Hispanic; 2) individuals are coded Non-Hispanic White if they identify as Non-Hispanic White (the reference group); 3) individuals are coded Non-Hispanic Black if they identify as Non-Hispanic Black in the race question; and 4) individuals are categorized as "other race" if coded as other race or multi-racial. Four levels of education are identified with dichotomous variables for those who have completed less than high school level, those who have received a high school diploma or a GED, those with some college but have not received a college degree, and those who have completed four years of college (the reference group). For marital status, I create dichotomous variables for married (reference group) and never married; I also group divorced, widowed, and separated and create a dichotomous variable. Employment status is coded to identify the employed, unemployed, and those who are not in the labor market (reference group).

**Analytical Approach**

In the analysis that follows, I used probit models to examine the association of each of the independent variables of interest—food insecurity, ADLs, and IADLs—on nutritional outcome controlling for demographic characteristics. The model for the probit regressions are as follows:

Model 1: $NutrOutcome_{it} = \alpha + X_{it}\beta_1 + \beta_2 FS_{it} + \beta_3 AL_{it} + \beta_4 IL_{it} + \varphi_t + \varepsilon_{it}$

The base of each model consists of $NutrOutcome_{it}$ a dummy variable for meeting any one of the eight nutrient outcomes for any senior individual *i*, in time *t*, $X_{it}$ contains measures of observable individual demographic characteristics at time *t*, $FS_{it}$ is a dummy variable for food security status, $AL_{it}$ is the sum of the number of the ADL scale for an

individual, $IL_{it}$ is the sum of the number of the IADL scale for an individual, $\varphi_t$is a set of dummy variables for each year, and $\varepsilon_{it}$ is a random error term

Model 2: $NutrOutcome_{it} = \alpha + X_{it}\beta_1 + \beta_2 FS_{it} + AL_{it}\beta_3 + IL_{it}\beta_4 + \varphi_t + \varepsilon_{it}$

In Model 2, all indicators are the same as Model 1 exception the measures $AL_{it}$, which in Model 2 is a set of dummy variables for each ADL (the ability to walk from room to room on the same floor, the ability to walk up 10 stairs, the ability to walk a quarter of a mile, the ability to sit up from an armless chair, the ability to get in and out of bed, the ability to dress oneself, and the ability to feed oneself using standard utensils), where one is given if an individual has some or more difficulty with a function and zero if they have no difficulty. Similarly, $IL_{it}$ is a set of dummy variables for each IADL (the ability to manage money, the ability to do chores around the home, and the ability to do their own meal preparation), where one is given if an individual has some or more difficulty with a function and zero if they have no difficulty. I interpret the marginal effects of these models for each outcome: calcium (milligrams), energy (kilocalories), folate (micrograms), protein (grams), vitamin A(micrograms), vitamin B12(micrograms), vitamin C(micrograms), and zinc(micrograms) intake recommendations.

## Results

### Descriptive Statistics

*Table 2* presents descriptive statistics for the demographic characteristics of the pooled sample. We see 51.2 percent of the sample is female. Those aged 80 and older make up 28.3 percent of the sample. While those aged 75-79 make up 19.1 percent of the sample, those aged 70-74 make up 25.3 percent of the sample, and those aged 65-69 make up 27.2 percent of the sample. Whites make up just over 57.1 percent of those sampled,

followed by Blacks and Hispanics who make up 18.6 percent and 18.4 percent, respectively. Those with education levels less than high school make up 36.9 percent of the sample, followed by those who have attained a high school degree or GED which make up around 23.5 percent of the sample. Individuals who have completed some college education make up 22.2 percent and those with a college degree make up 17.5 percent of the sample. The sample is composed of 52.9 percent of married individuals, followed by 41.4 percent of those who are divorced, widowed, and separated. Respondents age 65 and older who are categorized as never married or those who are living with a partner each make up less than 6 percent of the sample when combined. Nearly 85 percent of the sample are not in the labor market, which is not uncommon for this senior age group. Those who are employed make up 14.5 percent of the sample. About 60 percent are at or above 185 percent of the federal poverty line. Finally, the sample on average has a household size of about 2.3 people per household.

Table 2. Summary Statistics of the Sample

| | **Pooled Sample Ages 65+** (N=4,329) | **2007 Sample Ages 65+** (N=1,556) | **2009 Sample Ages 65+** (N=1,523) | **2011 Sample Ages 65+** (N=1,250) |
|---|---|---|---|---|
| **Demographic Characteristics** | | | | |
| Female | 51.17% | 52.06% | 50.76% | 50.56% |
| Age 65-69 | 27.23% | 25.77% | 26.99% | 29.36% |
| Age 70-74 | 25.29% | 24.94% | 26.59% | 24.16% |
| Age 75-79 | 19.13% | 21.08% | 18.52% | 17.44% |
| Age 80+ | 28.34% | 28.21% | 27.91% | 29.04% |
| White | 57.08% | 60.73% | 60.34% | 48.56% |
| Black | 18.62% | 17.35% | 15.56% | 23.92% |
| Hispanic | 18.36% | 19.02% | 19.76% | 15.84% |
| Other | 5.94% | 2.89% | 4.33% | 11.68% |
| Less than High School | 36.86% | 39.18% | 35.48% | 35.66% |
| High School or GED | 23.45% | 25.97% | 22.19% | 21.85% |
| Some College | 22.17% | 18.88% | 24.03% | 24.02% |
| College | 17.52% | 15.98% | 18.30% | 18.47% |
| Never Married | 4.28% | 4.63% | 3.41% | 4.89% |
| Living with Partner | 1.50% | 1.03% | 1.64% | 1.92% |
| Married | 52.86% | 52.41% | 54.37% | 51.56% |
| Divorced, Widowed, Separated | 41.36% | 41.93% | 40.58% | 41.62% |
| Employed | 14.47% | 13.63% | 14.84% | 15.05% |
| Unemployed | 0.53% | 0.19% | 0.59% | 0.88% |
| Not in Labor Market | 85% | 86.17% | 84.57% | 84.07% |
| At or above 185% FPL | 58.24% | 56.68% | 62.57% | 54.88% |
| Number of people in the household | 2.25% | 2.20% | 2.25% | 2.31% |

FPL=Federal Poverty Level

*Table 3* provides descriptive information for the independent variables of interest, food security status, ADLs, and IADLs. In the analytic sample, just over 90 percent of the sample is considered food secure. The average ADL score is 1.08, indicating that respondents had difficulty with one activity of daily living. The sample average IADLs score is 0.41. *Table 4* provides a detailed look at the average level of difficulty for each ADL and IADL. The table is ordered with the ADLs and IADLs that have the largest average of difficulty. *Table 4* shows the ADLs, the proportion of respondents with no difficulty walking from room to room, walking up 10 stairs, walking a quarter mile, sitting up from an armless chair, or getting in and out of bed ranges between 73.7 percent and 87.2 percent. Most of the sample, 93.9 percent, reports no difficulty feeding oneself. For IADLs, 91 percent of the sample have no difficulty managing money, 75.4 have no difficulty doing chores around the home, and 89.5 percent have no difficulty preparing their own meal.

Table 3. Descriptive Statistics for Independent Variables of Interest

| | **Analytic Sample** (N= 4,329) |
|---|---|
| **Percent Food Insecure** | 9.39% |
| **Average Activities of Daily Living (ADLs) Score** | 1.08 |
| **Average Instrumental Activities of Daily Living (IADLs) Score** | 0.41 |

Table 4. Distribution of Difficulty Level by Individual ADL and IADL Items

| | **Analytic Sample** (N= 4,329) |
|---|---|
| | Avg |
| **Activities of Daily Living (ADLs)** | **1.08** |
| The ability to sit up from an armless chair | |
| No difficulty | 73.72 |
| Some difficulty | 17.78 |
| Much difficulty | 5.73 |
| Unable | 2.76 |
| The ability to walk a quarter mile | |
| No difficulty | 74.92 |
| Some difficulty | 16.13 |
| Much difficulty | 4.87 |
| Unable | 4.08 |
| The ability to walk up 10 stairs | |
| No difficulty | 83.25 |
| Some difficulty | 12.44 |
| Much difficulty | 2.44 |
| Unable | 1.87 |
| The ability to get in and out of bed | |
| No difficulty | 83.42 |
| Some difficulty | 12.36 |
| Much difficulty | 3.18 |
| Unable | 1.04 |
| The ability to dress oneself | |
| No difficulty | 86.36 |
| Some difficulty | 9.42 |
| Much difficulty | 2.87 |
| Unable | 1.34 |
| The ability to walk from room to room on the same floor | |
| No difficulty | 87.24 |
| Some difficulty | 8.14 |
| Much difficulty | 2.76 |
| Unable | 1.86 |
| The ability to feed oneself using standard utensils | |
| No difficulty | 93.92 |
| Some difficulty | 5.18 |
| Much difficulty | 1.18 |
| Unable | 0.35 |
| **Instrumental Activities of Daily Living (IADLs) Scale** | **0.41** |
| The ability to do chores around the home | |
| No difficulty | 75.4 |
| Some difficulty | 14.66 |
| Much difficulty | 4.45 |
| Unable | 5.49 |
| The ability to prepare your own meal | |
| No difficulty | 89.54 |
| Some difficulty | 5.38 |
| Much difficulty | 1.62 |
| Unable | 3.46 |
| The ability to manage money | |
| No difficulty | 90.99 |
| Some difficulty | 5.17 |
| Much difficulty | 1.48 |
| Unable | 2.35 |

*Table 5* presents the proportion of seniors whose nutrient intake scored as meeting nutritional needs for the eight different measures. Only about 32 percent of seniors consume 1200 milligrams of calcium a day and roughly 50 percent meet their energy needs by consuming enough kilocalories per day. Similarly, close to 48 percent meet their folate consumption requirements. Nearly 79.2 percent fulfill their protein requirements and 43 percent meet daily requirements for vitamin A. Around 83 percent consume the daily needs for vitamin B12. Additionally, around 54 percent and 60 percent meet vitamin C and Zinc requirements respectively. Individuals' intake of nutrients is often correlated; thus, those with a high or sufficient intake of one nutrient have a high or sufficient intake of other nutrients. This is related to the nutrition behavior, in which dietary components and food groups are often consumed in combination (Ocké, 2013; Reddy, et al., 2014). However, research shows there is still variation in individuals' intake patterns across different nutrients. This variation in individuals' intake across nutrients is largely found in consumption patterns of nutrients across different food groups (Guenther et al., 2012)—as is the case for many of the nutrients that are important for seniors and, thus, are covered in this analysis.

Table 5. Proportion of Analytic Sample Meeting Nutrition Needs

| | **Percent** |
|---|---|
| Calcium | 32.36 |
| Kcal | 49.63 |
| Folate | 47.49 |
| Protein | 79.23 |
| Vitamin A | 42.78 |
| Vitamin B12 | 83.23 |
| Vitamin C | 54.59 |
| Zinc | 59.16 |

## Probit Model Estimation

In *Table 6*, I show the marginal effects for the probability of meeting the nutrient recommendations for Model 1.

Table 6. Marginal Effects for Full Models Including Food Insecurity, ADLs, and IADLs

| | Calcium | Folate | Kcal | Protein | Vitamin A | Vitamin B12 | Vitamin C | Zinc |
|---|---|---|---|---|---|---|---|---|
| | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx |
| | SE | SE | SE | SE | SE | SE | SE | SE |
| **Food Insecurity** | 0.0264 | -0.0149 | 0.00515 | -0.0553** | -0.0267 | -0.00938 | 0.00978 | -0.012 |
| | 0.0255 | 0.0276 | 0.0279 | 0.0215 | 0.0276 | 0.0197 | 0.0276 | 0.0272 |
| **Activities of Daily Living (ADLs)** | 0.0049 | -0.00384 | 0.00116 | -0.0119** | -0.0025 | 0.000208 | 0.00109 | -0.00589 |
| | 0.00604 | 0.00649 | 0.00657 | 0.00523 | 0.0065 | 0.00485 | 0.00651 | 0.00646 |
| **Intrumental Activities of Daily Living** | 0.0247** | 0.0299** | 0.0236* | 0.0262** | 0.0284** | 0.0124 | 0.0208 | 0.0337*** |
| | 0.0117 | 0.0127 | 0.0129 | 0.0105 | 0.0127 | 0.00966 | 0.0128 | 0.0127 |
| **Demographic Characteristics** | | | | | | | | |
| Female | -0.0763*** | 0.0299** | 0.0286* | -0.0141 | 0.0545*** | -0.0789*** | 0.0436*** | 0.0488*** |
| | 0.0152 | 0.0157 | 0.0164 | 0.0135 | 0.0162 | 0.0123 | 0.0162 | 0.0161 |
| Age 65-69 | | | | ommited variable | | | | |
| Age 70-74 | -0.0382* | -0.0003 | -0.0149 | -0.0143 | -0.0066 | -0.0105 | 0.00939 | -0.0306 |
| | 0.0204 | 0.0215 | 0.0218 | 0.0182 | 0.0216 | 0.016 | 0.0215 | 0.0214 |
| Age 75-79 | -0.0193 | -0.0175 | -0.0530** | -0.0550*** | 0.0123 | -0.00783 | 0.0217 | -0.0303 |
| | 0.0224 | 0.0237 | 0.0239 | 0.0195 | 0.0237 | 0.0177 | 0.0237 | 0.0235 |
| Age 80+ | 0.0387* | 0.0496** | -0.0294 | -0.0532*** | 0.0825*** | 0.013 | 0.0436*** | -0.0175 |
| | 0.0210 | 0.0224 | 0.0227 | 0.0187 | 0.0223 | 0.0172 | 0.0225 | 0.0224 |
| White | | | | ommited variable | | | | |
| Black | -0.0066 | -0.0452** | -0.018 | -0.0764*** | -0.0283 | -0.0871*** | 0.0577*** | -0.0984*** |
| | 0.0203 | 0.0213 | 0.0216 | 0.0171 | 0.0214 | 0.0154 | 0.0213 | 0.0209 |
| Hispanic | 0.0717*** | 0.0425* | -0.00288 | -0.0246 | 0.0162 | -0.0542*** | 0.111*** | -0.0471** |
| | 0.0213 | 0.0229 | 0.0233 | 0.0190 | 0.023 | 0.017 | 0.023 | 0.0227 |
| Other | 0.186*** | 0.208*** | 0.160*** | 0.0221 | 0.171*** | 0.000154 | 0.196*** | 0.0857** |
| | 0.0304 | 0.0343 | 0.0347 | 0.0295 | 0.0336 | 0.0266 | 0.035 | 0.0347 |
| Less than High School | 0.0172 | -0.0826*** | -0.0871*** | -0.0687*** | -0.0445* | -0.0646*** | -0.151*** | -0.0648*** |
| | 0.0234 | 0.0247 | 0.0251 | 0.021 | 0.0248 | 0.0197 | 0.0248 | 0.0247 |
| High School or GED | -0.00666 | -0.0494** | -0.0506** | -0.0417* | -0.0444* | -0.0435** | -0.112*** | -0.0483* |
| | 0.0238 | 0.0249 | 0.0253 | 0.0215 | 0.0249 | 0.0202 | 0.0251 | 0.025 |
| Some College | 0.0171 | -0.0654*** | -0.0262 | -0.0219 | -0.0183 | -0.0468** | -0.0930*** | -0.0205 |
| | 0.0236 | 0.0249 | 0.0253 | 0.0218 | 0.0249 | 0.0201 | 0.0252 | 0.0251 |
| College | | | | ommited variable | | | | |
| Never Married | 0.0584 | -0.015 | 0.0156 | -0.0558* | 0.0661* | -0.0108 | -0.0464 | -0.00193 |
| | 0.0359 | 0.0388 | 0.0393 | 0.0305 | 0.0386 | 0.0284 | 0.0386 | 0.0385 |
| Living with Partner | -0.00815 | 0.0161 | 0.029 | 0.0366 | 0.0268 | 0.0651 | 0.041 | -0.0522 |
| | 0.0605 | 0.0634 | 0.0646 | 0.0552 | 0.064 | 0.0528 | 0.0637 | 0.0628 |
| Divorced, Widowed, Separated | 0.0472*** | 0.0265 | 0.0398** | 0.0430*** | 0.0414** | 0.0192 | 0.0206 | 0.0431** |
| | 0.0167 | 0.0178 | 0.018 | 0.0148 | 0.0177 | 0.0133 | 0.0178 | 0.0176 |
| Married | | | | ommited variable | | | | |
| Employed | 0.0271 | 0.00437 | 0.0585** | 0.0569*** | -0.0235 | -0.00802 | 0.0134 | 0.0338 |
| | 0.0218 | 0.0232 | 0.0234 | 0.0205 | 0.0233 | 0.0176 | 0.0233 | 0.0232 |
| Unemployed | -0.326** | -0.0943 | -0.264** | -0.0531 | -0.243** | -0.215*** | -0.107 | -0.202* |
| | 0.1350 | 0.105 | 0.113 | 0.0818 | 0.114 | 0.0657 | 0.103 | 0.103 |
| Not in Labor Market | | | | ommited variable | | | | |
| At or above 185% FPL | 0.0123 | 0.0127 | 0.0197 | 0.0277** | 0.0143 | 0.0214* | 0.00971 | 0.0300* |
| | 0.0161 | 0.0171 | 0.0173 | 0.0140 | 0.0171 | 0.0128 | 0.0171 | 0.0169 |
| Number of people in the household | 0.0104* | 0.000302 | 0.00647 | 0.00876* | 0.00479 | -0.00647 | -0.00852 | 0.00325 |
| | 0.0058 | 0.00628 | 0.00633 | 0.0052 | 0.00625 | 0.00451 | 0.00628 | 0.00623 |
| Observations | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 |

All equations include dummy variables for years
*** p<0.01, ** p<0.05, * p<0.10
Standard errors in row below marginal effect

Food insecurity decreases the likelihood of meeting protein needs. Those who are food insecure have a decrease of 5.5 percentage points in the probability of meeting protein recommendations. This represents close to a 7 percent change in meeting protein needs. Similarly, there is a decrease in the likelihood of meeting protein needs as one's ADL scale score increases—as one has difficulty with more activities of daily living, there is a

1.2 percentage point decrease in the probability of meeting the recommended daily amount of protein, representing a 1.5 percent change in meeting protein needs of seniors.

While food insecurity and ADLs only have a statistically significant negative association with seniors' probability of meeting their protein requirement, IADLs score is associated with an increase in the probability of meeting calcium, folate, kcal, vitamin A, and zinc recommendations. This means that as an individual adds a difficulty with IADL, there is an increase in the likelihood of meeting the nutritional needs. Specifically, there is a 2.5 percentage point increase in meeting calcium, a 3 percentage point increase in meeting folate recommendations, a 2.4 percentage point increase in meeting kcal, a 2.6 percentage point increase in meeting protein needs, a 2.9 percentage point increase in vitamin A, and a 3.3 percentage point increase in meeting zinc recommendations as the IADL score increases. The increase in the likelihood of meeting calcium needs represents the largest percent change, with a roughly 8 percent change. The increase in the likelihood of meeting protein recommendations represents the smallest percent change at roughly a 3 percent change. The positive relationship between the number of IADLs one has and the difficulty meeting many of the nutrients and vitamins, might be due to the consumption of higher quality food as a result of receiving assistance with food preparation due to the high level of difficulty indicated in physical and mental functioning. Another explanation could that with an increase in health risks due to functional limitations, elders have been given a recommendation to consume more nutritious food to moderate the effect of these health issues.

Consistent with previous literature (Deirelein et al., 2014), *Table 6* shows there are patterns associated with the demographic characteristics used as controls in the

models and the probability of meeting nutrition outtakes. Senior women are less likely to meet their calcium, folate, and vitamin B12 needs, but are more likely to meet their kcal, vitamin A, vitamin C, and zinc needs. The increase in the likelihood of consuming recommended folate intake has the largest magnitude—there is a 14.8 percentage point increase in meeting folate needs for women relative to men, representing a 32 percent change in meeting folate needs. Those age 80 or more are more likely to meet calcium, folate, vitamin A, and vitamin C requirements, relative to those aged 65 to 69. Blacks have a decrease in the likelihood of consuming the recommended folate, protein, vitamin B12, and zinc, relative to Whites. Additionally, Blacks have an increased likelihood of meeting vitamin C recommended intake. This is consistent with prior research on racial differences in senior nutrient intakes (Storey & Anderson, 2014). There is an education gradient—lower education decreases the likelihood of meeting nutrient recommendations and the decrease in probability is larger with each lower education level. Those who are divorced, widowed, and separated have an increase in the likelihood of meeting daily nutritional intake recommendations for calcium, kcal, protein, vitamin A, and zinc relative to those who are married. These findings contrast with previous literature, that has shown married seniors have greater consumption of nutrients than those who are not married (Deirelein et al., 2014). Finally, those who are unemployed have a decrease in the likelihood of meeting folate, kcal, vitamin A, vitamin B12, and zinc.

**Detailed Look at Functional Limitation**

I further break down the IADLs and ADLs in the second model to investigate if individual IADLs or ADLs seniors have difficulty completing are driving the estimation of the relationship between the IADL and ADL scale scores on the probability of being

food insecure. I create dummy variables for each activity in which a one is given if an individual has some or more difficulty completing the individual ADL or IADL and zero is they have no difficulty. As seen in *Table 7*, among ADLs, difficulty walking from room to room increases the likelihood of meeting recommendations for calcium, folate, kcal, and zinc. Seniors with difficulty walking from room to room have an 18.9 percentage point increase in the probability of not meeting their calcium requirements, an 18 percentage point increase in the likelihood of consuming the daily requirements of folate and a 13.2 percentage point and 17.2 percentage point increase in meeting the requirements for Kcal and Zinc, respectively. Difficulty walking a quarter of a mile decreases the likelihood of meeting calcium requirements by 9.9 percentage points and decreases the likelihood of meeting vitamin C recommendations by 5.3 percentage points. Those with difficulty walking a quarter of a mile have a 6.7 percentage point and 6.6 percentage point decrease in the likelihood of meeting folate and vitamin A requirements, respectively. Diffiuclty with sitting up from an armless chair decreases the probability of consuming vitamin B12 daily requirements by 4.9 percentage points. Those with difficulty getting in and out of bed have an 11.5 percentage point decrease in the likelihood of meeting their folate requirements. Difficulty feeding oneself using standard utensils increases the likelihood of meeting folate and vitamin C needs by 11.6 percentage points and 11.9 percentage points, respectively.

Table 7. Marginal Effects for Models Including All Food Insecurity and detailed ADLs and IADLs

| | Calcium | Folate | Kcal | Protein | Vitamin A | Vitamin B12 | Vitamin C | Zinc |
|---|---|---|---|---|---|---|---|---|
| | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx | dy/dx |
| **Food Insecurity** | -0.0216 | -0.0363 | -0.0225 | -0.0587** | -0.0546 | -0.0216 | -0.00718 | -0.0399 |
| | -0.0339 | 0.0371 | 0.0377 | 0.0286 | 0.0376 | 0.0265 | 0.0373 | 0.0367 |
| **Activities of Daily Living (ADLs)** | | | | | | | | |
| Difficulty with walking from room to room on the same floor | 0.189*** | 0.180** | 0.132* | 0.0136 | 0.104 | -0.0365 | 0.0937 | 0.172** |
| | 0.0627 | 0.0713 | 0.0736 | 0.0572 | 0.0714 | 0.0528 | 0.0731 | 0.0746 |
| Difficulty with walking up 10 stairs | 0.0525* | -0.0159 | -0.024 | -0.0273 | -0.0102 | 0.0198 | 0.0514 | 0.00481 |
| | 0.0291 | 0.0311 | 0.0316 | 0.0246 | 0.0313 | 0.0235 | 0.0314 | 0.031 |
| Difficulty with walking a quarter mile | - | -0.0665** | -0.0116 | -0.0237 | -0.0664** | -0.00312 | -0.0531* | -0.0362 |
| | 0.0257 | 0.0271 | 0.0277 | 0.0219 | 0.0273 | 0.0207 | 0.0274 | 0.027 |
| Difficulty with sitting up from an armless chair | 0.0292 | 0.00771 | 0.0217 | -0.0295 | 0.00358 | -0.0492** | -0.0216 | -0.0143 |
| | 0.0309 | 0.0334 | 0.0339 | 0.0265 | 0.0335 | 0.0245 | 0.0336 | 0.0334 |
| Difficulty with getting in and out of bed | -0.0552 | -0.115*** | -0.0432 | -0.0305 | -0.00381 | -0.00507 | -0.0449 | -0.0389 |
| | 0.0403 | 0.0435 | 0.0436 | 0.0335 | 0.0429 | 0.0315 | 0.043 | 0.0427 |
| Difficulty with dressing oneself | -0.042 | -0.0306 | -0.0414 | -0.0142 | -0.0164 | -0.0137 | -0.0185 | -0.0249 |
| | 0.0442 | 0.0476 | 0.0481 | 0.0373 | 0.0477 | 0.0353 | 0.0476 | 0.0472 |
| Difficulty with feeding oneself using standard utensils | 0.0872 | 0.116** | 0.0251 | 0.0119 | 0.0718 | 0.017 | 0.119** | -0.0481 |
| | 0.0531 | 0.0589 | 0.0602 | 0.047 | 0.059 | 0.0457 | 0.0603 | 0.0589 |
| **Intrumental Activities of Daily Living (IADLs)** | | | | | | | | |
| Difficulty with managing money | 0.0482 | 0.0723* | 0.0672 | 0.0237 | 0.0276 | 0.0284 | 0.063 | 0.0236 |
| | 0.038 | 0.042 | 0.0431 | 0.0346 | 0.0425 | 0.0334 | 0.0432 | 0.0425 |
| Difficulty with completely chores | -0.0268 | -0.00248 | -0.0342 | -0.00002 | -0.024 | -0.0137 | -0.0383 | -0.0136 |
| | 0.0316 | 0.0335 | 0.034 | 0.0265 | 0.0336 | 0.0244 | 0.0335 | 0.0332 |
| Difficulty with preparing a meal | 0.0968* | 0.105* | 0.175*** | 0.0973** | 0.116** | 0.111** | 0.0626 | 0.133** |
| | 0.0527 | 0.0587 | 0.0604 | 0.0487 | 0.0588 | 0.0479 | 0.0598 | 0.0597 |
| Observations | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 | 4,092 |

all equations include variables for the demographic characteristics (gender, age categories, race, education, marital status, employment status, whether at or above 185 federal poverty level, and household size) and dummy variables for years

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

Standard errors in row below marginal effect

The IADL item of difficulty preparing a meal increases the likelihood of meeting nutrient needs except for vitamin C. Those with difficulty preparing meals have 9.7 percentage point increase in the probability of meeting daily requirements for calcium and protein. There is a 10.5 percentage point increase in the likelihood of meeting folate requirements for those with difficulty preparing a meal. Those with difficulty preparing a meal also have an 11.6 percentage point and 11.1 percentage point increase in the likelihood of meeting vitamin A and vitamin B12, respectively. Finally, those with difficulty preparing meals have a 17.5 percentage point increase the probability of meeting daily requirements for kcal and 13.3 percentage increase in the probability of meeting recommendations for Zinc. Having difficulty managing money increases the likelihood of meeting folate needs by 7.2 percentage points. This analysis shows that meal preparation is driving the IADLs' positive relationship with meeting nutrient recommendations for seniors. Individuals who are unable to prepare their own meals require assistance from others who may be making efforts to address these seniors' nutrient needs. While the food specific activity is driving the relationship between IADLs, each ADL has varied impacts on seniors meeting nutrient recommendations. The effects of ADLs associated with basic transferring and feeding oneself have positive relationships to meeting nutritional requirements. This suggests that as seniors face increased difficulty with the basic functions, there is likely an increase of seniors' need of assistance from others, including others assisting with food preparation.

## Discussion

Using 2007-2011 pooled data from NHANES, this paper examines the probability of meeting nutritional requirements among older Americans as a function of food

insecurity status, of activities of daily living (ADLs), and of instrumental activities of daily living (IADLs). The analysis presented demonstrates that being food insecure and having an increase in the number of ALDs that one has difficulty completing, are each associated with a decrease in the likelihood of an individual at age 65 or older will meet their protein needs. In contrast, an increase in the difficulty of an individual completing IDALs showed an increase in the likelihood of meeting most nutrient needs. Further modeling highlighted that a good portion of the IADLs relationship with meeting nutrient recommendations is driven by the specific item of being unable to prepare one's meals. This suggests that when another person is preparing a meal they may be considering the nutritional needs of the seniors whose meals they are preparing.

There are limitations to the analysis presented in the paper. While pooling multiple years of NHANES increased the sample size, the analytic sample is only 6,018. This small sample size can affect the reliability of the estimates and conclusions. Additionally, nutrient intake data is drawn from participants' daily dietary recalls, which may introduce measurement error. If an individual is so severely limited that another person is preparing meals, there is a concern over who is providing nutrition information. Additionally, there is no way to identify which seniors in the sample are using a proxy and which individuals are filling out their own dietary recall items. The use of a proxy can introduce another case of measurement error. Those responsible for assisting these seniors with several and possibly severe limitations may want to appear as if they are doing the best they can at assisting or preparing a meal for a senior individual. Thus, the potential for inaccurate recalls of food diaries could be a limitation to the analysis that would impact estimations.

Adequate nutrition is an important health prevention measure. Poor nutrition among the elderly is associated with poor health outcomes and an increase in risks of exacerbating chronic diseases (He et al, 2007; Meydani, 2001; Reedy et al, 2014). An inability to meet nutrition needs increases the costs of health care for seniors, their caretakers, and the health system. Elderly physiological changes, such as decreases in immunity, muscle tissues, and functioning of the digestive system (Brownie, 2005; Forster et al, 2012; Lesourd, 1997; Sullivan, 1995), require quality dietary intake. Appropriate nutrition can be a potential place to start interventions. The relationship between functional limitations and meeting nutritional needs is an area for further analysis. Additionally, research can examine if the mechanism for increased nutritional intake among those with numerous or more severe functional limitations operates through the role of others preparing meals. Specifically, further work could examine if meal preparation by others includes increasing nutrients as a conscious decision to mitigate poor health outcomes of seniors or if this is based solely on a caregiver.

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# CHAPTER 4: GENDER DISPARITIES IN FOOD SECURITY AMOUNG SENIORS

## Introduction

The gender inequities in the economic experiences of women and men in the United States are an issue through prime age, and continue as individuals enter senior ages (Sullivan & Meschede, 2016). Senior women are more likely to live in poverty than senior men (Administration of Aging, 2015). Racial and ethnic minorities are more likely to live in poverty than Whites in old age—with senior women of color having the highest rates of economic vulnerability (Administration of Aging, 2015). Unmarried senior women have higher poverty rates than those who are married. These gaps in economic well-being and employment are more conspicuous among men and women of lower socioeconomic statuses (Munnell, 2004; Butrica, Smith, & Iams, 2012). Women's higher risks of economic insecurity at senior age can in part be explained by women's lower accumulation of lifetime earnings, fewer years in the workforce, and lower financial net worth and likelihood of receiving pension income (Anzick & Weaver, 2001; Vartanian & MacNamara, 2002). The gendered differences in experiences of economic security among men and women during their prime-age has been shown to contribute to the continued gender differences in economic well-being and poverty among seniors. Additionally, gender inequality among seniors is driven by policies and experiences specifically related to retirement, Social Security, insurance programs, and labor force participation at senior age (Ellis, Munnell, & Eschtruth, 2014; Meschede, Sullivan, & Shapiro, 2011; Sullivan & Meschede, 2016).

An example of differences in economic well-being by gender is the inequity in material hardship[18]. Food security, a component of material hardship, which is associated with poverty and labor participation, has differential impact and prevalence by gender (LeBlanc, Betsey, & Blaylock, 2005). The United States Department of Agriculture (USDA) Economic Research Service (ERS) estimated single female-headed households with children have the highest risks of food insecurity, with a prevalence of food insecurity of 30.3 percent; in contrast, households headed by single men with children had a food insecurity prevalence rate of 22.4 percent (Colemen-Jensen, et al., 2016). Additionally, among the food insecure, women are more likely than men to have more adverse health effects—including obesity, cardiovascular disease, depression, and other mental health issues— relative to those of the same gender who are food secure (Casey et al 2004; Gooding, Walls, & Richmond, 2012; Heflin, Siefert, & Williams, 2005; Martin & Lippert, 2012; Olson 1999; Pan et al., 2012; Seligman, Laraia & Kushel 2010; Townsend et al, 2001; Wu & Schimmele 2005).

The strategies and coping mechanisms individuals use to mitigate the effect of limited or uncertain access to quality food due to social or economic condition vary by gender, leading to differing rates of food insecurity among women and men in the same household (Blake et. al, 2008; Devine et. al,2006; Hanson, Sobol, & Frongillo, 2007). For example, women will limit their own food intake to shield children and men in the household from experiencing food insecurity (Blake et. al, 2008; Hadley et al, 2008; Maxwell, 1998; Tarasuk, 2001). Subsequently, low-income households where resources

[18] Material hardship is the inability for a household to consume basic goods and services, like food, housing, and medical care (Beverly, 2001).

are managed by mothers find children in these homes have lower rates and severity of food insecurity, relative to low-income homes where resources are managed by fathers (Kenny 2008). These empirical findings suggest the gendered components of household and family structure create some of the differential food insecurity between men and women. What is unknown is whether the gender gap in food security levels continues as Americans age, in the same way as gendered differences in the labor market and economic well-being continue into senior age.

Senior food insecurity is a growing social problem. From 2004 to 2014 the rate of seniors experiencing marginal food insecurity has nearly doubled, rising from 7.4 percent to 15.8 percent. In 2013, nearly half of those 65 and older who lived below the poverty line faced marginal food insecurity (AbuSabha et al., 2011; Ziliak & Gundersen, 2014, 2016). Food insecurity among seniors is likely to continue to increase in the future. As the senior population becomes more racially and ethnically diverse, there is an increase in the numbers of individuals who are expected to have higher risks of food insecurity (Ortman & Velkoff, 2014; Ziliak & Gundersen, 2013, 2014). While food insecurity rates among seniors are increasing, there is still a relatively small body of literature on the relationship between senior food insecurity and gender. As seniors become a larger proportion of the United States population, it is important to better understand issues of material hardship, such as food insecurity, among seniors and how food insecurity may differ among subpopulations of seniors.

This paper answers the research question: What are the drivers behind differences in food security status among women householders[19] and men householders in the senior population? There are few evaluations that specifically explore gender and food security among seniors. In this paper, I begin with a review of the literature on senior food insecurity. I then review the literature on the relationship between food security and gender and explore where there are gaps in this literature. Using nationally representative data from the Current Population Survey Food Security Supplement (CPS-FSS) from the years 2005 to 2015, I present an analysis of food security and gender among men and women age 65 and older, presenting marginal effects from probit analysis to understand the relationship between gender, household and demographic characteristics, and food security.

## Literature Review

### Gender Disparities in Senior Food Security

Senior women have higher rates of food insecurity than senior men (Chung et al., 2011; Dean, 2011; Pierce et al., 2002; Sharkey, 2003). In 2013, roughly 17 percent of senior women and 14 percent of senior men reported facing marginal food insecurity (Ziliak & Gundersen, 2015). Among those 60 and older, 8.3 percent of women had either low food security or very low food security, and 6.7 percent of men were either identified as having low food security status or very low food security status (Strickhouser, Wright,

[19] In the Current Population Survey (CPS) householder is the "person (or one of the persons) in whose name the housing unit is owned or rented (maintained) or, if there is no such person, any adult member, excluding roomers, boarders, or paid employees. If the house is owned or rented jointly by a married couple, the householder may be either the husband or the wife" (United States Census Bureau). Prior to 1980 this was referred to as the head of household, but was changed in response to questions of gender bias in identification.

& Donely, 2014). However, when the sample is limited to those under 200 percent of the federal poverty there is little differences in the rates of the binary food security measure among senior men and women (Strickhouser, Wright, & Donely, 2014; Ziliak & Gundersen, 2012). For example, using the detailed food security measures, among women ages 60 and older with income 200 percent below the federal poverty line 10 percent had marginal food insecurity, 8 percent had low food insecurity, and 5 percent had very low food security. While among men ages 60 and older at the same income level 8 percent had marginal food security, 9 percent had low food security, and 6 percent had very low food security (Strickhouser, Wright, & Donely, 2014). Empirical research interested in exploring the differences in food security between genders has primarily focused on understanding the gendered differences in food security status among prime-aged individuals. There is very little research explaining the differences in food insecurity by gender among seniors.

**Demographic Characteristics and Senior Food Security**

Food security status among seniors varies by age, race/ethnicity, geography, and region (Lee, et al., 2012; Ziliak, Gundersen, & Haist, 2008). While there has been a growth in food insecurity among all age cohorts, younger cohorts of the elderly have higher rates of food insecurity (Ziliak & Gundersen, 2014, 2016). Among those aged 70-79 years in 2013, 14 percent were marginally food insecure. Conversely, 11 percent of those aged 80 and older were marginally food insecure (Ziliak & Gundersen, 2013, 2014). Seniors who identify as part of ethnic and racial minority groups have increased rates and likelihood of being food insecure (Goldberg & Mawn, 2016). Black and Hispanic seniors have consistently had higher food insecurity rates, including higher rates

of low food security, very low food security, and marginal food insecurity, than White seniors (Strickhouser, Wright, & Donely, 2014; Ziliak & Gundersen, 2013, 2014). With data from the CPS-FSS merged with March CPS Demographic Data pooled from years 2005 to 2012, Strickhouser and co-authors (2014), found among those ages 60 and older with income below 200 percent of the federal poverty line, approximately 23 percent of Black seniors and 23 percent of Hispanic seniors had low food security, compared to only 12 percent of White. Additionally, among those below 200 percent of the federal poverty line, 9 percent of Black seniors, 5 percent of Hispanic seniors, and just under 5 percent of White seniors had very low food security (Strickhouser, Wright, & Donely, 2014). Finally, geography and region can be a key theme in food insecurity among the aging. There is a strong correlation between residing in the South and food insecurity for seniors. The South has 9 out of 10 states with the highest rate of food insecurity in the country. Arkansas has the highest rate of marginal food insecurity among seniors with 26.1 percent of seniors experiencing marginal food insecurity (Ziliak & Gundersen, 2014, 2016).

**Socioeconomic Status and Senior Food Security**

Food security among seniors varies by socioeconomic status in commonly expected ways. Educational attainment, income, and employment status are associated with senior food insecurity (Guthrie & Lin, 2000; Wolf, Frongillo, & Valois, 2003; Ziliak & Gundersen, 2013, 2014). Strickhouser and colleagues (2014) estimate the determinants of food security among older Americans across several cohorts (ages 65-69, ages 70-74, and 75 years and older) finding that an increase in educational attainment decreases a seniors' odds of being food insecure. Among those ages 65 to 69 those without a high

school degree are 1.11 times more likely to be food insecure than those with just a high school degree, 1.30 times more likely to be food insecure than those with some college, and 2.70 times more likely to be food insecure than those with a college degree.

Similarly, low income has a negative relationship with food insecurity among seniors; senior food insecurity is greatest among the lowest income groups (Hall & Brown, 2005; Strickhouser, Wright, & Donely, 2014; Ziliak & Gundersen, 2013, 2014). Among seniors with household incomes below the federal poverty line, 48.8 percent have marginal food insecurity. While those with income between 100 percent and 200 percent of the federal poverty line and those above 200 percent of the federal poverty line have rates of 31.2 percent and 7.7 percent respectively. Finally, seniors not participating in the labor force and seniors who are unemployed have an increase in rates of food insecurity (Strickhouser, Wright, & Donely, 2014; Ziliak & Gundersen, 2013, 2014). Among seniors who are unemployed, 17 percent are food insecure, while those not in the labor force due to disability have a level of food insecurity of 25 percent (Strickhouser, Wright, & Donely, 2014).

**Household Composition and Senior Food Security**

Household and family structure are also associated with food security differences. Among the entire United States population in 2015, 9.2 percent of seniors living alone were food insecure, and 8.3 of households with seniors were food insecure (Coleman-Jensen et al., 2016). Seniors who are married are less likely than seniors who are unmarried, divorced, separated, and widowed seniors to be food insecure. However, having children in the home increases the risk of food insecurity among seniors (Lee & Frongillo, 2001). The presence of children and other non-marital family and nonfamily

co-habitation increase food insecurity among seniors relative to those seniors who live alone (Bhargava & Lee, 2016; Goldberg & Mawn, 2014; Hall & Brown, 2005; Ziliak & Gundersen, 2016). Furthermore, the magnitude of the increased odds of food insecurity among those living with family or nonrelatives increases with each older age group (Ziliak & Gundersen, 2012, 2015). Seniors with a grandchild present in the home have a 2.9 percentage point increase in the likelihood being food insecure, and 6.2 percentage point increase in the likelihood of being marginally food secure (Ziliak, Gundersen, & Haist, 2008).

**Food Security Coping Strategies Among Seniors**

Aging individuals participate in many of the same informal coping strategies (limiting personal food intake, relying on assistance from others, etc.) as those in prime-age to address the lack of resources (Sharkey, 2003; Wolfe, Olson, Kendall & Frongillo, 1998). For those able to gain transportation, older individuals use food pantries to help with food needs (Wolfe, Olson, Kendall & Frongillo, 1998). However, many seniors are disabled or unable to drive themselves; therefore, they use other coping strategies like consumption of food deemed undesirable (Sharkey, 2003; Wolfe, Olson, Kendall & Frongillo, 1998). Elderly individuals also receive food from the community or family as a coping strategy. Another popular coping strategy is Meals on Wheels which is a formal program used to provide food preparation and delivery for low income and aging individuals. On the other hand, elderly individuals have lower rates of the use of SNAP as a coping strategy (Duerr, 2006; Lee, Fischer & Johnson, 2010).

## Motivation of Analysis

There are well-known differences between senior men householders and women householders that increases the likelihood that senior women householders will be food insecure. Women have higher rates of poverty, lower levels of lifetime income, and lower amounts of senior-specific financial resources—i.e. pensions, Social Security income, etc. (Reno & Veghte, 2010; Vartanian & MacNamara). Previous literature on gender differences in food security among prime-aged individuals has focused on families with children, highlighting gendered household roles and increased predictors for food insecurity (Olson, 2005). The differing roles of mothers and fathers in food security coping strategies lead to disparate food insecurity rates between men and women even within the same household (Coltraine, 2000; Martin & Lippert, 2012). This research, on food insecurity differences by gender among prime-aged individuals, has found that the traditional gender norms found in work and home are also reflected in the choice of coping strategies for women and men (Devine, et al., 2006; Blake et. al, 2008; Tarasuk, 2001). For example, "maternal buffering" is a gendered coping strategy, where mothers limit their intake of food so their children can receive enough to eat, to limit the effect of food insecurity on other members of the household (DeVault, 1994; Martin & Lippert, 2012; Maxwell, 1996; Matud, 2004; Olson, 2005). This suggests men and women may have different predictors for food insecurity.

Additionally, research on gendered differences in food insecurity have found that the increase risks of food insecurity among women can be explained by women's increase rates of predictors of food insecurity (Ivers & Cullen, 2011). For example, women have lower income, poorer economic well-being, often are single parents, and

have lower education—all predictors for food insecurity (Tarasuk, 2001; Ivers & Cullen, 2011). Thus, knowing that both senior and prime-aged women have increased risks of poor economic well-being and prime-aged women have different interactions with food consumption related to family structures which increase risk, it is of interest to see what is driving the gendered differences in food security among seniors. Are the gendered differences in food insecurity among men and women a result of having more predictors of food insecurity or are unobservable gendered household roles and coping playing a role in the divergence of food insecurity rates among senior men and women? With the growth in senior food security, it is important to identify what may contribute to the difference in food insecurity between men householders and female householders.

## Methods

### Data

This paper examines food security, gender, and coping strategies among seniors. I used the Current Population Survey Food Security Supplement (CPS-FSS) years 2005 to 2015. The CPS-FSS is a nationally representative survey, conducted by the US Census Bureau since 1995, of about 50,000 households. The CPS-FSS is fielded in December and includes standard demographic information and food security information. The data includes 12-month household food security status, national nutrition assistance program participation, and emergency food assistance use. Food security data from the CPS-FSS is defined at the household level, and thus this work will focus on heads of household and household characteristics.

**Measures**

The goal of this descriptive paper is to examine how food security and coping strategies among seniors differ by gender. Age is included as a series of categorical binary variables identifying ages 65 to 69, ages 70 to 74, ages 75 to 79, and ages 80 and older. I use four racial and ethnic categories including: 1) individuals who answer yes to Hispanic ethnicity are coded as Hispanic; 2) individuals are assigned to White if they identify as White in the race question and not Hispanic in the ethnicity question; 3) individuals are assigned as black if they identify as black in the race question and not Hispanic in the ethnicity question; and 4) individuals are categorized as "other race" if they identify as American Indian or Eskimo, Asian or Pacific Islander, or "other race" who do not identify as Hispanic. Four levels of education are identified with indicator variables for those who receive less than high school diploma, those who have received a high school diploma or a GED, those with some college but who have not received a four-year college degree, and those who have completed four years of college or more. For marital status, I created indicator variables for each category of marital status: 1) married, 2) never married, 3) widowed, 4) divorced, and 5) separated. Employment status indicator variables are created to identify: 1) the employed, 2) unemployed, and 3) those who are not in the labor market. I create an indicator variable for the presence of a child under 18 in the home. I also include a variable for household size, calculate as the total number of individuals including children in the household. To address this issue of double counting those who are married and living in a household of two I include an

interaction term for married in a household size of two. Finally, household income is included, which is adjusted for inflation[20].

The outcome variable of interest is food security. There are ten household food security items for adults. Each question is a food insecure behavior strategy or food insecure condition and is answered in a dichotomous manner of yes if a respondent meets the condition or use the behavior or no if a respondent does not meet the condition or use the behavior. The FSS contains a detailed food security measure that includes four food security statuses: 1) food secure, 2) marginally food secure, 3) low food security, and 4) very low food security. To be marginally food secure a respondent meets the condition of one or two reported indications of food security. Respondents are deemed food insecure if respondents answer affirmatively to three or more conditions of food scarcity. Very low food security is characterized when multiple times through a year a household has limited access to food which leads to a reduction in food consumption. In the descriptive analysis, I use the detailed food security measure. For analysis, I also include the dichotomous food security measure, where if respondents meet more than two conditions, a household is food insecure.

**Analytic Sample and Procedures**

My analytic sample is restricted to those ages 65 and older who are identified as householders, who have no missing data for my independent and dependent variables. The sample is restricted to householders, because food insecurity is a variable collected at the household level. Additionally, the literature that covers gender differences in food

[20] Adjusted for inflation to buying power in 2013

insecurity indicates in some cases men and women have different patterns of food insecurity within their own homes, based on gendered coping strategies and household roles. Thus, to more accurately identify the food security status of the individual senior I focus on the food security answers given for the householder. This is more accurately gathered than taking the household food security status and applying it to every senior individual in the household and then estimating the gender differences. *Table 1* presents weighted[21] (N=97,521; Men=45,700; Women=51,821) descriptive statistics comparing men and women ages 65 and older representing a weighted population size of 9,623,993 men over the age of 65 and 10, 926, 028 women over the age of 65. In the first row of descriptive statistics, we see that there are more men ages 65 to 69, almost 7 percent, than the proportion of women age 65 to 69. Similarly, men comprise have a greater proportion of those ages 70 to 74, than women. However, women have greater proportions of those in older age groups. Women ages 80 to 84 have roughly 3 percent greater proportion in this age group then man. This distribution of age groups by gender is consistent with previous literature with senior women having increased longevity relative to senior men (Centers for Disease Control and Prevention, 2013). Also, 9 percent of men in the sample are 85 and older, while roughly 15 percent of women in the sample are ages 85 and older. There is a slightly larger proportion of Whites among men (about +2 percent) in the sample than women. The proportion of Black women in the sample is roughly 3 percent greater than the proportion of senior Black men in the sample. Additionally, regionally there are small differences in the proportion of men and women living in each region.

[21] Weighted using household supplement weights.

The proportion of senior men living in the West is close to 3 percent greater than the proportion of women living in the West.

Table 1. Weighted Descriptive Statistics for Those Age of 65+ by Gender

| | | 2005-2015 CPS-FSS Age 65+ (N=97,521) | | | Pooled |
|---|---|---|---|---|---|
| | | Men (n=45,700) | Women (n=51,821) | Diff | Sig |
| **Demographic Characteristics** | | | | | |
| Age | | | | | |
| | Age 65-69 | 34.48% | 27.85% | 6.64% | *** |
| | Age 70-74 | 24.94% | 21.94% | 3.00% | *** |
| | Age 75-79 | 18.52% | 19.39% | -0.87% | *** |
| | Age 80-84 | 12.73% | 16.02% | -3.29% | *** |
| | Age 85+ | 9.32% | 14.80% | -5.48% | *** |
| Race | | | | | |
| | White | 82.16% | 80.28% | 1.88% | *** |
| | Black | 7.44% | 10.16% | -2.73% | *** |
| | Hispanic | 6.30% | 6.13% | 0.17% | * |
| | Other | 4.10% | 3.43% | 0.67% | *** |
| Geography | | | | | |
| | Rural | 19.34% | 19.74% | -0.41% | |
| | Urban | 80.66% | 80.26% | 0.41% | |
| Region | | | | | |
| | Northeast | 18.19% | 19.62% | -1.43% | *** |
| | Midwest | 22.85% | 23.65% | -0.80% | ** |
| | South | 37.16% | 37.16% | 0.00% | ** |
| | West | 21.80% | 19.57% | 2.23% | *** |
| **Socioeconomic Status** | | | | | |
| Education | | | | | |
| | Less than High School | 17.28% | 19.52% | -2.25% | *** |
| | High School or GED | 29.16% | 37.10% | -7.94% | *** |
| | Some College | 22.46% | 23.91% | -1.45% | *** |
| | College | 31.10% | 19.47% | 11.63% | *** |
| Income | | | | | |
| | Household Income | $55,200 | $39,145 | $16,055 | *** |
| Employment Status | | | | | |
| | Employed | 19.71% | 13.16% | 6.55% | *** |
| | Unemployed | 1.32% | 0.83% | 0.49% | *** |
| | Not in Labor Market | 78.97% | 86.01% | -7.04% | *** |
| **Household Composition** | | | | | |
| Marital Status | | | | | |
| | Married | 67.14% | 26.49% | 40.65% | *** |
| | Never Married | 5.18% | 5.37% | -0.19% | |
| | Divorced | 10.99% | 16.02% | -5.03% | *** |
| | Widowed | 15.37% | 50.83% | -35.46% | *** |
| | Separated | 1.33% | 1.30% | 0.03% | |
| Household Size | | | | | |
| | 1 Person Household | 27.64% | 58.64% | -31.00% | *** |
| | 2 People Household Married | 55.11% | 21.87% | 33.24% | *** |
| | 2 People Household Not Married | 4.90% | 10.86% | -5.96% | *** |
| | 3-4 People Household | 10.57% | 7.06% | 3.52% | *** |
| | 5+ People Household | 1.78% | 1.57% | 0.21% | ** |
| Children | | | | | |
| | Child(ren) in the Home | 1.11% | 0.53% | 0.58% | *** |
| Weigthed Population Size | | 9,623,993 | 10,926,028 | -1,302,035 | |

*** p<0.01, ** p<0.05, * p<0.10 H

Weighted with Household Supplement Weight

ousehold income adjusted for inflation and set at 2015 levels

There are significant differences in the socioeconomic status of men and women in the sample. A greater proportion of senior women than senior men have a high school diploma or GED equivalent or some college education (+8 percent and +2 percent, respectively), while 31 percent of senior men in the sample are college educated compared to 20 percent of senior women. The average household income among senior women who are heads of households is $39,145, while senior men have an average household income that is $16,055 higher than women at $55,200. Additionally, senior men are more likely to be employed than senior women, 20 percent and 12 percent, respectively. Finally, there is only a small half a percent difference between the proportion of unemployed men and women in the sample. However, there is a nearly 7 percent increase in the proportion of women (86 percent) in the sample who are not in the labor market compared to men not in the labor market (79 percent).

Finally, there are significant differences in proportions of each category of marital status and household size between the two genders. 67 percent of men are married compared to 27 percent of women; conversely, 51 percent of women are widowed compared to 15 percent of men. Additionally, women have a 5 percent increase in the proportion who are divorced relative to men in the sample. Nearly 59 percent of senior women in the sample live alone in their household, which is 31 percent more than the proportion of senior men who live alone. While 55 percent of men who are householders in the sample live in two-person married households, compared to 22 percent of women householders who live in two-person married households. Additionally, 11 percent of women live in two-person non-married households, compared to almost 5 percent of men. The descriptive statistics of the sample highlight that women have greater

proportions of observations with characteristics known to be associated with food insecurity: more black, less educated, lower household income, less labor market participation, and more widowers and divorcees (Strickhouser, Wright, & Donely, 2014; Ziliak & Gundersen, 2012).

**Analytical Approach**

For analysis, I use forward stepwise probit regression, where I build an explanatory model in which sets of variables for demographic characteristics, socioeconomic characteristics, and household composition are sequentially added to the model based on their effect on the outcome variable of food insecurity and the change in magnitude of the effect of gender on food insecurity. I use the following model:

$$FoodInsecure_{it} = \alpha + FEM_i\beta_1 + X_i\beta_1 + SES_i\beta_2 + HH_i\beta_2 + \varphi_t +$$

$$\varepsilon_i \text{FoodInsecure}_{\text{it}} = \alpha + \text{FEM}_{\text{i}}\beta_1 + \text{X}_{\text{i}}\beta_1 + \text{SES}_{\text{i}}\beta_2 + \text{HH}_{\text{i}}\beta_2 + \varphi_{\text{t}} + \varepsilon_{\text{i}}$$

Where $FoodInsecure_{it}$ is the food security status of an individual $i$, $FEM_i$ is an indicator variable for gender, $X_i$ which is a set of indicator variables measures for demographic characteristics ( age , race, geography, and region), $SES_i$ is a set of variables for socioeconomic characteristics (educational attainment, employment status, and household income), $HH_i$ is a set indicator variables for household characteristics (marital status, household size, interaction term of household size of two and marital status of married, and the presence of children in the home), $\varphi_t$ is a set of indicator variables for each year, and $\varepsilon_i$ is a random error term. This model explores what contributes to the variation in senior food insecurity by gender, examining whether senior women's increase in predictors of food insecurity relative to senior men are the main contributor to the

difference. Additionally, for sensitivity analysis, I run the same model splitting the sample by gender, but omitting the gender term. This allows for testing if I see similar differences in predictors between senior men and women.

## Results

### Descriptive Statistics

*Table 2* shows weighted[22] differences in the distribution of food security status between senior men and women. For the detailed food security status, close to 89 percent of senior have high food insecurity compared to roughly 83 percent of senior women. Senior women have a higher proportion of those who have marginal food insecurity, approximately 8 percent of women have marginal food insecurity while approximately 5 percent of senior men have marginal food insecurity. Women also have a higher rates of low food security—around 5 percent compared to men who have a rate almost 4 percent. Women have an almost one percent increase in the prevalence of very low food insecurity compared to men. When the food security measure is collapsed into a binary measure of food insecurity, where those who have low food security or very low food security are designated food insecure, women have 3 percent higher rate of food insecurity than men in the sample, 9 percent and 6 percent, respectively.

[22] Weighted with household supplement weights

Table 2. Weighted Food Security Descriptive Statistics by Gender

| | | 2005-2015 Pooled CPS-FSS | | | |
|---|---|---|---|---|---|
| | | Age 65+ (N=97,521) | | | |
| | | Men (n=45,700) | Women (n=51,821) | Diff | Sig |
| **Detailed Food Security** | | | | | |
| | High Food Security | 88.57% | 82.79% | 5.78% | *** |
| | Marginal Food Security | 5.42% | 8.20% | -2.78% | *** |
| | Low Food Security | 3.67% | 5.72% | -2.05% | *** |
| | Very Low Food Security | 2.33% | 3.29% | -0.96% | *** |
| **Binary Food Security** | | | | | |
| | Food Insecure | 6.01% | 9.01% | -3.01% | *** |
| Weighted Population Size | | 9,623,993 | 10,926,028 | -1,302,035 | |

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

Weighted with Household Supplement Weight

## Probit Estimation

To further understand gender and food security among seniors I use forward stepwise probit models, using household supplement weights. *Table 3* shows the marginal effects for the model; first, I present the results of the models. Each paragraph focuses on the addition of each set of variables--demographic characteristics, socioeconomic status, and household characteristics-- and their role in explaining differences in food insecurity by gender. As seen in *Table 3*, Model 1 contains the marginal effect of gender on food security status absent covariates, but including year fixed effects. In this model, a senior woman has a 3.1 percentage point higher likelihood of being food insecure relative to a senior male.

Table 3. Marginal Effects for Model 1, Model 2, Model 3, and Model 4

| | | 2005-2015 Pooled CPS-FSS | | | |
|---|---|---|---|---|---|
| | | Age 65+ (N=97,521) | | | |
| | | Model 1 | Model 2 | Model 3 | Model 4 |
| **Gender** | | | | | |
| | Female | 0.0305 *** | 0.0311 *** | 0.0138 *** | 0.0067 *** |
| | | 0.00200 | 0.00197 | 0.00196 | 0.00206 |
| **Demographic Characteristics** | | | | | |
| Age | | | | | |
| | Age 65-69 | | | | |
| | Age 70-74 | | -0.0149 *** | -0.0245 *** | -0.0207 *** |
| | | | 0.00248 | 0.00245 | 0.00243 |
| | Age 75-79 | | -0.0241 *** | -0.0411 *** | -0.0344 *** |
| | | | 0.00272 | 0.00271 | 0.00271 |
| | Age 80-84 | | -0.0423 *** | -0.0639 *** | -0.0554 *** |
| | | | 0.00320 | 0.00319 | 0.00321 |
| | Age 85+ | | -0.0576 *** | -0.0848 *** | -0.0736 *** |
| | | | 0.00369 | 0.00366 | 0.00372 |
| Race | | | | | |
| | White | | omitted variable | | |
| | Black | | 0.0924 *** | 0.0615 *** | 0.0485 *** |
| | | | 0.00280 | 0.00271 | 0.00271 |
| | Hispanic | | 0.0882 *** | 0.0458 *** | 0.0355 *** |
| | | | 0.00369 | 0.00367 | 0.00362 |
| | Other | | 0.0433 *** | 0.0292 *** | 0.0216 *** |
| | | | 0.00474 | 0.00469 | 0.00464 |
| Geography | | | | | |
| | Rural | | omitted variable | | |
| | Urban | | -0.0169 *** | 0.0029 | -0.0001 |
| | | | 0.00223 | 0.00217 | 0.00215 |
| Region | | | | | |
| | Northeast | | omitted variable | | |
| | Midwest | | -0.0005 | -0.0021 | -0.0018 |
| | | | 0.00304 | 0.00295 | 0.00291 |
| | South | | 0.0065 ** | 0.00327 | 0.0027 |
| | | | 0.00276 | 0.00271 | 0.00267 |
| | West | | -0.0072 ** | 0.0009 | -0.0018 |
| | | | 0.00319 | 0.00316 | 0.00311 |
| **Socioeconomic Status** | | | | | |
| Education | | | | | |
| | Less than High School | | omitted variable | | |
| | High School or GED | | | -0.0358 *** | -0.0335 *** |
| | | | | 0.00241 | 0.00238 |
| | Some College | | | -0.0326 *** | -0.0307 *** |
| | | | | 0.00278 | 0.00276 |
| | College | | | -0.0525 *** | -0.048 *** |
| | | | | 0.00341 | 0.00341 |
| Income | | | | | |
| | Household Income (in $1,000) | | | -0.0019 *** | -0.0020 *** |
| | | | | 0.00007 | 0.00007 |
| Employment Status | | | | | |
| | Employed | | omitted variable | | |
| | Unemployed | | | 0.0784 *** | 0.0736 *** |
| | | | | 0.00721 | 0.00719 |
| | Not in Labor Market | | | 0.00671 ** | 0.0100 *** |
| | | | | 0.00302 | 0.00300 |
| **Household Composition** | | | | | |
| Marital Status | | | | | |
| | Married | | omitted variable | | |
| | Never Married | | | | 0.0205 *** |
| | | | | | 0.00584 |
| | Divorced | | | | 0.0466 *** |
| | | | | | 0.00497 |
| | Widowed | | | | 0.0182 *** |
| | | | | | 0.00486 |
| | Separated | | | | 0.0623 *** |
| | | | | | 0.00742 |
| Household Size | | | | | |
| | 1 Person Household | | omitted variable | | |
| | 2 People Household Not Married | | | | 0.0325 *** |
| | | | | | 0.00309 |
| | 2 People Household Married | | | | 0.00538 |
| | | | | | 0.00509 |
| | 3-4 People Household | | | | 0.0579 *** |
| | | | | | 0.00422 |
| | 5+ People Household | | | | 0.1050 *** |
| | | | | | 0.00688 |
| Children | | | | | |
| | Child(ren) in the Home | | | | 0.0077 |
| | | | | | 0.00946 |
| Weighted Population Size | | | | | 205,500,216 |

Standard errors below marginal effects
*** p<0.01, ** p<0.05, * p<0.1
Models include dummy variables for years with 2005 omitted
CPS household December supplement weights utilized in all models;
Household income adjusted for inflation and set at 2015 levels

Moving to Model 2 in *Table 3*, which adds demographic characteristics to the model, senior women face a 3.1 percentage point higher risk of being food insecure relative to senior men. Additionally, there is a negative relationship between age and food insecurity—older age groups have a decrease in the likelihood of being food insecure relative to those aged 65 to 69. Seniors ages 70 to 74 have a 1.5 percent increase in the probability of being food insecure relative to those ages 65 and 69. Seniors aged 75 to 79, 80-84, and 85 and older have an increase in the probability of being food insecure relative to the youngest age group of 2.4 percentage points, 4.2 percentage points, and 5.8 percentages points, respectively. Racially and ethnically, minorities have an increase in the probability of being food insecure relative to White seniors. As seen in *Table 3,* Black seniors have an 9.2 percentage point higher probability of being food insecure relative to Whites. Hispanics have a slightly lower probability than Blacks, with an increase of 8.8 percentage points and those identifying as "other race" have an increase of 4.3 percentage points relative to Whites. There is a 1.7 percentage point decrease in the likelihood of being food insecure for those living in urban areas relative to those in rural areas. Additionally, there is a small increase in the probability of being food insecure for those in the South, and a small decrease in the probability of being food insecure for those living in the West relative to those living in the Northeast.

As seen in the third column of *Table 3*, Model 3 includes the addition of socioeconomic status in modeling the determinants of food insecurity among seniors. Senior women have a 1.4 percentage point higher probability of being food insecure relative to men with the addition of socioeconomic status, a slight decrease in the magnitude from Model 2. The addition of socioeconomic status increases the magnitude

of the effects of each age category by about 1 percentage point, yet there continues to be the same negative relationship with age and food insecurity. Model 3 shows a decrease in the magnitude of the marginal effects of race on food insecurity, with ethnic and racial minority seniors still having an increase in the probability of being food insecure relative to White seniors. Among the socioeconomic characteristics, high educational attainment decreases the likelihood of seniors being food insecure relative to those with no high school degree; seniors with a high school degree or GED have a 3.6 percentage point decrease in the likelihood of being food insecure relative to seniors with less than a high school degree. Having some college education decreased the probability of being food insecure by 3.3 percentage points relative to those seniors with less than a high school degree. For seniors with a college degree there is a 5.3 percentage point decrease in the likelihood of being food insecure. Additionally, income has a negative relationship with food insecurity status, for one unit increase in income (an increase in one thousand) there is a 0.19 percentage point decrease in the probability of a senior being food insecure. Finally, seniors who are unemployed have at 7.8 percent increase in the probability of being food insecure relative to those who are employed. Seniors who are not participating in the labor market have a 0.7 percentage point increase in the likelihood of being food insecure relative to those who are employed.

Model 4 includes the addition of variables related to household composition to Model 3. As seen in *Table 3*, the inclusion of household composition variables decreases the magnitude of the effect of gender on food insecurity—women have a 0.7 percentage point higher probability of being food insecure. Those who were never married have a 2.1 percentage point increase in the likelihood of being food insecure relative to those who

were married. Similarly, those who were divorced, widowed, and separated had increases in the probability of being food insecure relative to those who were married of 4.7 percentage points, 1.8 percentage points, and 6.2 percentage points, respectively. Following the literature on food security and household composition, there is a positive relationship between food insecurity status and household size of seniors (Strickhouser, Wright, & Donely, 2014). For those two person households who are not married there is an 3.3 percentage point increase in the probability of being food insecure relative to those living in a one person households of any marital status. Those in households of three or four have a 5.8 percentage point increase in the probability of being food insecure, and those with five or more people have a 11 percentage point increase in the probability of being food insecure relative to those living alone. The addition of household composition variables appears to account for the food insecurity variability associated with gender. There were statistically significant differences between men and women in the analytic sample in marital status, and household size.

**Gender-Stratified Probit Analysis**

The probit estimation shows the addition of household characteristics significantly decrease the variability of gender on food security status of seniors. The distribution analysis and previous research highlight statistically significant variation between men and women related to increased proportion of demographic, socioeconomic, and household composition risk factors. To further examine what contributes to the variability in food security between men and women over the age of 65 years older, I use sensitivity analysis, *Table 4* shows the gender-stratified probit analysis of models.

Table 4. Additive Model Analysis: Marginal Effects for Model 1, Model 2, and Model 3

| | 2005-2015 Pooled CPS-FSS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age 65+ | | | | | | | | | | | | | | |
| | Model 1 | | | | | Model 2 | | | | | Model 3 | | | | |
| | Men (n=45,700) | | Women (n=51,821) | | Diff Sig | Men (n=45,700) | | Women (n=51,821) | | Diff Sig | Men (n=45,700) | | Women (n=51,821) | | Diff Sig |
| **Demographic Characteristics** | | | | | | | | | | | | | | | |
| Age | | | | | | | | | | | | | | | |
| Age 65-69 | omitted variable | | | | | | | | | | | | | | |
| Age 70-74 | -0.0111 | *** | -0.0185 | *** | | -0.0199 | *** | -0.0285 | *** | | -0.0171 | *** | -0.0241 | *** | |
| | 0.00316 | | 0.00376 | | | 0.00309 | | 0.00373 | | | 0.00307 | | 0.00371 | | |
| Age 75-79 | -0.0182 | *** | -0.0299 | *** | | -0.032 | *** | -0.0491 | *** | | -0.0272 | *** | -0.0414 | *** | |
| | 0.00360 | | 0.00402 | | | 0.00357 | | 0.00403 | | | 0.00355 | | 0.00405 | | |
| Age 80-84 | -0.0300 | *** | -0.0531 | *** | YES* | -0.0491 | *** | -0.0764 | *** | | -0.0425 | *** | -0.0673 | *** | |
| | 0.00443 | | 0.00459 | | | 0.00439 | | 0.00463 | | | 0.00437 | | 0.00466 | | |
| Age 85+ | -0.0318 | *** | -0.0774 | *** | YES*** | -0.0575 | *** | -0.106 | *** | YES*** | -0.0491 | *** | -0.0933 | *** | YES*** |
| | 0.00510 | | 0.00523 | | | 0.00497 | | 0.00528 | | | 0.00505 | | 0.00537 | | |
| Race | | | | | | | | | | | | | | | |
| White | omitted variable | | | | | | | | | | | | | | |
| Black | 0.0836 | *** | 0.1000 | *** | YES*** | 0.0492 | *** | 0.0722 | *** | | 0.0395 | *** | 0.0561 | *** | |
| | 0.00389 | | 0.00400 | | | 0.00368 | | 0.00394 | | | 0.00369 | | 0.00395 | | |
| Hispanic | 0.0790 | *** | 0.0953 | *** | YES** | 0.0382 | *** | 0.0521 | *** | | 0.0306 | *** | 0.039 | *** | |
| | 0.00463 | | 0.00567 | | | 0.00457 | | 0.00565 | | | 0.00447 | | 0.0056 | | |
| Other | 0.0360 | *** | 0.0502 | *** | | 0.0229 | *** | 0.0348 | *** | | 0.0162 | *** | 0.0263 | *** | |
| | 0.00590 | | 0.00734 | | | 0.00585 | | 0.00723 | | | 0.00576 | | 0.00717 | | |
| Geography | | | | | | | | | | | | | | | |
| Rural | omitted variable | | | | | | | | | | | | | | |
| Urban | -0.0140 | *** | -0.0196 | *** | | 0.0050 | * | 0.0008 | | | 0.0034 | | -0.0037 | | |
| | 0.00295 | | 0.00330 | | | 0.00289 | | 0.0032 | | | 0.00286 | | 0.00317 | | |
| Region | | | | | | | | | | | | | | | |
| Northeast | omitted variable | | | | | | | | | | | | | | |
| Midwest | -0.0058 | | 0.0041 | | | -0.0069 | * | 0.0023 | | | -0.0063 | | 0.0022 | | |
| | 0.00404 | | 0.00446 | | | 0.00391 | | 0.00435 | | | 0.00384 | | 0.00429 | | |
| South | 0.0007 | | 0.0117 | *** | | -0.0015 | | 0.0075 | * | | -0.0017 | | 0.00635 | | |
| | 0.00365 | | 0.00407 | | | 0.00358 | | 0.00399 | | | 0.00352 | | 0.00394 | | |
| West | -0.0102 | ** | -0.0044 | | | -0.0016 | | 0.0033 | | | -0.0042 | | 0.000739 | | |
| | 0.00414 | | 0.00477 | | | 0.00412 | | 0.0047 | | | 0.00407 | | 0.00463 | | |
| **Socioeconomic Status** | | | | | | | | | | | | | | | |
| Education | | | | | | | | | | | | | | | |
| Less than High School | omitted variable | | | | | | | | | | | | | | |
| High School or GED | | | | | | -0.0269 | *** | -0.0434 | *** | | -0.0261 | *** | -0.0397 | *** | |
| | | | | | | 0.00317 | | 0.00357 | | | 0.00314 | | 0.00351 | | |
| Some College | | | | | | -0.0278 | *** | -0.037 | *** | | -0.0268 | *** | -0.0344 | *** | |
| | | | | | | 0.00369 | | 0.0041 | | | 0.00366 | | 0.00407 | | |
| College | | | | | | -0.0434 | *** | -0.0606 | *** | | -0.0397 | *** | -0.0559 | *** | |
| | | | | | | 0.00428 | | 0.00525 | | | 0.00426 | | 0.00526 | | |
| Income | | | | | | | | | | | | | | | |
| Household Income (in $1,000) | | | | | | -0.0017 | *** | -0.0021 | *** | YES** | -0.0017 | *** | -0.0022 | *** | |
| | | | | | | 0.00009 | | 0.00010 | | | 0.00010 | | 0.00011 | | |
| Employment Status | | | | | | | | | | | | | | | |
| Employed | | | | | | omitted variable | | | | | | | | | |
| Unemployed | | | | | | 0.0619 | *** | 0.0956 | *** | | 0.0583 | *** | 0.0895 | *** | |
| | | | | | | 0.00809 | | 0.0123 | | | 0.00822 | | 0.012 | | |
| Not in Labor Market | | | | | | 0.0082 | ** | 0.0051 | | | 0.0099 | *** | 0.0108 | ** | |
| | | | | | | 0.00382 | | 0.00460 | | | 0.00380 | | 0.00458 | | |
| **Household Composition** | | | | | | | | | | | | | | | |
| Marital Status | | | | | | | | | | | | | | | |
| Married | | | | | | omitted variable | | | | | | | | | |
| Never Married | | | | | | | | | | | 0.0085 | | 0.0305 | *** | |
| | | | | | | | | | | | 0.00774 | | 0.00941 | | |
| Divorced | | | | | | | | | | | 0.0317 | *** | 0.0583 | *** | YES* |
| | | | | | | | | | | | 0.00704 | | 0.00793 | | |
| Widowed | | | | | | | | | | | 0.0094 | | 0.0248 | *** | |
| | | | | | | | | | | | 0.00694 | | 0.00769 | | |
| Separated | | | | | | | | | | | 0.0449 | *** | 0.076 | *** | |
| | | | | | | | | | | | 0.00959 | | 0.0118 | | |
| Household Size | | | | | | | | | | | | | | | |
| 1 Person Household | | | | | | omitted variable | | | | | | | | | |
| 2 People Household Not Married | | | | | | | | | | | 0.0194 | *** | 0.0405 | *** | YES** |
| | | | | | | | | | | | 0.00504 | | 0.00415 | | |
| 2 People Household Married | | | | | | | | | | | 0.0007 | | 0.00451 | | |
| | | | | | | | | | | | 0.00695 | | 0.00854 | | |
| 3-4 People Household | | | | | | | | | | | 0.0443 | *** | 0.0667 | *** | |
| | | | | | | | | | | | 0.00667 | | 0.00582 | | |
| 5+ People Household | | | | | | | | | | | 0.0783 | *** | 0.126 | *** | |
| | | | | | | | | | | | 0.00977 | | 0.0101 | | |
| Children | | | | | | | | | | | | | | | |
| Child(ren) in the Home | | | | | | | | | | | 0.0046 | | 0.0136 | | |
| | | | | | | | | | | | 0.01050 | | 0.0166 | | |
| Weight Population Size | 96,239,932 | | 109,260,284 | | | 96,239,932 | | 109,260,284 | | | 96,239,932 | | 109,260,284 | | |

Standard errors below marginal effects
*** p<0.01, ** p<0.05, * p<0.1
Models include dummy variables for years with 2005 omitted
CPS household December supplement weights utilized in all models;
Household income adjusted for inflation and set at 2015 levels

Among Model 1 in *Table 4*, the two stratums have similar probabilities as the combined sample and across demographic characteristics by age group, race, and geography. The marginal effects for men and women are statistically different for the age groups 80 to 84 years of age and those aged 85 and older, with larger negative effects to the probability of being food insecure for women relative to women ages 65 to 69 than the probabilities of men being food insecure among the older age groups relative to men ages 65 to 59 years old. Additionally, there is a 2 percentage point increase in the magnitude of the effect of being Black or Hispanic on food insecurity for women relative to White women, when compared to the effect of being Black or Hispanic on senior men relative to senior White men.

Additionally, *Table 4* includes Model 2 which adds the effect of socioeconomic status to the gender-stratified models. While women have higher magnitudes of effect of all education levels, the differences between the marginal effects for men and women are not statistically significant, and continue the consistent story of the increase in education resulting in a decrease in the likelihood of being food insecure. Similarly, they have larger magnitudes of effects for employment status, but there is not statistical difference between the effects for men and women. There is a statistically significant different in the effect of household income of food insecurity probability between men and women. For women, there is a 2.1 percent point decrease in the probability of being food insecure for every one dollar increase in household income for senior women. However, for men there is a 1.7 percentage point decrease in the probability of being food insecure for every one dollar increase in household income for senior men.

Finally, Model 3 in *Table 4* includes the addition of household composition variables to the gender-stratified models. There are large statistically significant differences in the effects of marital status between senior men and women. Senior women who have never been married have a 3.1 percent point increase in the likelihood of being food insecure relative to those senior women who are married. There is approximately a 5.8 percentage point increase for divorced senior women relative to women who are married; For senior men there is a 3.2 percentage point increase for those who are divorced relative to married senior men. Additionally, there is a 2.5 percentage point increase in the probability of being food insecure for widowed women relative to married women. Finally, women have a 4.1 percentage point in increase in being food insecure in a household of 2 people not married relative to those senior women living alone of any marital status, compared to a 1.9 percentage point increase in being food insecure for senior men living in a home of 2 people who are not married relative to senior men living alone of any marital status.

The initial forward stepwise probit estimation indicated that the inclusion of socioeconomic status and household characteristics reduced the variability in food security by gender. Both the initial models and the sensitivity analysis show that women have an increase in the rates of food insecurity largely do the increase in the predictors for food insecurity. If fact, the sensitivity analysis shows senior men and women have similar patterns of predictors for food insecurity. Women only had stronger returns for being age 85 and older, being divorced, and being in a household of two people not married, on being food insecure.

## Limitations

A significant limitation to this analysis, is the ability to make comparisons about seniors by gender when having to use a household measure. To address this, I limit the analysis to those householders, to address the fact research, suggest women put undue burden on themselves in households which limit the effect of food security on other individuals in the household. However, in home with multiple residences or where men and women are in a formal relationship those who would identify themselves as householders are likely to have differences relative to those who may not identify themselves as householders. Another limitation to this work is the inability to explore intergenerational household characteristics. The CPS doesn't allow for an examination of children living in the home whom are not the direct children of the householder. Thus, I am unable to examine the role of intergenerational relationships on food security difference among men and women. Additionally, to fully evaluate differing returns to predictors for men and women, likely a Oaxaca decomposition would be important for looking at if there are differences in returns to predictors. However, the results of the analysis suggest this would be unnecessary as the addition of predictors reduces the variations to nearly nothing. Finally, food security is a self-report measure, and with stigma identified as a particular issue surrounding identification of food insecurity among seniors there is the possibility of underreporting of those who are food secure in this data.

## Discussion

This paper sought to better understand the relationship between gender and food security among seniors. Similar to previous literature, this paper found socioeconomic status and household characteristics are predictors for food insecurity—lower educational

attainment, lower income, not being married, and being a racial minority all increase the likelihood of being food insecure among seniors. This paper finds that while there are statistically significant increases in food insecurity among senior women relative to senior men, the addition of more variables known as predictors for food insecurity reduce the gender difference. The stepwise probit modeling showed that the inclusion of household characteristics nearly eliminates the impact of gender on food insecurity among seniors. To further understand how the predictors of food insecurity reduce the gender gap in food insecurity a sensitivity analysis using gender-stratification in the probit models were conducted. The analysis found that women's increase in food insecurity is not due to differing effects of the predictors of food insecurity. In fact, there were very few differences in effects of predictors between senior men and women; this suggests that the variation in food insecurity rates between senior men and women is related to women having more of the characteristics that increase risk of food insecurity status, but some is related to increases in the effects of those predictors.

Finding that food insecurity differences in gender are related to women having more of the demographic and household predictors for food insecurity is valuable when thinking of ways to address food security among this growing population. Gender-specific or gender-targeted food insecurity interventions may not be effective if gender itself is not driving the differences. While the literature on gender and food security note differences in food coping strategies based on gender, gender alone is not what is placing senior women in food insecure status relative to men. Thus, there is an opportunity for further research to examine the experience of food security by gender among seniors, but

looking for gender as a predicted based on unobserved characteristics might not bring much to light.

The literature on senior food insecurity, in general, is sparse, and as the senior population becomes a growing proportion of the American population it is important to understand correlates of this hardship for this group. The predictors for food security among seniors are consistent with those of prime-age individuals, education and income have a negative relationship with food insecurity, and racial and ethnic minorities and those who are not married have increased rates of food insecurity. When looking at predictors for food insecurity among seniors there is a great opportunity to better understand the roles household characteristics and marital status play on the likelihood of being food insecure.

With gender differences in food insecurity mainly being attributed to senior women simply being more at risk for predictors of food insecurity. This paper's analysis suggests the higher rates of food insecurity for senior women is a symptom of poorer economic well-being relative to senior men. to address food insecurity among seniors, need to focus on assisting with the economic well-being of senior women and efforts for finding more support for unmarried senior women who may not be able to rely on two-person household earnings.

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# CHAPTER 5: CONCLUSION

Each the essays in this dissertation focus on seniors and their experiences with food insecurity, nutritional outcomes, and SNAP program participation. Survey data from nationally representative samples is used to further explore how components of senior life influence their relationship to nutrition and nutrition programs. The first essay focuses on what contributes to the change in SNAP program participation among seniors over time. The second essay explores how functional limitations and food insecurity impact the ability for seniors to meet nutritional recommendations. Finally, the third essay examines what factors create the variability in food insecurity between senior men and women. The chapters, together, create an exploration of the complexities of aging and the unique barriers seniors face in efforts to have nutritious food consumption.

## Complexities of Aging and Barriers to Quality Nutrition

The physiological changes of seniors require the need for increased quality nutrition as people age. Despite the increased need for nutritional food, seniors are a growing population forced to navigate being food insecure. In this dissertation, I show how changes in the senior population have resulted in a growing proportion of seniors with the predictors of food insecurity—predictors, such as racial and ethnic minority status and decreases in socioeconomic status. However, seniors are also forced to handle the complexities of aging that result in a reduction of nutritious food intake, and not merely, because of the lack of economic resources to consume quality food. Seniors must navigate how physical limitations increase over time and can impact their ability to have and consume quality nutrient intake. While, I find that having significantly more limitations to your abilities to complete instrumental activities of daily living show a

positive relationship with nutrition intake, I find this is present when individuals are unable to make their own meals, meaning other caregivers or members of the household are involved in the nutrition decision or nutrition preparation activities. These finding highlight, how seniors' experiences require a more robust understanding of the complexities of their needs, manifestations of food insecurity, and the role of others in the household, to truly understand senior's experiences with food. The federal government's primary nutrition program has the lowest rates of uptake among seniors, but I find that modernization policies and simplification of the application process influences senior participation. A better understanding of the senior experience may program implementers to come up with more effective policies and approaches to reduce the barriers to participation seniors' face has contributed to increased participation. Thus, finding ways to address the complex needs of seniors can allow for programs to help the population in need.

**Nutrition as a Health Policy Intervention**

The United States must address the impending effect of the increase in the proportion of seniors will have on our health policy and program resources. We face not only an increase in a population that has always put stress on our health care system and spending, but we also face a new senior population which is plagued with chronic disease risking further drain our resources. Public health officials and physicians know nutrition can be an early area for intervention to mitigate the effect of poor health outcomes later in life. To find effective nutrition interventions, policy makers, social scientists, and program developers should better understand how the senior experience may require different approaches to our standard methods of delivering more nutritious foods to those

in need. Future research must examine how nutrition can be an effective intervention for long-term health spending related to the senior population.

# VITA

Ashley Price, Ph.D., MPH, is a Research Associate at the Duke Center for Research on Personalized Health Care at Duke University School of Medicine. Her research interests include implementation science, evidence-based programs, social and health policy implementation and evaluation. She is also interested in research exploring the differing effects of public policies, programs, and health interventions on seniors, veterans, those in poverty, and other vulnerable populations. Ashley holds a bachelor's degree in Biology with a minor in Sociology from the University of Missouri. Prior to her doctoral work at the Truman School of Public Affairs, Ashley received her Masters of Public Health with an emphasis in Health Policy and Promotion.