UNDERSTANDING NUTRITION ISSUES AMONG GRANDPARENTS RAISING GRANDCHILDREN IN ATHENS, GEORGIA

by

SARA NAJAFI

(Under the Direction of Jung Sun Lee)

ABSTRACT

This study aims to better understand nutrition issues among grandparents who are raising their grandchildren in Athens, Georgia. This was a longitudinal study which consisted of four weekly in-depth data collections on nutrition issues in a convenience sample of grandparent caregivers by using in-person interviews, questionnaires, and observations, including a household food inventory. Participants included three female grandparents (mean age 68 ± 11 y) who were all obese and reported having at least one diet-related chronic condition. Two of the three reported symptomatic depression. All participants reported unbalanced diets with inadequate intakes of micronutrients including calcium and vitamin D. Participants also had a small proportion of healthful foods available in the home such as low fat, whole grain, low sodium, or low sugar options. More research is needed to better understand the challenges faced by these households and to develop programs to benefit them.

INDEX WORDS: Grandparents raising grandchildren; grandparent caregivers; household food inventory; food insecurity; dietary intake; diet related chronic diseases; stress; depression

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DEDICATION

I would like to dedicate this work to my mother and brother who have believed in me and supported me my whole life. You two have always provided me with the motivation, strength, and determination I need to accomplish my goals and I do not know what I would do without you. To the best, strongest, and closest family in the world, I dedicate this thesis to you.

This work is also dedicated to my late grandparents, Pamela and Chester Jackson. It was a blessing to have had you both in my life. You were a constant source of love and support and I miss you both every day. I hope to continue making you both proud.

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CHAPTER 1

INTRODUCTION

The number of grandparents raising their grandchildren is increasing in the Unites States (U.S.) (1-3). There are many terms used to describe this population but "grandparent caregivers" are defined by the U.S. Census Bureau as "grandparents who had primary responsibility for one or more of their co-resident grandchildren under 18". Grandparent caregivers have been reported to experience unique physical, financial, emotional, and psychological challenges (4).

One concern for grandparent caregivers is health problems; including high rates of stress and depression, poor self-rated health, and chronic health conditions (5). Many grandparents will likely disregard their own health in order to focus on that of their grandchildren due to limited resources including time and money (6, 7). These situations are especially prevalent in low-income communities (1, 5). Grandparent caregivers are more likely than all families with related children under 18 years of age to have incomes below the poverty level, with 21% meeting this criterion in 2010 (8).

Another major concern among this population group is the consumption of a healthy diet. Of all older adults with limited resources, food insecurity is much greater among those living with a grandchild, especially in cases where the grandparent is the primary caregiver (9). This is a major concern for grandparent headed households in Georiga because senior households in the South experience the highest rates of food insecurity (9). Marginal food insecurity occurred in 30% of grandparent caregiver households where the parent was not present compared to 10% of senior households with no grandchild present (10). Various factors that may influence food

insecurity among older adults include income level, poor health, functional limitation, disability, social isolation, community characteristics, marital status, race, and education level (10, 11). Food insecurity can result in lower nutrient intakes, fair or poor health, worsened chronic diseases, increased disability, and various forms of disordered or unhealthy eating patterns (9, 11-13).

Little research has been done on the nutritional issues grandparent caregivers face despite their rising numbers and propensity towards high levels of poverty, food insecurity, and chronic diseases (1, 6). Previous studies primarily focus on the characteristics of grandparent headed households but very limited information is available on the nutritional status of the grandparent caregivers and their needs, challenges, and opportunities to improve nutritional well-being.

The overall goal of this study is to better understand the nutritional issues of this population in order to act as a stepping stone to aid future studies with identifying needed assistance and support for grandparent caregivers. Chapter 2 is a review of the literature about grandparent headed households, depression and stress among grandparent caregivers, their increased risk for chronic diseases and neglected health, food insecurity, and household food inventories. Chapters 3 through 4 include the methods and results of this study, and chapter 5 consists of the discussion of this exploratory study's implications regarding nutrition issues among grandparent caregivers as well as the strengths and limitations of the study.

CHAPTER 2

LITERATURE REVIEW

Grandparents raising grandchildren households

Among the 5.7 million grandparents nationally who live in a household with at least one grandchild, approximately 50% of them, or 2.8 million, have primary responsibility for the grandchild(ren) (14). The number of caregiving grandparents has grown rapidly in recent years and this growth accelerated during the economic downturn (1). The number of grandparent caregivers grew by 100,000 between the years of 2000 and 2005, but by 300,000 between the years of 2005 and 2010 (2, 3, 15). According to Minkler and Chehimi (2003), some of the factors, aside from the poor economy, influencing the growth of grandparent caregiving include parental addiction, abuse and neglect, the rise in single parent households, HIV/AIDS, sharp increases in female incarceration, teen pregnancy, and policy changes favoring foster care placement of children with relatives over non-relatives (16). According to the 2011 American Community Survey, over 117,000 grandparents in Georgia were responsible for raising their grandchildren (17). About 23% of these grandparents were living below the poverty level and about 65% were female (17). In 2000, 925 grandparent caregivers resided in Athens-Clarke County alone (18).

The types of grandparent and grandchildren households are typically categorized based on the presence and involvement of the parents. “Multigenerational household” is a non-specific term which usually refers to households consisting of two or more generations, such as grandparents, parents, and grandchildren. However, this term does not specify whether the

grandparents or parents have primary responsibility for the grandchildren. Households in which the grandparents are considered the primary caregivers are called "grandparent headed households" and are broken down into two categories: skipped generation and three-generation. In skipped generation households, the parents of the grandchildren are not present whereas three-generation households are comprised of the grandparents, parents, and grandchildren (1). About 33% of grandparent headed households in the U.S. are skipped generation (14).

The majority of grandparent caregivers in the U.S. are female and between the ages of 30 and 59 years (14). Studies have shown that grandparent headed households have a high proportion of minorities, high levels of poverty, and the grandparent caregivers have low levels of education (1, 5). About 65% of these grandparents are white and 22% are black (14). However, grandparent caregivers are more prevalent among the black population; 48% of all black grandparents are primary caregivers for their grandchildren compared to about 40% of all white grandparents (19, 20). A study which used data from the National Survey of America's Families reported that 61.2% of grandmother caregivers in a sample of 1,363 grandmothers had an education level equivalent to a high school diploma or less and 30.5% were living below the poverty level (21). Additionally, caregiving grandparents are noted to be more likely than non-caregiving grandparents to report having trouble with mobility, completing daily household tasks, climbing stairs, and working to earn income (22, 23). Despite this growing population with poorer sociodemographic and health conditions, little research has been done on the difficulties they face in an effort to uncover needed assistance and support.

Depression and stress among grandparent caregivers

Grandparent caregivers experience more stress and psychological problems compared to non-caregiving grandparents (24). Musil et al (2009) stated that secondary analysis of the

National Survey of Families and Households showed that grandparents who were primary caregivers for their grandchildren for at least 6 months reported having more depressive symptoms before and after caring for their grandchild than grandparents who never raised a grandchild (25). The transition back into a parental role is a huge adjustment in their lives which can be overwhelming, especially for those grandparents who still work. There are increased physical and emotional challenges they must face (26). Many tend to feel stressed or get depressed, if not both (27). A national survey among grandparent caregivers showed that 25% had symptomatic depression as assessed by the Center for Epidemiologic Studies Depression Scale (28). Whitley et al (2001) reported that out of a sample of grandparent caregivers, 35% were not satisfied with their lives (23). Additionally, studies have also shown that many children in these living situations and low income households tend to act out, exhibit behavioral problems, and perform poorly in school, thereby adding to the stress of the grandparents (24, 29).

Several different measures can be used to evaluate depression and stress levels among grandparent caregivers. The Depression Anxiety Stress Scale (DASS-21), the Caregiver Burden Scale, and SF-36 are all useful tools in measuring depression and stress. However, some of the questions in those measures are targeted towards older adults or caregivers who are caring for older adults and not children. Therefore, they are not appropriate measures for depression and stress among grandparents raising grandchildren and would have likely yielded inaccurate results. The Center for Epidemiologic Studies Depression Scale (CES-D) is one of the most commonly used standardized self-screening tests which uses 20 questions to measure for depressive feelings in the past week (30, 31). The items of the CES-D scale are symptoms associated with depression which have been used in previously validated longer scales and do not target a specific age group. A score of 16 or higher has been identified in studies to identify

subjects with significant depression. The Perceived Stress Scale (PSS) is the most widely used psychological tool for measuring one's perception of stress. The questions were designed to understand how uncontrollable and congested participants found their lives in the past week (32-34). The items are easy to understand and interpret and the questions do not target any specific subpopulation groups. There are no cutoff values for scoring, but higher scores represent higher levels of stress. These two measures, when used together, can be used to evaluate the levels of depression and stress among grandparent caregivers.

Increased risk for chronic diseases and neglected health

Grandparent caregivers are at an increased risk for chronic conditions, particularly, diet related chronic diseases such as diabetes, hypertension, and cardiovascular disease (6, 7, 23, 35). An Atlanta based study conducted on 100 black grandparent caregivers showed that 54% had high blood pressure and 80% were overweight (23, 36). A possible explanation for this is that the stress of caregiving can drive grandparents to develop disordered eating habits, thereby affecting their nutritional status and possibly leading to chronic diseases (6, 35). However, this is an area that is not well understood and needs to be researched further. Furthermore, studies have shown that depressive symptoms have also been linked to other diseases such as diabetes and metabolic syndrome (37, 38). Metabolic syndrome is a name for a group of risk factors which occur together and increase the risk for certain diseases such as coronary artery disease, stroke, and type II diabetes.

Despite the increased risk for chronic disease, for many low-income, limited mobility grandparent caregivers, their health is most often the first thing to be neglected. Whitley et al (2001) reported that in a sample of grandparent caregivers, 45% reported their physical health as poor to fair. Kelley et al (2000) stated that over 35% of grandparent caregivers reported that their

health had deteriorated since they reassumed a caregiver role (27). Over half of these participants reported being concerned about their health yet a third of them had not seen a doctor in over three years. Whitley et al (2001) reported that in a sample of 100 grandmother caregivers, about 10% of them had never gone to the doctor for a mammogram or rectal exam. Even more recent studies show that caregiving grandmothers are more likely than non-caregiving grandmothers to opt out of other preventative health care measures such as cholesterol screening (39). These behaviors warrant concern for the overall health of grandparents who are raising their grandchildren.

Together, all these risk factors raise concern for the health of grandparent caregivers. The high prevalence and wide-ranging consequences of diet related chronic conditions as well as neglected health behaviors among this target population justify research that seeks to identify the nutrition issues they face.

Food insecurity

Food insecurity occurs when households report multiple indications of disrupted eating patterns, reduced quality, variety, or desirability of diet and reduced food intake (40). Food insecurity is at an all-time high at almost 15% of the population (40). Increases in food insecurity have been found to be most significant among 40-49 year olds, followed by 50-59 year olds, and then those 60 and older (41). Food insecurity for 40-49 year olds increased by 68% between 2007-2009 and by 38% for 50-59 year olds (41). Additionally, senior households in the south experience the highest rates of food insecurity (9). In Georgia, food insecurity among older adults is a considerable problem. Georgia's prevalence of food insecurity among older adults was 8.6 percent between 2001 and 2007, making it the 6th highest in the U.S. (10).

For households with incomes near or below the Federal poverty line, households with children headed by single women or single men, and Black and Hispanic households, rates of food insecurity are substantially higher than the national average **(**11, 40). Grandparent headed households may be at a high risk of food insecurity due to the fact that they share many of the same characteristics. Not only is food insecurity greater among grandparent headed households, but studies have also shown that skipped generation households actually have a greater severity of food insecurity than three-generational households (9). Ziliak et al (2008) show that among all married couples, about 3.7% are food insecure and this number jumps to 12% when a grandchild is present (9). Economic hardships are a major factor playing a role in this situation. A 2010 study that reported on the health related quality of life (HRQOL) of 119 custodial grandparents stated that 91.6% of participants reported having some money problems since they had become primary caregivers to their grandchildren (42). Many grandparent caregivers perceive economic issues as an obstacle to having a healthy diet (43). This can have strong implications for the overall health of individuals in this situation (44).

The most commonly used food security measures in the U.S. is the nationally validated standard U.S. Household Food Security Survey Module (HFSSM) which was developed in 1995 (45). The full version of the HFSSM is comprised of 18 questions regarding the food security situation of the household over the past year. The questions specify a lack of money, resources, or the ability to afford food as the reason for the condition. Ten of the 18 questions are specific to the experiences of adults in the household, and eight are specific to the experiences of children under the age of 18 years in the household. A Modified 6-item HFSSM has been developed in order to lessen the burden of the interview/survey on participants and make it simpler for self-administration (46, 47).

Disordered dietary pattern among grandparent caregivers

It is possible for many grandparent caregivers to develop disordered eating habits as a result of food insecurity. They could have constrained dietary options and possible compensatory strategies for dealing with times of food shortage as well as food adequacy. Figure 1 shown on the following page illustrates the cycle that can result from food insecurity over time adopted from Seligman and Schillinger (2010). In order to meet caloric needs, adults who worry that they will not have sufficient money for food, will concentrate their intake on low-cost, energy-dense foods, however these are also usually nutritionally poor foods. These are generally foods with added sugars, fats, and sodium because when comparing foods based on caloric content, these foods cost less than nutritionally rich fruits, vegetables, and dairy products. For example, $1 can purchase either 1200 kcal of cookies or potato chips or 250 kcal of carrots (48). This differential in the supermarket prices of less healthful and healthful foods has widened over the past two decades. The USDA reports that between 1985 and 2000, the retail price of carbonated soft drinks rose by 20%, the prices of fats and oils by 35%, and those of sugars and sweets by 46%, compared to a 118% increase in the retail price of fresh fruits and vegetables (48, 49). Additionally, many food insecure households utilize food or nutrition assistance programs such as food stamps. The food stamp program is the largest nutrition assistance program administered by the USDA. The program gives monthly benefits to eligible families with lower incomes so that they are able to purchase food. For these households, there has been a cyclical pattern found in the availability of food. Most food-stamp families live on a food cycle that starts off reasonably well in the beginning of the month when food stamps are distributed and grocery shopping can be done, but then dwindles as the month wears on. In severe situations, some families' food situations can become desperate in the final week or 10 days, depending on how

sparing they were earlier in the month (50). Many families experience periods of food plenty followed by food scarcity repeatedly and the nutritional consequences of this are not properly understood yet. Seligman and Schillinger (2010) suggested that adults who anticipate food scarcity will overconsume foods during periods of food plenty, which can increase the risk of diabetes if repeated over time. Further research is needed to fully understand the nutritional effects for families living this way.

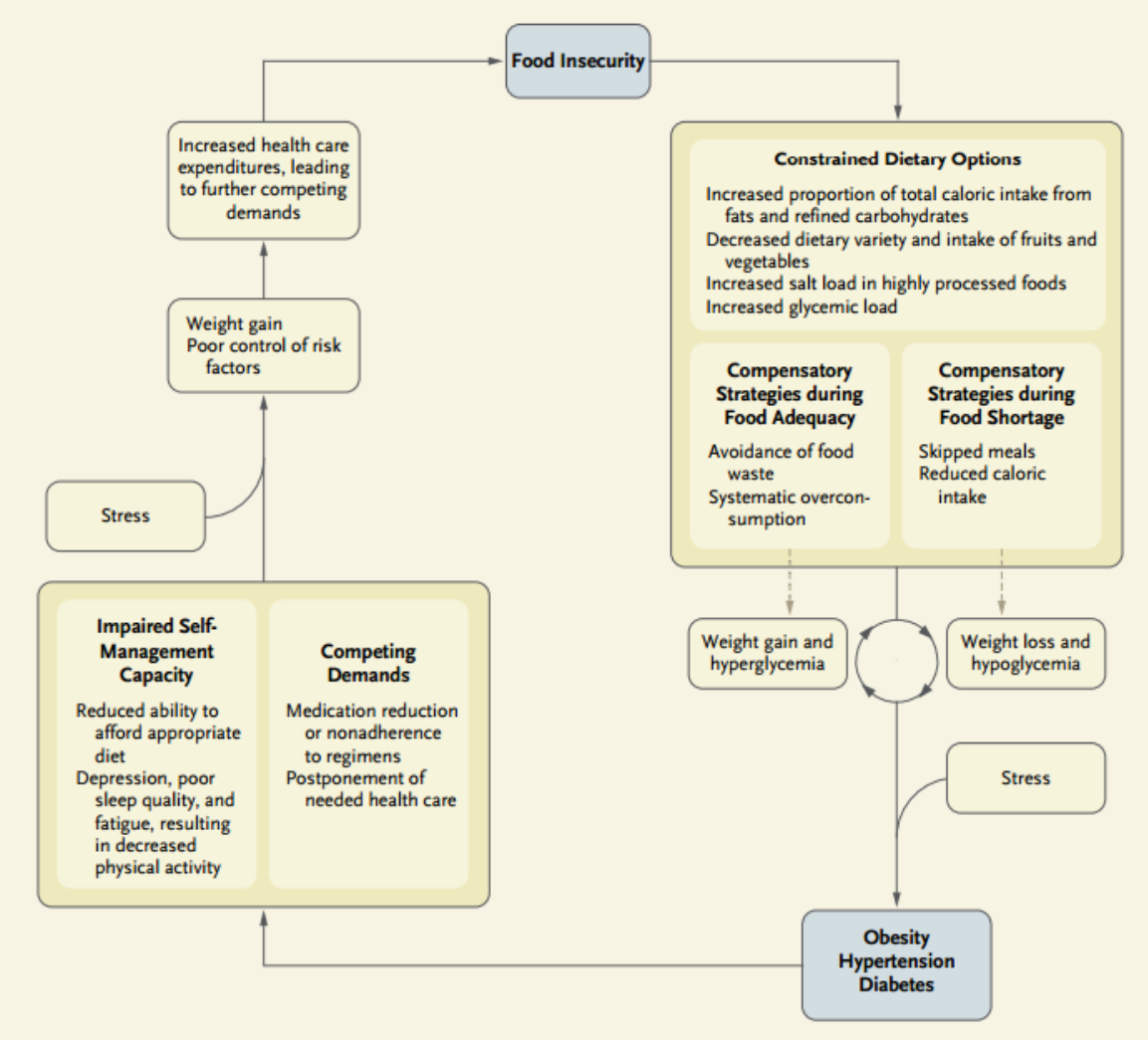


Figure 1. The cycle of food insecurity and chronic disease (13)

There has also been research showing a correlation between food insecurity and obesity, particularly for women. In the past decade, the prevalence of food insecurity and obesity has grown and some researchers suggest that these two are associated (45, 51-52). This connection seems counterintuitive and thus it is known as the food insecurity-obesity paradox (51, 54). Several researchers have put forth hypotheses to help explain this paradox. One possible reason is that children who grow up in poverty are more likely to become obese adults. The reason for this occurrence could possibly be that they likely experienced periods of food insecurity and developed disordered eating habits and compensatory strategies such as overconsumption as a result of food scarcity (13, 14). Another possible explanation is that in order to still get adequate energy intake while limiting food costs, some will select lower-quality diets comprised of energy dense but nutrient poor foods (48, 52, 53). This would mean an increased proportion of total energy coming from fats and refined carbohydrates and a decreased intake of fruits and vegetables which can have negative effects on one's health (13).

Household food inventory

Availability of foods in the household has been shown to be significantly associated with dietary practices, intake, and eating patterns (56-59). The home food environment supplies more than 70% of the food, by weight, eaten by Americans. It has been strongly associated with 75% of energy intake and overall food consumption (60-62). Previous studies have shown that greater availability of healthy foods in the home is associated with decreased fat intake and increased fruit and vegetable consumption (58, 63-65). Additionally, household food inventories provide insight into the types and amounts of foods being consumed by the individual, how well balanced and nutritious the diet is, as well as how food availability and/or choices change

throughout a one month period due to income cycles, purchasing behavior, limitations in storage, and other factors.

In order to better understand the types and amounts of foods present in homes throughout the month, several studies have pilot tested different methods of household food inventories on multiple occasions using direct observation or scanning tools (59, 66). Assessing the presence of various foods in the home, including healthful and less healthful is of interest to investigators examining food availability as a predictor of dietary intake, obesity, and food security (67-69).

Bryant et al (2011) conducted a study aimed to assess the association between objective measures of fruits and vegetables in the home with reported infant and maternal diet in low-income African Americans (69). They used an observational scanning tool to record the presence and description of household food availability. They inventoried over 70 households multiple times and then compared the results with 24-hour dietary recall records that they collected. Researchers found that availability of fruits and vegetables in the home was associated with intake of those foods and concluded that changing the home food environment can be an effective method of promoting fruit and vegetable intake.

Sharkey et al (2010) conducted household food inventories as well (59). However, he used direct observation and developed a 252-item inventory instrument targeted to low-income Mexicano residents in Texas colonias. They conducted five in-home household food inventories over a one month period in order to examine if this method would provide insight into the amounts and types of food items present throughout the month. They also took pictures each week of the food items in the refrigerator, panty, and cabinets, and more. The findings of this study stressed the importance of documenting multiple weekly household food supplies for low

income families with limited resources to adequately assess the changes in the types and amount of food available in the households.

Sisk et al (2010) conducted a similar study using a 251-item household observation guide that used direct observation to determine the presence and amount of food items in the home (70). Two trained researchers recruited a convenience sample of 9 households, consisting of women with at least one child, and conducted an in-home assessment each week over a 30-day period. Researchers found that the weekly presence and amounts of fresh and processed fruits and vegetables and dairy varied. This study confirmed the need and feasibility of conducting multiple in-home assessments and paid attention to the intra-monthly changes in household availability in type and amounts of foods. A study using these measures has not been conducted among grandparent caregivers.

Preliminary studies

Other researchers have established that the proposed research approach is needed and feasible.

Poverty and material hardships among grandparent caregivers

Baker and Mutchler (2010) investigated how generational structures of a household influence poverty and material hardships (1). Researchers used the 2001 Survey of Income and Program Participation (SIPP) conducted by the U.S. Census Bureau. The study sample included 24,315 households and 68,349 individuals. It encompassed children living in two parent households, single parent households, and grandparent headed households. Researchers focused on measures of poverty and material hardships, including health insecurity, housing insecurity, and food insecurity. As potential confounders, they considered various characteristics of the household and its members including age, race, educational attainment, ratio of children to

adults, and labor force participation. They found that after controlling for demographic variables, health insecurity was the only factor that was significantly more prevalent among grandparent headed households. The results were helpful in deciding which factors to explore further but there were also unmeasured characteristics of mental health and social support which are critical to examine the relationship among generational household structures, poverty, and material hardships.

Bachman and Chase-Lansdale (2005) utilized data from Welfare, Children, and Families: A Three-City Study in order to examine the implications of custodial grandparent care (71). It was a longitudinal study on the well-being of low-income families and looked at 2,400 low income families in Boston, Chicago, and San Antonio. Researchers looked at many factors, including information regarding demographics, employment, education, marital status, social support, mental health, physical health, chronic disabilities, and more. They found that caregiving grandmothers, particularly the younger grandmothers, were more financially strained and experienced more chronic mental and physical problems when compared to non-caregiving grandmothers and mothers. Additionally, the caregivers were more likely to report more mental or physical problems if they were unemployed. Studies like these confirm the need for a needs assessment for these caregiving grandparents.

Nutritional needs assessment among grandparent caregivers

Higgins and Murray (2010) used a semi-structured qualitative interview method on 23 participants recruited from local grandparent support groups in 17 counties across Kansas (43). The interviewer met with the participants one-on-one and asked in-depth qualitative questions. For the purpose of this research, Higgins and Murray (2010) used open ended questions and guided conversations to allow participants to express their concerns or beliefs about their

nutritional needs. In an effort to make the participants feel more at ease the interviews were conducted in their own homes. The interview guide consisted of questions from four main categories covering the aspects of nutrition they were concerned with, including participant characteristics, nutrition-related attitudes, nutrition education, and nutrition-related practices. Based on the responses collected, researchers concluded that this population could strongly benefit from a variety of nutrition education ranging from infant/child nutrition, healthy recipes on a budget, quick meals, limiting processed and fast foods, safe food handling practices, gardening and more. Several of the approaches of Higgins and Murray (2010) were used in this research study. This study employed a longitudinal in-person interview survey in a sample of grandparents raising grandchildren in Athens, Georgia.

Rationale, specific aims, and hypothesis

Little research has been done on the nutritional issues grandparent caregivers face despite their growing population and hardships faced. Compared to other household structures, grandparent headed households have a high proportion of minorities, high levels of poverty, and a high proportion of caregivers who are disabled and less educated (1). These grandparents have been shown to be at higher risk for chronic diseases such as cardiovascular disease and diabetes (6). The added stress during the transition into a caregiver role can increase their susceptibility to declining health (7). Previous studies primarily provide descriptive data on the characteristics of grandparent headed households but still little is known about the nutritional status of the grandparent caregivers and very limited information is available on their needs, challenges, and opportunities to improve nutritional well-being. Identification of the nutritional issues of this sample population has the potential to uncover needed assistance and support for these families.

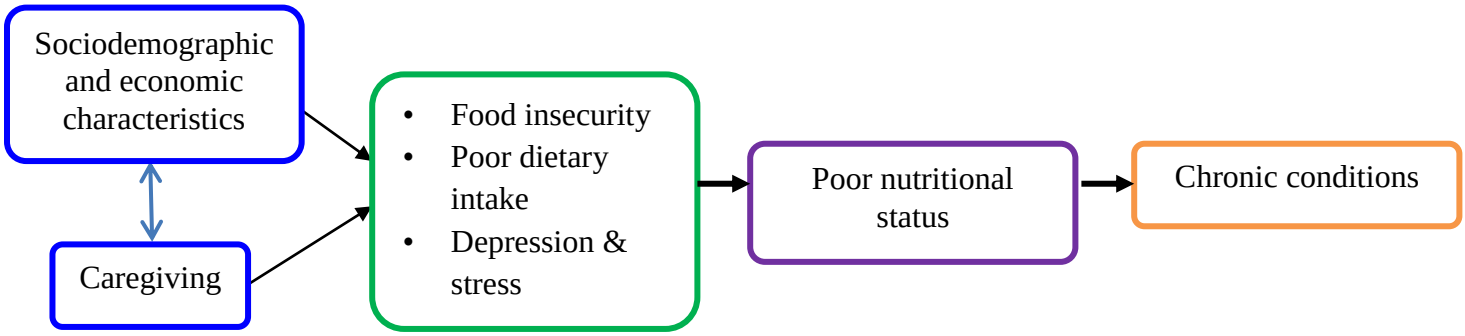


Figure 2. Conceptual framework - illustrates how, among grandparent caregivers, sociodemographic status and caregiving can influence food insecurity, dietary intake, and depression and stress levels which in turn can affect nutritional status and ultimately increase risk for chronic diseases.

The overall goal of this study is to better understand the nutritional issues of this population in order to act as a stepping stone to aid future studies with identifying needed assistance and support for grandparent caregivers. This study alone is a pilot study which aims to test the feasibility of using the proposed methods and measures among grandparent caregivers. The research question is to better understand nutrition issues among grandparents who are raising their grandchildren in Athens, Georgia. The overall hypothesis is that food insecurity and mental health issues will be major factors affecting nutritional status of grandparent caregivers. Figure 2 shows this conceptual framework among grandparent caregiving, food insecurity, mental health, and diet-related chronic diseases among grandparent caregivers. The overall hypothesis was tested in a sample of grandparent caregivers ages ≥40 y in the Athens, Georgia. The first specific aim was to develop a longitudinal in-person interview method combining surveys, interviews, and observations to identify major nutrition issues among grandparent

caregivers. The second specific aim was to conduct data collection in a sample of grandparent caregivers in Athens, Georgia. Lastly, the third specific aim was to analyze the data and report the results.

CHAPTER 3

METHODS

The present study involves the development, implementation, and analysis of interviews conducted among grandparent caregivers in Athens-Clarke County, GA. All methods and procedures were approved by the University of Georgia Institutional Review Board (IRB# 2013-10207-0).

Study design

This study was longitudinal in-person interviews which combined surveys, interviews, and observations to identify major nutrition issues among grandparent caregivers in Athens, GA. The researchers visited each participant's house once every week over the span of four weeks to collect data.

Study sample

Inclusion criteria included: (a) being a grandparent who is considered to be a primary caregiver to their grandchild(ren); does not require legal guardianship, (b) 40 years of age or older, (c) able to understand, write, and speak English, (d) live in Athens, Georgia, and (e) available for the entire duration of the study. Appendix A shows the checklist that was used during the screening process.

Recruitment

Starting in March 2012, Sara Najafi contacted Dr. Geraldine Clarke, the Resident Support Director of the Athens Housing Authority, and described the research project and requested assistance for participant recruitment. Dr. Clarke agreed to assist the recruitment and was

provided with recruitment flyers. Appendix B shows the recruitment flyer that was used. Recruitment began in October 2012.

Dr. Clarke contacted potential grandparents and passed out flyers at an Inter-Community Council, Inc. meeting. She informed them about the study and passed along Sara Najafi's information so interested grandparents could contact Sara Najafi directly by phone or email. Six grandparents were given Sara Najafi's information and three grandparents showed interest.

Once contact was made, participants were screened in person in early to mid-November and signed informed consent forms, shown in Appendix C, and then interviewed throughout the next four weeks. Interview dates were set up on a week to week basis based on participant availability and were always one week apart. If the first meeting took place on a weekday, all subsequent meetings with that participant also took place on a weekday and vice versa. This was done in an effort to reduce intra-variability due to typically different patterns in dietary intake during weekend from weekdays. Out of the three total participants, two participants consistently reported on weekdays and one participant consistently reported on weekends. The interview dates are shown in Table 1.

Table 1. Interview dates

Participant	Screening Date	First Interview	Second Interview	Third Interview	Fourth Interview
Participant 1	11/5/2012	11/8/2012	11/15/2012	11/21/2012	11/29/2012
Participant 2	11/15/2012	11/17/2012	11/24/2012	12/2/2012	12/9/2012
Participant 3	11/9/2012	11/20/2012	11/27/2012	12/4/2012	12/12/2012

In-person interviews

The longitudinal in-person interviews included questionnaires and observations to identify major nutrition issues among grandparent caregivers and interview instruments are

shown in Appendix D. The interview asked participants about the following domains: demographic, economic, anthropometric, food acquisition, food insecurity, stress/depression, health, caregiving, and dietary assessments. Table 2 shows a schedule of measurements across four weeks. The demographic, economic, anthropometric, food acquisition, health, and caregiving data were collected only during the first meeting. Food insecurity, stress/depression, and dietary assessments were conducted weekly for a month to examine any changes. The interview also included open ended questions to help address any issues emerging from the in-person survey. Interviews were audio recorded in order to have the ability to revisit any information presented during the interview. Two trained researchers collected the data when the household food inventory (HFI) was conducted; one researcher conducted the interviews while the other began the HFI.

Table 2. Interview measures across four weeks

	Interview 1	**Interview 2**	**Interview 3**	**Interview 4**
Background (demographic and economic)	X			
Anthropometric	X			
Food Acquisition	X			
Health	X			
Caregiving	X			
Stress/Depression	X	X	X	X
Food Insecurity	X	X	X	X
24-Hour Dietary Recall	X	X	X	X
Household Food Inventory	X			X

Background and anthropometric information

The in-person interview asked participants about their demographic and economic information including age, gender, education, race, and monthly household income. The interview questionnaires also asked about grandparent caregiver support group services utilized now and in the past. Height and weight were measured during the first meeting using a stadiometer (seca217 mobile, SECA, Birmingham, UK) and standard scale (H5301, Tania Inc., Tokyo, Japan) respectively in order to calculate Body Mass Index (BMI). Waist circumference was also measured during the first meeting using standard measuring tape. The body size measurements were conducted only at the first assessment since we did not expect significant changes in body size during the study period unless any significant health and/or other condition arose.

Food acquisition

The interviewer inquired about food acquisition habits such as where and how often grocery shopping occurs as well as how much money is usually spent during each trip. The interviewer probed and asked about other resources utilized in order to receive food such as the Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants and Children (WIC), food banks, and more.

Health

Participants were asked to rate their overall health as poor, fair, good, very good, or excellent. They were then asked if they had any diet related chronic conditions such as diabetes, cardiovascular disease, obesity, etc. If so, they were asked if and how they manage their conditions.

Caregiving information

The researcher asked about household/family structure and types of grandparent caregiving. They asked about the number and age of the grandchild(ren) present, the age of the grandchild(ren) when they were put under the grandparent's care, whether or not the parents are involved in the child's life, and why, when, and how the grandchild(ren) were put under the grandparent's care.

Dietary assessment

Two dietary assessment methods were used. Each participant was to complete a 24-hour dietary recall during the in-person interview which was administered by the researcher. The interviewer-administered 24-hour dietary recall has long been regarded as the optimal dietary assessment method because it provides the higher-quality and less biased data for a single day (73). It allows detailed food and portion size information to be collected. The interview style allows participants and researchers to interact and discuss dietary intake during the interview. Because the data collection occurs after consumption, this method does not affect an individual's food choices on a given day. However, the 24-hour dietary recall is not without limitations. The main weakness of the 24-hour recall approach is that individuals may not report their food consumption accurately for various reasons related to knowledge, memory, and the interview situation (73). By conducting these diet recalls once every week throughout the course of a month, researchers were able to gain a more accurate and comprehensive representation of the participants' diet. A 5-step multiple pass approach developed by the US Department of Agriculture was used to implement the dietary recalls (74, 75). The 24-hour dietary recalls were conducted using the automated self-administered 24-hour diet recall software (ASA24) which was developed by the National Cancer Institute (NCI) for use in large-scale nutrition research

studies (76, 77). The format and design of the ASA24 are modeled on the interviewer-administered Automated Multiple Pass Method 24-hour recall developed by the USDA which has been validated and shown to accurately estimate mean total energy and protein intakes (75, 78). The ASA24 software is programmed with a food database which includes all foods available from USDA's Food and Nutrient Database for Dietary Studies (FNDDS) database. In addition, the software includes pictures of foods in multiple portion sizes to help respondents estimate portion size. This branching database allows questions and possible responses to be displayed on the screen for respondent selection. Although ASA24 was selected, an interviewer-administered method was used because the format and design of ASA24 are modeled on the interviewer-administered Automated Multiple Pass Method 24-hour recall. This way, entering the information was kept consistent with how it was collected and reduced the chance for mistakes or forgotten items. Internet connection is required for the use of the ASA24 software, but since Internet connection was not available at each participant's home, diet recalls were recorded on paper during the interview and later entered into the ASA24 software. Audio recordings of the interview were revisited and used to confirm any unclear information.

Also, a HFI was conducted by the interviewer and the research assistant during the first and last weekly in-person interview visits to assess availability of foods in the household. Studies have shown that foods found in pantries are indicators of actual food consumption, and there has been discussion that availability influences food intake (63, 79, 80). This area of research has been growing and several instruments have been developed to assess the home food environment. For this study, a 236-item HFI instrument and protocol were developed based on a HFI instrument used in a similar study conducted in a low-income Mexican sample in Texas (59). It was modified and adapted to account for our target group and regional food items. The

HFI included the food items of: dairy, grains, protein, fruit, vegetables, snacks/desserts/pre-prepared foods, beverages, and oils/spreads/and other fats. The foods listed in the tables found in Appendix E were organized into an abridged checklist to facilitate direct observation of the presence and amount of specific foods. The HFI instrument was pre-tested in multiple graduate student homes in the Athens area. After pre-testing, additional changes were made including the addition of food items due to the frequency that they were seen in the pre-testing (e.g., kool-aid, cream of wheat, and granola bars). Amounts of foods were determined by a count of the number of items in a case, labeling of bottled, canned, or pre-packaged foods, estimation of previously opened food items, and if none of these were applicable, a kitchen scale (KD-200, Tanita inc., Tokyo, Japan) was used. A detailed breakdown of food items included in the HFI is shown in Appendix E.

Participants were reassured that all the information would be kept confidential and that they were not being judged on their eating habits. Researchers probed for foods kept in different locations such as the garage, closets, or night stands. Each food storage area was photographed as well. Baking ingredients such as flour and sugar were not recorded due to the fact that they are usually bought in bulk and it is unclear how they will be used, making it difficult to categorize as healthful or less healthful. If food items were partially used and labeled with the original net weight, the researcher estimated the remaining amount. If food items were not labeled, the kitchen scale was used to record the net weight. For pre-cooked meals, such as casseroles or lasagnas, pan size was noted, and then recorded as either full, half, or quarter full. Spoiled foods were noted as such.

Dietary assessment protocols including HFI, 24-hour dietary recalls, and ASA24 protocol are shown in Appendix E, F, and G respectively.

Food insecurity assessment

To assess food insecurity, a modified 6-item U.S. Household Food Security Survey Module (HFSSM) was used. The modified version was used as opposed to the original 10 or 18 item HFSSM in order to lessen the burden of the interview survey on participants (47). The modification from the standard 6-item HFSSM involved separating the single question that asked about cutting the size of meals or skipping meals into two questions in order to separate out the two behaviors (47). The questions were also modified from asking about food security within the last month to the food security within the past week to accommodate this study's aim to observe weekly fluctuations.

Depression and stress assessment

In order to measure reported depression, the researcher used the Center for Epidemiologic Studies Depression Scale (CES-D). CES-D is one of the most commonly used standardized screening tests which uses 20 questions to measure for depressive feelings in the past week (30, 31). Scores can range from 0-60 and a score of 16 or higher has been identified in studies to identify subjects with symptomatic depression. In order to measure stress, researchers utilized the Perceived Stress Scale (PSS). The PSS is the most widely used psychological tool for measuring one's perception of stress. The questions were designed to understand how uncontrollable and congested participants found their lives in the past week (32-34).

Data analysis

Descriptive statistics including means, standard deviations, and percentages were calculated for various measures collected through the surveys, interviews, and observations using Microsoft Excel. Content analysis was conducted for the qualitative responses. ASA24 was used to estimate dietary intake based on the 24-hour dietary recalls. The researcher chose to look at

energy intake, carbohydrate/fat/protein composition, fiber, calcium, vitamin D, vitamin C, magnesium, and vitamin B-12 because older adults may fall short of the recommended intake for these nutrients (81). They were compared to the dietary reference intakes (DRI) set out by the Institute of Medicine (82). The carbohydrate/protein/fat composition was compared to the acceptable macronutrient distribution ranges (AMDR). Protein recommendations were also calculated based on body weight as 0.8g/kg and compared to the recommended dietary allowances (RDA) for further analysis. Fiber intakes were compared to the adequate intake (AI) and the micronutrients were compared to the RDA. Calorie needs were calculated using estimated energy requirements (EER), which was calculated from the DRI equation using "low active" for a physical activity factor (83). For the HFI analysis, the food items shown in Appendix E were further classified by healthfulness factors such as low fat, whole grains, low sodium, and/or low sugar. Proportions were calculated for availability of food items according to healthfulness factors. Proportions for low fat dairy were compared against high fat dairy, whole grain and low sugar cereals against enriched and high sugar cereals, low fat meats and proteins against high fat and processed meats and proteins, proportions of fresh, frozen, and canned fruits and vegetables were compared against each other, unsaturated or low fat oils and spreads were compared to saturated and full fat oils and spreads, and proportions for low calorie and regular beverages were compared. Healthful foods were considered to be low fat dairy, whole grain and low sugar cereals, fresh or frozen fruits and vegetables, lean meats and proteins, unsaturated fats and oils, as well as low-calorie beverages.

CHAPTER 4

RESULTS

All participants were female and had an average age of 68.3 ± 11 y. All three participants were single and primary caretakers with a mean caregiving period of 8.6 ± 6.6 y. Two participants were African American and one was White. They were all obese and two participants reported having cardiovascular disease and diabetes. All participants had a waist circumference greater than 43 inches. . All households participated in food stamps and lived under the poverty line, but reported food security throughout the month. Each participant was unique and different from one another and therefore will be described on an individual basis. The following provides a summary of each participant's unique situation.

Participant 1

Participant 1 lives with her teenage granddaughter. The granddaughter was under her care from the time she was born until she reached the age of 3. When the grandchild reached the age of 10, she came back to live with her grandmother, at which point participant 1 got legal guardianship and they have lived together since then. Participant 1 reported that the child's mother is still involved in the granddaughter's life and helps out financially and the father is in prison. Despite the emotional circumstances surrounding her situation, participant 1 is a positive person, a pleasure to talk to, and eager to help others. However, she did consistently report significant signs of depression and high levels of stress as revealed by the CES-D and PSS assessments. Participant 1 reported that her sleep was restless most times and was bothered by

the physical effects of aging. Most frequently, participant 1 reported that she could not get "going" and that everything she did felt like an effort.

Figure 3. Participant 1 HFI snapshots at week 1

Figure 4. Participant 1 HFI snapshots of refrigerator comparing weeks 1 and 4 from left to right

Participant 1 reported being food secure every week with the exception of week 1. She explained that her granddaughter's job started just recently and the extra income has helped with her food costs greatly because of the added income as well as the fact that the job is at a restaurant where she eats a free meal each time she works. Before her granddaughter started working, participant 1 reported that they could not afford to eat balanced meals and that they did sometimes run out of food and did not have money to get more. When asked about her grocery shopping habits, participant 1 reported that she utilizes food stamps, food banks, campus kitchen, and the Athens Community Council on Aging (ACCA) and spends about $150 on grocery shopping. She reported that she does grocery shopping once or twice a month at Kroger, Wal-Mart, ALDI, and frequenting Fresh Market to purchase deli-sandwiches and pastries for lunch. When conducting the HFI, the research team noted that participant 1 kept her kitchen clean and organized, however this may have been due to the lack of cooking participant 1 did. Participant 1

consumed mostly canned soups and pastries. She claimed her meals were rarely planned out and that she would eat what she could find around the house or at the store. Her diet fell short of her recommended intake for fiber, calcium, magnesium, and vitamins C, D, and B-12. Most of the foods she consumed required minimal or no preparation. There were few foods stored in her refrigerator and a large portion of foods were canned, boxed, or frozen. Although there were none present during the weeks of the HFI, campus kitchen provides fresh produce and meals that are prepared beforehand and then delivered to participants.

Participant 2

Participant 2 lives with her teenage granddaughter, toddler grandson, and her own daughter - the mother of the toddler. Participant 2 appeared to have a very hectic life and would even forget appointments made with the researcher. She was the only participant who had clinically diagnosed depression and had just begun taking antidepressant medication when the interview process began. Participant 2 claimed it had been a difficult year for her because her mother had passed away a few months ago and her son died last year. Her PSS and CES-D depression scores were the highest of all participants but by the last week, she reported that her medication seemed to be taking effect which was reflected in her significantly lower PSS and CES-D scores. Participant 2 reported that her sleep was restless most times. Most frequently, Participant 2 reported she felt lonely, had crying spells most days of the week, that she could not get "going", and that everything she did felt like an effort.

Figure 5. Participant 2 HFI snapshots at week 1

Figure 6. Participant 2 HFI snapshots of refrigerator comparing weeks 1 and 4 from left to right

Participant 2 reported the lowest income per family size. When asked about her grocery shopping habits, participant 2 reported that she "hoards food" and keeps her kitchen overly stocked at all times. She does her grocery shopping once or twice a month at Kroger, Wal-Mart, Publix, and Bells and spends an average of $670 per month. When conducting the HFI, the research team noted that the kitchen had very unsanitary conditions for cooking. Cockroaches and bugs were seen crawling around the ground and counters. There was also a large amount of food stored in the refrigerator, freezer, and pantry. Participant 2 also had an extra freezer in the kitchen which was mostly stocked with meat. Based on the 24-hour dietary recalls done throughout the month, participant 2 consumed a higher energy intake at 168% of her needs throughout the month. Her diet recalls showed that she consumed large quantities of food but still fell short of her recommended intake of calcium and vitamin D. Participant 2 had three to four planned out meals with large portions each time.

Participant 3

Participant 3 lives with her teenage great-granddaughter. Participant 3 has a very relaxed and happy attitude and her PSS and CES-D scores reflected her happy-go-lucky attitude. She has the lowest scores of all three participants. Her answers consistently reported that she felt happy, enjoyed life, and felt that things were going her way.

When asked about the grocery shopping habits, participant 3 reported that her daughter drives her to get groceries about twice a month at Kroger, Ingles, Fred's, and Bells and spends about $350 per month. When conducting the HFI, the research team noted that the kitchen was well stocked. Participant 3 has an extra deep freezer that was fully stocked with frozen meats and a pantry full of canned goods.

Figure 7. Participant 3 HFI snapshots at week 1

Figure 8. Participant 3 HFI snapshots of refrigerator comparing weeks 1 and 4 from left to right

Participant 3 said she would like to prepare foods in large batches and freeze them for later use. Despite the large amount of food available, participant 3 reported consuming only 45% of her energy needs throughout the month. The 24-hour dietary recall showed that participant 3 would consume foods in small quantities and she claimed it was due to a lack of appetite. Her meals were infrequent and did not follow a consistent pattern. Her diet assessments showed that her diet was below the recommended intake of fiber, calcium, magnesium, vitamin C, and vitamin D.

Food insecurity and HFI

Based on the current literature, it was initially expected that these grandparent headed households would be food insecure and therefore also have a small amount of food available in the home at some point in the month. However, this was not the case in our study sample. Table 3 shows the results of the weekly HFFSM. All of the households were food secure and had well stocked kitchens throughout the month. However, the HFI data showed that participants had a small proportion of healthful foods. More than 70% of dairy products were high fat items; more than 60% of grains and cereals were enriched and/or high sugar; more than 65% of fruits were canned; more than 40% of vegetables were canned without a low-sodium option; and all drinks were high sugar items. The proportion of low fat dairy and whole and/or low sugar grains was lower by week 4 compared to week 1 for each participant. Other than that, there was not a visible difference in the proportion of healthful food items available between weeks 1 and 4. Table 9 shows the detailed results. Each participant reported having done their major grocery shopping trips just two or three days prior to the first HFI. Participants one and two reported that they only went to the grocery store for a few filler items in-between weeks 1 and 4. However, participant three reported that she went grocery shopping again a few days prior to the last HFI.

Dietary recalls

For the 24-hour dietary recalls, the results showed a wide range of energy intakes and two participants also had over 40% of their calories coming from fat. Participants consistently reported unbalanced diets with inadequate intakes of micronutrients including calcium and vitamin D. Two of the three participants consumed less than 50% of their recommended intake of fiber, vitamin C, and magnesium. The one participant who met the recommendations for fiber, vitamin C, and magnesium also consumed a higher energy intake at 168% of her needs throughout the month. Most of the participants met the recommended intake for vitamin B12, however studies have shown that only 50% of dietary vitamin B12 is absorbed by healthy adults (84). Therefore, a vitamin B12 supplement may be needed and none of the participants reported regularly consuming a multi-vitamin or vitamin/mineral supplement. Detailed dietary intake values for all three participants are shown on Tables 6-8.

Depression and stress

Two of the three participants reported symptomatic depression (>16 CES-D), and one of them had clinically diagnosed depression (taking antidepressant medication). Most frequently, participants reported that their sleep was restless, they could not get "going", and that everything they did felt like an effort. The PSS showed that on a scale of 0-40, the two participants who reported symptomatic depression also had an average PSS score of 22 while the other averaged 5. The most commonly high ranked responses from the PSS were regarding being upset because of something that happened unexpectedly, feeling nervous/stressed, and not being able to cope with all the things they had to do. The fluctuations seen across the weeks were different for each participant and therefore likely due to various events in each participant's life. Tables 4 and 5 show the results of the PSS and CES-D, respectively.

Caregiving

Each grandparent had unique circumstances surrounding the reasons behind their caregiving situations ranging from parental incarceration, alcohol addiction, mental handicaps, and rape. The average length of caregiving for the three participants was 8.7 years with a range of 3 to 16 years. Each grandparent had intermittent periods of caring for their grandchildren prior to becoming legal guardians. Despite having been grandparent caregivers for some time, participants still reported struggling with stress and depression. One grandparent stated during the interviews that, "Grandparents should be spoiling their grandkids, not raising them". One thing that was made clear through doing the in-person interviews was that grandparent caregiving is a constant struggle and does not get easier with time.

Overall findings

It was observed that despite being the youngest participant, the grandparent who assumed more caregiving responsibility, also consistently reported higher levels of stress and depression, had larger amounts of food available in the home, higher caloric and fat intake, a higher BMI, and also had more diet related chronic conditions that the other grandparents. This could imply that the strain caregiving puts on a grandparent can contribute to stress and depression as well as poor dietary habits, leading to diet related chronic diseases.

Table 3. Household food security for three participants across four weeks using the Modified 6-item Household Food Security Survey Module

Food Insecurity	Participant 1	Participant 2	Participant 3
Week 1	Insecure	Secure	Secure
Week 2	Secure	Secure	Secure
Week 3	Secure	Secure	Secure
Week 4	Secure	Secure	Secure

Table 4. Perceived stress scaled score of three participants across four weeks[1]

Stress	Participant 1	Participant 2	Participant 3	Average	SD
Week 1	24	26	10	20	±8.7
Week 2	21	31	5	19	±13.1
Week 3	19	21	3	14	±9.9
Week 4	23	9	1	11	±11.1
Average	22	22	5		
SD	±2.2	±9.4	±3.9		

Table 5. Center for Epidemiologic Studies Depression Scale scores of three participants across four weeks[2]

Depression	Participant 1	Participant 2	Participant 3	Average	SD
Week 1	26	36	8	23	±14.2
Week 2	18	35	12	22	±11.9
Week 3	18	31	4	18	±13.5
Week 4	23	12	3	13	±10
Average	21	29	7		
SD	±3.9	±11.2	±4.1		

[1] Higher numbers are related to higher levels of stress (Range: 0-40)
[2] Score of 16 or higher is indicative of symptomatic depression (Range: 0-60)

Table 6. Dietary intake over a month period based on weekly 24-hour dietary recalls: Participant 1

	Calories[ϕ]	**Carbohydrate[‡]**	**Fat[‡]**	**Protein[‡]**			**Fiber**	**Calcium**	**Vitamin D**	**Vitamin C**	**Magnesium**	**Vitamin B-12**
DRI	1907 kcals	45-65% of total kcals	20-35% of total kcals	10-35% of total kcals	69.3 g[¥]	46g/d[ß]	21 g/d*	1,200 mg/d[ß]	15µg/d[ß]	75 mg/d[ß]	320 mg/d[ß]	2.4 µg/d[ß]
Week 1	43%	45	39	16	48%	72%	24%	39%	3%	3%	20%	42%
Week 2	95%	43	48	9	56%	85%	38%	21%	1%	20%	35%	42%
Week 3	114%	45	35	19	150%	226%	48%	19%	13%	29%	52%	83%
Week 4	111%	47	47	7	56%	85%	43%	38%	4%	7%	38%	42%
Average ±SD	91% ±28.5	45 ±1.6	42 ±6.3	13 ±5.7	78 % ±48.5	117% ±73	38% ±10.3	29% ±10.7	5% ±5.2	10% ±12	40% ±13.1%	52% ±20.5

[ϕ] EER
[‡] AMDR
* AI
[ß] RDA
[¥] Calculated RDA for protein

Table 7. Dietary intake over a month period based on weekly 24-hour dietary recalls: Participant 2

	Calories[ϕ]	**Carbohydrates[‡]**	**Fat[‡]**	**Protein[‡]**			**Fiber**	**Calcium**	**Vitamin D**	**Vitamin C**	**Magnesium**	**Vitamin B-12**
DRI	2125 kcals	45-65% of total kcals	20-35% of total kcals	10-35% of total kcals	87.2 g[¥]	46g/d[ß]	21 g/d*	1,200 mg/d[ß]	15µg/d[ß]	75 mg/d[ß]	320 mg/d[ß]	2.4 µg/d[ß]
Week 1	180%	25	67	9	102%	193%	100%	47%	28%	259%	75%	167%
Week 2	206%	41	39	21	259%	491%	123%	145%	60%	399%	143%	375%
Week 3	212%	56	33	12	156%	296%	138%	116%	9%	624%	120%	333%
Week 4	72%	62	28	12	52%	100%	57%	18%	9%	91%	353%	83%
Average ±SD	168% ±56.4	46 ±16.6	42 ±17.4	14 ±5.2	142% ±88.7	270% ±168	105% ±35.3	82% ±59	27% ±24.1	343% ±225.6	173% ±123.4%	240% ±137.7

[ϕ] EER
[‡] AMDR
* AI
[ß] RDA
[¥] Calculated RDA for protein

Table 8. Dietary intake over a month period based on weekly 24-hour dietary recalls: Participant 3

	Calories[ϕ]	**Carbohydrates [‡]**	**Fat[‡]**	**Protein[‡]**			**Fiber**	**Calcium**	**Vitamin D**	**Vitamin C**	**Magnesium**	**Vitamin B-12**
DRI	1870 kcals	45-65% of total kcals	20-35% of total kcals	10-35% of total kcals	78.4 g[¥]	46g/d[ß]	21 g/d*	1,200 mg/d[ß]	20µg/d[ß]	75 mg/d[ß]	320 mg/d[ß]	2.4 µg/d[ß]
Week 1	57%	51	35	15	50%	85%	38%	38%	1%	15%	37%	83%
Week 2	43%	51	29	18	48%	83%	29%	33%	14%	2%	42%	42%
Week 3	51%	60	20	20	61%	104%	24%	68%	27%	23%	41%	208%
Week 4	80%	42	31	27	130%	221%	33%	62%	15%	28%	37%	208%
Average ±SD	58% ±13.8	51 ±7.3	29 ±6.3	20 ±5.1	72% ±38.9	123% ±66	31% ±5.9	50% ±17.3	14% ±10.5	17% ±11.3	39% ±2.6%	135% ±85.7

[ϕ] EER
[‡] AMDR
* AI
[ß] RDA
[¥] Calculated RDA for protein

Table 9. Proportion of the variety of food groups available in a sample of grandparent caregivers' home based on HFI

		Participant 1		Participant 2		Participant 3		Average	
Proportion of Variety (%)	**Total Possible**	**Week 1**	**Week 4**	**Week 1**	**Week 4**	**Week 1**	**Week 4**	**Week 1**	**Week 4**
Dairy									
Low Fat Dairy	28	33%	17%	17%	0%	33%	25%	28%	14%
High Fat Dairy		67%	50%	83%	100%	67%	75%	72%	75%
Grains									
Whole Grain & Low Sugar	27	42%	33%	27%	33%	50%	25%	40%	31%
Enriched Grains and High Sugar		58%	67%	73%	67%	50%	75%	60%	70%
Protein									
Low Fat Meat/Protein	14	57%	58%	42%	30%	57%	50%	52%	46%
High Fat Meat/Protein		43%	42%	58%	70%	43%	50%	48%	54%
Fruit									
Fresh Fruit	40	25%	25%	0%	0%	43%	29%	23%	18%
Frozen Fruit		25%	25%	0%	0%	0%	0 %	8%	8%
Canned Fruit		50%	50%	100%	100%	57%	71%	69%	74%
Vegetables									
Fresh Vegetables	48	31%	36%	30%	19%	24%	18%	28%	24%
Frozen Vegetables		31%	29%	30%	38%	24%	18%	28%	28%
Canned Vegetables		39%	36%	40%	38%	53%	59%	44%	44%
Snacks and Desserts									
Snacks	37	60%	67%	22%	13%	0%	33%	27%	38%
Desserts		40%	33%	78%	88%	100%	67%	73%	63%
Pre-Prepared Foods									
Frozen Meals	18	0%	0%	33%	33%	14%	16%	48%	17%
Canned Soups		60%	60%	33%	33%	43%	33%	45%	42%
Instant Meals		40%	40%	33%	33%	43%	50%	39%	41%

Oils, Spreads, and Added Fats									
Low/Unsaturated Fats	13	67%	50%	0%	0%	33%	33%	33%	28%
High/Saturated Fats		33%	50%	100%	100%	67%	67%	67%	72%
Beverages									
Low-Calorie Beverages	11	0%	0%	0%	0%	0%	0%	0%	0%
Regular Beverages		100%	100%	100%	100%	0%	100%	67%	100%
TOTAL	236								

CHAPTER 5

DISCUSSION/CONCLUSIONS

The purpose of this research project was to employ a longitudinal in-person interview method in order to identify major nutrition issues in a sample of grandparents raising grandchildren in Athens, Georgia as well as to test the feasibility of conducting this nature of research using these methods and measures. In particular, this research explored the current status of food insecurity, food items in the household, dietary intake, depression and stress, and caregiving issues in the study sample, all of which has a potential to impact the grandparent caregivers' increased risk for diet-related chronic diseases. This pilot study successfully implemented these methods and measures and proved the feasibility of this type of study. The findings from this exploratory study revealed that the households all lived below the federal poverty level and reported difficult family situations surrounding the reasons for having to be grandparent caregivers. Most of the grandparents reported having significant depression. All three participants were food secure and had well stocked kitchens throughout the month; however, they had a small proportion of healthful food items and their diets consistently fell short on the recommendations for many micronutrients that are important for older adults, particularly women. The combination of these factors could help explain the relationship between grandparent caregivers and their increased risk for diet related chronic diseases.

Strengths

To our knowledge, this is the first study to collect data of this nature among the grandparent caregiver population. This study collected in depth data on general characteristics,

caregiving, health status, stress, depression, food insecurity, dietary intake, and the home food environment. The study was also longitudinal, so it collected the data over the span of four weeks and was able to capture any fluctuations or changes in one month's time, which is commonly seen among food stamp participants.

By conducting this study in each participant's home, the researcher was able to develop a relationship with each participant and was able to observe characteristics and living situations that would have not been captured if surveys were simply mailed out or done cross-sectionally. A certain level of trust was developed that allowed participants to share intimate details of their lives which contributed to a better understanding of their living situation. It also made participants more comfortable with the HFI process.

Additionally, dietary intake is something that has not been researched in depth among grandparent caregivers. Understanding and changing dietary patterns to decrease the consumption of unhealthy foods requires an accurate measurement of the foods that are available in the home as well as an understanding of how much these foods are being consumed. By assessing the presence and amounts of various foods in the home, this research provides understanding of what foods are available for home consumption and insight needed in order to assess dietary behavior. The repeated 24-hour dietary recalls aided in understanding how these foods are prepared, in what quantities they are eaten, and how often. It also helped in understanding which foods from the HFI the grandparents are actually consuming.

Limitations

Recruitment for this study was a challenge due to the time commitment and extensive nature of the data collected. Therefore, this study was limited to just a few participants. This study was unfunded and therefore had no monetary compensation to offer participants for the

time they spent participating. The data collection process is also highly invasive and many people are hesitant to open up their homes for the household food inventory. That said, the three grandparents who volunteered their time to this study are unique individuals who may not be representative of all grandparent caregivers in Athens, Georgia. Additionally, the 24-hour dietary recalls were conducted face to face, recorded, and later entered into the ASA24 program. The dietary recalls would have been more accurate if it had been possible to conduct the recalls while using the program. However, ASA24 requires Internet access and there were no Internet connection options available in the participants' homes. Additionally, some foods consumed by participants were not recognized by the ASA24 software and substitutions were made. Some of those foods included turkey gizzards, goose, and some specific fast food items.

Another challenge was HFI data collection. Two researchers were needed in order to complete the data collection in a timely manner. One researcher began the interview while the other began the HFI. Once the interview with the participant was completed, the researchers would work together to complete the HFI. For interview dates in which the HFI was conducted, the entire process took about one and a half to two hours to complete. Due to the high volume of food items in a couple of the homes, the process was time consuming and some items may have been overlooked. This is likely the reason why there have been so few studies to do this on a large scale. Additionally, data was collected during the months of November and December, which are holiday months and therefore, may not be comparable to other times of the year.

Implications

This study has several implications for research, practice, and policy. First, it identified potential barriers to conducting this type of research. Recruitment of participants is the first barrier to conducting this type of research. Due to the extensive nature of the data collected,

future researchers will need to have more time set aside for recruitment as well as time to conduct the actual interviews. Furthermore, the HFI can be refined and improved. Future researchers should be sure to photograph food storage areas from the same angles each time a HFI is conducted in order to have comparable photographs at the end. Additionally, this study inventoried each food by the net weight in grams and the results compared food items by food group and healthfulness factor. Future researchers can collect and analyze the HFI differently in order to breakdown the results in a different way. For example, the checklist can be made into a simple scoring [1-10] format with higher scores indicating greater availability as opposed to weighing food items. Researchers can also create instructions for participants to be able to complete the HFI themselves. This method would require highly motivated participants but would also eliminate the hesitation participants feel towards allowing researchers to inventory all their food. Furthermore, results can also compare specific food items to one another across time or focus on a specific food group such as produce for more detailed analysis.

The findings from this study regarding food insecurity, food items in the home, dietary intake, depression and stress, and caregiving issues as they relate to an increased risk for diet related chronic conditions can be utilized for future expansion of research in this field. Most of the programs utilized by these grandparent households are food assistance programs. However based on the findings of this exploratory study, grandparent caregivers would also benefit from wellness and support interventions to provide nutrition education and social support. The wellness promoting interventions should address both physical and mental health. Grandparent support groups have been established in just a few communities. The Athens Community Council on Aging has a support group program for the grandparents and grandchildren which aims to provide home-based and community resources to improve the physical and emotional

well-being of inter-generational families. The program offers case management, health screenings and counseling, legal services, parenting education, and support groups for both the grandparents and grandchildren. The Department of Foods and Nutrition at the University of Georgia worked with this program to provide nutrition education as well, but could not continue due to lack of funding for the program.

Greater research attention needs to be devoted to the health and well-being of grandparent caregivers and the potential health consequences of this type of caregiving. Public health policies that promote health and provide outreach and access to health clinics and services targeted towards families are needed. More research is still needed to better understand the challenges faced by these households and to develop programs to benefit them.

REFERENCES

1. Baker LA, Mutchler JE. Poverty and material hardship in grandparent-headed households. J Marriage Fam 2010;72:947-62.
2. U.S. Census Bureau. American Community Survey. 2005. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_05_EST_B10001&prodType=table (accessed 27 April 2012).
3. Simmons T, Dye JL. Grandparents living with grandchildren: Census 2000 Brief. U.S. Census Bureau [serial online] 2003;10:1-10. Internet: http://www.census.gov/prod/2003pubs/c2kbr-31.pdf (accessed 19 January 2012).
4. Hayslip B, Kaminski PL. Grandparents raising their grandchildren: A review of the literature and suggestions for practice. Gerontologist 2005;45(2), 262-269.
5. Fuller-Thomson E, Minkler M, Driver D. A profile of grandparents raising grandchildren in the United States. Gerontologist 1997;37(3):406-11. doi: 10.1093/geront/37.3.406
6. Lee S, Colditz G, Berkman L, Kawachi I. Caregiving to children and grandchildren and risk of coronary heart disease in women. Am J Public Health 2003;93:1939-44.
7. Waldrop DP, Weber JA. From grandparent to caregiver – the stress and satisfaction of raising grandchildren. Fam Soc 2001;82:461-72.
8. U.S. Census Bureau. American Community Survey. 2011. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_1YR_B10059&prodType=table (accessed 12 January 2013).

9. Ziliak JP, Gundersen C**,** Haist M. The causes, consequences, and future of senior hunger in America. University of Kentucky center for poverty research special reports. 2008. Internet: http://www.ukcpr.org/Publications/SeniorHungerStudy.pdf (accessed 7 April 2012).
10. Ziliak JP, Gundersen C. Senior hunger in the United States: Differences across states and rural and urban areas. September 2009. Internet: http://www.mowaa.org/Document.Doc?id=193 (accessed 19 April 2012).
11. Lee JS, Fischer JG, Johnson MA. Food insecurity, food and nutrition programs, and aging: Experiences from Georgia. J Nutr Elder 2010;29(2):116-149.
12. Kaiser LL, Townsend MS. Food insecurity among US children. Top Clin Nutr 2005;20:313-20.
13. Seligman HK, Schillinger D. Hunger and socioeconomic disparities in chronic disease. N Engl J Med 2010;363(1):6-9.
14. U.S. Census Bureau. American Community Survey. 2011. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_1YR_B10056&prodType=table (accessed 12 January 2013).
15. U.S. Census Bureau. American Community Survey. 2010. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_1YR_S1002&prodType=table (accessed 15 January 2013).
16. Minkler M, Chehimi S. A profile of California grandparents raising grandchildren. January 2003. Internet: http://cssr-pw01.berkeley.edu/pdfs/Grandparents_FINAL.pdf (accessed 21 April 2012).

17. U.S. Census Bureau. American Community Survey. 2011. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_1YR_S1002&prodType=table (accessed 15 January 2013).
18. U.S. Census Bureau. American Community Survey. 2000. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_00_SF3_QTP18&prodType=table (accessed 24 April 2012).
19. U.S. Census Bureau. American Community Survey. 2011. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_1YR_B10051B&prodType=table (accessed 1 February 2013).
20. U.S. Census Bureau. American Community Survey. 2011. Internet: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_5YR_B10051A&prodType=table (accessed 1 February 2013).
21. Park HOH. The economic well-being of households headed by a grandmother as caregiver. Soc Serv Rev 2006;80(2):264-96.
22. Minkler M, Fuller-Thomson EF. The heath of grandparents raising grandchildren: results of a national study. Am J Public Health 1999;89(9):1384-89.
23. Whitley DM, Kelley SJ, Sipe TA. Grandmothers raising grandchildren: Are they at increased risk of health problems? Health & Soc Work 2001;26(2):105-12.
24. Lumpkin JR. Grandparents in a parental or near-parental role: sources of stress and coping mechanisms. J Fam Issues 2008;29(3):357-72.
25. Musil C, Warner C, Zauszniewski J, Wykle M, Standing T. Grandmother caregiving, family stress and strain, and depressive symptoms. West J Nurs Res 2009;31:389-408. doi: 10.1177/0193945908328262

26. Inwood S. Grandparents raising grandchildren: When grandparents are raising their children's children, family dynamics change considerably. Can Nurse 2002;98(4):21-5.
27. Kelley SJ, Whitley D, Sipe TA, Yorker BC. Psychological distress in grandmother kinship care providers: the role of resources, social support, and physical health. Child Abuse Negl 2000;24(3):311-21.
28. Fuller-Thomson E, Minkler M. African American grandparents raising grandchildren: a national profile of demographic and health characteristics. Health Soc Work 2000;25(2):109-18.
29. Gershoff ET, Aber JL, Raver CC, Lennon MC. Income is not enough: Incorporating material hardships into models of income associations with parenting and child development. Child Dev 2007;78(1):70–95. doi:10.1111/j.1467-8624.2007.00986.x
30. Beekman ATF, Deeg DJH, Van Limbeek J, Braam AW, De Vries MZ, Van Tilburg W. Criterion validity of the Center for Epidemiologic Studies Depression scale (CES-D): results from a community-based sample of older subjects in the Netherlands. Psychol Med 1997;27:231-5.
31. Bigbee JL, Musil C, Kenski D. The health of caregiving grandmothers: A rural-urban comparison. J Rural Health 2011;27:286-96.
32. Kwag KH, Martin P, Russell D, Franke W, Kohut M. The impact of perceived stress, social support, and home-based physical activity on mental health among older adults. Int J Aging Hum Dev 2011;72(2):137-54. doi: 10.2190/AG.72.2.c
33. Rueggeberg R, Wrosch C, Miller GE. The different roles of perceived stress in the association between older adults' physical activity and physical health. Health Psychol 2012;31(2):164-71. doi: 10.1037/a0025242

34. Stawski RS, Sliwinski MJ, Almeida DM, Smyth JM. Reported exposure and emotional reactivity to daily stressors: The roles of adult age and global perceived stress. Psychol Aging 2008;23(1):52–61.

35. Kichlighter JR, Whitley DM, Kelley SJ, Shipkie SM, Taube JL, Berry RC. Grandparents raising grandchildren: a response to a nutrition and physical activity intervention. J Am Diet Assoc 2007;107:1210-13.

36. Svetkey LP, Simons MD, Vollmer WM, Appel LJ, Conlin PR, Ryan DH, Ard J, Kennedy BM. Effects of dietary patterns on blood pressure: subgroup analysis of the dietary approaches to stop hypertension (DASH) randomized clinical trial. Arch Intern Med 1999;159:285-93.

37. Heiskanen TH, Niskanen LK, Hintikka JJ, Koivumaa-Honkanen HT, Honkalampi KM, Haatainen KM, Viinamäki HT. Metabolic syndrome and depression: a cross sectional analysis. J Clin Psychiatry 2006;67(9):1422-7.

38. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic disease, and decrements in health; results from the World Health Surveys. Lancet 2007;370(9590):851-8. doi:10.1016/S0140-6736(07)61415-9

39. Baker LA, Silverstein M. Preventive health behaviors among grandmothers raising grandchildren. J Gerontol B 2008;63(3):304-11.

40. Coleman-Jensen A, Nord M, Andrews M, Carlson S. Food insecurity in the United States in 2011. Economic Research Report No. (ERR-141). Version current 7 September 2012. Internet: http://www.ers.usda.gov/publications/err-economic-research-report/err141.aspx (accessed 8 March 2013).

41. Ziliak JP, Gunderson C. Food insecurity among older adults. August 2011. Internet: http://www.aarp.org/content/dam/aarp/aarp_foundation/pdf_2011/AARPFoundation_HungerReport_2011.pdf (accessed 27 April 2012).
42. Neely-Barnes SL, Graff JC, Washington G. The health-related quality of life of custodial grandparents. 2010. Internet: http://web.ebscohost.com.proxy-remote.galib.uga.edu/ehost/pdfviewer/pdfviewer?sid=218c693b-32b8-4246-b170-ad48d49a0b05%40sessionmgr114&vid=2&hid=125 (accessed 21 April 2012).
43. Higgins MM, Murray BJ. Nutrition-related practices and attitudes of Kansas skipped-generation(s) caregivers and their children. Nutrients 2010;2:1188-1211. doi:10.3390/nu2121188
44. Ivers LC, Cullen KA. Food insecurity: Special considerations for women. Am J Clin Nutr 2011;94:1740-4. doi: 10.3945/ajcn.111.012617
45. Nord M. Characteristics of low-income households with very low food security: An analysis of the USDA GPRA food security indicator. Washington, DC; 2007. Report No. : EIB-25.
46. Blumberg SJ, Bialostosky K, Hamilton WL, Briefel RR. The effectiveness of a short form of the Household Food Security Scale. Am J Public Health 1999;89:1231-4.
47. Lee JS, Johnson MA, Brown A, Nord M. Food security of older adults requesting older Americans act nutrition program in Georgia can be validly measured using a short form of the U.S. household food security survey module. J Nutr 2011;141(7):1362-68. doi: 10.3945/jn.111.139378
48. Drewnowski A, Specter SE. Poverty and obesity: The role of energy density and energy costs. Am J Clin Nutr 2004;79:6-16.

49. Putnam J, Allshouse J, Kantor LS. U.S. per capita food supply trends: More calories, refined carbohydrates, and fats. Food Review 2002;25:2–15

50. Wilde P, Ranney C. The monthly food stamp cycle: shopping frequency and food intake decisions in an endogenous switching regression framework. American Agricultural Economics Association. 2000;82:200-13.

51. Dinour LM, Bergen D, Ming-Chin Y. The food insecurity-obesity paradox: A review of the literature and the role food stamps may play. J Am Diet Assoc 2007;107:1952-61. doi: 10.1016/j.jada.2007.08.006

52. Dietz WH. Does hunger cause obesity? Pediatrics 1995;95:766-7.

53. Townsend MS, Peerson J, Love B, Achterberg C, Murphy SP. Food insecurity is positively related to overweight in women. J Nutr 2001;131:1738–1745.

54. Troy LM, Miller EA, Olson S, Medicine RIO. Hunger and Obesity: Understanding a Food Insecurity Paradigm: Workshop Summary. Washington, D.C. : The National Academies Press 2011.

55. Basiotis P, Lino M. Food insufficiency and prevalence of overweight among adult women. Fam Econ Nutr Rev 2003;15:55-57.

56. Turrini A, Saba A, Perrone D, Cialfa E, D'Amicis A: Food consumption patterns in Italy: the INN-CA Study 1994-1996. European Journal of Clinical Nutrition 2001;55:571-588.

57. Coates T, Jeffrey R, Wing R: The relationship between persons' relative body weights and the quality and quantity of food stored in their homes. Addict Behav 1978;3(3-4):179-184.

58. Patterson RE, Kristal AR, Shannon J, Hunt JR, White E: Using a brief household food inventory as an environmental indicator of individual dietary practices. Am J Public Health 1997;87(2):272-275.

59. Sharkey JR, Dean WR, St John JA, Huber Jr JC. Using direct observations on multiple occasions to measure household food availability among low-income Mexicano residents in Texas colonias. BMC Public Health 2010;10:445-59. doi:10.1186/1471-2458-10-44

60. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: Policy and environmental approaches. Annual Rev Public Health 2008;29:1-6.

61. Carlson A, Kinsey J, Nadav C. Consumers' retail source of food: A cluster analysis. Family Economics and Nutrition Review 2002;14(2):11-20.

62. Raynor H, Polley B, Wing R, Jeffery R: Is dietary fat intake related to liking or household availability of high- and low-fat foods? Obesity Research 2004;12(5):816-823.

63. Cullen KW, Baranowski T, Owens E, Marsh T, Rittenberry L, de Moor C: Availability, accessibility, and preferences for fruit, 100% fruit Juice, and vegetables influence children's dietary behavior. Health Education & Behavior 2003;30(5):615.

64. Gattshall M L, Shoup JA, Marshall JA, Crane LA, Estabrooks PA. Validation of a survey instrument to assess home environments for physical activity and healthy eating in overweight children. Int J Behav Nutr Phys Act. 2008;5:3. doi:10.1186/1479-5868-5-3.

65. Kerr J, Norman GJ, Sallis JF, & Patrick K. Exercise aids, neighborhood safety, and physical activity in adolescents and parents. Med Sci Sports Exerc 2008;40:1244–1248.

66. Mello JA, Gans KM, Risica PM, Kirtania U, Strolla LO, Fournier L. How is food insecurity associated with dietary behaviors? An analysis with low income, ethnically diverse participants in a nutrition intervention study. J Am Diet Assoc 2010;110(12):1906-11. doi: 10.1016/j.jada.2010.09.011
67. van der Horst K, Oenema A, Ferreira I, Wendel-Vos W, Giskes K, van Lenthe F, Brug J. A systematic review of environmental correlates of obesity-related dietary behaviors in youth. Health Educ Res 2007;22:203–26.
68. Campbell KJ. Associations between the home food environment and obesity-promoting eating behaviors in adolescence. Obesity (Silver Spring). 2007;15:719–30.
69. Bryant M, Stevens J, Wang L, Tabak R, Borja J, Bentley ME. Relationship between home fruit and vegetable availability and infant and maternal dietary intake in African-American families: evidence from the exhaustive home food inventory. J Am Diet Assoc 2011;111:1491-1497.
70. Sisk C, Sharkey JR, McIntosh WA, Anding J. Using multiple household food inventories to measure food availability in the home over 30 days: a pilot study. Nutrition Journal 2010;9(19). doi: 10.1186/1475-2891-9-19.
71. Bachman HJ, Chase-Lansdale PL. Custodial grandmothers' physical, mental, and economic well-being: comparisons of primary caregivers from low-income neighborhoods. Fam Relat 2005;54:475-87.
72. Rose D, Bodor JN. Household food insecurity and overweight status in young school children: results from the early childhood longitudinal study. Pediatrics 2006;117:464–73.

73. Thompson FE, Subar AF. Nutrition in the treatment and prevention of disease. 3rd ed. Elsevier 2013

74. U.S. Department of Agriculture. Products and services. Version current 29 September 2010. Internet: http://www.ars.usda.gov/Services/docs.htm?docid=7711 (accessed 1 March 2013).

75. Moshfegh AJ, Rhodes DG, Baer DJ, Murayi T, Clemens JC, Rumpler WV, Paul DR, Sebastian RS, Kuczynski KJ, Ingwersen LA, Staples RC, Cleveland LE. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. Am J Clin Nutr 2008;88(2):324-32.

76. Baranowski T, Islam N, Baranowski J, et al. Comparison of a web-based versus traditional diet recall among children. J Acad Nutr Diet 2012;112(4):527-32. doi: 10.1016/j.jada.2011.10.002.

77. Subar AF, Kirkpatrick SI, Mittl B, et al. The Automated Self-Administered 24-hour dietary recall (ASA24): a resource for researchers, clinicians, and educators from the National Cancer Institute. J Acad Nutr Diet 2012;112(8):1134-7. doi: 10.1016/j.jand.2012.04.016.

78. Kipnis V, Subar AF, Midthune D, Freedman LS, Ballard-Barbash R, Troiano RP, Bingham S, Schoeller DA, Schatzkin A, Carroll RJ. Structure of dietary measurement error: results of the OPEN biomarker study. Am J Epidemiol 2003;158(1):14-21.

79. Baranowski T, Missaghian M, Watson K, Broadfoot A, Cullen K, Nicklas T, Fisher J, O'Donnell S: Home fruit, juice, and vegetable pantry management and availability scales: A validation. Appetite 2008;50(2-3):266-277.

80. Kratt P, Reynolds K, Shewchuk R: The role of availability as a moderator of family fruit and vegetable consumption. Health Education & Behavior 2000;27(4):471-482.

81. Lichtenstein AH, Rasmussen H, Yu WW, Epstein SR, Russell RM. Modified MyPyramid for older adults. J Nutr, 2008;138(1):5-11.

82. Food and Nutrition Board, Institute of Medicine. Dietary reference intakes tables and applications, Version current 12 September 2011. Internet: http://www.iom.edu/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx (accessed 26 February 2013).

83. Food and Nutrition Board, Institute of Medicine. Dietary reference intakes for energy, carbohydrates, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Washington, DC: National Academy Press, 2005.

84. Watanabe F. Vitamin B12 sources and bioavailability. Experimental Biology and Medicine 2007;232:1266-1274.

APPENDICES

APPENDIX A

SCREENEING CHECKLIST

Understanding Nutrition Issues among Grandparents Raising Grandchildren in Athens, Georgia

Date/Time:_____

Participant Screening #_____

Criteria	Yes	No
Are you a grandparent who is considered a primary caregiver for your grandchild(ren)? **[Does not require legal guardianship]**		
Are you 40 years of age or older?		
Are you able to understand, write, and speak English?		
Do you live in the northeast Georgia area?		
Will you be available for the entire duration of the study?		

Does not meet qualifications:_____
Meets qualifications:_____

If participant meets, qualifications:

Preferred method of contact: Phone: _____
Email: _____
Does your home have internet access? Yes / No

APPENDIX B

RECRUITMENT FLYER

Are you a grandparent raising your grandchild?

A UGA Graduate student is conducting a research project which could help benefit grandparents who are raising their grandchildren and needs participants.

The purpose of this research project is to identify major nutrition issues among grandparents who are raising their grandchildren in northeast Georgia. Your part in this study will last about 6-7 hours. The researcher will visit your home once a week for approximately one month to interview you and collect information regarding your nutritional and health status. You must be 40 years of age or older, a primary caregiver to your grandchild, and live in the northeast Georgia area.

Please call the number below or email if you are interested in participating.
All individually identifiable information in kept completely confidential!

Sara Najafi
Phone: (xxx)xxx-xxxx
Email: synajafi@uga.edu

Sara Najafi
Phone: (xxx)xxx-xxxx
Email: synajafi@uga.edu

APPENDIX C

INFORMED CONSENT FORM

I, _____ agree to take part in a research study titled "Understanding Nutrition Issues among Grandparents Raising Grandchildren" which is being conducted by Sara Najafi, Department of Foods and Nutrition, University of Georgia under the direction of Dr. Jung Sun Lee, Department of Foods and Nutrition, University of Georgia. My participation is voluntary; I can refuse to participate or stop taking part at any time without giving any reason, and without penalty or loss of benefits to which I am otherwise entitled. If I decide to withdraw from the study, the information that can be identified as mine will be kept as part of the study and may continue to be analyzed.

The purpose of this research project is to identify major nutrition issues among grandparents who are raising their grandchildren in northeast Georgia.

The benefits that I may expect from it are insight into my nutritional status assessed by dietary intake and body measurements.

If I volunteer to take part in this study, I will be asked to do the following things:
My part in this study will last for about 4-5 weeks. The researcher will visit my home once a week for approximately one month to interview me and collect information regarding my nutritional and health status. Each weekly visit will last one to two hours and take place in my home. I will need to be willing to allow these interviews to be audio taped. I will need to be prepared to answer questions and share personal information regarding the following:

a) Personal background, economic, and health information

b) Body measurements

c) Caregiving regarding my grandchildren

d) Stress and depression

e) Food acquisition /situation

f) Dietary intake

- I will need to be open and honest about my food intake/eating habits and recall my food intake from the previous day each time I am interviewed by the researcher. I will need to be willing to open up my home and kitchen to allow the researcher to record all the food items in my household. With my permission, the researcher will also take pictures of my refrigerator, freezer, etc.

Some discomfort or stress may be faced during this research when asked questions about caregiving, food situations, and mental health. Sensitive information about my physical and mental health will only be used for the purposes of this research project. In the unlikely event of a breach of confidentiality, there would be a loss of privacy. All information and audio files will be kept on file for 2 years after the completion of this study. The key to the codes will be secured in a locked file cabinet in a locked room and the electronic files will be password protected. After two years, audio files will be destroyed and my name will be removed from all electronic and paper files and only my participant ID number will be saved. Photographs taken of my food and food storage areas may be used in presentations and publications.

The only people who will know that I am a research subject are members of the research team. No individually-identifiable information about me, or provided by me during the research, will be shared with others, except if necessary to protect my rights or welfare (for example, if I am injured and need emergency care); or if required by law. If information about abuse is observed, researchers will be required to report this to the proper authorities.

The researcher will answer any further questions about the research, now or during the course of the project, and can be reached by telephone at: (xxx)xxx-xxxx.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study.
I have been given a copy of this form.

_____	_____	_____
Name of Researcher	**Signature**	**Date**

Telephone: _____

Email: _____

_____	_____	_____
Name of Participant	**Signature**	**Date**

Please sign both copies, keep one and return one to the researcher.

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 629 Boyd Graduate Studies Research Center, Athens, Georgia 30602; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

APPENDIX D

INTERVIEW MATERIALS

Understanding Nutrition Issues among Grandparents Raising Grandchildren in Athens, Georgia

Participant ID:_____

Date:_____

Week # _____

BACKGROUND INFORMATION

1. What is your age in years? ___ ___ ___

2. Gender
   (1) Male
   (2) Female

3. Which race do you most identify with?
   (1) White
   (2) Black
   (3) Other

4. Which of the following best describe your marital status?
   (1) Single
   (2) Married
   (3) Widowed
   (4) Divorced
   (5) Member of an unmarried couple

5. What is your household size?
   (1) **1**
   (2) **2**
   (3) **3**
   (4) **4**
   (5) **5**
   (6) **6**
   (7) **7+**

   Please describe your household composition:

6. What is your household's income?
(Only need to provide one or the other; monthly or annual)

Gross income is any income from any source. Keep in mind all paychecks, child support, military benefits, loans, alimony, pensions, etc.

Family Size	Monthly Gross Income	Annual Gross Income

7. What is the highest level of education you have completed?
   (1) Less than high school
   (2) High school/GED
   (3) Some college
   (4) Associates Degree
   (5) BS/BA
   (6) Masters

8. Which support group services and/or food assistance programs have you used in the past year?
   (1) ACCA
   (2) Campus Kitchen
   (3) Food Bank
   (4) Food Stamps
   (5) Soup Kitchens
   (6) WIC
   (7) Other(s)

If other(s), please list:

ANTHROPOMETRY

Self-Reported:

9. **Height** (without shoes)	___ feet and ___ ___. ___inches
10. **Weight** (with clothes and without shoes)	___ ___ ___.___ pounds

Measured by Interviewer:

11. **Waist Circumference**	___ ___.___ INCHES
12. **Height** (without shoes)	___ feet and ___ ___. ___inches
13. **Weight** (with clothes and without shoes)	___ ___ ___.___ pounds
14. **BMI** body mass index [wt_lbs x 703 /(ht_inches)^2]	

FOOD ACQUISITION

	Kroger	Ingles	Wal-Mart	Publix	Piggly Wiggly	ALDI	Bells	Fred's	Fresh Market	Food Assistance Programs
Where										
How Often										
How do you get there?										
Money Spent										

FOOD INSECURITY

These next questions are about the food eaten in your household in the last week and whether you were able to afford the food you need.	
15. During the last week, how often was this statement true: The food that we bought just didn't last, and we didn't have money to get more.	1) Often 2) Sometimes 3) Never
16. During the last week, how often was this statement true: We couldn't afford to eat balanced meals.	1) Often 2) Sometimes 3) Never
17. In the past week, did you or other adults in your household ever cut the size of your meals because there wasn't enough money for food?	1) Yes 2) No
18. In the past week, did you or other adults in your household ever skip meals because there wasn't enough money for food?	1) Yes 2) No
19. In the last week, did you ever eat less than you felt you should because there wasn't enough money for food?	1) Yes 2) No
20. In the last week, were you ever hungry but didn't eat because there wasn't enough money for food?	1) Yes 2) No

DEPRESSION/STRESS ASSESSMENT (1 of 2)

Perceived Stress Scale

To be self-reported and the reviewed with interviewer

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

21. In the last month, how often have you been upset because of something that happened unexpectedly?..... ……..0 1 2 3 4

22. In the last month, how often have you felt that you were unable to control the important things in your life?.....…..0 1 2 3 4

23. In the last month, how often have you felt nervous and "stressed"? 0 1 2 3 4

24. In the last month, how often have you felt confident about your ability to handle your personal problems?..... 0 1 2 3 4

25. In the last month, how often have you felt that things were going your way?..... 0 1 2 3 4

26. In the last month, how often have you found that you could not cope with all the things that you had to do? 0 1 2 3 4

27. In the last month, how often have you been able to control irritations in your life?..... 0 1 2 3 4

28. In the last month, how often have you felt that you were on top of things?..... 0 1 2 3 4

29. In the last month, how often have you been angered because of things that were outside of your control? ..... ……..... 0 1 2 3 4

30. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?..... 0 1 2 3 4

DEPRESSION/STRESS ASSESSMENT (2 of 2)

Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

	During the Past Week			
	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
31. I was bothered by things that usually don't bother me.	☐	☐	☐	☐
32. I did not feel like eating; my appetite was poor.	☐	☐	☐	☐
33. I felt that I could not shake off the blues, even with help from my family or friends.	☐	☐	☐	☐
34. I felt I was just as good as other people.	☐	☐	☐	☐
35. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
36. I felt depressed.	☐	☐	☐	☐
37. I felt that everything I did was an effort.	☐	☐	☐	☐
38. I felt hopeful about the future.	☐	☐	☐	☐
39. I thought my life had been a failure.	☐	☐	☐	☐
40. I felt fearful.	☐	☐	☐	☐
41. My sleep was restless.	☐	☐	☐	☐
42. I was happy.	☐	☐	☐	☐
43. I talked less than usual.	☐	☐	☐	☐
44. I felt lonely.	☐	☐	☐	☐
45. People were unfriendly.	☐	☐	☐	☐
46. I enjoyed life.	☐	☐	☐	☐
47. I had crying spells.	☐	☐	☐	☐
48. I felt sad.	☐	☐	☐	☐
49. I felt that people disliked me.	☐	☐	☐	☐
50. I could not get "going".	☐	☐	☐	☐

- zero for answers in the first column, 1 for answers in the second column, 2 for answers in the third column, 3 for answers in the fourth column.
- The scoring of positive items (34, 38, 42, and 46) is reversed. Possible range of scores is zero to 60, with the higher scores indicating the presence of more symptomatology.

HEALTH INFORMATION

51. How would you rate your overall health?

(1) Poor
(2) Fair
(3) Good
(4) Very good
(5) Excellent

52. Do you have any of the following diet related chronic diseases?

Disease	Yes	No	If yes, how do you manage your chronic disease?
Diabetes			
Cardiovascular Disease			
Obesity			
Osteoporosis			
Other:			
Other:			

CAREGIVING INFORMATION

53. Number of grandchildren in the household?	a) **1**	b) **2**	c) **3**	d) **4**	e) **5**
1) Gender: M / F					
2) Current age:					
3) What age was the grandchild when they were put under your care? Age:					
4) Are the parents involved in the child's life? Yes or No and describe:					

5) Why, when, and how were the children originally put under your care?	**Why:**				
	When:				
	How:				
6) How long are you expecting to have the children under your care?					

54. Are you or the children currently participating in any food and support assistance programs?

Food Assistance Program	Grandparent	Grandchild(ren)	Both
a) ACCA			
b) Campus Kitchen			
c) Food Bank			
d) Food Stamps			
e) Soup Kitchens			
f) School Lunch Program			
g) WIC			
h) Other(s)			

55. Are these programs sufficient for your family's needs?

56. Which has been most helpful to your family?

57. What kind(s) of resources would you find most beneficial to you?

58. What kind(s) of resources would you find most beneficial to other grandparents who are raising their grandchildren?

DIETARY ASSESSMENT (1 of 2)

24-Hour Diet Recall

SERVING ABBREVIATIONS:	
Tablespoon	= TBSP
Cup	= c
Teaspoon	= tsp
Pound	= lb
Ounce	= oz
Slice	= sl

Meal Abbreviations: **B**=breakfast, **L**=lunch, **D**=dinner, **S**=snack

(Use food models to demonstrate portions)

Please be as specific as possible. Include all beverages, condiments, and portion sizes.

Meal/Time	Food Item and Method of Preparation	Amount Eaten	Where

24-Hour Diet Recall

Additional Questions

Was this intake unusual in any way?

(1) Yes
(2) No

If yes, in what way?

Do you take vitamin or mineral supplements?
(1) Yes
(2) No

If yes:

Supplement Name	How many per day?	(or) How many per week?

DIETARY ASSESSMENT (2 of 2)

Household Food Inventory

Start Time: _____ AM/PM Â Â Â Â Â Â Â Â End Time: _____ AM/PM

What is the date of your most recent grocery shopping trip? _____

Initial Observations:

Storage	Yes	No
Refrigerator Describe type and size: ie) traditional, side by side, top refrigerator/bottom freezer style, French door style, mini-fridge		
Freezer		
Pantry		
Is food stored anywhere else in the house?		
List other(s):		

DAIRY

ie: Milk, yogurt, cheese, cream

Yes	Item	Number	Unit
	Milk (non-fat)		Gallon
			½ Gallon
			Quart
			Fluid Ounces
	Milk (1%)		Gallon
			½ Gallon
			Quart
			Fluid Ounces
	Milk (2%)		Gallon
			½ Gallon
			Quart
			Fluid Ounces
	Milk (Whole)		Gallon
			½ Gallon
			Quart
			Fluid Ounces
	Milk (Chocolate/Flavored)		Fluid Ounces
	Milk (Condensed)		Grams
	Cheese (Regular)		Grams
			Pound
			Slice
	Cheese (Low-fat)		Grams
			Pound
			Slice
	Cheese (Spread)		Grams
	Cheese (Grated)		Grams
	Cottage Cheese		Grams
	Yogurt (Plain)		Grams
	Yogurt (Flavored)		Grams
	Cream		Grams
	Other:		

GRAINS

ie: Cereal, breads, rice, pasta, etc.

Yes	Item	Number	Unit
	Cereal (Whole Grain/ Low Sugar)		Gram
	Cereals (Low-Sugar)		Gram
	Cereals (High Sugar)		Gram
	Oatmeal		Gram
	Cream of Wheat		
	Grits		Gram
	White Bread (Rolls, buns, biscuits, sandwich, French bread, etc.)		Grams
			Slices
			Rolls
			Buns
	Whole Wheat Bread		Grams
			Slices
			Rolls
			Buns
	Muffins		Small
			Medium
			Large
	White Rice		Gram
	Brown Rice		Gram
	Rice a Roni		Gram
	Couscous		Gram
	Barley		Gram
	Dough		Gram
	Enriched Pasta (spaghetti, noodles, lasagna)		Gram
	Whole Wheat Pasta (spaghetti, noodles, lasagna)		Gram
	Macaroni and Cheese (Boxed or canned)		Gram
	Tortillas (Corn or Flour)		Gram
			Each
	Ramen Noodles		Gram

PROTEIN

ie: Meat, poultry, fish, beans, legumes, eggs, etc.

Yes	Item	Number	Unit
	Beef (ground, hamburgers, steaks)		Gram
	Pork / Pork chops		Gram
	Turkey (Fresh, frozen, or smoked)		Gram
	Chicken Breast		Gram
	Chicken (Whole or pieces)		Gram
	Chicken (Frozen breaded)		Gram
	Hot Dogs (beef or pork)		Gram
	Hot Dogs (chicken or turkey)		Gram
	Corn Dogs		Each
	Bacon		Gram
	Sausage		Gram
	Ham		Gram
	Deli meats		Gram
	Canned Meats (spam, or Vienna sausage)		Gram
	Fish (Breaded)		Gram
	Fish (Fresh, frozen, fillet un-breaded)		Gram
	Canned Fish (Tuna, sardines)		Gram
	Other seafood (clams, crab, oysters, shrimp, etc)		Gram
	Beans		Gram
	Refried Beans		Gram
	Lentils		Gram
	Eggs		Each
	Peanut butter		Gram
	Protein Substitute and Protein drinks		Gram

FRUIT:

Fresh:

Yes	Item	Number	Unit
	Apples		Small
			Medium
			Large
	Bananas		Small
			Medium
			Large
	Pears		Small
			Medium
			Large
	Berries (Strawberries, cherries, etc)		Each
	Oranges/Tangerines		Small
			Medium
			Large
	Grapefruit		Small
			Medium
			Large
	Mangos		Each
	Peaches/Nectarines		Small
			Medium
			Large
	Pineapple		Each
	Grapes		Each
	Kiwi		Each
	Papaya		Each
	Melons		Small
			Medium
			Large
	Avocados		Small
			Medium
			Large
	Dried Fruit		Grams
	Other:		

Canned:

Yes	Item	Number	Unit
	Apple Sauce		Gram
	Jams/Jellies		Gram
	Orange/Tangerine		Gram
	Pineapple		Gram
	Peach/Nectarine		Gram
	Mixed Fruit		Gram
	Other:		Gram

Frozen:

Yes	Item	Number	Unit
	Blueberries		Gram
	Cranberries		Gram
	Peaches		Gram
	Pineapple		Gram
	Raspberries		Gram
	Strawberries		Gram
	Other:		Gram

VEGETABLES:

Fresh:

Yes	Item	Number	Unit
	Broccoli, Cauliflower, Brussels sprouts		Each
	Cabbage		Head
			Gram
	Carrots		Each
			Gram
	Corn		Ears
	Cucumber		Each
	Lettuce		Head
			Gram
	Onion		Each
			Gram
	Mushroom		Each
			Gram
	Green peas / green beans		Pound
			Gram
	Peppers		Each
	Potatoes		Small
			Medium
			Large
	Yams/Sweet Potatoes		Small
			Medium
			Large
	Squash/Zucchini		Each
	Tomatoes		Each
	Celery		Stalk
	Eggplant		Each
	Asparagus		Each
	Collard Greens (kale, spinach, etc)		Pound
			Gram
	Okra		Each
	Turnip Greens		Each
	Other:		

Canned:

Yes	Item	Number	Unit
	Asparagus		Gram
	Beets		Gram
	Carrots		Gram
	Collard greens		Gram
	Corn		Gram
	Green beans		Gram
	Green peas		Gram
	Mixed Vegetables		Gram
	Mushrooms		Gram
	Okra		Gram
	Potatoes		Gram
	Squash/Zucchini		Gram
	Tomatoes		Gram
	Turnip Greens		Gram
	Yams/Sweet potatoes		Gram

Frozen:

Yes	Item	Number	Unit
	Asparagus		Gram
	Broccoli, cauliflower, Brussels sprouts		Gram
	Carrots		Gram
	Corn		Gram
	Dark leafy greens		Gram
	Green beans		Gram
	Green peas		Gram
	Mixed Vegetables		Gram
	Okra		Gram
	Potatoes		Gram
	Peppers		Gram
	Squash/Zucchini		Gram
	Other:		Gram

SNACKS, DESSERTS, and PRE-PREPARED FOODS:

Yes	Item	Number	Unit
	Potato Chips		Gram
	Crackers		Gram
	Crackers - Low Fat or Low Sodium		
	Tortilla Chips		Gram
	Granola Bars		Gram
	Popcorn		Gram
	Pretzels		Gram
	Donuts		Gram
	Cakes		Gram
	Cookies		Gram
	Candy		Gram
	Ice Cream (Regular)		Gallon
			½ Galllon
			Pint
			Bars
	Ice Cream (Low or non fat)		Gallon
			½ Galllon
			Pint
			Bars
	Ice Cream Popsicles		Popsicles
	Frozen Desserts		Gram
	Pancake Mix		Gram
	Cake Mix		Gram
	Frozen Meals		Gram
	Instant Meals		Gram
	Canned Soups		Gram
	Stock		Fluid Ounces
	Casserole (Meat Based)		Pan Size: Full/Half/Quarter
	Casserole (Vegetable Based)		Pan Size: Full/Half/Quarter
	Casserole (Starch Based)		Pan Size: Full/Half/Quarter
	Other:		

BEVERAGES:

Yes	Item	Number	Unit
	Soda (regular)		Fluid Ounces
	Soda (diet)		Fluid Ounces
	Fruit Juice (from concentrate)		Fluid Ounces
	Fruit Juice (100%)		Fluid Ounces
	Vegetable Juice		Fluid Ounces
	Kool-Aid		Fluid Ounces
	Sweet Tea		Fluid Ounces
	Other:		Fluid Ounces

OILS, SPREADS & OTHER FATS

Yes	Item	Number	Unit
	Veggie Dip		Gram
	Sour Cream		Gram
	Butter -Stick		Gram
	Butter - Spread		Gram
	Butter – low fat		Gram
	Margarine – Stick		Gram
	Margarine – Spread		Gram
	Margarine – Low fat		Gram
	Cooking Oil – Vegetable		Fluid Ounces Cans
	Cooking Oil – Olive		Fluid Ounces Cans
	Cooking Oil – Corn		Fluid Ounces Cans
	Cooking Oil – Other		Fluid Ounces Cans
	Lard		Gram
	Fat		Gram
	Other:		

APPENDIX E

HOUSEHOLD FOOD INVENTORY PROTOCOL

Purpose

The purpose of the household food inventory is to gain information regarding the participants' food and beverage availability. By conducting the household food inventory multiple times, researchers are able to see how food availability changes throughout a one month period due to income cycles, purchasing behavior, limitations in storage, and other factors.

Background

Availability of foods in the home has been shown to be significantly associated with dietary practices, intake, and eating patterns (1-4). The home food environment supplies more than 70% of the food, by weight, eaten by Americans, and has been strongly associated with 75% of energy intake and overall food consumption (5-7). Studies have shown that foods found in pantries are indicators of actual food consumption and there has been discussion that availability influences food intake (1, 2, 8). This area of research has been growing and several instruments have been developed to assess the home food environment, although few have been validated (9). Two general approaches have been used to document the presence of food items in the home; one that documents food items coming into the home using grocery store receipts and another that inventories actual food items present in the home (1, 2, 10).

Rationale

Understanding and changing dietary patterns to decrease the consumption of unhealthy foods requires an accurate measurement of the foods that are available in the home as well as an understanding of how much these foods are being consumed. Assessing the presence and amounts of various foods in the home may provide understanding of what foods are available for home consumption and insight needed in order to assess dietary behavior (2, 11). This inventory includes a wide range of foods including healthful and less healthful. The inventory may be useful in studies examining the contextual influences on obesity, weight gain, and nutritional intake. It can also be helpful in studies determining appropriate intervention strategies for individual households or might identify targets for public health messages.

Reliability and Validity

Few household food inventories have been validated (9), but research has shown that a single household food inventory is unable to address intra-household variation throughout the month which can be caused by income cycles, refrigeration and storage capacity, family events,

illnesses, and other events (12, 13). Therefore, more than one household food inventory is suggested in order to capture a more accurate picture of the home food environment.

Preparation

A 236-item HFI instrument and protocol was developed based on a HFI instrument used in a similar study in a low-income Mexican sample in Texas (14). It was modified and adapted to account for our target group and regional food items. The foods listed in the following tables were organized into an abridged checklist to facilitate direct observation of the presence and amount of specific foods. Food items were broken down into the following categories: dairy, grains, protein, fruit, vegetables, snacks/desserts/pre-prepared foods, beverages, and oils/spreads/and other fats. After the development of the 236-item HFI guide, two trained researchers pre-tested the guide in multiple homes in the Athens area. After pre-testing, additional changes were made including the addition of food items due to the frequency that they were seen in the pre-testing (e.g., kool-aid, cream of wheat, and granola bars). Amounts of foods were determined by a count of the number of items in a case, labeling of bottled, canned, or pre-packaged foods, estimation of previously opened food items, and if none of these were applicable, a kitchen scale was used.

Scheduling

Household food inventories were conducted on the first and last visits with each participant. The first interview with each participant took place a couple days after food stamp benefits were distributed and major grocery shopping was done.

Confidentiality

All individually identifiable information remained confidential. The data was labeled with a code that the research team could link to individually identifiable information. The codes were securely maintained as follows; the paper records of the key for the coding were secured in a locked container in a locked room. The coded data was maintained in a different location. The electronic records of the key for the coding were in a password protected file. The coded data file was maintained on a separate computer. By using an indirect identifier, researchers were able to link all the data collected from the in-person interview survey while reducing the risk of losing confidentiality.

Detailed descriptions and steps of protocols for the household food inventory, are shown on the following pages as well as a table illustrating how food items included in the household food inventory were categorized by food groups and subcategories.

HOUSEHOLD FOOD INVENTORY

Materials Needed
Pencil
Inventory Log
Calculator
Kitchen scale
Camera

Procedure

Prep:
1. Explain to the participant how the household food inventory will be conducted and request full participation and assistance to complete the inventory.
2. Reassure participants that all the information is confidential and they are not being judged by their eating habits. Everyone has very different eating habits based on their own needs.
3. Ask participants if they have foods stored in any place other than the ones that are listed on the form.
4. Probe for less common places such as a night stand or bedroom closet while reassuring them that many people keep foods all over the house for various reasons.
5. Begin filling out form (shown below) showing which food storage systems are available in the home.
6. If available, begin with the refrigerator, then move on to freezer, pantry, and then on to any other places that food may be stored (ie. counter tops, garage, closets, etc.)

Photos:
7. Record each food storage area by taking a picture if participant agrees.
    a. Photos should be taken at an angle in which the entire food storage area can easily be seen.
        i. Refrigerators should been shot with the door and drawers open and should capture all the contents in one shot
        ii. Freezers should be captured separately
        iii. Cabinets should be shot at a distance that captures the size of the entire cabinet
        iv. Deep freezers should be shot from above to show the contents of the freezer
8. Do not move participant's food items for the purpose of the pictures

Inventory:

9. Amounts of foods can be determined by a count of the number of items in a case, labeling of bottled, canned, or pre-packaged foods, estimation of previously opened food items, and if none of these are applicable, a kitchen scale is to be used.
10. Do not record baking ingredients such as flour or sugar - as these are usually bought in bulk and it is unclear how they will be used. Therefore they are difficult to categorize as healthful or less healthful.

11. For pre-cooked meals, such as casseroles or lasagnas, pan size should be noted and then recorded as either full, half, or quarter full.
12. If food items are partially used and labeled with the original net weight, the researcher should estimate the remaining amount.
13. If food items are not labeled, the kitchen scale should be used to record net weight of food.
14. If a holiday is in the near future, ask participant if and which foods are set aside for the occasion and disregard these foods in the inventory
15. Note any spoiled food as such.

Table 10, shown on the following pages, provides detailed lists of which foods were included in the household food inventory and how they were categorized.

Table 10. Food items included in the household food inventory categorized by food groups and subcategories

Dairy			
	Cheese	Reg Fat Cheese	Shredded or block cheese, sliced cheese, ricotta or cottage cheese, cream cheese, Cheez Whiz/Velveeta, canned cheese or other similar cheese
		Red Fat Cheese	Shredded or block reduced-fat cheese, sliced reduced-fat cheese, string cheese, mozzarella cheese, reduced–fat ricotta or cottage cheese, reduced-fat cream cheese
	Milk & Other Dairy Drinks	Reg Milk	Whole Milk
		Red Fat Milk	Skim milk, 1% or 2% low fat milk, chocolate or flavored milk, reduced-fat yogurt drinks
	Yogurt	Reg Yogurt	Regular yogurt
		Red Fat Yogurt	Reduced fat yogurt
	Other Dairy	Regular Dairy	Half and half, whipping cream or heavy cream, condensed milk, sour cream or cheese dips
		Red Fat Dairy	Reduced-fat sour cream or low fat sour cream/cheese dips
Grains			
	Bread	Wheat Bread & Whole Grains	Wheat bread or rolls, English muffins, bagels, tortillas, pita bread, oatmeal, cream of wheat, couscous, barley, brown rice, wheat dough, wheat pasta/spaghetti
		White/Corn Flour Bread	White bread or rolls, English muffins, bagels, tortillas (flour or corn), pita bread, croissants, grits, white rice, white/corn dough, enriched pasta/spaghetti
	Dry Breakfast Cereal	Whole Grain Cereal	Ready-to-eat cereals that are labeled "whole grain," "whole wheat" or have at least 3 grams of fiber per serving
		Low Sugar Cereal	Ready-to-eat cereals that indicate on the nutrition label that they have less than 6 grams of sugar per serving
		High Sugar Cereal	Ready-to-eat cereals that indicate on the nutrition label that they have 6 or more grams of sugar per serving

Protein	
High Fat, Processed, or Red Meat	Beef, pork, lamb, bologna, salami, sliced ham or roast beef, sausage, pepperoni, bacon, breakfast sausage, hot dogs, bratwurst, polish sausage, Spam,
Other Protein	Chicken, turkey, tofu, seitan, tempe, textured vegetable protein, veggie burger, fish, shellfish, lentils, beans, peanut butter, eggs
Fruit	
Fresh	Apples, apricots, avocado, bananas, blueberries, cranberries, dates, grapes, grapefruit, kiwi, lemons or limes, mango, melons, nectarines, oranges, pears, peaches, pineapple, plums, prunes, raisins, raspberries, strawberries, tangerines/clementines
Frozen	Blueberries, cranberries, peaches, pineapple, raspberries, strawberries
Canned	Apple sauce, jams/jellies, oranges, pineapple, peaches/nectarines, mixed fruit, cranberry sauce
Vegetables	
Fresh	Asparagus, beets, bell peppers, broccoli, cabbage, cauliflower, carrots, celery, corn, cucumbers, eggplant, green beans, lettuce, mushrooms, okra, peas, spinach/other greens, squash, sweet potatoes, tomatoes
Frozen	Asparagus,bell peppers, broccoli, cabbage, cauliflower, carrots, celery, corn, green beans, mushrooms, okra, peas, spinach/other greens, squash, mixed vegetables
Canned	Asparagus, beets, carrots, corn, green beans, mushrooms, okra, peas, spinach/other greens, squash, sweet potatoes, tomatoes, mixed vegetables

Snacks, Desserts, and Pre-Prepared Foods	
Snack Foods	Snack crackers, potato chips, corn chips, tortilla chips, cheese curls or puffs, bagel chips, graham crackers, pretzels, popcorn, peanuts, cashews or other nuts, granola bars, sports bars
Desserts	Cookies, cake/cupcakes, muffins, brownies/bars, other snack cakes, pastry, sweet rolls, donuts, cake/pancake mix, frosting, ice cream, popsicles, sherbet, sorbet, frozen fruit juice bars, chocolate candy, hard candy, gummies, fruit rollups, fruit snacks or other fruit-based candy, chewy candy
Frozen Meals	Pizza, Hot Pockets, pizza rolls or bagel snacks, burritos, chicken nuggets, French fries or tater tots, egg rolls, waffles, toaster pastries
Canned Soup	Canned soups, Ramen noodles, stock
Instant Meals	Boxed mac & cheese, instant rice, instant mashed potatoes
Oils, Spreads, & Added Fats	
High / Saturated Fats	Butter, margarine, corn oil, seed oil, lard, shortening, dressing, fat
Low/ Unsaturated and Polyunsaturated Fats	Olive/vegetable oil, light butter, light margarine or butter substitute
Beverages	
Regular Beverages	Regular soda pop, prepared iced teas or lemonade, sports drinks, 100% fruit/vegetable juice, fruit drinks, soy milk or rice milk
Low Calorie Beverages	Diet soda pop, prepared light iced teas or lemonade

APPENDIX F

24-HOUR DIETARY RECALL PROTOCOL

Purpose

The purpose of the 24-hour dietary recalls is to gain information regarding the participants' food and beverage consumption and nutrient intake. It will provide insight into the types and amounts of foods being consumed by the individual, how well balanced and nutritious the diet is, as well as how food choices change throughout a one month period due to income cycles, purchasing behavior, limitations in storage, and other factors.

Background

In the 24-hour dietary recall, the respondent is asked to remember and report all the foods and beverages consumed in the preceding 24 hours or in the preceding day. The recall typically is conducted by interview, in person or by telephone (15, 16), either computer assisted (17). When interviewer-administered, well-trained interviewers are key because much of the dietary information is collected by asking probing questions. Ideally, interviewers would be dietitians with education in foods and nutrition; however, non-nutritionists who have been trained in the use of a standardized instrument can be effective. All interviewers should be knowledgeable about foods available in the marketplace and about preparation practices, including prevalent regional or ethnic foods (18).

The interview is often structured, usually with specific probes, to help the respondent remember all foods consumed throughout the day. Probing is especially useful in collecting necessary details, such as how foods were prepared. It is also useful in recovering many items not originally reported, such as common additions to foods and eating occasions not originally reported such as snacks and beverage breaks (18).

Rationale

A 24-hour dietary recall will aid in understanding how foods are prepared, in what quantities they are eaten, and how often. It will also aid in deciphering which foods from the household food inventory the grandparents are actually consuming.

Reliability and Validity

The interviewer-administered 24-hour recall has long been regarded as the optimal dietary assessment method because it provides the highest-quality and least biased data for a single day. It allows detailed food and portion size information to be collected. The interview style allows participants and researchers to interact and discuss dietary intake during the interview. Because the data collection occurs after consumption, this method does not affect an individual's food

choices on a given day. The main weakness of the 24-hour recall approach is that individuals may not report their food consumption accurately for various reasons related to knowledge, memory, and the interview situation. However, by conducting these diet recalls once every week throughout the course of a month, researchers are able to gain a more accurate and comprehensive representation of the participants' diet.

Preparation

The researcher practiced administering 24-hour diet recalls among UGA graduate students on paper using food models in order to obtain accurate information on the amounts of foods and beverages consumed.

Scheduling

Dietary assessments were conducted once a week, either a weekend or weekday, depending on participant availability, for one month to get a representative idea of any changes or fluctuations in the participant's diet. By using both weekends and weekdays, there is potential for variability, however in order to reduce this, the researcher designated participants to report only on a weekday or only a weekend. Out of the three total participants, two participants consistently reported on weekdays and one participant consistently reported on weekends.

Confidentiality

All individually identifiable information remained confidential. The data was labeled with a code that the research team could link to individually identifiable information. The codes were securely maintained as follows; the paper records of the key for the coding were secured in a locked container in a locked room. The coded data was maintained in a different location. The electronic records of the key for the coding were in a password protected file. The coded data file was maintained on a separate computer. By using an indirect identifier, researchers were able to link all the data collected from the in-person interview survey while reducing the risk of losing confidentiality.

Detailed descriptions and steps of protocols for the 24-hour dietary recalls are shown on the following pages.

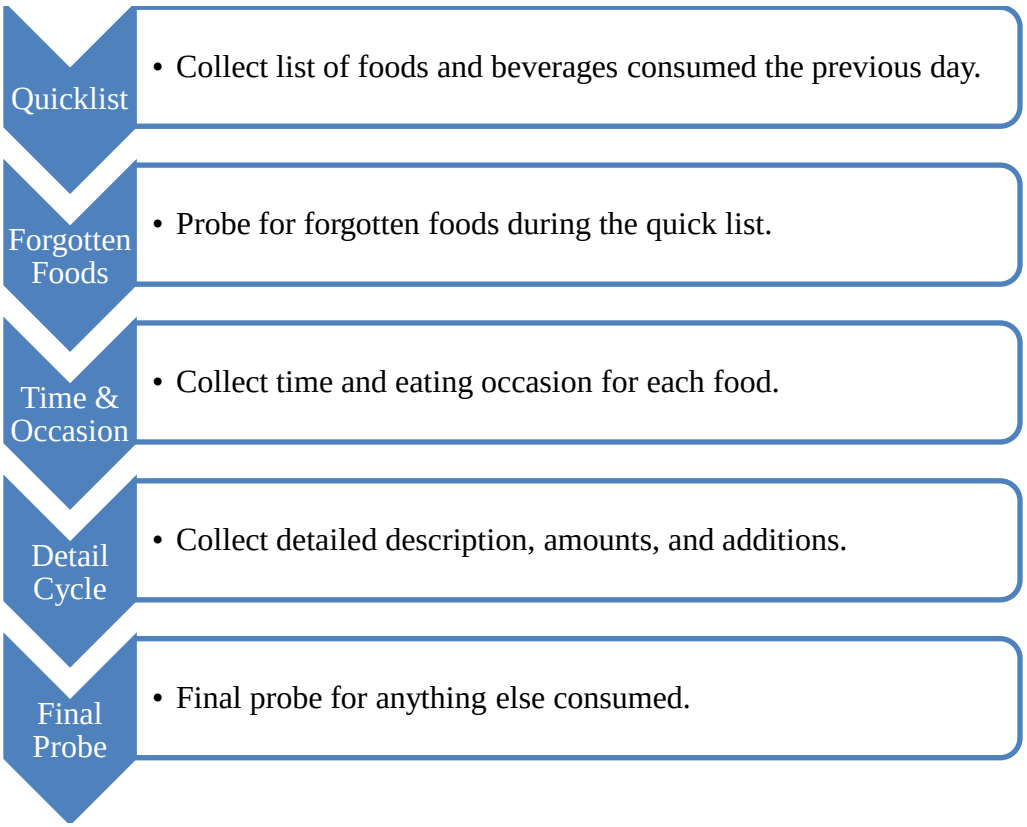
24-HOUR DIETARY RECALL

Materials needed
24-hour recall form
Pencil
Food recall kit with props to help estimate portions
- ✓ Measuring cups and spoons
- ✓ Food models

Procedure
1. Explain to the participant that you need to know only what she/he actually ate and drank in the last 24 hours. She/he should not feel embarrassed about any food, as there are no "good" or "bad" foods. No one eats just the right foods all the time.

2. Start with breakfast and go through all the foods consumed in the last 24 hours. Weekends and holidays are not typical days and recalls from only these days may provide an inaccurate view of the participant's diet. Therefore, in order to reduce intra-variability the researcher should designate an equal number of participants to report only on a weekday or only a weekend.

3. A 5-step multiple pass approach was used (19, 20). The process is shown and explained below:



a. **Quick List**

Record the list of foods as the participant remembers them; portion sizes and preparation methods will be recorded in the following steps. This list of foods is termed the quick list. To obtain this list of foods from the participant, ask them to walk you through their day starting with the time they woke up.

b. **Forgotten Foods**

Probe for foods that may be commonly forgotten such as snacks or drinks.
Examples:

"What did you do this morning?"
"While you were working around the house, did you take a break to have something to eat or drink?"
"Did you watch TV last night? When you watched TV, did you eat anything?"
"Did you have anything to drink with this?"

c. **Time & Occasion**

Collect the time and occasion of each food with probing questions.

Examples:
"At what time was this? Did you eat or drink anything before or after that?"
"What did you have at that time?"
"At what time did you go to bed?"

d. **Detail Cycle**

After you have recorded the participant's quick list, you can then complete the detailed description of foods consumed. This will include recording preparation method, brand name, portion size, and the time the food or beverage was consumed. To get more information on the amounts and the type of foods eaten use the following techniques:

i. Determine if all of the food was eaten or if some food was left on the plate.
ii. Use your Food Recall Kit to determine the amounts/portions of foods consumed.

Examples:

"Was your serving of meat the size of this deck or cards? If not, was it bigger or smaller and by how much?"
"Was the amount of peanut butter you used about the size of this gold ball?"

iii. Encourage the participant to describe foods as clearly as possible. The interviewer may have to restate questions to get more information.
iv. Describe combination dishes carefully. Mixtures such as sandwiches, soups, stew, pizza, casseroles, etc. can be prepared in many ways.
v. Ask to see packages, if available, on prepackaged foods, and record brand name and other pertinent information.

e. **Final Probe**

This type of probe tries to get more complete information about foods already reported.

Examples:

"Do you remember anything else that you ate or drank with this food?"
"What else did you have at this meal?"
"Was the (bread, vegetable) eaten plain or did you put something on it?
"Did you have anything in your coffee?"
"Did you have a second helping?"

4. **Side Notes and Review**

a. Do not express in words or facial expressions either approval or disapproval of foods mentioned by the participant.
b. Do not ask questions that would lead the participant to feel she/he "should" have had a certain item and, thus say that they did.
c. Once the 24 hour food recall is complete read the list back to the participant.
d. Ask the participant if the recall is correct or if they forgot to mention any food that was consumed.
e. Thank the participant for their cooperation. Do not comment on the recall at this time, unless the participant asks a specific question.

APPENDIX G

ASA24 PROTOCOL

Purpose

The purpose of the ASA24 program is to gain information regarding the participants' food and beverage consumption and nutrient intake. It will provide insight into the types and amounts of foods being consumed by the individual, how well balanced and nutritious the diet is, as well as how food availability and/or choices change throughout a one month period due to income cycles, purchasing behavior, limitations in storage, and other factors.

Background

The 24-hour recall process consists of an initial "quick list" where the respondent reports all the foods and beverages consumed during the day by eating occasion. Respondents are then queried about whether they might have consumed foods between eating occasions. This is followed by detailed probing questions about food preparation, additions to food and amount consumed. Respondents are then queried about forgotten foods; these represent food in categories commonly omitted in 24-hour recall reporting. The 24-hour recall ends with a final review, where any other item not already reported can be added. Throughout the program, respondents can add, delete, copy, modify or change foods reported on their recalls. The 24-hour recall usually takes 20–30 minutes. Intake of dietary supplements for the past 24-hours can also be queried (21).

Rationale

The Self-Administered Automated 24-hour Dietary Recall (ASA24) was selected despite the fact that the diet recalls were not self- administered because the thorough prompts follow the same pattern and process/protocol that the diet recalls were administered. This leaves little room for mistakes or forgotten items.

Reliability and Validity

The format and design of the ASA24 are modeled on the interviewer-administered Automated Multiple Pass Method 24-hour recall developed by USDA which has been validated and shown to accurately estimate mean total energy and protein intakes (20, 22).

Preparation

The researcher practiced administering 24-hour diet recalls among UGA graduate students on paper and later practiced entering the information into the ASA24 program to become familiar with the software.

Scheduling

ASA24 requires Internet access and there were no Internet connection options available in the participants' homes. Therefore, diet recalls were recorded on paper during the interview and later entered into the ASA24 software.

Software

The National Cancer Institute (NCI) has developed a Self-Administered Automated 24-hour Dietary Recall (ASA24) for use in large-scale nutrition research studies. The format and design of the ASA24 are modeled on the interviewer-administered Automated Multiple Pass Method 24-hour recall developed by the US Department of Agriculture (USDA). This recall requires multi-level food probes to accurately assess food types and amounts (21).

The ASA24 software is programmed with a food database which includes all foods available from USDA's Food and Nutrient Database for Dietary Studies (FNDDS) database. In addition, the software includes pictures of foods in multiple portion sizes to help respondents estimate portion size. This branching database allows questions and possible responses to be displayed on the screen for respondent selection (21).

Data files include nutrients, foods, pyramid food groups, and Healthy Eating Index (HEI) variables. The software can quickly compute nutrient and food group estimates for each recall day. A Spanish version of the software will be available by 2010. The software also has the capacity to accommodate languages other than English (21).

The ASA-24 software:

- Provides tutorials for respondents on how to complete the interview;
- Provides an animated audio character to guide respondents through the interview, with an option to turn off the audio portion;
- Asks respondents to report eating occasion with time of consumption;
- Asks respondents to provide a "quick list" of foods consumed the previous day;
- Allows respondents to find foods to report either by browsing through food groups or by typing and searching;
- Uses the USDA's Automated Multiple Pass Method (AMPM) interview as a basis for asking detailed probes about each food reported in the quick list;
- Uses photographs to assist respondents in reporting portion size;
- Allows the respondent to add or modify food choices at multiple times during the interview; includes a final review of the day's intake;
- Produces individual-level nutrient and My Pyramid Equivalent Database (MPED) estimates for researchers based on USDA's Food and Nutrient Database for Dietary Studies nutrient values (FNDDS). These data can be further analyzed by researchers or used to provide reports to respondents;
- Provides an optional vitamin and mineral supplement module;

- Provides optional modules to assess where meals were consumed, where food was obtained, who the meals were eaten with, and whether or not the TV was on and being watched.
- Allows researchers to add their own opening and closing text scripts and study logo specific to their project's needs; and allows researchers to monitor study progress and to obtain a variety of reports including complete, incomplete and upcoming recalls.

Results

Researchers may request any or all of the following seven analytic files:

- My Selections - food list terms, questions, and answers.
- Individual Foods - FNDDS Food Code & Gram weights plus Nutrients (each row is a food).
- Individual Foods - FNDDS Food Code & Gram weights, Pyramid Equivalents/Servings + HEI.
- Total Nutrients - FNDDS Nutrients (each row/record is a Day for an ID).
- Total Nutrients - Pyramid Equivalents/Servings + HEI* (each row/record is a Day for an ID).
- Individual Supplements - NHANES** Nutrients.
- Supplements Total Nutrients - NHANES Nutrients.
- Total Nutrients (Foods + Supplements) - FNDDS Nutrients and NHANES

*HEI = Healthy Eating Index
**NHANES = National Health and Nutrition Examination Survey (NHANES)

Issues

Some foods consumed by participants were not recognized by the ASA24 software and substitutions were made. Some of those foods included turkey gizzards, goose, and some specific fast food items.

Confidentiality

All individually identifiable information remained confidential. The data was labeled with a code that the research team could link to individually identifiable information. The codes were securely maintained as follows; the paper records of the key for the coding were secured in a locked container in a locked room. The coded data was maintained in a different location. The electronic records of the key for the coding were in a password protected file. The coded data file was maintained on a separate computer. By using an indirect identifier, researchers were able to link all the data collected from the in-person interview survey while reducing the risk of losing confidentiality.

PROTOCOL REFERENCES

1. Kratt P, Reynolds K, Shewchuk R: The role of availability as a moderator of family fruit and vegetable consumption. Health Education & Behavior 2000;27(4):471-482.
2. Cullen KW, Baranowski T, Owens E, Marsh T, Rittenberry L, de Moor C: Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. Health Education & Behavior 2003;30(5):615.
3. Coates T, Jeffrey R, Wing R: The relationship between persons' relative body weights and the quality and quantity of food stored in their homes. Addict Behav 1978;3(3-4):179-184.
4. Turrini A, Saba A, Perrone D, Cialfa E, D'Amicis A. Food consumption patterns in Italy: the INN-CA Study 1994-1996. European Journal of Clinical Nutrition 2001;55:571-588.
5. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: Policy and environmental approaches. Annual Rev Public Health 2008;29:1-6.
6. Carlson A, Kinsey J, Nadav C. Consumers' retail source of food: A cluster analysis. Family Economics and Nutrition Review 2002;14(2):11-20.
7. Raynor H, Polley B, Wing R, Jeffery R: Is Dietary fat intake related to liking or household availability of high- and low-fat foods? Obesity Research 2004;12(5):816-823.

8. Baranowski T, Missaghian M, Watson K, Broadfoot A, Cullen K, Nicklas T, Fisher J, O'Donnell S. Home fruit, juice, and vegetable pantry management and availability scales: A validation. Appetite 2008;50(2-3):266-277.
9. Fulkerson JA, Nelson MC, Lytle L, Moe S, Heitzler C, Pasch KE. The validation of a home food inventory. Int J Behav Nutr Phys Act 2008;5:55-65. doi: 10.1186/1479-5868-5-55
10. French SA, Shimotsu ST, Wall M, Gerlach AF. Capturing the spectrum of household food and beverage purchasing behavior: A review. Journal of the American Dietetic Association 2008;108(12):2051-8.
11. Swinburn B, Egger G, Raza F: Dissecting Obesogenic Environments: The development and application of a framework for identifying and prioritizing environmental interventions for obesity. Preventive Medicine 1999;29:563-570.
12. Kegler MC, Escoffery C, Alcantara I, Ballard D, Glanz K. A qualitative examination of home and neighborhood environments for obesity prevention in rural adults. Int J Behav Nutr Phys Act 2008;5:65. doi: 10.1186/1479-5868-5-65.
13. Sisk C, Sharkey JR, McIntosh WA, Anding J. Using multiple household food inventories to measure food availability in the home over 30 days: a pilot study. Nutrition Journal 2010;9(19). doi: 10.1186/1475-2891-9-19.
14. Sharkey JR, Dean WR, St John JA, Huber Jr JC. Using direct observations on multiple occasions to measure household food availability among low-income Mexicano residents in Texas colonias. BMC Public Health 2010;10:445-59. doi:10.1186/1471-2458-10-44

15. I.M. Buzzard, C.L. Faucett, R.W. Jeffery, L. McBane, P. McGovern, J.S. Baxter, et al. Monitoring dietary change in a low-fat diet intervention study: advantages of using 24-hour dietary recalls vs food records, J. Am. Diet. Assoc. 1996;96:574-579.

16. P.H. Casey, S.L. Goolsby, S.Y. Lensing, B.P. Perloff, M.L. Bogle. The use of telephone interview methodology to obtain 24-hour dietary recalls, J. Am. Diet. Assoc. 1999;99:1406-1411.

17. U.S. Department of Agriculture. What we eat in America. Agricultural Research Service, U.S. Department of Agriculture. Version current 29 September 2010. Internet: <http://www.ars.usda.gov/Services/docs.htm?docid =13793> (accessed 27 October 2012).

18. Thompson FE, Subar AF. Nutrition in the treatment and prevention of disease. 3rd ed. Elsevier 2013

19. U.S. Department of Agriculture. Products and services. Version current 29 September 2010. Internet: http://www.ars.usda.gov/Services/docs.htm?docid=7711 (accessed 1 March 2013).

20. Moshfegh AJ, Rhodes DG, Baer DJ, Murayi T, Clemens JC, Rumpler WV, Paul DR, Sebastian RS, Kuczynski KJ, Ingwersen LA, Staples RC, Cleveland LE. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. Am J Clin Nutr 2008;88(2):324-32.

21. National Cancer Institute. ASA24. Version current 19 March 2013. Internet: http://riskfactor.cancer.gov/tools/instruments/asa24/ (accessed 5 October 2012).

22. Kipnis V, Subar AF, Midthune D, Freedman LS, Ballard-Barbash R, Troiano RP, Bingham S, Schoeller DA, Schatzkin A, Carroll RJ. Structure of dietary

measurement error: results of the OPEN biomarker study. Am J Epidemiol 2003;158(1):14-21