DISSERTATION

DEVELOPMENT AND TESTING OF MEASURES TO ASSESS NUTRITION BEHAVIOR CHANGE IN LOW INCOME ADULTS PARTICIPATING IN THE EXPANDED FOOD AND NUTRITION EDUCATION PROGRAM

Submitted by

Erin K. Murray

Department of Food Science and Human Nutrition

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Doctoral Committee:

Advisor: Susan Baker
Co-Advisor: Garry Auld

Nancy Betts
Ann Hess

ABSTRACT

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Purpose

The primary purpose of this research was to develop measures of diet quality and nutrition behavior to evaluate the effectiveness of the Expanded Food and Nutrition Education Program (EFNEP). EFNEP is a United States Department of Agriculture nutrition education program that works with low-income families to improve their diet quality and food-related behaviors. The research objective was to develop a reliable and valid short dietary assessment instrument that can be used nationally by EFNEP to assess diet quality behavior change among low-income adults. Short dietary assessment instruments provide cost-effective ways to evaluate federally-funded nutrition education programs and the low-income adults they serve. However, few valid instruments exist for use nationally with low-income populations.

Methods

This research was part of a multi-state, multi-year Agricultural Experiment Station research project, NC2169: EFNEP-Related Research, Program Evaluation and Outreach. Goals of the multi-state project included developing a new EFNEP national evaluation questionnaire that would include diet quality questions.

A mixed methods observational study design, including 8 phases, was used to develop and test the dietary assessment questions. Phases 1-5 pertain to question development, and phases 6-8 relate to question testing. The research phases are listed below.

1. **Nutrition education curricula content analysis**. The content analysis determined current nutrition information taught nationally to EFNEP participants. Curricula used by the majority of EFNEP state programs served as a proxy for nutrition content taught to EFNEP participants. A tested data recording instrument captured nutrition content in the curricula.
2. **Dietary Guidelines expert panel (expert panel #1)**. A panel of 6 national nutrition experts identified and prioritized the nutrition recommendations from the 2010 Dietary Guidelines for Americans deemed most critical to teach low-income adults. The study protocol used a modified Delphi Technique to build consensus among experts through structured feedback.
3. **EFNEP expert panel (expert panel #2)**. Twenty-one EFNEP program administrators and other researchers from 15 states further prioritized the nutrition recommendations identified by the first expert panel to those most critical to evaluate in EFNEP.
4. **Literature review and question generation.** A literature review of published manuscripts and government and research organization websites identified validated questions that addressed the nutrition recommendations deemed critical to evaluate. Questions and response options were revised, eliminated or created to meet the needs of the EFNEP population and program.
5. **Content validity expert panel (expert panel #3).** Seven EFNEP program administrators from different US geographic regions reviewed the dietary assessment questions and response options to confirm content validity for use in a national EFNEP questionnaire. Questions and response options were revised as necessary.

6. **Cognitive interview testing**. Researchers conducted cognitive interviews with EFNEP participants (at program enrollment "pre" or at program completion "post") in 7 states. An iterative process and scripted probing questions were used to determine ease of understanding and face validity. Interviewers in each state were trained via webinar. Interviews were audio-recorded, transcribed and analyzed pre/post to identify themes and dominant trends. Questions and response options were revised as needed.
7. **Reliability testing**. The test-retest method assessed temporal stability reliability of the questions. A total of 217 low income EFNEP-eligible women from 7 states completed the dietary assessment instrument twice, at a 1-month interval. Paired t-tests ($p \leq 0.05$), Spearman's rank order correlation coefficients (SCC) and intraclass correlation coefficients (ICC) were used to assess reliability ($r > 0.5$). Exploratory factor analysis was used to determine whether the questions grouped together (factor loading cut-offs > 0.5).
8. **Construct validity testing**. A total of 60 EFNEP participants were recruited from 8 states to complete the dietary assessment instrument and 3, 24-hour food recalls pre/post the EFNEP intervention. Wilcoxon signed rank test ($p \geq 0.05$), SCC ($r > 0.5$), and Bland-Altman plots were used to assess construct validity of the questions.

Results

Phases 1-5. The curricula content analysis findings revealed considerable variability in both the frequency of certain nutrition content and depth of educational instruction provided across curricula used in EFNEP. The Dietary Guidelines expert panel determined 2 overarching and 8 specific nutrition messages critical to teach low income adults.

Overarching recommendations

- Focus on nutrient-dense foods, including vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood and fish, lean meats, poultry, eggs, beans and peas, and nuts and seeds.
- Cook and eat more meals at home. The behaviors of portion control and how to prepare lower calorie options can be emphasized within teaching how to prepare meals at home.

Specific recommendations

- Increase vegetable and fruit intake. Eat a variety of vegetables.
- Consume at least half of all grains as whole grains.
- Increase intake of low-fat dairy or fortified soy products.
- Eat a variety of protein foods, including beans, legumes, nuts and seeds, eggs, seafood, and lean meats and poultry.
- Develop skills in reading the Nutrition Facts panel to identify portion size and calorie intake for packaged foods.
- Prepare, serve, and consume smaller portions of food and beverages.
- Reduce intake of foods such as chips and crackers and sweets such as cookies, cakes, pie, muffins, doughnuts, and pastries.
- Limit the intake of sugar-sweetened beverages.

Using the Dietary Guidelines panel findings, the EFNEP expert panel prioritized 6 diet quality content areas to evaluate in EFNEP.

Nutrition behaviors to evaluate in EFNEP

- Cook and eat more meals at home.
- Increase fruit intake.

- Increase vegetable intake.
- Eat a wider variety of vegetables.
- Increase intake of dairy of fortified soy products.
- Limit the intake of sugar-sweetened beverages.

The literature review produced an average of 40 questions (range 19-71) per diet quality content area and 46 response scales. Questions were eliminated or revised to yield 22 questions with 1-2 response scales per question. Content validity expert panel feedback resulted in 20 revised questions for cognitive interview testing.

Phases 6-8. A total of 111 cognitive interviews in 3 rounds of interviews/question revisions were completed with EFNEP participants in 7 states. Cognitive interviews yielded a 14-item dietary assessment instrument covering the 6 nutrition content areas. Reliability testing results showed all questions had at the least moderate correlations (SCC > 0.40) and fair agreement (ICC > 0.41), with at least half the questions indicating strong (SCC > 0.60) and moderate (ICC > 0.61) correlations ($P < 0.001$). The majority of questions (12/14) grouped together to align with the 6 nutrition content areas to evaluate in EFNEP (factor loadings >0.50).

For construct validity testing, data were collected from EFNEP participants in 8 states (n = 60 pre, 30 post). Food recall data were collected an average of 14 days after participants completed the instrument (range 6-32 days). Results demonstrated significant differences (Wilcoxon signed rank test p = < 0.05) and low or no correlations both pre (SCC = 0.01 – 0.44) and post (SCC = 0.01 – 0.44) between the instrument and 24-hour food recall data. The Bland-Altman method was not pursued due to the lack of significant correlations. The researchers concluded that incompatible methods along with measurement error from multiple sources contributed to the lack of association between the instrument and 24-hour food recall data.

Conclusions and Implications

This research resulted in nationally-tested reliable and valid dietary assessment instrument for low-income adults that can be used to evaluate EFNEP's effectiveness at improving diet quality among participants. The mixed-methods approach established temporal stability reliability and content, face, and factor validity of the dietary assessment instrument. Questions were developed to meet program objectives and tested with the target EFNEP population in multiple states, which confirmed their appropriateness for evaluating behavior change for this national nutrition education program. This research has implications that extend beyond EFNEP, as other nutrition education programs serving low-income adults may adopt the methods used to develop their own validated evaluation questionnaire. Nutrition education programs or interventions may also adopt the validated instrument to evaluate their programs.

Future research directions include testing the dietary assessment instrument questions for sensitivity to change and/or with a compatible comparison tool to establish construct or convergent validity. For example, a modified 7-day food record tailored to the needs of low-income participants and the behaviors captured in the instrument may be an appropriate comparison measure to assess convergent validity of the dietary assessment questions.

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CHAPTER 1. LITERATURE REVIEW

The Health Status of Americans

Trends in many indicators of chronic disease show the overall health status of Americans is worsening.[1] The Centers for Disease Control and Prevention (CDC) defines chronic diseases as "illnesses that are prolonged in duration, do not resolve spontaneously and are rarely cured completely."[2] Examples of chronic health conditions include cardiovascular disease, diabetes, cancer, and respiratory disease. From 2000 to 2010, U.S. adults experienced rising rates of heart disease, cancer, hypertension, high cholesterol, and obesity.[1] Not surprisingly, during this same time period a higher percentage of Americans reported fair or poor health. Chronic diseases account for 70 percent of all deaths in the United States (U.S.), and are among the most preventable health problems.[2]

Contributing to the problem of rising rates of chronic diseases is the complex issue of health disparities among Americans. Health disparities are differences in health outcomes among specific populations and include differences in measures of health status, such as morbidity and mortality, and measures of health care, such as access, utilization, and quality.[3] Reducing health disparities among Americans could have enormous potential economic benefits in addition to improving the nation's health.[4]

Racial and ethnic groups experience disparities in health. Overall, minorities in the U.S. have elevated rates of chronic diseases, such as diabetes, hypertension, and cardiovascular disease, compared to whites.[5] Mortality risk is higher among Blacks and Native Americans compared to whites.[5] This risk continues throughout life. Minorities suffer from earlier onset and greater severity of disease, and lower survival rates.[6]

The persistent pattern of racial disparities in morbidity and mortality exists at every level of socioeconomic status. The term socioeconomic status includes multiple characteristics of individuals and groups, such as the level of education, occupational attainment and income.[7] Education and income are generally regarded as two of the most important characteristics of socioeconomic status,[8] and are used to distinguish health outcomes nationally.[1] Though socioeconomic status plays a role in racial disparities in health, after controlling for this measure, racial disparities in health remain as markers of chronic disease such as inflammation, hypertension, blood lipids, and glycated hemoglobin.[6]

Income disparities are seen in the U.S. in health care quality, access, and progress in healthy living measures, with low-income individuals experiencing a worse level of care compared to those with higher incomes.[9] This is displayed in the poor health outcomes of low-income people. Adults in the U.S. living in the lowest income levels have the highest rates of a combination of chronic health conditions, depression, and obesity.[1] Low-income Americans also report the lowest number of healthy days compared to middle and higher income Americans, which is associated with high health inequality.[10]

One of the most pressing and systemic health problems in the U.S. which contributes to chronic disease development is rising obesity. Obesity is associated with increased risk of morbidity and mortality.[11,12] Obesity in adults is defined as having excess body fat and documented by a body mass index (BMI) equal to or greater than 30.[13] In just a ten-year time period, from 2000 to 2010, obesity among adults rose from 30 percent to 36 percent.[1]

Obesity rates are rising for children of all ages as well. Childhood obesity is defined as a BMI for age and sex above the 95th percentile using CDC growth charts.[14,15] From the time period 1988-1994 to 2010, obesity among young children (ages 2-5 years of age) increased from

7 percent to 12 percent nationally. For older children (ages 6-19 years of age) during this time, obesity climbed from 11 percent to 18 percent.[1]

The problem of obesity is more widespread among Americans with lower socioeconomic status and minorities, where health disparities are more prevalent. Over the last 15 years obesity rates rose for both men and women in all socioeconomic status levels; however, obesity rates for women were highest at the lowest socioeconomic level (39-43 percent obesity for women with a high school degree or less versus 25 percent obesity for women with a Bachelor's degree).[1] The disparity in obesity rates also occurs for children living in lower socioeconomic status households. For children at the lowest socioeconomic level, there was a dramatic increase in child obesity between 1988-1994 and 2007-2010, with boys experiencing a 60 percent rise in obesity (15 percent to 24 percent), and girls experiencing a 100 percent increase in obesity (11 percent to 22 percent).[1] Data about children at the highest socioeconomic level is not sufficient to support conclusions about the rise in obesity over this time period; however, the obesity rate during 2007-2010 for boys was 11 percent and for girls was 7 percent.

Among minorities, Blacks and Hispanics are at greater risk of obesity compared to whites and the magnitude is greater for women than for men.[16] In 2003-2004, about 58 percent of non-Hispanic Black women aged 40-59 were obese compared to 38 percent of non-Hispanic white women of the same age.[17] Native Hawaiian/Pacific Islanders also have higher rates of obesity compared to whites and Asian Americans, with men at greater risk.[18]

Though it is well-documented the prevalence of obesity has increased over time, and with it increased risk of chronic diseases, adults' perceptions of their weight change may not be accurate. During the time period 2008 and 2009 American adults reported the misperception of not gaining weight over time while weight gain trends show the opposite.[19]

Summary

The health status of Americans is worsening, with rising rates of chronic diseases such as heart disease, cancer, hypertension, diabetes, and respiratory disease. Minorities in the U.S. experience higher rates of chronic disease and lower life expectancies, even after adjusting for socioeconomic status. Low-income individuals also experience higher rates of chronic disease and poor health outcomes. Among the list of factors contributing to the worsening health of Americans is the problem of rising rates of obesity. Low income Americans and minorities are at greater risk of developing obesity, for both children and adults.

Poverty in the United States

Poverty is a complex set of conditions associated with having inadequate resources and is difficult to adequately define. The most common way for governments and organizations to describe poverty is through two distinct terms: absolute poverty and relative poverty.[20] Absolute poverty is a lack of the minimum amount of goods and services to meet families' basic needs. Relative poverty is a measure that compares families' financial situations to the population as a whole, as a percentage of the median or mean income.[21] The U.S. Census Bureau uses both absolute and relative poverty thresholds from current population surveys to determine estimates of the number of Americans living in poverty each year.[22,23]

Federal poverty guidelines are determined each year by the U.S. Department of Health and Human Services.[24] The guidelines are a simplified version of the Census Bureau poverty thresholds, and used for administrative purposes.[23] Some programs use the poverty guidelines, or percentage multiples of the guidelines, to determine financial eligibility. These programs include Head Start, the Supplemental Nutrition Assistance Program, and the National School Lunch Program.[23] Though the federal government has poverty guidelines, no federal guidelines exist for the terms middle class, middle income, rich, or upper income.[25]

In 2011, the percentage of Americans living in poverty was 15.9 percent, or 48.5 million people.[26] The percentage of children under age 18 living in poverty was 21.9 percent in the same year. This was the fourth consecutive annual increase in the U.S. poverty rate. When poverty was estimated using the relative poverty definition of a percentage of the overall population, based on 50 percent of the median U.S. income for 2010, the result was an increase in the poverty rate from 15.1 percent to 22.6 percent.[27]

Disparities in poverty exist for women and minorities, with a disproportionate number of people from these groups living in poverty. A higher percentage of females (16.3 percent) compared to males (13.6 percent) lived in poverty in 2011.[26] The circumstances of poverty are also worse for female head of household families. Those living in female head of household families were more likely to experience episodic poverty, chronic poverty, and remain in poverty, compared to married-couple families.[28] From 2007 to 2011 the highest poverty rates for minority groups were for native American and Alaska Natives (27 percent), Blacks (25.8 percent), and Hispanics (23.2 percent), well above the national poverty rate of 14.3 percent for this combined multi-year time period.[29]

Poverty is often joined by the concomitant conditions of low levels of literacy and employment. The National Assessment of Adult Literacy assessed literacy levels in over 19,000 U.S. adults using direct measures.[30] The findings show literacy is closely related to income and employment status. A higher percentage of adults with poor basic literacy skills lived in households with incomes below $10,000 per year, compared to adults with higher literacy levels.[30] Adults with lower literacy were also employed in lower paying service occupations. In contrast, those with the highest literacy level were more likely to be employed in professional, managerial, business, and financial occupations than other occupations.[30]

Parental educational attainment is the strongest predictor of childhood poverty persistence.[31] In 2003, 58 percent of adults with the lowest literacy levels lived in poverty, and the majority of adults with the lowest literacy levels did not have a high school diploma or GED.[32] The needs of these families are multidimensional. Programs that focus on improving family functioning and the home environment help long-term outcomes of children and families.[31]

Higher educational attainment is a key component in avoiding or overcoming poverty. Completion of a college degree is the most effective way to achieve incomes well above the poverty guidelines.[33] With education beyond a bachelor's degree, there is a trend toward higher income. Adults in the U.S. in 2011 with advanced degrees earned higher incomes than those with a bachelor's degree, regardless of the field or whether they were salaried workers or self-employed.[33]

Dietary Guidelines for Americans

The Dietary Guidelines for Americans provide recommendations for promoting health, reducing the risk of chronic diseases, and reducing the prevalence of overweight and obesity through improved diet quality.[34] The United States Department of Agriculture (USDA) and Department of Health and Human Services (HHS) jointly issue the dietary guidelines.[35] The guidelines are intended to provide consistent, evidence-based, guidance on diet and health to Americans age 2 and older. They are used as the foundation for federal nutrition policy, food guides and nutrition education materials.[35] These national guidelines recommend consuming more nutrient dense foods like vegetables, fruits, whole grains, low-fat dairy and seafood, and consuming less sodium, saturated and trans fats, refined grains, and added sugar.[34]

The first national dietary recommendations were published in 1894 by the USDA.[35] Many recommendations from this first publication have remained, such as emphasizing a

balanced intake of protein, fats, and carbohydrates, and moderation of food intake. The USDA published essentially 5 different versions of food guides from 1916 through 1979. These dietary recommendations evolved into an official set of national guidelines, referred to as the Dietary Guidelines for Americans. The first edition of the Dietary Guidelines for Americans were published in 1980 and have been mandated by federal statute since 1990.[35] They are updated every five years.

Since 2005, the Dietary Guidelines for Americans have shifted toward a more evidence-based approach, resulting in a greater number of more specific food and nutrient recommendations rather than general guidelines.[36,37] The USDA issues recommended servings of foods from food groups, referred to as USDA food patterns, that meet the nutrient needs of the Dietary Guidelines.[38] Though the USDA food patterns have not been specifically tested, they reflect evidence-based research and align with other research based diets that have been shown to improve health and reduce the incidence of chronic diseases such as the Dietary Approaches to Stop Hypertension (DASH)[39-43] and Mediterranean diets.[44-46] The Dietary Guidelines and USDA food patterns are also consistent with dietary recommendations of other organizations, including the American Cancer Society,[47] American Institute for Cancer Research,[48] and American Heart Association.[49]

The Dietary Guidelines are used to promote healthy eating and as a measure to assess the quality of American's diets. Consumer messages about the Dietary Guidelines are promoted through the "MyPlate" icon and "Choose MyPlate.gov" website education materials.[50] The Healthy Eating Index measures diet quality across the population using a scoring system based on the USDA food patterns.[51] The Healthy Eating Index was updated to reflect the 2010 Dietary Guidelines for Americans and has not been updated since.[52] The Index does not address total

calorie intake or physical activity, however, which are components of the U.S. Dietary Guidelines.

Eating Habits of Americans

Several nationally recognized food-based recommendations have emphasized the importance of increasing intake of vegetables, fruits, legumes and whole grains while limiting consumption of excess calories, refined grains, solid fats, and added sugars.[53] Despite those recommendations, trends in what Americans eat show a dramatic departure from these conventional nutrition recommendations.[54,55]

Trends in Eating Habits

Between 1977 and 2006, national data reflect total energy intake increased by 570 calories per day in U.S. adults.[56] An analysis of eating trends among Mexican American adults show a similar increase in calorie intake over a 25 year period (1982 to 2006).[57] The largest contributor to calorie intake between 1977 and 2006 was an increase in eating frequency (the number of meals and snacks per day).[56] Changes in specific snack food intake during this time period for adults included an increased consumption of salty snacks, candies, nuts and seeds, alcoholic beverages and sports drinks, with decreased consumption of fresh fruit and dairy foods.[58] Other contributors to the rise in calorie intake for this 30 year period of time were an increase in portion sizes and the energy density of food.[56] Portion sizes increased both inside and outside the home for salty snacks, desserts, soft drinks, fruit drinks, french fries, hamburgers, and Mexican food between 1977 and 1998.[59]

Predictably, the trend of increased calorie intake remained consistent for U.S. children as well. For American children ages 2 to 6 years of age, energy intake increased by 109 calories in just a twenty year time span (1989 to 2006).[60] Preschooler diet trends show greater intake of foods high in added sugars, refined carbohydrates, solid fats, and sodium, with the greatest

increased calorie intake from savory snacks, pizza, and sweet snacks/candy.[60] Similarly, total daily energy intake increased for all age groups of children and adolescents between 1977 and 2006.[61-63] The largest contributing factors were an increase in eating frequency and portion sizes,[61] of energy dense, nutrient-poor foods such as pizza, french fries, salty snacks, and sugar-sweetened beverages,[62] largely consumed away from home.[63] In 2006, fast food provided the highest proportion of calories from foods prepared away from home.[63]

Trends show U.S. children and adults are eating more frequently throughout the day. There was an increase in eating occasions from 3 to 5 per day between 1977 and 2006 for children and adults.[64] This coincides with a decrease in the amount of time between eating occasions by an hour to an average of 3.0 hours for children and 3.5 hours for adults. Regardless of age or race/ethnicity, all children and adolescents were eating more frequently throughout each day over a recent 20-year period (1988 to1994 and 2003 to 2008), contributing to the increase in body mass index over time.[65] Snacking is positively associated with greater calorie intake in American adults, and the snacks consumed provide more low-nutrient dense foods such as alcohol, refined carbohydrates, and sugars.[66]

A greater number of beverages are available than ever before, most with added calories, and Americans are consuming them. Over a recent 40-year period (1965 to 2002), the contribution of beverages (namely soda and alcohol) to overall calorie intake increased.[67] During this time period there was a 31 percent increase in the percent of the U.S. population consuming calorically-sweetened beverages with low nutritional value, with a significant increase in the percentage of the population consuming at least one quarter of their calories from beverages.[67] In 2007-2008, beverages provided an average of 483 calories for men and 297 calories for women aged 20 and older, with soft drinks supplying about one-third of those

calories.[68] American children and adults also increased consumption of low-calorie sweeteners (between 1999 to 2008), mostly attributed to intake of reduced calorie beverages.[69]

Intake of milk has dramatically decreased over time for all Americans.[70] Between 1977-1978 and 2005-2006, milk intake decreased for children age 2 to 11 years old by ½ cup, to an average consumption of 1 1/3 cups per day. For adolescents aged 12 to 19 years, milk intake decreased by 45 percent to an average of less than 1 cup per day. And children consume on average twice the amount of milk as adults. Blacks consumed significantly less milk in all age groups except those over 50 years old, compared to whites and Mexican Americans.

Children and adolescents in the U.S. are consuming a large portion of their calories from added sugars, often with the accompaniment of solid fats. For both boys and girls consumption of added sugars increased with an increase in age, with more sugar calories coming from foods rather than from beverages in 2005-2008.[71] There were no significant differences in the percentage of calories from added sugars based on income level. For solid fats and added sugars, intakes far exceed the recommended levels for American children and adolescents.[72] Nearly 40 percent of calorie intake came from foods high in solid fats and added sugars.[73] Major sources are grain-based desserts (cakes, cookies, granola bars, donuts), pizza, sugar-sweetened beverages, and cheese.[72,73]

Another contributor to increased calorie intake is the rise in meat consumption over the past several decades. In the U.S., meat consumption nearly doubled between 1909 and 2007.[74] Red meat is the highest contributor to total meat consumption, comprising 58 percent of total meat consumed.[74] Poultry is the second highest meat category consumed and the rise in total meat intake over the last century was attributed to the increased consumption of poultry. Twenty two percent of red meat and poultry intake is from processed food products. Fish intake

remained relatively low over the past century, comprising 10 percent of total meat intake. When meat intake was stratified by education level, Americans with less education consumed less fish and poultry compared to those with higher education levels.[74]

There was a significant increase (> 1000 fold) in per capita soybean oil consumption in the U.S. over the 20th century.[75] This comprised one of the most striking changes to the U.S. food supply over this time period. The majority of the increase occurred in the last half of the 20th century. The dramatic increased use of soybean oil resulted in an estimated 3-fold increase in linoleic acid (omega-6 fatty acid) and twice the amount of alpha linoleic acid (omega-3 fatty acid) in the American diet.

Americans fall short in meeting recommendations for fruit and vegetable intake.[76,77] Fewer than 10 percent of American adolescents and adults met their calorie-specific recommendations for fruit and vegetable intake in 2003-2004.[77] The major contributor to fruit intake was orange juice, and to vegetable intake were fried and non-fried potatoes. Adults who consumed at least three serving of vegetables per day in 1988-1994 consumed multiple servings of the same vegetable, which reflects a lack of variety in nutrient consumption.[76] Poverty continues to be a barrier to consuming fruits and vegetables, with consumption lower among low-income and education populations.[76]

Many fruits and vegetables are rich sources of potassium, which may explain why most Americans do not meet the recommended intake for this nutrient. In 2009-2010, the average potassium intake for Americans was 2640 mg per day, far below the recommended potassium intake of 4700 mg per day.[78] People with lower incomes, younger adults (aged 20 to 39), and Black adults had significantly lower potassium intakes compared to higher income individuals, those over 40 years of age, and Hispanics and white, non-Hispanics.

The average sodium intake for U.S. children and adults was 3330 mg per day in 2007-2008.[79] This was above the recommended levels of less than 2300 mg per day, with further reductions to 1500 mg per day for high risk groups such as African Americans, individuals age 51 years and older, and those with hypertension and diabetes.[34] Major contributors to sodium intake include processed packaged foods and restaurant and fast food meals.[79]

The trends in food choice and amounts eaten are reflected in the U.S. food supply. The diet quality of the U.S. food supply from 1970 to 2007 shows a consistent lack of recommended foods such as vegetables, fruits, and milk products, with a corresponding overabundant supply of calories, saturated fats, sodium, and added sugars.[80]

There has also been a shift among American adults in their food shopping, preparation, and eating behaviors. Total time spent eating increased between 1975 to 2006 for both men and women.[81] Time spent eating as a primary activity, when eating was the main focus, however, decreased between 1975 and 2006. Correspondingly, there was a significant increase in eating as a secondary activity (time spent when something else was the primary focus and eating accompanied the activity).[81]

Regarding food preparation and shopping time, a consistent downward trend occurred for both activities between 1975 and 2006.[81] When Americans shop for food, there is a wide disparity among those who refer to food labels to make shopping choices. White, non-Hispanic women at a higher socioeconomic status were more likely to report using food labels than women of other race/ethnicities and lower socioeconomic status levels.[82] Food label users were also more likely to have lower reported intakes of total calories, fat, saturated fat, and sugar intake compared to those who reported not using food labels.[82]

Diet Quality and Health Status of Americans

Diet plays a significant role in reducing the risk of chronic diseases, including heart disease, diabetes, hypertension, obesity, stroke, and cancer – independent of genetic predisposition.[55,83] The total economic costs attributed to diet in the U.S. associated with heart disease, stroke, cancer, and diabetes is in excess of $70 billion.[55] This cost understates the true cost associated with current eating habits of Americans.

A comprehensive review of the evidence regarding dietary factors and cancer risk suggest an overall diet that is predominantly plant-based (vegetables, fruits, whole grains, and legumes) lowers the risk of several different kinds of cancer.[84] Based on the available evidence, the following dietary guidelines were suggested to reduce the risk of developing certain types of cancer:[84]

1. a reduction in dairy products and dairy protein may decrease prostate cancer risk;
2. decreasing alcohol intake may reduce cancer risk of the mouth, pharynx, larynx, esophagus, colon, rectum, and breast;
3. avoiding red meat may reduce the risk of colorectal cancer;
4. avoiding grilled, fried, and broiled meats and fish cooked at a high temperature may reduce the risk of colorectal, breast, prostate, kidney, and pancreatic cancer;
5. consumption of traditional soy products (over soy protein concentrates and isolates) during adolescence and in adulthood may reduce the risk of breast cancer or the recurrence of breast cancer; and
6. a diet rich in a variety and amount of fruits and vegetables will help prevent several forms of cancer.

There is strong evidence that diet quality is associated with the development of coronary heart disease,[85] which is the leading cause of death among U.S. adults.[86] Intake of vegetables,

nuts, a Mediterranean diet, fish, whole grains, alcohol, fruit, fiber,[85] chocolate,[87-90] and limiting refined carbohydrate intake, reducing excess body weight, and substituting polyunsaturated fats for saturated fats[91] were found to be protective against the development of coronary heart disease. Dietary factors found to be strongly associated with an increased risk of heart disease include trans-fatty acids and a high glycemic index or load diet (the consumption of a high amount of refined carbohydrates).[85] Furthermore, a systematic review and meta-analysis of the research regarding dietary sugars and cardiometabolic risk showed higher intakes of dietary sugars increased risk of higher blood pressure, triglycerides, total and LDL cholesterol, independent of the effect of dietary sugars on body weight.[92]

Though the 2015-2020 Dietary Guidelines for Americans[34] and 2015 American Heart Association's Healthy Diet Guidelines recommend limiting dietary saturated fat,[93] the evidence supporting these claims is less clear. Two independent reviews and meta-analyses of studies evaluating the effects of dietary saturated fat intake and cardiovascular disease risk concluded there was no association between the two.[91,94,95] A meta-analysis examining fat intake and coronary heart disease risk using randomized controlled trials found reduced risk when saturated fats were replaced with polyunsaturated fats rather than monounsaturated fats or carbohydrates.[96]

The rise in obesity rates for children and adults is related to changes in Americans' eating habits.[97,98] Adolescents who ate breakfast together as a family had better diet quality including fruit, whole grains, and fiber intake, with a correspondingly lower risk for overweight or obesity.[99] Total calorie intake has been most strongly associated with obesity in U.S. children and adults.[97,100] An investigation of dietary components and the rise in obesity showed corn product consumption was correlated to rising obesity independent of race/ethnicity or gender.[98] Corn products are widely used in the manufacture of processed food products.

In adults 40 to 59 years of age, higher calorie intake as well as total protein, animal protein, and total fat intakes were associated with higher BMI.[100] BMI and waist circumference was also found to be inversely associated with whole grain consumption, yet only 5 percent of U.S. adults consume the recommended three or more servings per day.[101]

In comparison to overweight and obese individuals, those with lower BMIs consumed fewer total calories with higher consumption of nutrient dense foods, vegetable protein, and fiber and less energy dense foods and beverages.[100] Examples of energy dense foods and beverages included meats, fats, sugar-sweetened beverages, and alcoholic beverages. There is no evidence from observational and randomized controlled studies that low-calorie sweeteners cause weight gain.[102]

To address the importance of diet quality and health, national public health goals, *Healthy People 2020*, include a variety of specific goals addressing the problem of American's poor diet quality and weight, and health status.[103] Dietary intervention to prevent chronic diseases is an effective approach to improve diet quality, and has been shown to have a positive effect on health.[83]

Diet Quality and Socioeconomic Status

Regardless of socioeconomic status or race/ethnicity, Americans overall did not meet the national dietary recommendations for most foods including fruits, vegetables, and milk products.[55,104,105] Intake of dark green vegetables, orange vegetables, legumes, and whole grains were especially low, while sodium and calories from added sugars and solid fats exceeded recommended levels of intake.[104]

Diet quality for households with lower income and education levels was much lower. Those with a high school degree or GED have a poorer diet quality compared to those with greater than a high school degree, with lower intakes of whole fruit, vegetables, and whole

grains, with excessive intakes of solid fats and added sugars.[55,104,105] Among a group of low-income women in California, those with the highest energy density diets consumed a low variety of vegetables and had the lowest diet quality.[106] Women who ate a wide variety of vegetables had better diet quality and attitudes about eating healthy, suggesting vegetable variety may be a marker of overall diet quality.[106]

The diet quality of preschool children was significantly lower in low-income households compared to higher income households.[107] Low-nutrient sweetened beverages add to poor diet quality among low-income families. Purchases of higher calorie sugar-sweetened beverages were significantly higher among low-income families and among families with children than for higher income families and families without children.[108]

The cost associated with eating healthy is an important consideration for many Americans. An analysis of diet cost and diet quality among Americans found a significant positive relationship between overall diet quality and cost, including fruit and vegetable intake.[109] In contrast, there was a negative association between diet cost and total calories from solid fats and added sugars. The study found lower family income and educational attainment was associated with both lower diet costs and poor quality diets.[109] A recent USDA analysis, however, of healthy and less healthy foods using the 2010 Dietary Guidelines for Americans discovered cost depends largely on a specific food and the authors could not conclude that healthier foods were more expensive than less healthy foods.[110]

To help low-income Americans eat healthy on a limited budget, the USDA developed the *Thrifty Food Plan.*[111] It provides a minimal cost meal plan that makes up a healthy eating pattern based on the Dietary Guidelines for Americans. An analysis of food costs of the recommended amounts of fruits and vegetables, and compared to the *Thrifty Food Plan* allocations, showed that

limited-resource families can meet the recommendations for the amount and variety of fruits and vegetables on a limited budget.[112] However, it takes careful budgeting skills along with adequate knowledge and skill regarding food shopping and preparation to achieve a healthier diet quality.

Food Insecurity, Food Budgets, and the Health Status of Americans

An estimated 14.5 percent of U.S. households (17.6 million) experienced food insecurity at least some time during the year in 2012.[113] The U.S. Department of Agriculture (USDA) defines food security as "all household members had access at all times to enough food for an active, healthy life." Food insecurity results from a lack of resources to consistently provide enough food for a household. Food insecurity was substantially higher for those living near or below the federal poverty level (43.4 percent), and for household with children headed by single women (35.4 percent) or men (23.6 percent).

The USDA monitors food security annually and administers food assistance programs to improve diet quality and food availability for those with food insecurity through the provision of healthy foods and nutrition education. Nearly six out of ten (59.4 percent) of food insecure households participated in at least one of three federal food assistance programs in 2012 – the Supplemental Nutrition Assistance Program (SNAP), formerly called the Food Stamp Program, the National School Lunch Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).[113] An estimated 52 percent of food-insecure households received SNAP benefits, 47 percent of households participated in free and reduced lunches, and 40 percent of food-insecure households received WIC benefits.[113]

Median U.S. household expenditures for food was $50.00 per person each week in 2012.[113] As expected, the amount of money spent on food varied based on household income. Food insecure households spent $37.50 per person each week on food in 2012. For low-income households living up to 130 percent of the U.S. poverty level, the median weekly amount spent

on food was $35.00 per person. For female heads of households with children, the amount spent on food shrank to $33.33 per person each week.

A review of the literature investigating the relationship between food insecurity and weight among U.S. children and adults found women who experienced food insecurity were more likely to be obese compared to food secure women.[114] The results were mixed for children and men living in food-insecure households. Similar results were found using national data - BMI was positively associated with food insecurity in women aged 24-32 after adjusting for demographic and health behavior variables associated with either BMI and food security status.[115] There was no association for men the same age.

SNAP participation may influence the weight status of program participants. Two independent reviews of the literature assessing whether SNAP participation contributes to obesity found long-term use of SNAP benefits increased the risk of obesity among women.[114,116] Results were mixed for children and men. The literature investigating the SNAP-obesity relationship, however, did not control for the influences of food insecurity, selection bias, neighborhood food environments, or consider how SNAP benefits effect consumption behaviors and body weight.[116] A study by Jilcott et al., found households that received more SNAP benefits per person had lower BMIs compared to households that received less SNAP benefits per person, and BMI was positively associated with food insecurity, suggesting that adequate SNAP benefits help to ameliorate the food insecurity-obesity relationship.[117]

SNAP participation may positively impact health. Using a nationally-representative sample of non-elderly adults, Gregory and Deb found SNAP improved self-assessed health status, increased medical check-ups, and reduced health care costs compared to non-SNAP participants.[118] The authors suggested the improved health among SNAP participants may be

related to decreased stress and improved well-being due to extra food resources within the household.

Summary

Trends in the eating habits of Americans reveal the vast majority diverged from national nutrition recommendations. The U.S. population has experienced significant increases in calorie intake as a result of increased frequency of eating and larger portion sizes. Americans increased consumption of foods high in sodium, refined grains, solid fats, and added sugars. Intake of fruits, vegetables, whole grains, legumes, and dairy products do not meet recommended levels. The diet quality is far worse among U.S. children and adults living at a lower socioeconomic status. The poor diet quality of Americans has contributed to increases in several chronic diseases such as obesity, coronary heart disease, stroke, hypertension, and diabetes.

Healthy eating patterns can be achieved on a limited budget with careful budgeting. Food insecurity is a barrier to healthy eating and highly prevalent among those living near or below the federal poverty level and for single heads of households with children. About half of food insecure households receive benefits from at least one federal food assistance program - the Supplemental Nutrition Assistance Program (SNAP), the National School Lunch Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Food insecurity is associated with obesity in women. Long-term participation in the SNAP has been associated with a greater risk of obesity. The complex etiology of the SNAP participation-obesity relationship is uncertain, and may be related to persistent food insecurity.

Determinants of Food Choice and Eating Behaviors

A constellation of factors determines food choice and eating behaviors. These determinants include the interplay between individual, interpersonal, and environmental levels that influence what and how people eat.[119]

Significant differences exist in eating behaviors between normal weight adults and overweight or obese adults.[120] Eating fast, skipping meals, filling the plate with food, and eating for emotional reasons were factors associated with overweight status. Eating slowly was associated with a reduced risk for overweight or obesity. These findings suggest *how* people eat is an important consideration when evaluating weight status. Stress can promote irregular eating patterns and altered food preferences. There is substantial evidence that stressful events and chronic stress are associated with weight gain and obesity.[121] This occurs through a complex set of stress response hormones and metabolic and neuroendocrine reactions that result in the desire to consume highly palatable foods to relieve emotional stress. These effects are observed with overweight rather than normal weight individuals.[121]

Knowledge of healthy foods is not a good predictor of eating healthy foods.[122] Hedonic eating, characterized as food consumption that is driven by pleasure rather than the need for calories, is an important determinant of food consumption.[123] Hedonic pleasure involves a visceral reaction and a tendency to think about short-term benefits rather than a cognitive understanding of the usefulness and long-term benefits of an experience.[124] A complex network of physiologic pathways are involved in feeding regulation that include both hedonic and homeostatic mechanisms.[123]

Attentive eating is another important consideration with regard to eating behaviors. A review and meta-analysis of studies assessing attentive eating and food behaviors found the cognitive processes of distraction, awareness of food eaten, and memory have a significant effect on subsequent food intake.[125] There was consistent evidence that reduced attention when eating via distraction (television, computer, etc) and reduced awareness of food consumed increased subsequent food intake. In contrast, enhancing memory of food eaten earlier in the day

decreased later intake. Cultural practices play a role in attentive eating and in the enjoyment of food. A comparison of French to U.S. cultural food practices found that in France, where obesity rates are much lower than in the U.S., people eat meals more slowly without distraction and eating is perceived to be more pleasurable.[126] The French also view freshness and taste as more important than shelf-life and convenience, snack less, eat a greater variety of foods, and eat smaller food portions than Americans.

Environmental factors, such as the types of food available from grocery stores and restaurants, influence food choices. A review of studies evaluating the food environment and diet quality found a consistent positive association between perceived availability of healthy foods and following a healthy diet.[127] Lower regional food prices were also positively associated with diet quality. There was an inconsistent relationship, however, between food accessibility and diet quality.[127] The authors of the review noted the lack of a standard to measure the construct of food access.

People living in socioeconomically–deprived areas have poorer diet quality and dietary behaviors that contribute to overweight and obesity.[128] Access to affordable healthy foods is a major problem for low-income families. Disparities in supermarket access exist, with racial and ethnic minority and low-income populations disproportionally affected.[129] The lowest income neighborhoods had 30% fewer supermarkets than the highest income neighborhoods. Furthermore, the majority of smaller food stores are located in low-income areas, with higher food prices, poorer food quality, and less variety compared to higher-income areas.

The lack of adequate transportation is another barrier to accessing healthy foods. Low-income households may not either have access to a car or cannot afford the costs associated with getting to a supermarket outside their area.[129] The lack of access to supermarkets with healthier

foods influences weight status. People with greater access to supermarkets and fewer take-out/fast foods had a lower prevalence of overweight and obesity than people who did not have access to nearby supermarkets and had greater access to take-out/fast foods.[128]

Low-income consumers are most influenced by cost and convenience in making food choices.[130] Fast food meals meet these requirements along with taste and satisfaction, which often overrides any worries about the longer-term health risks associated with fast food.[122] The use of menu labeling in fast food restaurants for selecting healthy foods is limited among low-income and minority individuals due to a preference for certain menu items regardless of their calorie content.[131] Other reasons for not using menu labeling include the habitual ordering of specific menu items, the perception that healthier foods are not filling, and not understanding the meaning or importance of calories on health.[131] To influence food choices, strategies need to incorporate the principle beliefs and attitudes that determine fast food meal intake and apply them to healthier alternatives.[122]

A review of studies investigating the effect of food advertising on food consumption patterns showed a lack of consistency about whether advertising influences food-related behaviors, attitudes, or beliefs in adults.[132] The authors noted weak study designs as a possible explanation for the inconclusive results.

Summary

Many factors work together to influence food intake and eating behaviors, including individual, interpersonal, and environmental factors. Emotional factors such as stress and hedonic influences, along with attentive eating practices, impact eating behaviors, food choice, and whether a person is at risk for overeating and weight gain. Societal/cultural beliefs and practices also influence food choice and eating behaviors. The relationship between poverty and

lower intakes of healthy foods is complex and influenced by access to supermarkets and take-out/fast food, neighborhood characteristics, and the cost and convenience of foods.

Nutrition Education

The term "nutrition education" is broad in scope, and may apply to individual, group, community, and public policy efforts. Nutrition education has three essential components and the ultimate goal of voluntary changes in food choice and food-related behaviors that improve health status.[133] The three essential components to nutrition education include: 1) a motivational component, where the goal is to increase awareness of behaviors and the motivation to change behaviors, 2) an action component, where the goal is focused on how to make changes, and 3) an environmental component, where the goal is to promote environmental changes that support healthy eating.[133] A total diet approach, rather than focusing on individual foods, is recommended for nutrition education interventions.[134] Nutrition education should also incorporate appropriate behavioral theory to affect changes in diet.[49,133,134]

Government Funded Nutrition Education Programs for Low Income Adults

Several federally-funded food assistance and nutrition education programs exist in the U.S. for low-income adults.[135] Brief descriptions of the largest national programs are included below.

Expanded Food and Nutrition Education Program (EFNEP). The objectives of EFNEP are to help low-income families improve their nutritional well-being to address the health disparities associated with hunger, malnutrition, poverty, and obesity.[136] EFNEP is administered nationally by the National Institute of Food and Agriculture under the United States Department of Agriculture.[136]

The program currently operates in all 50 states and the U.S. territories. In 2015, a total of 119,351 adults participated in, and 340,000 other family members benefitted from, EFNEP.[137]

Funding for EFNEP is provided to states through their land grant universities and cooperative extension offices. State extension family and consumer science professionals provide training and supervise paraprofessionals (peer educators) to teach EFNEP in their communities throughout each state.[138]

EFNEP paraprofessional educators, as well as community organizations and agencies affiliated with EFNEP, recruit eligible families.[139] Trained and supervised EFNEP paraprofessionals teach group or one-on-one education lessons.[136] In 2015, over 87% of adult participants received group lessons, averaging 8 lessons prior to graduation.[137]

EFNEP is required to teach the following content areas to program participants to improve behavioral outcomes: diet quality/nutrition, physical activity, food safety, food resource management, and food security.[140] EFNEP policy states the content of nutrition education should reflect the U.S. Dietary Guidelines nutrition recommendations and address public health priorities such as reducing obesity and other chronic diseases.[140] EFNEP policy also states the educational content must be evidence based, learner-centered, and use interactive hands-on learning methods to support the needs and learning styles of program participants. States develop and maintain their own curricula to teach EFNEP lessons, or adopt curricula another state has developed.

Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program. The objective of SNAP is to help low-income families, low-income seniors, and disabled persons living on fixed incomes protect against hunger and afford an adequate diet.[141] Households eligible for SNAP receive an electronic benefit transfer card which is loaded with a cash amount each month to purchase food through approved retailers. In fiscal year 2015, more than 45 million Americans received SNAP benefits, with the average recipient receiving

about $127 month.[141] The program is administered federally by the Food and Nutrition Service, under the United States Department of Agriculture.[142]

Supplemental Nutrition Assistance Program - Education (SNAP-Ed). The goal of the SNAP-Ed program is to increase the purchase and consumption of healthy food choices within a limited budget for persons eligible for SNAP benefits.[143] The healthy food choices promoted by the program are consistent with the U.S. Dietary Guidelines. A major focus of the SNAP-Ed program is the primary prevention of chronic diseases, including obesity, among SNAP participants.[143] Nutrition education approaches developed by each state for use in SNAP-Ed must include individual or group-based education and might include comprehensive multilevel interventions and/or community and public health approaches.

The SNAP-Ed program is federally funded by the Food and Nutrition Service (FNS), housed under the United States Department of Agriculture.[144] Program services are delivered by many public and private organizations – the largest single organization is Cooperative Extension through land grand universities.[144] Though SNAP-Ed data are not currently aggregated at the national level, the FNS has developed a reporting system. The reporting system will provide information about participant enrollment in the future.[145]

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). WIC provides supplemental foods, nutrition education, and referrals to health care for low-income women, infants, and children who are at nutritional risk.[146] The target population are low-income pregnant and breastfeeding women, infants up to one year of age, and children up to age five.[147] In fiscal year 2015, over 8.6 million Americans participated in WIC,[148] and 53 percent of all infants born in the US received WIC services.[147]

WIC is administered federally by the Food and Nutrition Service, under the United States Department of Agriculture.[146] The program provides federal grants to states, which administer the program through health departments and other public health agencies. WIC provides vouchers that participants use at retailers to obtain supplemental foods that meet specific nutrient standards.[146] WIC also provides nutrition education through individual or group counseling based on nutritional risks and the life stage of program participants.

Effects of Adult Nutrition Education on Dietary Behavior Change and Health

Several randomized controlled trials have been completed evaluating the effectiveness of nutrition education interventions on specific dietary changes and health, with promising results.[149-154] An intervention using three different weight loss diet patterns (low fat diet, Mediterranean diet, and a low carbohydrate diet) were assessed, which showed significant decreases in total food intake and long-term weight loss across each diet group.[149] Major contributors to the weight changes observed across all groups were an increased intake of vegetables and decreased intake of sweets and cakes.

Large randomized controlled trails have recently revealed that interventions focusing on low fat, high carbohydrate diets are not as effective at improving health outcomes as are interventions with Mediterranean diet patterns. Long-term weight loss was greatest for those eating Mediterranean and low-carbohydrate diets compared to those instructed to follow a low-fat eating pattern.[149] The Mediterranean diet is rich in fruit, vegetables, nuts and seeds, olive oil, and whole grains, with lower intakes of meat, dairy products, sugar, and processed grains.[149] The effects of a Mediterranean diet pattern, which tends to be lower in total carbohydrates, compared to a low-fat eating pattern showed positive outcomes for reducing Type II diabetes[153] and cardiovascular disease risk.[154] In contrast, a long-term low-fat diet intervention among women did not improve cardiovascular disease risk factors.[155] Though this study found the

women instructed to follow a low-fat diet consumed a higher fat intake (30% of total calories) than recommended.[155]

A systematic review of behavioral interventions to increase fruit and vegetable intake showed that overall the interventions increased intake of these foods.[156] The average increased intake of fruits and vegetables by 1.13 servings per day, however, were small in comparison to the amount necessary to achieve recommended levels of intake.

Numerous nutrition education intervention strategies have been evaluated.[151,157-159] There are limitations, however, in their ability to assess the interventions' effectiveness due to the lack of robust dietary assessment tools that measure changes in diet quality as a result of the interventions.[157,160] An analysis of three different review papers evaluating the effectiveness of nutrition intervention at improving diet quality found effective interventions had some common themes: a theoretical basis based on behavior change strategies, some support aspect such as small groups, use of personalized tailored advice with active involvement, and food-related activities.[157] Unsuccessful interventions did not address the context in which food behavior occurs – such as one's sense of self, family, and community.

To promote behavior change, Houts, et al., suggests using a five-step conceptual framework, which incorporates problem solving techniques, as a model for nutrition education interventions.[159] The framework is based on research showing problem-solving therapy and training is effective at helping people cope with stress and influences successful weight management. The five steps to problem solving address: attitudes, defining the problem, identifying new strategies, planning, and trying the new strategy out.

Group versus Individualized Nutrition Education. Which system of providing nutrition education is better at improving diet and health, a group or individualized setting? A

review of studies assessed the effectiveness of individualized nutrition education based on characteristics unique to each person – tailored nutrition education – compared to group teaching or no nutrition education.[158] The review found tailored individual nutrition education was more effective than group teaching or no education at improving dietary intake, including for low-income and minority groups.[158]

The combination of individualized and group education may improve long-term nutritional status. Adding group counseling to individualized lifestyle counseling significantly improved long-term (5-year) dietary intake, compared to only individualized counseling.[151] Family dietary counseling has also been shown to significantly improve diet quality, especially when it focuses several different approaches to making dietary changes (serving sizes, cooking methods, kinds of foods eaten).[150]

Internet-Based Nutrition Education. Internet-based nutrition education interventions aimed at improving diet quality and nutritional status appeal to a higher educated, older population, with varying levels of success.[161-163] In a web-based program to improve overall diet and physical activity, participants reported weight loss and reductions in blood pressure, with increased consumption of fruits and vegetables and decreased intake of grain products at 12 months.[161] A randomized controlled trial assessing diet quality, however, showed no changes to fruit and vegetable intakes or weight as a result of a 5 week computer nutrition and health program.[162] Both studies included participants with a higher education and level of income who had access to computers and the internet. A large population based study that assessed changes in fruit and vegetable intake as the result of a computer-based nutrition education program showed increased fruit and vegetable intake by at least 2 servings per day.[163] In this study,

however, those who enrolled in the on-line intervention were on average older, not likely to be a minority, and had a higher level of education.

Farmers Markets. A review of studies evaluating the effects of the use of farmers markets and community gardens on dietary intake found they had a positive impact on increasing access to vegetables and fruits, especially for low-income families.[164] The results suggest greater intake of vegetables and fruits. The studies, however, used dietary assessment tools with many limitations and there were no studies found that assessed the effects of farmers markets on dietary changes without using monetary incentives such as coupons. The authors note that more well-developed studies are needed that assess the effects of farmers markets and community gardens on dietary intake, especially among low-income families.[164]

Effects of Adult Nutrition Education on Low-Income Populations

Federal nutrition assistance programs that serve low-income Americans include nutrition recommendations that align with the current Dietary Guidelines for Americans.[165] These nutrition recommendations include increasing intake of fruits and vegetables and whole grain foods while decreasing intake of sodium and solid fats and added sugars.[165] Due to the many factors associated with poverty, it may be difficult to achieve the recommended changes in eating behaviors that improve the health of populations who are most vulnerable to chronic diseases.

Nutrition interventions for low-income populations need to be relatively short-term due to competing time demands of the population.[166] It is also important to have culturally sensitive training for educators working with low-income women and culturally sensitive nutrition education messages and materials, as they improve diet quality when compared to standard nutrition education.[167] Nutrition education provided by trained peers in the community has been

shown to have a positive impact on nutrition knowledge, dietary behaviors, breastfeeding outcomes, and diabetes self-management.[160]

Nutrition Education Interventions. A review of evaluation studies assessing the impact of maternal and child health programs (Head Start, Healthy Start, WIC, and Medicaid) that serve low-income families on overall health outcomes found largely inconclusive results.[168] One study included in the review showed WIC had a significant impact on reducing hunger and food insecurity but did not report other nutrition-related or health outcomes as a result of this nutrition education program.[169] The review noted the lack of information evaluating the effects of federally-funded nutrition education programs.

A review of studies evaluating the impact of federal food subsidy programs on the health and nutritional intake of low-income families showed the majority of the studies evaluated WIC.[170] Results from this review showed a small increase in mean birthweight due to prenatal participation in WIC. Adult WIC program participants also increased key nutrients by 10-20 percent (protein, calcium, iron, and vitamin C) due to the supplemental foods provided. The review also found that targeted fruit and vegetable subsidies with nutrition education increased fruit and vegetable intake by a reported 1-2 servings per day.[170]

A nutrition education curriculum for California WIC program participants was evaluated using a non-validated survey to capture food consumption behaviors targeted in the curriculum.[171] WIC participants reported eating more fruits with greater variety, and less fruit juice intake, more whole grains, and more low-fat milk as a result of the nutrition education.[171] There were no reported changes in vegetable intake or reported food label reading as a result of the education.

Smaller nutrition education interventions studies with low income women have shown promising results.[172,173] A pilot study testing the efficacy of short-term multifactorial nutrition education program showed improved nutrition knowledge and behaviors.[172] A limitation of the study, however, was that the researchers did not use a valid evaluation tool to measure the changes in knowledge and behaviors. Another study used 8 weeks of group classes to test the efficacy of a nutrition education curriculum that also addressed food attitudes, emotional eating, and barriers to healthy eating among low-income women.[173] Results showed a significant decrease in weight, percent body fat, waist circumference, and a reduction in emotional eating.

EFNEP Nutrition Education Interventions. Families benefit from EFNEP nutrition education through improved nutrition knowledge and food management skills,[174] and changed dietary behaviors.[175-179] An evaluation of California's EFNEP showed participants significantly improved their diet quality.[175] Program participants increased consumption of milk, fruits and vegetables, protein, and nutrition knowledge compared to no changes in food group intake among the control group.[175]

A Texas EFNEP obesity prevention intervention showed goal attainment among the participants was related to self-reported healthier dietary behaviors.[176] There were improvements in many dietary behaviors for both the obesity prevention intervention group and those participation in existing EFNEP classes (the comparison group).[177] Weight loss is not a program goal for EFNEP. Only the obesity intervention group experienced a decrease in BMI post-intervention, however, the decrease in BMI was not maintained at 4 months after program participation.[177] Participant motives for enrolling in EFNEP vary and are linked to their outcomes and experiences.[180] Gathering information about participant goals and providing on-going support may be necessary to sustain behavior change among low-income families.

Research investigating the benefits gained from participation in EFNEP showed long-term maintenance of nutrition knowledge as a result of the program.[178] The results also showed nutrition knowledge, health and eating practices continued to improve 1 year after program completion. Research also suggests behavior change in EFNEP is influenced by the nutrition educator. More positive behavior changes occurred among EFNEP participants when the paraprofessional educator providing the lessons perceived a high value of EFNEP and also received strong managerial support.[181]

The method of delivery may play a role in program participant success. Dicken et al., observed greater behavior changes when participants received individualized instruction rather than group instruction.[181] This study, however, did not compare individualized plus group support in their intervention, which has resulted in stronger behavior change outcomes than either individual approach.[151] A pilot study investigating changes in dietary intake and nutrition behavior change among EFNEP participants, comparing group classes to video-instruction, showed both groups significantly increased their diet quality.[182] There were no differences between the method of instruction in the amount of changes in diet intake or improved dietary behaviors.[182]

EFNEP Economic Evaluation of Nutrition Education. EFNEP has shown through a variety of economic assessment measures it is a cost-beneficial program. The program has demonstrated health-related savings using cost-benefit analyses from small[183,184] and large[185] EFNEP state programs in terms of the number of participants served. The cost effectiveness of EFNEP's nutrition practices has also been demonstrated on a national scale.[186] EFNEP's cost-effectiveness was determined to be comparable to other health improvement interventions.[187]

SNAP-Ed Nutrition Education. As with all federal nutrition education programs, SNAP-Ed gives states the opportunity to tailor activities to the unique needs of the state and their preferences for delivering nutrition education.[188] The result is wide variability in nutrition education provided within the same program.[188] While the ability to tailor activities provides opportunities for innovative nutrition education strategies, a major limitation of this approach is the ability to evaluate SNAP-Ed program effectiveness at changing dietary and health behaviors nationally using a common valid and reliable instrument. At the request of the Food and Nutrition Service (FNS), within the USDA, a comprehensive set of best practices was developed for SNAP-Ed to use as a guide in developing, implementing, and evaluating effective nutrition education programs.[189]

Learner-Centered Nutrition Education. A learner-centered approach to teaching adults is an effective way to promote behavior change because it allows learners to make personal meaning of information and apply new information and skills to their own situations.[190] A learner-centered approach, compared to traditional classes, was applied to a nutrition education program among California WIC participants.[191] The study findings showed mothers who received learner-centered education personalized the information and adapted it to their families more than mothers who received the same nutrition information using traditional methods.[191]

A learner-centered nutrition education pilot study targeting low-income adults showed differences in outcomes based on food assistance program participation.[192] WIC clients improved intake of targeted foods as they were provided by the program, but food stamp participants did not. The folate-rich foods targeted in the study were provided by the WIC program, whereas food stamp participants could purchase a variety of foods. Due to the study

design, it could not be concluded that the observed changes were due to the learner-centered approach rather than the nutrition education content.[192]

Summary

Nutrition education is a broad term encompassing individual, group, environmental, and community systems with the objective to improve nutrition and health status. Effective nutrition education interventions focus on a whole-diet approach, incorporate a Mediterranean diet pattern, use food activities, have a theoretical basis, and include support and personalized information tailored to the unique needs of the individual. Internet-based interventions are used primarily by older, higher educated adults with consistent access to a computer. Though promising, more high-quality studies are needed to determine whether internet-based nutrition education is effective at improving nutrition and health status.

Several federally-funded nutrition education programs exist for low-income families to promote healthy food choices and food-related behaviors to improve health status. These programs include EFNEP, SNAP-Ed, and WIC, and they all follow the Dietary Guidelines for Americans nutrition recommendations. Several smaller, community-based evaluations have demonstrated the effectiveness of federally-funded programs at improving eating behaviors. There is, however, a lack of published information assessing the programs' effectiveness on a national scale. One of the challenges to adequately evaluating the effectiveness of nutrition education interventions is the lack of valid, sensitive tools that measure changes in dietary behavior as a result of the interventions.

Behavior Change Theories and Models

Health behavior theory and models in the context of nutrition education provides an explanation of the influencers and motivators that drive individual food choice and food-related

behaviors.[193] These theories and models are based on research and can be used to develop effective nutrition education interventions.

The Health Promotion Model

The Health Promotion Model is a comprehensive theoretical model used to explain health behaviors. The model was developed for the nursing profession as a method of understanding major determinants of health behaviors and to assist individuals in changing behaviors to improve their health.[194] Due to the comprehensiveness of the model, it has been used in nutrition education to identify constructs that were predictors of breakfast consumption among adolescent females,[195] and to develop an effective nutrition education intervention targeting adolescent females.[196] The model constructs have also been used to identify predictors of nutrition behaviors among adults with diabetes.[197]

The central focus of the Health Promotion Model is a set of eight constructs that influence health behaviors.[194] Interventions targeting the eight constructs may assist people in changing behaviors to improve their health. The eight constructs of the Health Promotion Model are listed below:

1. perceived benefits of action,
2. perceived barriers to action,
3. perceived self-efficacy (self-confidence in performing a health behavior successfully),
4. activity-related affect (emotions occurring prior to, during, and after a specific health promoting activity),
5. interpersonal influences (family, peers, providers, norms, social support, role models),
6. situational influences (perceptions of compatibility with the life context or environment),
7. commitment to a plan of action, and
8. immediate competing demands (low control) and preferences (high control).[194]

Community Nutrition Education Logic Model

Logic models are used as an efficient way to present information for planning interventions and contribute to program development, implementation and evaluation.[198] The basic logic model includes the following components:

1. inputs (human, financial, and organizational resources),
2. activities (what the program does with the inputs; the actions developed and carried out by the program),
3. outputs (the direct product of the activities, usually expressed in the volume of work and number of participants reached), and
4. outcomes (benefits or changes in the program's target population; includes short-term impacts and medium- and long-term outcomes).[198]

The Community Nutrition Education (CNE) Logic Model applies the concepts of program planning and evaluation, using the logic model framework, to assess the effectiveness of national nutrition education programs.[199] The CNE Logic Model was developed and pilot tested for the national Food Stamp Nutrition Education program (FSNE) – the former name of the current SNAP-Ed program - as a way to systematically collect and summarize program outcomes.[200] Though originally developed for the FSNE program, the CNE Logic Model can serve as a guide for the development and evaluation of community-based or large nutrition education programs.[200]

The CNE Logic Model incorporates the 4 basic components of inputs, activities, outputs, and outcomes. It also incorporates the socio-ecological approach to support nutrition intervention strategies on the individual, family or household level, community level, and social or policy level.[199] A new version of the CNE Logic Model for nutrition education program planning is currently being tested by the USDA.[199]

Social-Ecological Model

The social-ecological model (SEM) is a framework that illustrates and describes how individual behaviors are shaped by multiple levels of influence. Numerous variations of the SEM are used in research and in the public health arena.[193,201] The SEM defines the multiple levels or spheres influencing health behaviors as the following:

1. individual (including knowledge, attributions, beliefs, genetic characteristics),
2. interpersonal (interactions or relationships shared within social networks),
3. institutions and organizations (rules or policies such as at schools, work),
4. community (larger societal groups and cultural norms; environment), and
5. structures and systems (local, state, and federal structures which affect the environment and larger policies surrounding communities and individuals).[201]

The U.S. Dietary Guidelines highlights the importance of the SEM as a way to explain eating behavior.[34] The Dietary Guidelines used the SEM to describe the complex set of factors that combine to shape an individual's daily food and beverage choices. The SEM has also been used to understand the components of healthy eating among a specific group of people, with the goal of developing interventions to improve eating behaviors.[202] As discussed by Contento, nutrition education interventions need to address how elements in each sphere of the SEM interrelate to influence daily food choices, and comprehensive nutrition education efforts need to address these elements.[193]

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) has been widely incorporated into nutrition and other health-related interventions.[193] The core concept of the TPB is that one's behaviors are influenced by their intentions, which in turn are influenced by their attitudes, social norms, and

perceptions of control over the behavior.[203] The theory consists of three main constructs which influence one's behavioral intentions:

1. attitudes toward a behavior (including beliefs, knowledge, and values),
2. subjective norms (perceived social pressure to do a behavior), and
3. perceived behavioral control an individual has to perform a behavior.[203]

Dietary intervention research has investigated use of the TPB to predict or change desired behaviors. The constructs of attitudes and perceived behavioral control were found to be predictors of dairy product consumption among older adults.[204] Attitudes and perceived behavioral control along with goal attainment were also predictors of the amount of weight lost among a group of college women participating in a weight reduction program.[205] A review of dietary interventions evaluating the effectiveness of the TPB for adolescents and young adults found moderate effectiveness at changing behaviors.[206]

Social Cognitive Theory

Social Cognitive Theory (SCT) is one of the most commonly used theoretical frameworks in health and nutrition behavior programs.[193] The theory identifies factors that influence motivation to change behaviors, and provides direction on how to facilitate a person's ability to take action. The key concepts of SCT are that personal, behavioral, and environmental factors work in interrelated dynamic ways to influence health behaviors.[207]

The key factors and constructs of SCT are listed below:[193,207]

1. personal factors (thoughts and beliefs about ourselves)
    a. self-efficacy – the skills and confidence one has to carry out the intended behavior successfully
    b. outcome expectations – belief about the value of a behavior and perceived costs and benefits

2. behavioral factors (knowledge and skills)
    a. behavioral capabilities – knowledge and skills needed to carry out a behavior
    b. self-regulation and goal setting – ability to direct and monitor a behavior through skills and self-influence
3. environmental factors (the social, physical, and one's perception of their environment)
    a. environmental influences – physical and societal environment affecting the ability to engage in a behavior
    b. people's influence on the environment – how one interacts with and shapes their environment
    c. social environment – other people's influence on a one's behaviors
    d. observational learning – learning a behavior through peer modeling

Social cognitive theory had been applied to nutrition research to identify predictors of healthy eating behaviors. Studies which used the SCT constructs to predict healthy eating behaviors showed the concepts of self-efficacy, outcome expectations, and self-regulating behaviors had the strongest associations with healthy eating behaviors,[208,209] and healthier weight status.[209] The construct of self-efficacy was strongly associated with healthy eating among a group of low-income adolescent girls.[210] Intention of behavior was not significantly related to actual behavior among the adolescent girls, which demonstrates the need for further investigation of behavioral intent among this population.

Transtheoretical Model of Behavior Change

The transtheoretical model (TTM) has been widely used to study health and dietary behavior change and as an approach for nutrition counseling.[193] The core concept of the TTM is

that behavior change is a gradual and dynamic process consisting of progress through 6 stages. These stages of change in which behavior change progresses are listed below:[211]

1. Precontemplation – one is not intending to take action now or in the immediate future (next 6 months) and does not want to discuss or know about the health behavior.
2. Contemplation – one is intending to change within the next 6 months and is aware of the benefits and acutely aware of the costs of adopting the health behavior.
3. Preparation – one is intending to take action in the immediate future (within the next month) and typically has taken some action regarding the health behavior.
4. Action – one has taken action to change, and has made some modifications to the health behavior.
5. Maintenance – one is working to prevent relapse of the health behavior with increased confidence as the behavior continues over time (from 6 months to 5 years).
6. Termination – one has complete self-efficacy about the health behavior change and is confident about not returning to the prior behavior even if stressed, sick, depressed, anxious, or bored.

Another concept of the TTM is the construct of processes of change.[211] The processes of change are the explicit and hidden activities people use to make progress through the stages of change and that are used to guide intervention programs.

Using the TTM stages of change to promote dietary behavior change and improve health status has shown promise, though more high-quality research assessing the effects of TTM is needed. Tailored TTM interventions were shown to be predictors of successful long-term (measured at 12 and 24 months) dietary behavior changes,[212] and to improve fruit and vegetable intake.[213] A worksite wellness weight loss intervention modeled on the stages of change showed

positive changes in weight loss, body fat and waist circumference.[214] A review of randomized controlled trials of dietary interventions that assessed the TTM stages of change at affecting weight loss in overweight and obese adults, however, showed inconclusive evidence that the model led to sustained weight loss.[215] The authors noted the results are limited due to the lack of well-designed studies.

Nutrition Education Curricula Content Analysis

Nutrition Education Content Analysis

Content analysis is used widely in research to gather objective information about a topic from verbal, print, electronic, or other forms of communication. Content analysis focuses on the similarities and differences of a topic of interest (e.g., weight loss strategies presented in magazines), the frequency and extent of coverage of the topic, and how the content is presented.[216] Categories and subcategories of content are organized and condensed using a systematic approach and qualitative or quantitative research methods that are dependent on the content of interest.[216]

Content analysis has been used in nutrition research to gather information from the media regarding health and nutrition messages. For example, content analysis was used to identify trends over several decades in infant feeding messages in a popular women's magazine.[217] This type of analysis was also used to gather health and nutrition messages from popular women's magazines, and to compare the content to current national dietary recommendations.[218]

The implications for content analysis in nutrition education extend beyond identifying media messages. Content analysis can be used anywhere there are nutrition questions such as in public health, clinical, or research settings, and whose answers can improve the nutrition education materials, counseling techniques, care, or outcomes.[219]

Methods to consider in conducting a content analysis related to nutrition education include the following:[219]

1. Determine whether the researcher is using an inductive (open-ended inquiry) or deductive (predetermined variables) approach to gathering information.
2. Decide whether to examine manifest (observable or visible) or latent (hidden or implied) information.
3. Use data collection approaches that are valid and reliable.

To establish validity of the topic under study, content analysis needs a systematic method to select a representative sample of text from the overall universe of text within the topic of interest.[219] Validity should also be established in a content analysis by testing the data collection tool to ensure it will address the actual research questions.[219] It is strongly recommended to use more than one coder/data recorder to independently test the data collection tool to further strengthen validity to the tool. Two independent data collectors should also be used throughout the content analysis to ensure reproducibility of the collected data.[219]

Curricula Content Analysis

Content analysis has been used to assess different education curricula. A content analysis was performed to assess whether statewide nursing education curricula aligned with public health practice competencies.[220] The purpose of the curricula content analysis was to determine and delineate where gaps occurred in the curricula. An analysis of physician trainee (medical students and residents) quality improvement curricula was completed to see where the instruction aligned with established guidelines and to identify gaps.[221] Content analysis has also been applied to nutrition education curricula. One example was a content analysis of kindergarten nutrition education curricula, which assessed the consistency of the curricula with national nutrition recommendations.[222]

EFNEP Curricula Content Analysis. A content analysis of the EFNEP youth curricula for children in 3rd through 5th grades was completed using multiple states' curricula.[223] The purpose of the content analysis was to identify common topics and theory-based educational strategies used in the curricula. The content collected was used to develop outcome evaluation measures. Another content analysis of two adult EFNEP curricula used within a state assessed the utility and effectiveness of each (the state transitioned from the use of one curriculum to the use of another).[224] The curricula were compared with each other in terms of their ability to influence established outcomes, including nutrition behavior change as identified by the U.S. Dietary Guidelines. The influence of other program factors on behavior change, such as the race of instructor, was also assessed.

Best Practices for Nutrition Education Curricula Review

An expert committee for the National Institute of Food and Agriculture, Nutrition and Health Planning Guidance Committee, developed a list of best practice recommendations for conducting a curricula review for nutrition education programs.[225] The recommendations were intended to be used by state Extension programs and other entities overseeing nutrition education programs to conduct a systematic curriculum review process.[225]

Per the best practices document, "an effective curricula review system is one that:

- Has a documented review process.
- Is easy to understand.
- Is easy for Extension faculty and staff to access and use.
- Includes a peer review process where reviewers have expertise in subject matter, learning theory, and the audience for whom the curriculum in intended.

- Evaluates curricula based on clearly articulated standards of content, readability, utility, and intended outcomes."[225]

Summary

Content analysis is a research method used to systematically gather valid information about a topic or phenomenon of interest. Content analysis has been used in nutrition research to gather nutrition-related media messages, and in nutrition education to assess materials and curricula. Recommendations exist for conducting content analyses in nutrition education that include determining whether the researcher is using an inductive or deductive approach, and deciding to examine manifest or latent variables. Data collection methods need to be valid and reliable. Nutrition education curricula content analysis is important for developing and improving effective curricula which result in behavior change. A national expert committee developed a set of best practices for conducting a nutrition education curricula review. The best practices advise evaluating curricula based on clearly articulated standards of content, readability, utility, and intended outcomes.

Dietary Assessment Evaluation Measures

Effective evaluation measures are necessary to determine the impact of nutrition education interventions. Impact evaluation is defined as "the process of determining whether the program's methods and activities resulted in the desired changes in the client."[226] To evaluate the impact of nutrition education programs, valid measures are needed.[227] Valid evaluation instruments help to inform key stakeholders, refine content and education strategies, and focus programs to improve service delivery. Evaluation measures should address the purpose, duration, and power of the intervention and meet the needs of the target population.[228] This includes extensive work to develop and test the evaluation measures, such as cognitive testing

with the target population, and testing for reliability (internal consistency, test-retest), and validity (content, construct).[228]

Dietary Assessment Methods

The most common dietary assessment methods used to assess food intake and the impact of nutrition education interventions include 24-hour dietary recalls, food frequency questionnaires (FFQ), food records, and brief instruments.[229]

The USDA developed and maintains an automated 24-hour dietary intake system to collect and analyze data on the foods consumed by Americans.[230] Examples of national surveys using the 24-hour dietary intake system are the National Health and Nutrition Examination Survey (NHANES) and the Continuing Survey of Food Intakes by Individuals (CSFII).[230] National and population-specific dietary intake information largely comes from these surveys. What We Eat in America (WWEIA) is the dietary interview component of the NHANES.[231] Dietary intake information is collected for NHANES through 2 days of 24-hour food recalls; day 1 is collected in person in a mobile assessment center and day 2 is collected via telephone interview using the automated multiple pass method.

A review of dietary intake evaluation measures used for adult nutrition education interventions showed most studies used 24-hour food recalls, food records, and FFQ.[228] The review also showed that most of the measures used to assess nutrition education interventions targeted specific behaviors or changes in food intake. For example, many nutrition education interventions used short FFQ screeners (brief instruments) for foods targeted in the interventions, such as fruit and vegetable intake.[233-240] Three or seven day food records were used to assess usual dietary behaviors for intensive individualized interventions.[241-245]

Food frequency questionnaires have been effective at measuring aspects of food intake such as fruit and vegetable consumption,[246] and used effectively as an evaluation tool in

interventions to promote healthy dietary changes.[247] When FFQ delivery methods were tested, focusing on a food group prior to questions about foods in the food group increased understanding compared to asking about each food type separately.[248]

Innovative dietary assessment technologies have been used to collect food intake data for nutrition education evaluation. These technologies include personal digital assistants, mobile phones, web-based systems, cameras, tape recorders, and interactive computer-based technologies.[249] Their validity and feasibility to estimate individual intake, however, is not well established with specific population groups such as low-literacy populations. For example, the use of a computer-based FFQ with graphical displays was found to be an effective approach for use with higher-educated, computer literate adults.[250] The computerized FFQ was not tested with a lower-educated and less computer literate population.

Dietary Assessment Limitations. Both conventional dietary assessment measures (FFQ, 24-hour food recalls, food records) and alternative methods (mobile phones, interactive computer-based systems) share the same limitation of relying on the accurate recall of an individual's food intake.[249] Dietary intake can rarely be directly observed due to the high cost and invasive techniques needed to collect the data, thus dietary assessment research typically relies on self-report measures/instruments.[251] Precise measures of food intake are difficult to achieve due to the misreporting of food and beverage intake.[252]

There are two types of measurement error with self-report dietary assessment measures due to misreporting intake: systematic error and within-person random error.[253] Systematic error, or bias, is a type of error in which people over- or under-report intake in a way that consistently departs from true intake.[253] Systematic error cannot be ameliorated by administering repeated measures of food intake. Two main components of systematic error

include: 1) *intake related bias*, in which people consistently under-report or over-report certain foods/beverages in a way that deviates from their true intake, and 2) *person-specific bias*, which personal characteristics such as social desirability affects how a person reports dietary intake of certain foods/beverages.[253]

The second type of measurement error, within-person random error is defined as the difference between a person's reported intake for specific period of time (e.g., one 24-hour period) and the person's long-term usual intake of foods/beverages (e.g., captured through multiple 24-hour periods).[253] Day-to-day variations in food/beverage intake is a source of within-person random error. Dietary data that has within-person random error are not biased, but may be inaccurate; this type of error is reduced by administering repeated measures and averaging food/beverage intake across several days (e.g., administering multiple 24-hour food recalls).[253]

A comparison of national estimates of energy intake data compared to total energy expenditure over a 39 year period showed significant bias with under-reporting of energy intake - an estimated 365 calories per day for women and 281 calories per day for men.[254] There was also strong evidence of under-reporting socially undesirable foods high in fat and sugar with an increased prevalence of obesity over the time studied. The under-reporting of dietary intake was related to an underestimation of portion size, omission of foods, social desirability in reporting food intake, and bias in converting food to nutrients.[255] Caution should be used, therefore, in estimating specific dietary intake or in using dietary assessment measures to support diet-health relationships.[254]

Lengthy Dietary Assessment Tools

FFQ provide a measure of usual dietary intake by individuals over a specified time through multiple questions about specific food consumption.[256] FFQ are usually self-

administered, and occasionally interviewer-administered when literacy is low or when other reading problems occur. Data from FFQ can be used to assess specific aspects of a study population's diet, or to assess total dietary intake for prospective, retrospective case-control, or interventions studies.[257] FFQ may be better than short-term dietary instruments at capturing intake of episodically-consumed foods because they capture usual intake of foods over a longer period of time. [257]

Epidemiologic research studies commonly use FFQ as the main dietary assessment instrument to gain understanding of individual dietary patterns or assess diet-disease relationships. Examples of nationally tested multiple item FFQ used by in research studies include the National Cancer Institute's 144-item Diet History Questionnaire,[258] the 127-item Block Questionnaire,[259] and the NHANES 139-item Food Questionnaire.[260] All of these forms are available in English and Spanish. Some FFQ are used within a specific population. For example, the American Association of Retired Persons 124-item FFQ was tested for use nationally with elderly adults to detect the link between nutrient intake and cancer risk.[261]

Nutrition education interventions have used a combination of FFQ to evaluate changes in family intake of fruits, vegetables, fat, and sugar.[262] Tools have also been developed for specific interventions, such as the 94-question FFQ to assess fat intake among African American women living in Boston.[263]

Short Dietary Assessment Tools

Brief food behavior questionnaires and FFQ assessing specific foods or nutrients are used in a variety of nutrition education interventions.[172,264] These short dietary assessment instruments aim to capture limited aspects of the diet over a specified period of time, and are useful for characterizing a population's median intakes or distinguishing among individuals or populations with regard to higher versus lower intakes.[265] The questionnaires are usually self-

administered, but may also be interviewer-administered. Short dietary assessment instruments can be used to assess relationships between diet and other factors in prospective or retrospective case-control studies when interest is limited to a set of dietary components.[266] The strengths of using brief dietary assessment tools include lower respondent burden and lower program/investigator cost compared to other methods.[252]

Short diet assessment instruments (generally less than 30 questions) have been developed and tested to target changes in specific dietary behaviors, such as mindfulness when eating,[267] diabetes self-management,[268-270] and adolescent food habits.[271] NHANES[272] and the National Health Interview Survey[273] developed short FFQs, often called screeners, that measure the frequency of consumption over the last month of several types of selected foods and drinks. Short instruments have also been developed to assess the dietary intake of beverages and snacks,[274] fat,[275-278] soy,[279] calcium,[280,281] sodium,[282] shellfish,[283] and fruits and vegetables.[264,284-289]

A review of short validated tools assessing fruit and vegetable intake showed greater validity for tools with a higher number of items per tool and questions with portion size information.[264] The number of items varied from 6 to 16 per instrument. The results are consistent with another study which demonstrated greater validity for a 36-item instrument measuring fruit and vegetable intake compared to two shorter (two-item and seven-item) instruments.[288] A study investigating differences in self-reported fruit and vegetable intake showed intake varied significantly depending on whether estimated serving size information was provided.[290] The study did not investigate, however, whether providing serving size information increased the accuracy of the self-reported fruit and vegetable intake.

Limitations of Lengthy and Short Dietary Assessment Tools

The main limitation of using FFQ and short dietary assessment instruments is the risk of systematic error (bias).[257,291-293] This type of error can be addressed by administering a less biased short-term reference instrument (e.g., multiple 24-hour food recalls) to a subsample of the study population, and use the reference instrument data to calibrate the main dietary instrument.[257] Another limitation of these dietary assessment tools is they contain a list of pre-specified foods, which may not align with eating patterns of the study population.[257] To address this limitation, the dietary assessment tools should be developed and tested with the target population in which they will be used.[228] In addition, detailed information about food preparation or consumption patterns are generally not included in these instruments, therefore, the potential to assess the role these factors play in dietary intake is not available.

FFQ and short dietary assessment tools have be used to evaluate the effectiveness of interventions at changing diet-related behaviors or food intake. The *sole* use of these dietary assessment instruments for interventions, however, is not recommended due to the potential for differential response bias - the proclivity of the intervention group to misreport their diet to a greater degree than the control group due to their exposure to the intervention.[257]

Dietary Assessment in Low-Income Populations

Developing and testing valid diet assessment tools for use with low-income adults presents numerous challenges. These challenges include low literacy skills and the multiple cognitive steps required to accurately recall foods eaten or food behaviors.[294] Low-literacy populations have more difficulty using computerized dietary assessment tools due to the increased respondent burden of using these tools compared to paper diet assessment systems.[295] A literature review found a lack of developed diet quality measurement tools for low-income audiences for use in nutrition education interventions.[296]

The following are recommendations for developing dietary assessment measures for low-income populations, which are based on the limitations of developed measures:[294,296,297]

- Develop evaluation tools with the respondent's needs (lower literacy, shorter tools) as the first priority.
- Use the research literature to identify potential items.
- Use visuals to aid respondent understanding.
- Test potential items using cognitive interviewing techniques with the target audience.
- Assess the readability of the developed items.
- Gain an understanding of the regional and racial/ethnic differences that change or influence the interpretation of items that measure changes in dietary intake.
- Minimize respondent bias over time as a result of the program that influences how participants respond to items. For example, learning about food groups may change respondents' interpretation of a question and thus they may answer it differently due to the changed knowledge rather than due to changes in food intake due to the program.
- Develop more comprehensive measures of intakes of whole grains and dried beans and legumes due to the difficulty with accurate measurement of these foods for a low-income audience.

The following is a recommended research process for developing diet assessment evaluation measures for low-income adults:[297]

1. Develop scales reflecting the subcomponents of diet, such as fruit and vegetable intake, or content domains that should be measured, as judged by experts in the field. This provides content validity.

2. Generate items to test using peer-reviewed, tested items from the research literature. This provides content validity.
3. Pre-test items with the target audience using cognitive interviewing. This provides face validity.
4. Revise and retest items with the target population.
5. Assess the items for test-retest reliability and internal consistency reliability.
6. Assess the items for sensitivity to changes on the post-test.
7. Assess the items using measures of convergent validity or criterion validity, such as 24-hour food recalls or biomarkers of dietary intake.

SNAP-Ed and EFNEP Nutrition Education Dietary Assessment. Though there is no national evaluation instrument currently used, dietary assessment tools have been developed and tested for use within SNAP-Ed state programs.[298,299] For example, food behavior checklists were developed and tested with low-income English-[298] and Spanish-speaking[300,301] participants targeted for EFNEP and SNAP-Ed in California. Evaluation measures for SNAP-Ed have been developed for specific interventions rather than on a national scale,[299] because the program gives states the opportunity to tailor activities to the unique needs of the state and their preferences for delivering nutrition education.[188]

No published research exists in which valid measure of nutrition behavior change were developed on a national scale for EFNEP, though tests of validity were completed in the mid-1990s for the currently used 10-item behavior checklist. Researchers have developed valid instruments to measure behavior change on a smaller scale.[302-305] These instruments were developed to evaluate specific curricula and subgroups of EFNEP participants (e.g., children), and were tested within the specific community or state.

A multistate effort is recommended to test behavior checklist items with EFNEP audiences because of the program's national reach and diversity of participants.[302] The evaluation items must be appropriate for the EFNEP audience, based on the current curricula, and reliable, valid, and sensitive measures of behavior change.[298,306] EFNEP administrators recognize data quality may be compromised due to the high cognitive burden and potential stress participants experience from the required data collection process.[307] Evaluation methods used to test the validity of items should not be overwhelming for the EFNEP audience, as this may result in inaccurate responses to all items.[303]

A recommended strategy for developing a diet assessment instrument for low-income participants involves incorporating principles of cognitive load theory, which includes the evaluators division of responsibility.[307] The evaluators division of responsibility clarifies that the evaluator decides the focus and content and the participant decides how to word each item, the sequence, and the format of the evaluation tool. Another recommended strategy is the addition of representative visual images to improve understanding and readability of the items for low-income individuals.[301,308]

Summary

Nutrition education interventions need appropriate evaluation measures to determine their effectiveness at changing nutrition-related behaviors. Appropriate evaluation measures need to address the purpose, duration, and power of the intervention, be sensitive to dietary changes and meet the needs of the target population. Lengthy and brief FFQs, brief food behavior questionnaires, 24-hour food recalls, and food records are used to assess dietary intake for adult nutrition education interventions. Regardless of the diet assessment method used, it is difficult to get accurate measures of food intake due to misreporting.

A systematic approach is recommended to develop valid evaluation measures. Developing evaluation measures for a low-income population involves several challenges associated with the literacy level and cognitive load needed for items measuring dietary intake and nutrition behaviors. EFNEP has developed valid diet assessment instruments on a smaller scale and for specific sub-groups. A multistate effort is needed to develop and test a national food behavior checklist for EFNEP.

Literature Review Summary

The abundance of affordable convenience foods combined with our modern lifestyle have contributed to the poor diet quality among US families. Low-income adults experience greater risk of poor diet quality than those with more resources, which makes them more vulnerable to developing chronic diseases, including obesity, diabetes, cardiovascular disease, and some cancers. Nutrition education programs are necessary to address the complex relationship between poverty and food choice, as well as the variability in knowledge and skills about healthy eating among low-income families. Without valid program evaluation tools, however, it is impossible to determine whether nutrition education is effective at improving diet quality.

The Expanded Food and Nutrition Education Program (EFNEP) is a USDA-funded national program serving low-income adults that evaluates nutrition-related outcomes. EFNEP teaches program participants using curricula states develop or purchase from another state; curricula content should reflect the most current US Dietary Guidelines recommendations. EFNEP collects self-reported information via a 10-item questionnaire from participants pre- and post-education to evaluate changes in behaviors as a result of the program. The 10-item questionnaire used to evaluate behavior change nationally (referred to as the EFNEP behavior checklist) was implemented in the 1990s and has not been updated since. Thus, the current

nutrition questions used to evaluate EFNEP may not be accurate behavior change measures for the current program.

Accurate evaluation measures of behavior change should be an integral component of federally-funded nutrition education programs, as the measures inform program decisions and promote effective nutrition education. Evaluation measures should be tested with the target audience to ensure they have adequate psychometric properties, including reliability and validity. Programs serving low-income populations require feasible measures that are simple to use, with low staff and respondent burden. Short dietary assessment questionnaires measuring intake meet these needs and are used to evaluate the effectiveness of nutrition education programs. However, there is a lack of data on their reliability and validity for national use with low-income adults.

This dissertation research project was designed to develop and test the reliability and validity of a dietary assessment instrument for a new national EFNEP evaluation questionnaire. The implications of this research extend beyond the EFNEP program, as other national nutrition education programs or interventions serving low-income adults may use the questionnaire to evaluate their effectiveness at improving diet quality.

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CHAPTER 2. NUTRITION CONTENT IN A NATIONAL NUTRITION EDUCATION PROGRAM FOR LOW INCOME ADULTS: CONTENT ANALYSIS AND COMPARISON TO THE 2010 DIETARY GUIDELINES FOR AMERICANS[1]

Introduction

Low-income families are at greater risk of poor diet quality,[1-3] which contributes to obesity[4-6] and other chronic diseases.[7] Effective nutrition education programs serve an important role in helping to change eating behaviors to improve diet quality and the health status of low income families.[8,9] The Expanded Food and Nutrition Education Program (EFNEP) is a national program, implemented locally through cooperative extension offices, that teaches low-income families how to improve their diet quality.[10] In 2013, 121,025 adults participated in EFNEP, and a total of 359,120 family members benefited from the program nationally.[11]

Trained EFNEP paraprofessionals, indigenous to the communities they serve, teach in group or one-on-one settings.[10] Participants attend an average of 8 lessons taught over a period of 2 to 3 months.[11] At the state level, EFNEP develops and implements its own curricula or adopts curricula developed by another state.[12] Some state programs use more than one curriculum.

Program policy requires EFNEP nutrition education content reflect the most current version of the Dietary Guidelines for Americans, address public health priorities such as reducing obesity, be evidence-based, and learner-centered to support the needs and learning styles of participants.[13] Nutrition interventions for a low-income audience need to be relatively short-term due to competing time demands of the target population.[14] The EFNEP is challenged

[1] Published in another format in the Journal of Nutrition Education and Behavior: Murray EK, Auld G, Inglis-Widrick R, and Baker S. Nutrition content in a national nutrition education program for low-income adults: content analysis and comparison with the 2010 Dietary Guidelines for Americans. *J Nutr Educ Behav*. 2015;47(6):566-573.

with meeting program requirements to provide education about not just diet, but also physical activity, food safety, food resource management, and food security within a limited number of classes.[13]

No published information exists that evaluates the nutrition-related content used to teach EFNEP adult participants nationally. However, content analysis has been used to evaluate different curricula, including nursing[15] and physician[16] education curricula, nutrition education curricula for kindergarten students,[17] youth EFNEP participants,[18] adult EFNEP participants on a community or state-wide level[19] and nutrition and health messages from the media.[20,21]

Nationally, there is a need to identify the nutrition content in curricula used by EFNEP and how the content aligns with national nutrition recommendations, which could contribute to improvements in nutrition education materials by identifying omissions or inconsistencies across curricula.[22] The reach of curricula used in EFNEP extends beyond the program as the curriculum are also used by other nutrition education programs, including the Supplemental Nutrition Assistance Program – Education (SNAP-Ed).[14]

The purpose of this study was to use a systematic content analysis to identify the nutrition-related content topics addressed in the most widely used adult curricula in EFNEP and compare it to the nutrition recommendations of the 2010 DGA.[23] This analysis will help identify the most important content for EFNEP to teach and evaluate nationally and also supports the work of a USDA Agricultural Experiment Station multi-state research project (NC2169: EFNEP Related Research, Program Evaluation and Outreach).[24] The purpose of the multi-state research project includes the development of valid evaluation measures that assess EFNEP adult participant changes in diet quality and nutrition-related behaviors.

Description of the Content Analysis

Curricula Selection

In January 2013 at the researchers' request, the EFNEP national office provided the number of adult graduates reported through annual EFNEP year-end reports and names of curricula that state programs (75) reported using to teach adults in 2011, which was the most recent data available at the time. Researchers used a systematic approach[22] to select the most widely used curricula based on: (1) the number of EFNEP state programs using a curriculum, (2) the percentage of EFNEP adult participants who were exposed to a particular curriculum (reach) and (3) the percentage of the largest funded (tiers 1 and 2) EFNEP state programs using a specific curriculum. EFNEP is separated into 7 levels (tiers) based on the federal allocation of EFNEP funds,[25] which influences the potential reach of the individual programs. *Reach* was a crude estimate because several state programs reported using more than 1 curriculum but did not identify the number of participants taught with each curriculum; researchers estimated these numbers by dividing the total number of program participants by the total number of curricula used by the state program.

In 2011, the most widely used adult curricula were: *Eating Smart • Being Active* developed by Colorado State University and the University of California-Davis (31 programs, 42% of participants); *Eating Right is Basic–4* developed by Michigan State University (9 programs, 11% of participants); *Eating Smart, Moving More* developed by North Carolina State University (8 programs, 12% of participants); *Healthy Food, Healthy Families* developed by Texas A & M University (1 program, 15% of participants); *Eat Right for Life* developed by the University of Florida (6 programs, 8% of participants); and *Cent$ible Nutrition* developed by the University of Wyoming (6 programs, 3% of participants). The curriculum *Healthy Food,*

Healthy Families is used only in Texas but Texas is the single largest program in terms of the number of adult participants.

State EFNEP coordinators were contacted in 2013 to verify the curricula they used to teach adult participants and to obtain copies of the curricula for the content analysis. Two curricula were considered out-of-date because they were last revised before the 2010 DGA were issued: *Eating Right is Basic* (last revised in 2007) and *Eat Right for Life* (last revised in 2005). The researchers did extensive work to contact curriculum developers and states that reported using the out-of-date curricula to discern what curricula were currently being used. The states that reported using these out–of-date curricula in their 2011 year-end report told us they had already switched or were in the process of switching to 1 of the 3 curricula we reviewed. Current information about curricula use indicates these 3 curricula are still the most-used and more states report they are now using 1 of the 3 curricula included in this content analysis. As a result of this investigation, which took several months of communication with EFNEP state programs, the researchers have a high level of confidence that using core lessons from the 3 curricula for this multistate review captured the majority of EFNEP state programs.

The curriculum *Cent$ible Nutrition* was used for the pilot study to test the content analysis instrument. The curriculum remained the fourth most-used nationally with a total of 5 state programs, but the curriculum's reach was small, only 0.7% of participants.

Thus, 3 curricula were chosen for the EFNEP curricula content analysis and numbers of state programs and percent of participants were revised based on 2013 data: *Eating Smart • Being Active* (37 state programs, 51% of participants); *Eating Smart, Moving More* (8 state programs, 12% of participants); and *Healthy Food, Healthy Families* (1 state program, 15% of

participants). These 3 curricula were used in 9 of the 13 largest state programs (69%), 46 of 75 state programs (61%), and an estimated total of 104,638 (78%) of adult participants.

No national data were available to determine the number and kind of supplemental lessons taught in addition to the core lessons from a curriculum that are typically taught to EFNEP participants. Developers of the 3 curricula were contacted to determine the estimated percentage of adults taught from the supplemental lessons. The Texas curriculum *Healthy Food, Healthy Families* has 1 supplemental lesson that was included in the content analysis because it was reportedly taught to 50% of participants. Supplemental lessons from the other curricula were not included in the content analysis due to the reported low use and inability to determine an accurate estimate of use.

Instrument Development and Procedures for the Content Analysis

Researchers used a systematic approach to develop a content analysis instrument and conduct the content analysis, by incorporating reliable and valid methods[20,22,26] and best practices to evaluate curricula.[27] The approach involved 3 overarching steps: (1) develop an instrument to capture all relevant nutrition education content in curricula; (2) test the instrument using an existing curricula currently used by EFNEP state programs; and (3) conduct the content analysis using the tested instrument.

As a first step in the process, a curricula content analysis instrument was developed by the researcher and reviewed by a group of 5 experts in the field of nutrition education curricula development and EFNEP administration (Appendix A). The content analysis instrument captured nutrition-related content compared to the 2010 DGA.[23] Concrete nutrition recommendations (n=23) from the 2010 DGA, including key recommendations and principles, were included in the content analysis instrument (Table 2.1). Two 2010 DGA recommendations, "Choose foods that provide more nutrients of concern: potassium, dietary fiber, calcium, and

Vitamin D" and "Focus on Nutrient Dense Foods" were combined due to overlap in the recommended foods (vegetables, fruits, low-fat dairy products, nuts and seeds) and the potential problems of differentiating between the 2 recommendations. The findings showed educational content about vegetables and fruits were combined within the same lesson at the same depth of instruction. Therefore, the data were combined to track the 2010 DGA recommendation "increase vegetable and fruit intake" within and across curricula.

Based on expert feedback, the instrument also needed to capture 2010 DGA nutrition recommendations missing from lessons. The instrument captured frequencies of educational instruction of nutrition content topics of the 2010 DGA nutrition recommendations as well as the inclusion of additional curricula characteristics, such as whether goal setting was included in the lesson plan. The instrument also included a 5-point Likert scale with response options (strongly agree to strongly disagree) for each content category of curricula characteristics. For example, for the content category *"the lesson plan provides clear nutrition-related learning and behavioral objectives"* a reviewer would mark a response option (*strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree)* on the instrument based on their assessment of the lesson content.

The second step in the process involved testing the content analysis instrument with all lessons from the *Cent$ible Nutrition* curriculum to confirm the instrument would capture all nutrition content presented in a curriculum. Appendix B lists the procedures used to pilot test the instrument. Two independent reviewers tested the instrument and analyzed the data for the content analysis. The reviewers were registered dietitian nutritionists (RDN) who had experience working with low-income adults. Independent testing of the data recording instrument verified that the categories were understood and interpreted the same way by each

reviewer.[28] Independent review of the curricula helped establish interrater reliability for the analyses.[22]

After each lesson was reviewed, the reviewers met to discuss their findings, interpretations of content categories, and make needed changes to the instrument to capture specific nutrition content. The reviewers reached agreement if both of their responses to a content category were *strongly agree* or *agree*, *disagree* or *strongly disagree*, or *neither agree or disagree* in each of the content categories for each lesson in a curriculum. If there was not agreement in a specific content category, the reviewers checked lesson content together and discussed until they reached consensus.

The instrument was significantly revised after each lesson was reviewed to clarify the information that should be collected for each content category and more accurately capture nutrition content. For example, 2010 DGA recommendations were present in lessons with differing degrees of educational instruction. The researchers therefore identified 2 levels of depth of educational instruction to capture nutrition content: information that was briefly mentioned or alluded to in lessons versus more in-depth interactive instruction that included activities to apply the information (Table 2.1). Each revised instrument was tested with subsequent lessons, with a total of 5 revisions, until the reviewers reached agreement about the instrument's completeness and accuracy of capturing nutrition-related content. A score of at least 90% agreement was the criteria used to confirm the instrument identified appropriate content; however, the reviewers discussed any differences and reached 100% agreement of the test review of the *Cent$ible Nutrition* curriculum.

The third step was the content analysis of the 3 curricula using the same 2 independent reviewers and the tested and revised instrument. Appendix B lists the procedures for the multi-

state content analysis. For each curriculum, the independent reviewers met after each lesson was reviewed to discuss their findings and reach consensus.

Curricula Alignment with 2010 DGA

For each lesson for all curricula, the independent reviewers had 100% agreement about the nutrition content. Overall, the 3 EFNEP curricula addressed the majority of the nutrition recommendations of the 2010 DGA[23] (Table 2.1). The information is grouped by the depth of educational instruction for each nutrition recommendation – whether the information was mentioned or alluded to in the lesson versus more in-depth interactive instruction with participant involvement and/or activities.

The frequency of inclusion and the depth of instruction varied across the curricula, both factors ranging from 0-5 occurrences across curricula. For 10 of the 22 nutrition recommendations, the amount of in-depth interactive instruction varied by 2 occurrences; for 6 recommendations, the interactive instruction varied by 3 occurrences.

Nutrition messages with the greatest differences (defined as 3 or more) in the frequency of occurrences of more in-depth interactive instruction across curricula were: increase vegetable and fruit intake; focus on nutrient-dense foods; focus on total calories; monitor food intake; when eating out choose smaller portions; and prepare, serve, and consume smaller portions of food and beverages. Nutrition messages missing from at least 2 of the 3 curricula at a more in depth level of instruction were the recommendations: increase seafood consumption; reduce intake of refined grains, especially those containing solid fats and added sugars; consume alcohol in moderation; keep trans fats as low as possible; and consume less than 300 mg dietary cholesterol. This demonstrates potential differences in nutrition education provided to low-income adults within this national program.

Curricula Characteristics

The researchers collected additional information (Table 2.2) about each curriculum (year developed, number of lessons, lesson format, training materials) and instructional strategies used (learning theories, major concepts presented, instructional materials). All 3 curricula were developed prior to the 2010 DGA and revised to incorporate the updated nutrition recommendations. The 3 curricula included a total of 24 core lessons, with a range of optional lessons. Each of the 3 curricula included clear nutrition-related learning objectives but varied in their content and the amount of nutrition information provided (Table 2.2). All incorporated participant learning materials and food activities with recipes, although the food activities varied in how they were incorporated in lesson plans and the kind of activity (food preparation, food demonstration, or food tasting). The curricula differed in the inclusion of participant enhancements given to reinforce learning and encourage attendance.

Each curriculum developer reported using a dialogue-based, learner centered approach to adult education by incorporating the concepts of *Anchor, Add, Apply, and Away* from Joye Norris' book *From Telling to Teaching*, which outlines an approach to embedding adult learning principles[29] into lesson design.[30] The curricula varied, however, in the reported use of behavior change theory to guide lesson plan development (Table 2.2).[31-33]

Within their own institutions, curricula developers offered ongoing in-depth training for paraprofessionals about how to use their curriculum. The curricula did not, however, inform people using the curricula in other programs or states how to train paraprofessional educators.

Discussion

This report evaluated the type, frequency, and depth of nutrition-related instruction employed by EFNEP, a national nutrition education program for low-income families. All 3 curricula met program requirements by teaching the current 2010 DGA nutrition

recommendations. All curricula employed the majority of the 2010 DGA nutrition recommendations, with differences in the amount of specific nutrition education content in each curriculum. Though nutrition content varied across curricula, there was an overall emphasis on the "Foods and Nutrients to Increase" and "Principles for Promoting Calorie Balance and Weight Management" sections from the 2010 DGA. With the exception of reducing solid fats and added sugars, the curricula did not focus instruction on the majority of the messages from the "Foods and Food Components to Reduce" section of the 2010 DGA, e.g., reduce intake of refined grains, especially if they contain solid fats and added sugar, and keep trans fatty acid intake as low as possible.

This content analysis used a deductive approach, with content components identified using the 2010 DGA. While their methods were different, other published nutrition education content analyses either compared curricula appropriate for children[17] to the 2010 DGA or to dietary changes that align with the 2010 DGA.[19] Content analysis has also been used to identify the degree to which nutrition education content was included in the overall curricula.[18] However, these studies have not evaluated the frequency or depth of instruction of each of the 2010 DGA nutrition recommendations employed across curricula for a national nutrition education program.

These 3 EFNEP curricula are described as being learner-centered, interactive, and using hands-on learning methods for nutrition instruction. For example, the curricula used open-ended questions, food activities, and participant goal setting. The curricula differed, however, in how these instructional strategies were used within lessons. For example, food activities were a part of all 3 curricula but with varying degrees of instruction for the paraprofessional educator, differences in who chose the recipe (incorporated within the lesson, chosen by the supervisor,

chosen by the participants), different amounts of time allotted for the food activity, and different levels of hands-on learning (food tasting, food demonstration, food preparation).

There are several strengths to this content analysis. Best practices recommendations for conducting a nutrition education content analysis were used.[22,27] A thorough approach was taken to identify curricula most-used nationally by EFNEP. The use of independent reviewers experienced in nutrition education for low-income audiences and testing of the data recording instrument with an EFNEP curricula added validity to the content collected.

A limitation of the content analysis is that it does not provide an evaluation of the quality or effectiveness of curricula nor does it evaluate the impact of frequency of addressing each DGA recommendation on program outcomes. The content analysis, however, does specify what nutrition information is being provided to participants in a national nutrition education program. This information can help programs make decisions about curricula content.

Another limitation to the content analysis was the use of curricula to infer how nutrition education instruction was provided to program participants. The content analysis could not assess state programs' fidelity to the curricula. For example, the curricula developers all reported on-going, intensive paraprofessional training about how to teach EFNEP participants within their state using the curricula they developed. There was no information, however, about how other programs use the curricula or the extent of staff training. Comprehensive initial and ongoing training of paraprofessional educators is a critical component to ensuring the effectiveness of nutrition education and fidelity to the curricula.[34] Coordinated training requirements on a national scale might help to ensure consistency across states and improve the effectiveness of the nutrition education provided to EFNEP participants.

Implications for Research and Practice

It is important for researchers, program administrators, and policy makers to know what nutrition education messages are included in a national program that reaches almost 360,000 family members annually. This content analysis reports the type, frequency, and depth of nutrition-related instruction employed across curricula most-used by EFNEP to instruct low-income adults. The findings from this content analysis can be used to strengthen the effectiveness of the nutrition education provided to the low-income population EFNEP serves. The findings can also be used to develop national program evaluation measures.

The reach of these curricula extends far beyond the EFNEP program, as they are used by other nutrition education programs such as the SNAP-Ed[14] and public health programs. The nutrition education content taught through these curricula therefore has broad implications nationally for low-income adults. Further research is needed to determine the most effective number and types of dietary messages to include in nutrition education programs for low-income adults. The content analysis strategies and instrument from this report could be used to compare curricula content to the 2015 DGA after they are published.

Table 2.1 Frequency of Nutrition Recommendations from the 2010 Dietary Guidelines for Americans (2010 DGA) Contained in Adult EFNEP Curricula, by Depth of Educational Instruction.

2010 DGA Nutrition Recommendations[1]	Eating Smart • Being Active Curriculum		Eating Smart and Moving More Curriculum		Healthy Food, Healthy Families Curriculum	
	Depth of Educational Instruction[2]					
	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]
Foods and Nutrients to Increase						
Increase vegetable and fruit intake	2	1	4	4	4	2
Eat a variety of vegetables	1	1	1	2	0	2
Consume at least half of all grains as whole grains; replace refined grains with whole grains	3	1	0	3	3	1
Increase intake of fat-free and low-fat dairy or fortified soy products	2	1	2	3	3	2
Choose a variety of protein foods	1	1	2	1	1	1
Increase seafood consumption; choose seafood in place of some meat and poultry	2	0	2	0	0	1
Replace protein foods higher in solid fats with those lower in fat and calories	2	2	4	2	1	1
Use oils to replace solid fats	0	1	1	0	0	1

2010 DGA Nutrition Recommendations[1]	**Eating Smart • Being Active Curriculum**		**Eating Smart and Moving More Curriculum**		**Healthy Food, Healthy Families Curriculum**	
	Depth of Educational Instruction[2]					
	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]
Focus on nutrient dense foods prepared without added solid fats, sugars, starches, and sodium; Choose foods that provide more potassium, fiber, calcium, and Vitamin D	1	3	4	4	5	1
Principles for Achieving a Healthy Eating Pattern						
Beverages contribute substantially to dietary and calorie intake	1	1	2	1	2	1
Principles for Promoting Calorie Balance and Weight Management						
Focus on total calories; consume foods low in calorie density	0	1	2	5	2	2
Monitor food intake; Use the Nutrition Facts panel on food labels; Also monitor body weight	1	4	2	1	0	3

2010 DGA Nutrition Recommendations[1]	**Eating Smart • Being Active Curriculum**		**Eating Smart and Moving More Curriculum**		**Healthy Food, Healthy Families Curriculum**	
	Depth of Educational Instruction[2]					
	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]
When eating out, choose smaller portions and lower calorie options; Cook and eat more meals at home	1	2	3	5	2	2
Prepare, serve, and consume smaller portions of food and beverages	1	0	5	2	0	3
Eat a nutrient dense breakfast; encourage children and adolescents to eat a nutrient dense breakfast	1	2	1	0	1	2
Foods and Food Components to Reduce						
Reduce sodium intake to less than 2,300 mg (1,500 for special groups)	2	1	1	2	2	1
Consume less than 10% of calories from saturated fats; replace with mono- and polyunsaturated oils	2	1	1	0	1	1

2010 DGA Nutrition Recommendations[1]	Eating Smart • Being Active Curriculum		Eating Smart and Moving More Curriculum		Healthy Food, Healthy Families Curriculum	
	Depth of Educational Instruction[2]					
	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]	Information Mentioned[3]	Interactive Instruction Provided[4]
Consume less than 300 mg per day of dietary cholesterol	1	0	0	0	1	1
Keep trans fat intake as low as possible; limit partially hydrogenated oils and other solid fats	2	0	0	0	1	1
Reduce intake of solid fats and added sugars	3	2	1	3	1	1
Reduce intake of refined grains, especially if they contain solid fats, added sugars, and sodium	2	0	0	0	1	0
If alcohol is consumed, drink in moderation – 1 drink for women, 2 drinks for men	0	0	0	0	1	0

EFNEP indicates the Expanded Food and Nutrition Education Program.
[1]Condensed version of the 2010 Dietary Guidelines for Americans nutrition recommendations. [2]Frequency of educational instruction of the 2010 Dietary Guidelines for Americans nutrition recommendations in curricula by depth of instruction, captured once per lesson. [3]Information is briefly mentioned or alluded to in the lesson or included in a recipe. The information is not included in the objectives of the lesson and does not include activities to apply the information. [4]New information is presented in the lesson and includes a group discussion or kinesthetic activity to apply the information. The new information is presented with a rationale and/or examples. The information is included in the objectives of the lesson.

Table 2.2 Characteristics of Adult Nutrition Education Curricula Used Nationally by the Majority of EFNEP State Programs.			
Curriculum Characteristics	**Eating Smart · Being Active Curriculum**	**Eating Smart and Moving More Curriculum**	**Healthy Food, Healthy Families Curriculum**
Year developed	2007	2007	2010
Year of last revision	2011	2011	2012
Number of core lessons	8	9	7
Number of optional lessons	3	12	1
Expected length of time to teach each lesson	1 to 1 ½ hours	45 minutes to 1 hour	1 to 1 ½ hours
Expected class size	12 or fewer	Not listed	Ideal is 15; range from 15 to 25
Reported behavior change theories used to develop curriculum	Adult learning theory Social cognitive theory	Stages of Change Model	None
Reported strategy used to present nutrition content in curriculum	4 A's (Anchor, Add, Apply, and Away) approach for adult learners	4 A's (Anchor, Add, Apply, and Away) approach for adult learners	4 A's (Anchor, Add, Apply, and Away) approach for adult learners
Participant goal setting activities	Gives participants choice in setting personal goals for each lesson. Follow-up on goals at the next lesson.	Gives participants choice in setting personal goals for each lesson. Discussion of potential barriers to achieving goals and problem-solving to overcome barriers. Follow-up on goals at the next lesson.	Participant goals are assigned.
Visual aids used to reinforce learning	Session materials and posters	PowerPoint slides	Session materials and posters

Curriculum Characteristics	Eating Smart Being Active Curriculum	Eating Smart and Moving More Curriculum	Healthy Food, Healthy Families Curriculum
Participant handouts provided at each class that support lesson objectives?	Yes	Yes	Yes
Lessons include participant enhancements that support lesson objectives?	All lessons list suggested enhancements	3 lessons list suggested enhancements	4 lessons list suggested enhancements
Lessons include food activities?[a] Food preparation (FP) Food demonstration (FD) Food tasting (FT)	Yes 1st, 2nd, 7th and 8th lessons – FT All remaining lessons – FP or FD and FT. Average time allotted to taste, prepare or demonstrate and discuss recipes was 15 minutes.	Yes 1st lesson – FT 2nd lesson – FD All remaining lessons – food preparation incorporated into lesson plan.	Yes FD incorporated into all lessons. Time allotted to demonstrate and taste. Recipes were missing from lessons.
Lesson materials free of sponsor bias?	Yes	Yes	Yes

EFNEP indicates the Expanded Food and Nutrition Education Program.
[a]Food preparation (FP) activities include participants in the preparation, cooking, and tasting of food. Food demonstration (FD) activities include food prepared by educators while participants observe. Food tasting (FT) activities include foods prepared outside of class time by educator, with participant tasting during class.

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CHAPTER 3. NUTRITION RECOMMENDATIONS FROM THE US DIETARY GUIDELINES CRITICAL TO TEACH LOW INCOME ADULTS: EXPERT PANEL OPINION[2]

Introduction

Nutrition education is critical for low-income adults as a means to address the poor diet quality and nutritional status of this population.[1,2] Diet quality is inversely associated with development and progression of chronic diseases[3-5] and excess adiposity.[6] Low-income adults have elevated rates of chronic diseases, such as diabetes, cardiovascular diseases and obesity, and shorter life expectancies compared to higher-income adults.[7] Low-income adults experience lower intakes of key foods and nutrients that contribute to health, such as fruits and vegetables, whole grains and low-fat dairy.[8] Many low-income families also exceed recommended intakes of sweets, sugar-sweetened beverages, snack foods and processed meats.[1]

Low-income adults have varied levels of knowledge regarding nutrition, health, cooking skills, what constitutes a healthy diet,[9] and would benefit from a more accurate understanding of nutrition and healthy eating to improve overall diet quality.[10] To reduce confusion about healthy eating, experts recommend state and federal nutrition education programs have consistent, targeted nutrition messages that align with national recommendations.[11]

Prioritizing nutrition education content and messages in a coordinated manner for large nutrition education programs is a necessary and effective strategy to increase consumption of targeted foods in low-income families.[12] Due to multiple recommendations contained in national

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nutrition guidelines, however, educators may emphasize different nutrition messages to varying degrees. For example, educators may include cooking activities in each class that demonstrate how to incorporate fruits and vegetables in meals and snacks while other educators may focus on teaching cup-equivalent fruit and vegetable servings. A recent study found variability in the frequency (how many times a topic was included) and depth of nutrition education content (whether the topic was just mentioned or included more in-depth experientially-based learning activities) contained in different curricula used nationally by the Expanded Food and Nutrition Education Program (EFNEP), targeting low-income families.[13] This report builds on these findings by identifying consistent nutrition messages that are most important to teach low-income adults.

The purpose of this study was to assemble a panel of nutrition experts to prioritize which nutrition recommendations from the 2010 Dietary Guidelines for Americans (2010 DGA)[14] were most critical to teach low-income adults, to improve health and reduce the development of diet-related chronic diseases. A prioritized set of nutrition recommendations across EFNEP programs will guide the development of curricula and evaluation tools to assess the effectiveness of EFNEP on a national level. The use of prioritized nutrition messages may strengthen this nutrition education program through the use of consistent nutrition content across the country.

EFNEP Description

EFNEP is a nutrition education program targeting low-income families in all 50 states and US territories through 75 Land Grant University Extension programs.[15] EFNEP strives to improve the health status of low-income families and reduce chronic disease risk. In 2015, EFNEP enrolled 119,351 adults and reached over 340,000 family members indirectly.[15] The majority of EFNEP adult participants receive eight to ten, one-to-two hour group lessons over a two-to-three month period.[16] EFNEP program guidelines stipulated that the Dietary Guidelines

for Americans (DGA) will be the basis for nutrition content.[17] EFNEP is challenged with meeting program requirements to teach not just nutrition but also physical activity, food safety, food security, and food resource management within a limited number of classes.

Expert Panel Selection

A diverse group of national nutrition experts were selected in May 2014 to prioritize nutrition recommendations from the 2010 DGA that are critical to teach low-income adults. At the time the panel was convened, the 2010 DGA were the most current national nutrition recommendations. Nutrition content taught to EFNEP participants typically focuses on concrete recommendations, which were more fully represented through the "Key Recommendations" section of the 2010 DGA, which the experts prioritized.

Expert panel members were selected because they collectively possessed the professional experience needed to prioritize the DGA that should be taught nationally to low-income adults. Panel members had specific expertise in the following areas: serving on the 2010 DGA Advisory Committee, developing current national consumer nutrition messages from the DGA, evaluating and conducting national nutrition research related to the prevention of chronic diseases and underserved populations, leading nutrition education programs targeting low-income adults, training paraprofessionals in nutrition content and appropriate teaching methodologies, and/or EFNEP administration. Five of the six panel members were Registered Dietitian Nutritionists (RDNs). Panel members received an honorarium. This study was deemed exempt by the Colorado State University Institutional Review Board.

Methods for Prioritizing Nutrition Recommendations

The researchers used a modified Delphi Technique, by using a purposeful sample of experts and a systematic method for building consensus among those experts through structured feedback, to prioritize the DGA nutrition messages for low-income adults.[18] All expert panel

members received a packet of materials and participated in two conference calls from July through August 2014 (Figure3.1). The packet of materials included a project overview and timeline (Appendix C), expert panel biosketches, nutrition recommendations from the 2010 DGA (Appendix D), and a rating form for panel members to list the DGA they determined should be taught nationally to low-income adults, grouped by priority category: "critical to include," "good to include" and "nice to know" (Appendix E).

The purpose of the first conference call was to introduce the expert panel and discuss the project tasks, timeline, and potential outcomes. After the first call, experts returned their individual list of prioritized 2010 DGA nutrition recommendations to the researchers, who de-identified and summarized the recommendations into a tabular format. The table included DGA nutrition recommendations, listed by frequency of expert opinion by priority category and expert comments related to the nutrition recommendations. The prioritized nutrition recommendations were sent to panel members prior to the second conference call.

The purpose of the second conference call was to review and discuss common themes and differences among the expert's individually prioritized DGA recommendations. One of the researchers with expertise in leading focus groups facilitated the call. The DGA nutrition recommendations were discussed by the frequency in which they were grouped, beginning with the highest frequency of experts choosing guidelines as "critical" to teach, followed by those with lower "critical" frequencies. Differences were discussed and reconciliation was reached for any discrepancies. This led to a larger discussion of which overall messages were most important to teach a low-income audience, with the experts coalescing around two overarching messages and 8 specific messages. The expert panel provided confirmation of their consensus recommendations at the end of the call in response to a summary of the discussion provided by

the researchers. The second call was recorded and transcribed to capture all of the discussion. A report was drafted after the call summarizing the collective opinion. All members reviewed the report to ensure it fully represented each expert's opinions and perspectives of the discussion and recommendations.

Nutrition Recommendations

The expert panel reached consensus on two overarching and eight specific recommendations that incorporated numerous specific 2010 DGA recommendations into concrete, actionable messages (Table 3.1). The 2015-2020 Dietary Guidelines for Americans (2015-2020 DGA) were released in December 2015,[19] after the expert panel convened. However, the recommendations are supported by and concur with the 2015-2020 DGA. The table lists how expert recommendations compare to both the 2010 and 2015-2020 DGA.

Overall, the recommendations focus on consuming nutrient dense foods, cooking and eating more meals at home to improve diet quality and address excess calorie intake, and decreasing intakes of low-nutrient foods. The majority of the recommendations include instructional approaches that complement an overall eating pattern, such as focusing on simple meal- and food-based rather than nutrient-based messages.

Most of the recommendations considered not as critical to teach low-income adults came from the *Food Components to Reduce* section of the 2010 DGA: reduce sodium, saturated fat, dietary cholesterol, trans fats, solid fats and added sugars, and alcohol.[14] This was due to the expert panel's focus on foods rather than food components (solid fats and added sugars) or nutrients (sodium). The experts also considered not as critical to teach from the 2010 DGA, due to the use of jargon: replace protein foods high in solid fats with those lower in solid fats and calories, use oils to replace solid fats where possible, and eat a nutrient dense breakfast.[14] These food component-based nutrition recommendations, however, are addressed by selecting a dietary

pattern aligned with expert panel recommendations, e.g., eating a nutrient-dense meal pattern higher in dietary quality has correspondingly lower levels of sodium, added sugars and saturated fats, and higher ratios of polyunsaturated to saturated fat.[20]

Expert panel recommendations complement the 2015-2020 DGA focus on teaching healthy eating patterns as a whole rather than focusing on individual nutrients or foods in isolation[19] (Table 3.1). While the 2015-2020 DGA do not directly address the recommendation to "Cook and eat more meals at home," cooking at home is identified in multiple places in the 2015-2020 DGA as a means to increase nutrient density and reduce saturated fat and sodium.

Two panel recommendations "Prepare, serve, and consume smaller portions of food and beverages" and "Reduce intake of foods such as chips and crackers and sweets" were addressed in the 2015-2020 DGA Key Recommendations implicitly using more general language that discussed adhering to appropriate calorie levels and reducing saturated fats and added sugars. Rather than using the general language of the DGA, the expert recommendations focus on concrete food-based nutrition messages that low-income adults can better understand and RDNs and nutrition educators can incorporate into nutrition education instruction. One recommendation from the 2010 DGA, "Identify key points on the Nutrition Facts panel," was not included in the 2015-2020 DGA.

Implications for National Nutrition Education Programs

The nutrition recommendations for low-income families may have major national implications for:

- *EFNEP nutrition education curriculum content.* The information will help guide development and revision of EFNEP curricula.

- *EFNEP program evaluation criteria.* The program uses a pre/post questionnaire to assess changes in nutrition-related behaviors. The expert panel recommendations will guide the selection of evaluation content and questions to assess the program's effectiveness among adults through the development of a new instrument.
- *Other nutrition programs that serve low-income adults.* For instance, the Supplemental Nutrition Assistance Program-Education (SNAP-Ed) serves thousands of limited resource families annually[21] and often use similar curricula and/or EFNEP nutrition behavior evaluation tools. Specifically, Colorado State University's Extension program reported 24 state-wide SNAP-Ed programs purchased their EFNEP curriculum *Eating Smart • Being Active* in 2015.[22]

Implications for RDNs and Nutrition Educators

There is an urgent need for RDNs to implement dietary interventions for low-income adults to improve diet quality, thus reducing the progression of chronic diseases such as obesity, cardiovascular disease, cancer, and type 2 diabetes.[23] This research provides a prioritized set of nutrition education content from which nutrition professionals can develop nutrition interventions for low-income adults. National nutrition experts identified a set of concrete nutrition recommendations from the 2010 DGA that complement the 2015-2020 DGA key recommendations, focusing on an overall healthy eating pattern that provides food-based rather than nutrient-based messages. The nutrition recommendations can be used to guide individual, group, community, policy, and system-wide nutrition education interventions and evaluation tools to affect nutrition behavior change among low-income families.

Conclusions

The present study describes the development of a set of nutrition recommendations from the 2010 DGA that complement the 2015-2020 DGA, that can be used to educate low-income adults. Competing demands placed on low-income adults require simple, focused nutrition messages to positively impact food choice.[24] Experts developed the set of recommendations to maximize the impact of nutrition education on health status. The experts considered the time and resource constraints which limit the amount of nutrition education content that can be taught to low-income adults. RDNs can use the nutrition recommendations to develop and evaluate nutrition interventions for low-income adults. The researchers recommend EFNEP use these nutrition recommendations to guide the development of nutrition education curricula and national program evaluation tools.

Table 3.1. Nutrition messages critical to teach low-income adults from the 2010 US Dietary Guidelines (2010 DGA), based on expert panel opinion, with comparison to the 2015-2020 US Dietary Guidelines (2015-2020 DGA).

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
Overarching recommendations			
1. Focus on nutrient dense foods including vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood and fish, lean meats, poultry, eggs, beans and peas, and nuts and seeds.	- These foods supply nutrients of concern that are under-consumed by low-income adults: potassium, dietary fiber, calcium, magnesium, and Vitamins A, D, E, and C. - This approach provides the foundation for an overall eating pattern for EFNEP participants. - EFNEP should focus on teaching food-based concepts (add fresh, frozen or canned peaches without sugar to meals and snacks) rather than nutrient-based (peaches are high in potassium) or food component-based concepts (avoid peach products with solid fats and added sugar) that achieve the desired nutrient density while minimizing calorie density. Use simple terms without using jargon.	- Focus on total calories; consume foods low in calorie density.[3] - Focus on nutrient dense foods prepared without added solid fats, sugars, starches, and sodium; choose foods that p2rovide more potassium, fiber, calcium, and vitamin D.[4]	- Follow a healthy eating pattern across the lifespan.[7] - Focus on variety, nutrient density, and amount.[7] - Limit calories from added sugars and saturated fats and reduce sodium intake.[7] - Shift to healthier food and beverage choices.[7] - A healthy eating pattern includes:[8] • A variety of vegetables from all subgroups • Fruits, especially whole fruits • Grains, at least half are whole grains • Fat free or low-fat dairy or soy products • A variety of protein foods • Oils - A healthy eating pattern limits: • Saturated fats and trans fats, added sugars, and sodium

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
2. Cook and eat more meals at home.	- The behaviors of portion control and how to prepare lower calorie options can be emphasized within teaching how to prepare meals at home. - Fosters better understanding of how food is prepared and how to choose the ingredients that go into making a meal. - Cooking and eating more meals at home saves money and models healthy eating behavior/habits. - Emphasize healthy cooking methods over frying.	- When eating out, choose smaller portions and lower calorie options; cook and eat more meals at home.[3]	- To shift from solid fats to oils, use oils to replace solid fats when cooking.[9] - Reduce saturated fats by changing ingredients in mixed dishes to increase the amounts of vegetables, whole grains, lean meat, and low-fat cheese.[9] - Reduce sodium intake by eating at home more often, cooking foods from scratch, limiting "instant" products, and flavoring foods with herbs and spices instead of salt.[9]
Specific recommendations			
1. Increase vegetable and fruit intake. Eat a variety of vegetables.	- These foods fit into the overarching concept of focusing on nutrient dense foods to improve diet quality and promote calorie balance and weight management. - Teach appropriate consumer messages related to increasing vegetable and fruit intake (make half your plate fruits and vegetables, choose two	- Increase vegetable and fruit intake.[4] - Eat a variety of vegetables.[4] - Focus on total calories; consume foods low in calorie density.[3] - Focus on nutrient dense foods prepared without added solid fats, sugars, starches, and sodium.[4]	- Follow a healthy eating pattern across the lifespan.[7] - Focus on variety, nutrient density, and amount.[7] - Consume more fruits, especially whole fruits.[8] - Consume more vegetables and a variety of vegetables from all subgroups.[8]

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
	different vegetables for dinner, make lunches with a fruit and vegetable choice, add fruit to cereal or yogurt at breakfast).		
2. Consume at least half of all grains as whole grains.	- Whole grains fit into an overall eating pattern focusing on nutrient dense foods, and are more easily incorporated into a healthy eating pattern when meals are prepared at home. - The concept of whole grains is challenging to teach. The focus should be on food-based messages such as the definition of the grain, what foods contain grains, and how to look for whole grains in foods (whole grain should be the first ingredient—or the second ingredient, after water). - Teach concepts including: 100% whole grain bread, pasta, breakfast cereals (without high sugar content) brown rice, etc. Although not a food-based message, teaching fiber content along with a whole grain message may be helpful.	- Consume at least half of all grains as whole grains; replace refined grains with whole grains.[4]	- Make half of all grains consumed whole grains.[8]

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
3. Increase intake of low-fat dairy or fortified soy products.	- These foods fit into a nutrient-dense eating pattern. Preparing food at home allows for incorporation of low-fat dairy products into meals and snacks. - Low-fat milk (unsweetened) and plain low-fat yogurt should be encouraged as having the best nutrient profiles in the dairy group. If milk intake is low, increasing intake regardless of whether milk is whole or low-fat should be a priority for educational efforts. - Soy milk is an appropriate alternative to cow's milk if fortified with calcium and vitamin D and has equivalent amounts of protein. - Cheese consumption is high in the U.S., therefore the emphasis should be on limiting portion size.	- Increase intake of fat-free and low-fat dairy or fortified soy products.[4]	- Consume more dairy products and/or fortified soy beverages in nutrient dense forms.[8]
4. Eat a variety of protein foods, including beans, legumes, nuts and seeds, eggs, seafood, and lean	- Eat more plant sources of protein and teach that replacing animal protein at meals with plant protein on a daily basis is acceptable and potentially helpful to improve overall nutrient density of the	- Choose a variety of protein foods.[4] - Replace protein foods higher in solid fats with those lower in fat and calories.[4] - Increase seafood consumption; choose seafood in place of	- Increase variety in protein foods and make more nutrient-dense choices, including seafood, lean meats and poultry, eggs, legumes, and nuts and seeds and soy

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
meats and poultry.	diet. - Plant protein sources such as dried beans and peas help stretch food dollars while providing high-quality protein, fiber, potassium, folate, and other nutrients. - Teach how to incorporate less expensive sources of seafood at least twice a week. These include tilapia, canned salmon, tuna, or sardines.	some meat and poultry.[4]	products.[8]
5. Develop skills in reading the Nutrition Facts panel to identify portion size and calorie intake for packaged foods.	- Basic portion monitoring is important to control calorie intake. - The Nutrition Facts panel offers useful information, especially for calorie balance, fiber, sodium, and sugar intake, to identify packaged foods with greater nutrient density, but does not address overall nutrient intake.	- Monitor food intake; use Nutrition Facts panel on food labels.[3]	- Nutrition Facts panel not included in the 2015-2020 DGA.
6. Prepare, serve, and consume smaller portions of food and beverages.	- Portion size is a fundamental problem contributing to excessive calorie intake leading to the rise in obesity. - It is important to teach appropriate portions when eating at or away from home.	- When eating out, choose smaller portions and lower calorie options; cook and eat more meals at home.[3] - Prepare, serve, and consume smaller portions of food and beverages.[3]	- Consume a healthy eating pattern that accounts for all foods and beverages within an appropriate calorie level.[8]

Recommended Nutrition Messages	Rationale/Application of Nutrition Messages	2010 DGA nutrition recommendations[1]	2015 – 2020 DGA nutrition recommendations[2]
7. Reduce intake of foods such as chips and crackers and sweets such as cookies, cakes, pie, muffins, donuts, and pastries.	- These foods are low in nutrient density and high in calories, saturated fats, and added sugars. - A food based approach to decreasing calories from refined grains made with solid fats, added sugars and salt is preferred rather than teaching technical concepts or nutrients. Many processed foods contain significant amounts of sugar, fat, and salt. - Teach how to replace these foods with other snack foods and how to cook healthier versions of baked goods.	- Reduce intake of solid fats and added sugars.[5] - Reduce intake of refined grains, especially if they contain solid fats, added sugars, and sodium.[5]	- Limit saturated fats, trans fats, added sugars, and sodium.[8] - Consume less than 10% of calories from added sugars and saturated fats, and less than 2,300 mg of sodium.[8]
8. Limit the intake of sugar-sweetened beverages.	- These beverages contribute substantially to calorie intake without providing nutrients and are therefore low in nutrient density. - Water or low-fat milk should be encouraged, especially with meals.	- Beverages contribute substantially to dietary and calorie intake.[6]	- Reduce added sugar consumption to less than 10% of calories.[8]

[1]Condensed version of the 2010 DGA nutrition recommendations. The 2010 DGA were in effect at the time the expert panel was convened.
[2]Condensed version of the 2015 DGA nutrition recommendations. The 2015-2020 DGA were released after the expert panel was convened, and are included here for comparison to the 2010 DGA and expert panel recommendations.
[3]From the *Principles for promoting calorie balance and weight management* section of the 2010 DGA.

[4]From the *Foods and nutrients to increase* the section of the 2010 DGA.
[5]From the *Foods and food components to reduce* section of the 2010 DGA.
[6]From the *Principles for achieving a healthy eating pattern* section of the 2010 DGA.
[7]Overarching guideline from the 2015 DGA.
[8]Key recommendation (a component of a healthy eating pattern) from the 2015 DGA.
[9]From the *Shifts needed to align with healthy eating patterns* section from the 2015 DGA.

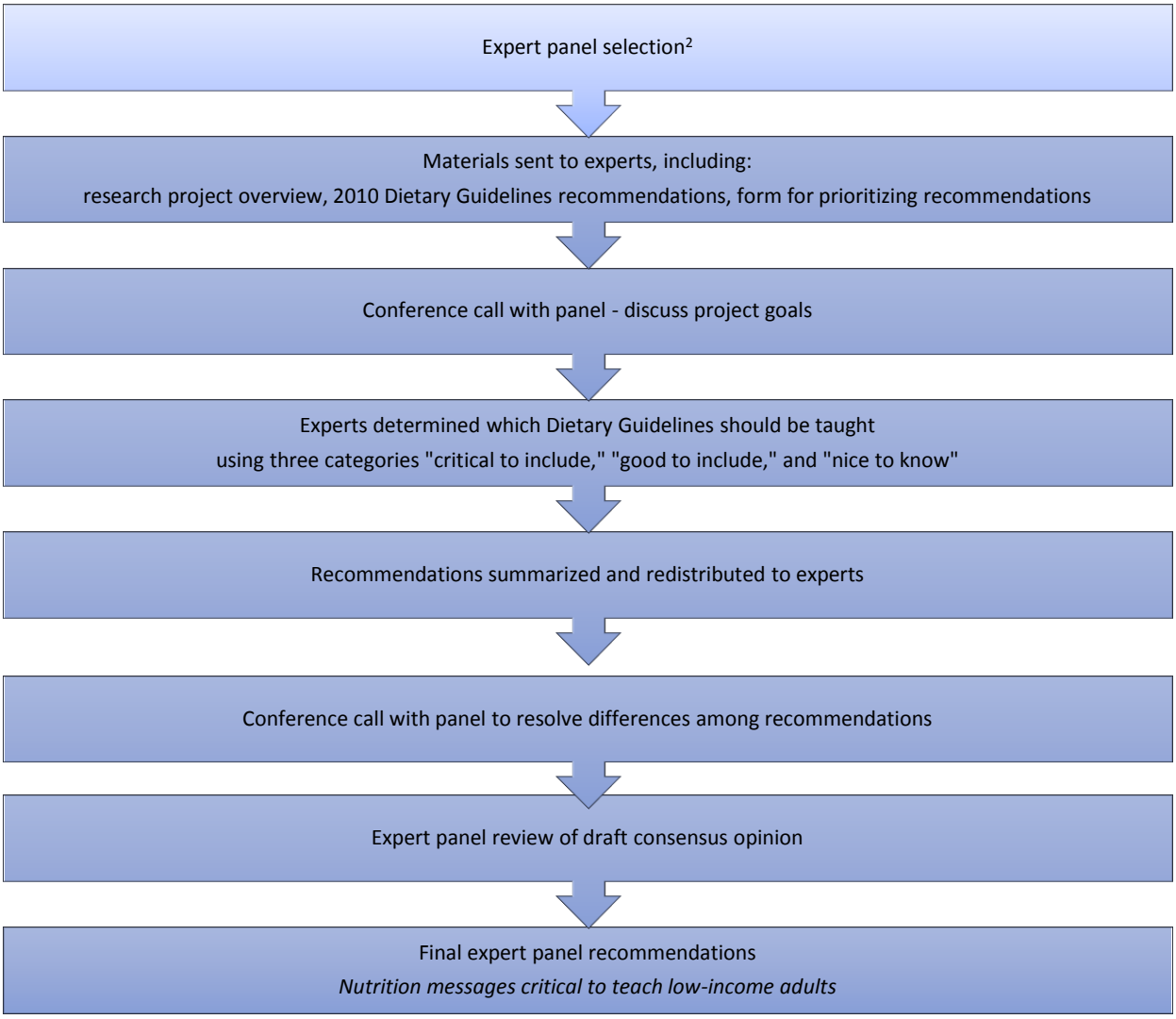

Figure 3.1. Protocol to determine the US Dietary Guidelines nutrition recommendations[1] critical to teach low-income adults.

[1]US Department of Agriculture. Dietary Guidelines for Americans, 2010. http://www.dietaryguidelines.gov.
[2]Expert panel members (5 of 6 were RDNs) had expertise in: serving on the 2010 DGA Advisory Committee, developing current national consumer nutrition messages from the DGA, nutrition research related to chronic disease prevention and underserved populations, and/or directing nutrition education programs targeting low-income adults, including EFNEP.

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CHAPTER 4. METHODOLOGY FOR DEVELOPING A NEW EFNEP FOOD AND PHYSICAL ACTIVITY BEHAVIORS QUESTIONNAIRE[3]

Introduction

Program evaluation is an essential component of nutrition education interventions,[1] assessing the extent to which a program produces specific results and impacts.[2] Nutrition education evaluation tools should address program objectives and undergo testing to confirm appropriateness.[1,3] Extensive work is required to develop and test the evaluation tool with the target population to have adequate psychometric properties, including reliability and validity.[3]

The Expanded Food and Nutrition Education Program (EFNEP) is a national nutrition education program that works with low-income families to improve their food-related behaviors.[4] Policy makers have directed federally-funded nutrition education programs, such as EFNEP, to evaluate their impact on improving healthful eating behavior and preventing obesity.[5] The majority of nutrition education programs, however, lack consistent evaluation tools that accurately measure program impacts on diet, food choice, and physical activity behaviors.[5] Thus, there is a need to develop evaluation tools to assess the impact of national nutrition interventions targeting low-income families.[6]

Developing evaluation tools for use with low-income adults requires sensitivity to the potential challenges of low-literacy skills and the multiple cognitive steps required to accurately recall foods eaten or health behaviors.[7] Due to lower respondent burdens and administration costs, in comparison to other methods, questionnaires can be appropriate evaluation tools.[8]

[3] Submitted for publication to the Journal of Nutrition Education and Behavior as a Research Methods paper.

The goal of EFNEP is to help low-income families improve nutritional status to reduce health disparities associated with hunger, malnutrition, poverty, and obesity.[9] To fulfill this goal, EFNEP interventions are delivered as a series of classes to improve behaviors in the areas of nutrition/diet quality, physical activity, food safety, food resource management, and food security.[9] A 10-item questionnaire, developed in 1997, is used nationally by EFNEP but does not comply with current program requirements and existing nutrition and physical activity guidelines[10,11] As a consequence, there is a need to develop an updated EFNEP national evaluation tool.

The purpose of this paper is to describe methods for the development of a valid multi-domain food and physical activity behaviors questionnaire (FPAB Questionnaire) for EFNEP. The EFNEP FPAB will be administered to all EFNEP adult participants, approximately 120,000 annually,[12] most of whom are female (86%), and Hispanic (41%), White non-Hispanic (27%), or Black non-Hispanic (23%).[13]

The questionnaire will align with national EFNEP administration requirements, which include: 1) a paper questionnaire format administered pre- and post- intervention, 2) a limited number of questions to reduce participant and staff burdens, and 3) question wording that meets the needs of low-literacy adults. By limiting the number of questions per domain to accommodate EFNEP's desire to minimize participant burden, the ability to create scales with internal consistency within each domain is threatened.[14] This challenge is one example of the compromises necessary to achieve the national program's desire for an evaluation instrument that assesses specific behaviors while limiting participant burden.

Methods used to develop and test the FPAB Questionnaire need to be documented for several reasons. Because EFNEP is mandated to evaluate and report program impact,[15] to have

confidence in reported outcomes, the validation and appropriate application of evaluation instruments must be established. The FPAB Questionnaire has implications that extend beyond EFNEP, as other nutrition education programs or interventions serving low-income adults may adopt this validated questionnaire.[16] The methods may also be used as a model for developing evaluation tools for other national nutrition education programs.

This paper reflects the efforts of 2 national evaluation committees[17]: 1) the US Department of Agriculture, Agriculture Experiment Station (USDA-AES) multistate research project (NC2169: EFNEP Related Research, Program Evaluation and Outreach,) and 2) the EFNEP National Behavior Checklist Workgroup.

Methods

The FPAB Questionnaire will include items that evaluate 5 health behavior domains the program is required to teach participants: diet quality, physical activity, food safety, food security, and food resource management. Five multistate research teams (1 for each domain) from different regions of the US will coordinate protocols to develop and test questions (Table 4.1). Team leaders will be members of the EFNEP national evaluation committees and university faculty, many of whom direct their state's EFNEP. Institutional Review Board approval will be obtained by participating institutions in the following states: Colorado, Florida, Kansas, Kentucky, Maine, Nevada, New Jersey, Oklahoma, South Carolina, Pennsylvania, Tennessee, Virginia, and Washington. The developed questions will be tested using a convenience sample of English-speaking EFNEP eligible women from states in the 4 EFNEP regions in the US (Western, North Central, Eastern, and Southern) and from the 3 primary racial/ethnic groups (Hispanic, Black, and White).

To address the challenges of coordinating the research and ensuring consistency using teams located in different universities and states, research teams will implement a 5-stage

systematic process to develop the questions,[18] which uses established health assessment and survey design methodology.[14,19,20] Table 4.2 describes the process to develop questions, and how each stage relates to establishing reliability and validity of the FPAB Questionnaire. Steps to ensure research process coordination will include: 1) annual face to face and virtual meetings, 2) monthly phone calls, and 3) written protocols with detailed descriptions of any variations.

Stage 1: Domain Selection/Confirmation

Health domains included in the questionnaire are based on EFNEP core content requirements.[15] Each team will use a systematic approach (standardized procedures and independent review of curricula using a tested tool) to review EFNEP adult curricula to confirm content or identify missing content as compared with national program guidelines or expert recommendations. Methodology to determine the most widely used adult EFNEP curricula and the systematic content analysis process have been reported previously.[21]

Due to the high number of nutrition-related concepts from the Dietary Guidelines for Americans (DGA)[22] and limited class time to teach these concepts, the diet quality research team will prioritize which DGA concepts are deemed most important to teach low-income adults. Two expert panels will be engaged. One will consist of 6 national nutrition researchers with expertise in chronic diseases, nutrition education targeting low-income adults, and development of the DGA (DGA expert panel); the other will be comprised of EFNEP state coordinators and other researchers (n = approximately 20) involved with the USDA-AES multistate research project. The latter group will prioritize the nutrition concepts most appropriate to evaluate, from among those prioritized by the DGA expert panel.

Stage 2: Question Generation

Research teams will identify relevant behavioral assessment questions from multiple sources, focusing on questionnaires developed and validated for a low-income population. The

sources will include the research literature, government websites and documents, and questions currently approved for EFNEP use. Questions will be compared to gold standard assessments of behavior constructs for each domain, as well as curricula content to confirm that curricula match the prioritized topics. Gold standard constructs include the DGA (diet quality),[22] the 2008 Physical Activity Guidelines for Americans (physical activity),[11] the DGA Food Safety Principles (food safety)[22] and the US Department of Agriculture Household Food Security Module (food security).[23] There are no identified gold standards for the food resource management (FRM) domain, therefore, a FRM expert panel consisting of 10 faculty from the national EFNEP FRM workgroup[17] and family finance specialists will confirm key concepts from the research literature and EFNEP curricula. Key concepts may relate to menu planning, shopping, food preparation and budgeting.

After questions are identified or drafted, each research team will convene a content analysis panel consisting of 6-8 EFNEP program administrators from different regions of the US to review and assess the questions. Panelists will be sent a packet that includes: 1) the questions, 2) a rating form, and 3) instructions for rating each question in terms of representativeness to specific domain content and clarity of wording for low-literacy adults. Panelists will be asked to make recommendations to add, delete or modify questions or response options. Based on panel feedback, questions and response options will be revised before cognitive testing.

Stage 3: Question pretesting

Face validity for questions developed in Stage 2 for each of the 5 domains will be determined through cognitive testing. Cognitive interviews will be coordinated by each research team to test the questions and response options with Hispanic, Black, and White EFNEP participants in different regions of the country. Cognitive interviews are a form of pretesting using one-on-one structured interviews with target audience members to gain insights about how

questions are understood and interpreted.[24] The goal is to develop questions that are interpreted as intended. Target audience members will be asked to read and respond to questions and to suggest wording to improve ease of reading, comprehension, and relevance to decrease errors in interpretation.[25]

Cognitive interview data will be collected before or during the normal EFNEP class intervention. All interviewers will be trained via webinar. Scripted probing questions will be used to obtain detailed information relevant to each question and response option to ensure consistency across interviews.[24] Participants will be compensated for their time.

For each health behavior domain, research teams will take detailed notes from each interview or produce typed notes from audio-recorded interviews. Findings across interviews will be systematically summarized to identify themes and dominant trends[26] which will be used to revise questions and response options. Revised questions and response options will be retested through additional cognitive interviews. Revisions and retesting will continue until questions are easily understood and interpreted as intended. Items and response options resulting from cognitive interview testing will be used for stages 4 and 5 (reliability and validity testing).

Stage 4: Reliability testing

The test-retest method will be used to assess temporal stability reliability of the questions by giving the questionnaire to the same individuals on 2 separate occasions without an intervention, but with enough time between for individuals to forget their initial responses. Scores from the first administration will be correlated with those from the later administration.[14] Since many low-income families receive regular monthly federal food assistance benefits that could affect food availability and dietary intake, the retest will be scheduled one month after initial testing to control for this potential source of measurement error.[27]

Questions from all domains will be combined into a single questionnaire and tested in the 4 EFNEP regions of the country. Two states from each region (8 total) will recruit a convenience sample of 30 Hispanic, Black, and White low-income females with young children who are eligible for, but not enrolled in, EFNEP classes. Participant responses will be assigned a numeric score for each item, and the scores from test and retest will be matched for analyses. Reliability will be determined using paired t-tests, difference scores from retest to test, Spearman's correlations and intraclass correlation coefficients.[28] Cronbach alpha coefficients will reflect the internal consistency of questions within each domain. Questions with significantly correlated responses ($p \leq 0.05$ and correlation r values ≥ 0.5) will be considered for the FPAB Questionnaire.[29]

Stage 5: Construct validity testing

Construct validity, the last stage in the development of the questionnaire, will be assessed by comparing scores from items in each health behavior domain to established gold standard measures of the behaviors.[30] For each domain, testing will be done using convenience samples of volunteer participants recruited from states in each EFNEP region of the country. Cash incentives will be provided.

Diet assessment question responses will be coded and correlated to the mean intake from 3, 24-hour telephone administered food recalls. Multiple 24-hour food recalls are widely used and considered valid dietary assessment measures of usual, recent intake,[31] though cost- and time-prohibitive, for regular evaluation of nutrition education programs.[32] Food recalls will be collected from the same EFNEP participants within the same week (2 week days and 1 weekend day) of either the first day of classes (program enrollment) or last day of classes (program completion). Food recall data will be coded to capture frequency of intake for the

foods/beverages and behaviors corresponding to the diet assessment questions. Eighty EFNEP participants (10 participants from 8 states) will be recruited.

Responses from the food security questions collected in EFNEP classes will be compared to those of the 18 item US Household Food Security Survey Module[33] within the same week. The latter will be collected through phone interviews with approximately 125-150 participants in 6-8 states.

Accelerometers will be used to assess the physical activity questions by recruiting 80 EFNEP participants nationally, 20 from each of 4 EFNEP regions. ActiGraph accelerometers (model GT3X-BT; ActiGraph LLC, Pensacola, FL) will be used to measure participants' physical activity levels. On data collection day-1, after informed consents are obtained, participants' height and weight will be measured and entered into the Actilife v6.8.0 software (Actigraph, Fort Walton Beach, FL, USA) to initialize the device. Participants will be instructed to wear the accelerometer on the right hip for 7 consecutive days, except when they bathe or swim. Subjects' will be compensated for each day for which there is a minimum of 10 hours' accelerometer data; only those with at least 5 days of data will be included in analyses. Participants will also be asked to self-report their physical activity levels using the newly developed items over the week during which the accelerometer data was collected. Data from the accelerometer will be processed and analyzed using a 60s epoch length, which is comparable to previous studies.[34,35] Time spent in moderate to vigorous physical activity will be determined using the Actilife software algorithm. [35,36] Pearson correlation coefficients will be used to examine the time spent in moderate to vigorous physical activity (according to the accelerometer data) as compared to the self-reported responses.

To assess the validity of the food safety questions, 80 EFNEP participants will be recruited from 8-10 states across the country. Food safety questions will be compared to observations of food safety behaviors following procedures described in a previous food safety questionnaire validation study.[37] Food resource management questions have no comparable gold standard measures, therefore, individual qualitative interviews will be used to triangulate results using approximately 30-40 interviews in 4-6 states with EFNEP participants.

Parameters for determining validity of each of the domain questions have not yet been established, however, low construct validity would be indicated by Pearson's correlation coefficients of $r < 0.5$ and, using Bland-Altman methodology, data plots that do not fit within the 95% limits of agreement.[38] Questions considered to have low validity will not be retained.

National EFNEP administrators will determine which of the questions considered reliable and valid will be incorporated into the FPAB Questionnaire used to evaluate behavior change for all participants. The goal of this project is a 25-30 item questionnaire evaluating 5 health behavior domains. Questions not included in the national EFNEP FPAB Questionnaire will be incorporated into a bank of optional questions individual EFNEP state programs could add to the FPAB Questionnaire to provide more in-depth assessments for specific domains.

Discussion

This paper describes the systematic approach to develop a multi-domain food and physical activity behaviors questionnaire using mixed methods to establish reliability and validity for use with low-income adults from different regions of the country. Rigorously tested behavioral assessment measures for national use are limited.[39] Multistate nutrition research projects have published study protocols describing interventions.[40,41] Our project contributes to this literature by presenting a multistate protocol for developing and testing a nutrition education evaluation instrument.

Strengths of developing the FPAB Questionnaire include the methodological approach with standardized protocols to establish reliability (test-retest) and validity (face, content, construct).[14,18,39] Pretesting questions with the target population (EFNEP eligible women from the 4 EFNEP regions and primary EFNEP ethnic groups – Hispanic, Black and White) using cognitive interviews and multiple testing rounds will help to establish the questions' cross-regional and cultural equivalence.[42] After the English language tool has been established as reliable and valid, a Spanish language version will be developed and tested.

Limitations of this research include the use of convenience samples for testing items. However, in each phase of the project, participants will be recruited from all regions of the country from the major race/ethnic groups to ensure representativeness relative to geography, race/ethnicity, and culture as well as consistent interpretation of the wording of questions/responses. Another potential limitation is the one-month time interval that will be used in testing the instrument's reliability. This period could allow time for participants' behaviors to change but will be needed to address variations in household food availability of adults who receive monthly federal food assistance.

The methods presented herein are for the development of a self-report instrument with a limited number of items and scales. Self-report instruments introduce possible systematic measurement error,[27] including social desirability bias.[43] Also, the internal consistency of scales representing each domain in the FPAB Questionnaire may be compromised due to the small number of items per scale.[14] Given the restricted program time and resources, evaluating self-reported behaviors within a limited number of items is appropriate in this context.

Conclusion and Implications

It is important to document the methods used to develop and test a reliable and valid EFNEP FPAB Questionnaire, as the evaluation tool will be used nationally. The expected

outcome of the research presented is an evaluation questionnaire that can be used to assess the degree to which EFNEP participants improve their health behaviors.

The questionnaire's application extends beyond EFNEP, as EFNEP's assessment measures are routinely used by other programs due to the limited number of valid nutrition education evaluation instruments for low-income adults. For example, the nutrition education program *Cooking Matters* incorporated EFNEP evaluation questions into their program evaluation instrument,[44] and the Supplemental Nutrition Assistance Program-Education (SNAP-Ed) uses EFNEP's evaluation questionnaire in many state programs[45] since SNAP-Ed policy encourages the use of a consistent instrument to assess dietary, physical activity, and food resource management behavior changes.[46] The FPAB Questionnaire will be seminal in providing an improved questionnaire that can be used to document EFNEP's effectiveness to change health behaviors among low-income adults nationally.

Table 4.1. Developing a National Expanded Food and Nutrition Education Program Questionnaire: Food and Physical Activity Behavior Domains and Research Team Leadership.

Domain	EFNEP Goals	Research Team Leadership
Diet Quality	Improved diets and nutritional well-being through adoption of the U.S. Dietary Guidelines for Americans.	Colorado State University
Physical Activity	Improved physical well-being through adoption of the Physical Activity Guidelines for Americans.	Clemson University Rutgers University
Food Safety	Improved household food safety and sanitation practices.	University of Tennessee
Food Security	Increased ability to obtain food directly (and from food assistance programs) to ensure having enough healthy food to eat.	University of Florida University of Kentucky
Food Resource Management	Increased ability to buy, grow, or otherwise appropriately obtain, prepare, and store food that meets nutritional needs.	Washington State University

Table 4.2. Overview of Stages of Development and Testing for an Expanded Food and Nutrition Education Program Food and Physical Activity Behaviors Questionnaire.

Stage	Protocols	Selected Examples of Protocols	Validity Addressed
1. Domain selection/confirmation: • nutrition/diet quality • physical activity • food safety • food security • food resource management	Content analysis of most widely used adult curricula[1]	Independent reviewers; standardized procedure and review tool	Content
2. Question generation	a. Identify validated questions in literature b. Compare questions to appropriate domain-specific, gold standard behavior constructs (for example, 2010 DGA[2]) and EFNEP curricula content c. Expert panels rate questions and response options for content, clarity	a. Physical activity questions identified from government websites, validated physical activity assessment instruments, and papers published within last 10 years b. Physical activity questions matched to 2010 DGA,[2] and 2008 PAA[3] recommendations c. Packets and instructions mailed to expert panels	Content
3. Question pre-testing (multiple rounds)	Cognitive interviews with EFNEP participants in multiple states and regions to assess participant interpretation of questions/responses	Interviewer training via webinar Consistent protocols including scripted probing questions	Face
4. Temporal stability reliability	Test-retest protocols with low-income women with young children in multiple states and regions using tested questions from cognitive interviews	Low-income, non-EFNEP participants (e.g., on-campus housing and dining staff, food service workers, job training participants or hotel	

Stage	Protocols	Selected Examples of Protocols	Validity Addressed
		housekeeping) Administered one month apart[4]	
5. Validity testing	Questions administered with a gold standard measure of the behaviors with EFNEP participants in multiple states and regions	Using appropriate gold standards for each domain, e.g., EFNEP participants complete food safety questions and observed preparing foods following the procedures outlined in a food safety validation study[5]	Construct

1. *Eating Smart • Being Active*, developed by Colorado State University and the University of California-Davis; *Eating Smart, Moving More*, developed by North Carolina State University; and *Healthy Food, Healthy Families*, developed by Texas A & M University were used by 61% of state programs, and an estimated 78% of adult participants[17]
2. 2010 Dietary Guidelines for Americans
3. 2008 Physical Activity Guidelines for Americans
4. One month apart to account for variations in household food availability due to monthly federal food assistance
5. Kendall P, Elsbernd A, Sinclair, K, et al. Observation versus self-report: validation of a consumer food behavior questionnaire. *J Food Prot*. 2004;67(11):2578-2586.

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CHAPTER 5. DEVELOPMENT AND TESTING OF A NATIONAL QUESTIONNAIRE TO ASSESS DIETARY PRACTICES OF LOW INCOME ADULTS PARTICIPATING IN EFNEP[4]

Introduction

The abundance of affordable convenience foods combined with our modern lifestyle have contributed to poor diet quality among US consumers,[1,2] particularly low-income adults.[3,4,5] This situation makes the low-income population more vulnerable to developing chronic diseases, including obesity, diabetes, cardiovascular disease, and some cancers.[4,6] Nutrition education programs are crucial to address the variability in knowledge and skills about healthy eating among low-income families.[7,8] Without valid program evaluation tools, however, it is impossible to determine whether nutrition education is effective.

Accurate evaluation measures of behavior change should be an integral component of federally-funded nutrition education programs,[9,10] as the measures inform program decisions and promote effective nutrition education.[11,12] Programs serving low-income populations require measures that are tested with the target audience[10] and have low staff and respondent burdens.[13] Short dietary assessment questionnaires address these needs and are used to evaluate the effectiveness of interventions and nutrition education programs.[14] However, there is a lack of data on reliability and validity of dietary questionnaires for national use with low-income adults.[15]

The Expanded Food and Nutrition Education Program (EFNEP) is a national program serving low-income adults.[16] EFNEP collects self-reported data via a 10 item questionnaire and

[4] Will submit for publication to the Journal of Nutrition Education and Behavior as a Research Article.

24-hour food recall collected from participants pre- and post-education. This questionnaire, first implemented in 1997, has not been updated,[17] yet EFNEP adult curricula have changed to keep current with national nutrition recommendations and program requirements.[18] It is likely that EFNEP's current nutrition questions do not assess the most appropriate behaviors.

Short dietary assessment instruments for use with EFNEP-eligible low-income populations have been developed to evaluate specific curricula,[19,20] EFNEP participant subgroups,[20–22] communities or single states.[13] EFNEP needs dietary assessment measures for adults that are tested nationally with the target low-income audience and reflect current nutrition recommendations.

This study was designed to test the reliability and validity of a dietary assessment instrument that will be part of a larger evaluation tool for EFNEP. The implications of this research extend beyond the EFNEP program, as other nutrition education programs serving low-income adults may use the instrument.

Methods

Study Design

This mixed methods observational study was conducted as part of a multi-state, multi-year Agricultural Experiment Station research project, NC2169: EFNEP-Related Research, Program Evaluation and Outreach. The NC2169 project goals include developing a new EFNEP national evaluation questionnaire that, in addition to diet quality, will measure behaviors in 4 other domains: physical activity, food safety, food security, and food resource management.[18]

The questionnaire will be developed and tested in English. The measures (questions) will comply with current EFNEP administration requirements that include a limited number of questions to reduce participant burden, a paper format administered pre- post-intervention, and

question wording that accommodates low-literacy adults. EFNEP nutrition content must reflect current national nutrition recommendations - the Dietary Guidelines for Americans (DGA).[23]

Methods to develop and test the dietary assessment questions have been reported.[24] The questions were developed and tested using multiple stages: 1) identify/confirm nutrition content through a curricula content analysis; 2) use experts to confirm nutrition content to teach/evaluate and determine appropriateness of questions/responses; 3) identify question/responses from the research literature; 4) establish face validity using cognitive interviews; 5) establish temporal stability using test-retest assessment; and 6) assess the reliability of scales using exploratory factor analysis.

Instrument Development

An in-depth curricula content analysis identified nutrition-related content and served as a proxy to determine common nutrition information taught to EFNEP participants.[25] In addition, a panel of 6 nutrition experts (DGA expert panel) determined which DGA nutrition recommendations were most important to teach the low-income population EFNEP serves.[26] A second group of experts (EFNEP expert panel) further prioritized which nutrition content areas should be evaluated in EFNEP using a national questionnaire. The EFNEP expert panel consisted of 21 researchers (state EFNEP program directors, national EFNEP program administrators, and academic researchers) from 15 states across the US.

For each nutrition content area, that the EFNEP expert panel determined should be evaluated, dietary assessment questions and responses were selected from a literature review identifying validated instruments. Search terms included "intervention, nutrition education, dietary assessment, evaluation and questionnaire;" emphasis was given to questionnaires developed for low-income populations. EFNEP administrators from different regions of the US (content expert panel) assessed the degree to which questions/responses characterized nutrition

content areas, and their suitability for EFNEP evaluation needs and participants. Appendix F includes the content expert panel form used to assess the questions/response options. The purpose of the curricula content analysis, identification of validated questions, and use of expert panels was to establish content validity of the dietary assessment questions.

Participants and Recruitment

Each stage of question testing (cognitive interviews and reliability assessment) was completed using convenience samples of English-speaking EFNEP or EFNEP-eligible participants in multiple states and each EFNEP region of the US.[27] For cognitive testing, EFNEP participants were recruited at program enrollment or completion. For test-retest reliability testing and factor analysis, 30 low-income EFNEP-eligible women (not enrolled in the program) from 7 states (total n=210), were recruited from low-income communities and food service employers.

Demographic information was collected for each stage of testing, including age, education, number of children in the home, race, and ethnicity. Participants provided written consent at all stages of testing and received incentives valued at $25 to $60. Protocols for each stage of testing were approved by the Institutional Review Board (IRB) at Colorado State University and each university involved with data collection. The approved IRB protocols are listed in Appendix G (cognitive interview testing), Appendix H (test-retest reliability testing) and Appendix I (construct validity testing).

Instrument Testing

Cognitive testing. The purpose of cognitive testing was to test questions with the target population to determine ease of understanding and face validity.[28] Researchers used webinars to train interviewers from each state to conduct multiple rounds of interviews with EFNEP participants. Cognitive interviews included protocols with scripted probing questions to collect

specific information about the understanding of words, concepts, or behaviors related to each question and response option.[29] Cognitive interview protocols are included in Appendix J (interview round 1 protocol, consent form, gift card receipts), Appendix K (interview round 2), and Appendix L (interview round 3).

Participants were asked to provide their internally-generated response to questions before answering with the responses provided to assess whether their response matched the response options listed. Interviews were conducted at program enrollment or completion to assess if participants interpreted the questions and responses differently due to EFNEP education. In addition, participants were asked to recommend changes to questions and responses to improve clarity, ease of reading and accuracy of reporting. Interviews, revisions to questions/responses, and subsequent rounds of interviews using revised questions/responses continued until the questions were easy to understand, interpreted as intended, and no new information was gleaned. Revised questions/responses from pre-testing were combined into one instrument for reliability and factor analysis.

Test-retest reliability and factor analysis. The test-retest method was used to assess temporal stability, or the consistency of responses over time without an intervention between the measures.[30] Low-income women completed the same instrument one month apart,[31] an interval selected to account for the timing of food resources from Federal food assistance programs that often provide food benefits the same week each month. Appendix M includes the test-retest research protocol and required documents for testing (recruitment script, recruitment flyer, consent form, nutrition questionnaire, and gift card receipts). Exploratory factor analysis determined whether questions grouped together into scales.[32]

Data Analysis

All cognitive interviews were audio recorded. The same researcher listened to and typed detailed notes from each interview. Interview notes were stratified by EFNEP status (enrollment or program completion), and analyzed question-by-question for emerging themes in terms of differences in interpretation or difficulty answering questions and for suggested changes from participants. For each round of interviews, findings were combined into a report of major themes and suggested revisions. A committee of 3 researchers with expertise in questionnaire development and EFNEP program administration reviewed the report and revised questions/responses for retesting. Revised questions/responses were retested until the questions were easy to understand and interpreted as intended.

All statistical analyses were performed using SPSS software (SPSS Statistics version 22.0, IBM Corp., Armonk, NY, 2013). Participant responses for each instrument question were assigned a numeric score (1=one time a day, 2=2 times per day, etc.). For test-retest assessment, participant scores from times 1 and 2 were compared using single measures intra-class correlation coefficient (ICC) and Spearman rank-order correlation. These methods are generally used to assess test-retest reliability,[22,33] though the ICC also assesses *within subject agreement*.[32,34] ICC can be interpreted as: 0.00–0.10=virtually no agreement, 0.11–0.40=slight agreement, 0.41–0.60=fair agreement, 0.61–0.80=moderate agreement, and 0.81–1.0=substantial agreement.[35] Spearman correlations are used to assess the *association* between two measures that may not have a linear relationship (question scores), and can be interpreted as: 0.00-0.10= very weak, 0.20–0.39=weak, 0.40–0.59=moderate, 0.60–0.79=strong, and 0.80–1.0=very strong.[36] Participants were stratified by age (18-29 years, 30-39 years, 40-67 years) and race/ethnicity (Hispanic, non-Hispanic white, and Black) to assess whether responses differed across the groups using ANOVA.[31]

Paired t-tests with Bonferroni adjustment assessed differences between means from time 1 to time 2 scores for each instrument question. Additionally, nominal difference scores were calculated by subtracting time 2 from time 1 scores for each question, then combining the difference scores to: (-1=-6 to -2; 0=-1, 0 and +1; 1=2 to 6). The percentage of adults with nominal difference scores of 0 were noted, which provided an estimate of adults who reported similar responses at times 1 and 2.

For exploratory factor analysis, scales were derived using principle components analysis. All factors with eigen values greater than 1.0 were retained for rotation. The analysis used varimax rotation and factor loading cut-offs of 0.5 for questions in each factor for time 1 and 2. Spearman rank-order and single measures ICC were used to assess time 1 to time 2 correlations for the scales identified through factor analysis. Paired t-tests assessed scale differences between means from time 1 to time 2 scores.

Results

Participant Characteristics

Participants in each testing stage (cognitive interviews, test-retest, and factor analysis) were low-income, primarily women, from different regions of the US (Table 5.1). The majority were young adults (18-39 years) and did not have a college degree, which aligns with the overall EFNEP population. Compared to national EFNEP data, lower proportions of Hispanic and higher proportions of white, non-Hispanic adults participated in testing (Table 5.1). This difference may be due in part to the exclusion of Hispanic adults who did not speak English, because the questions were developed in English. National EFNEP data do not present information about the percentage of Hispanic participants who do not speak English.[37]

Instrument Development

Due to the variability of nutrition content across curricula used in EFNEP,[24] the researchers employed expert panels to prioritize what nutrition content should be taught and evaluated in EFNEP. The DGA expert panel determined 2 overarching and 8 specific nutrition recommendations critical to teach low-income adults (Figure 5.1).[25] The EFNEP expert panel further prioritized the DGA expert panel recommendations to 6 nutrition behaviors the program should evaluate: 1) cook and eat more meals at home, 2) eat more fruit, 3) eat more vegetables, 4) eat a wider variety of vegetables, 5) increase low-fat dairy or fortified soy products, and 6) avoid sugar sweetened beverages. The EFNEP expert panel determined these behaviors based on the limited time frame of EFNEP education, and which concepts were feasible to assess within a brief questionnaire.

Dietary assessment questions identified through the literature review produced an average of 40 questions (range 19-71) per content area and 46 different response scales. Based on the content expert panel feedback, 20 revised questions with two response scales per question moved forward for cognitive testing.

Cognitive Testing

Interviews were completed with 111 EFNEP participants in 7 states through 3 rounds of revisions (Table 5.1). Questions were re-worded based on themes that emerged in each round of interviews to improve question clarity and ease of understanding (Table 5.2). Response options were revised to align with participants' internally-generated responses and recommendations. This process resulted in 14 questions covering the six nutrition content areas. There were no differences in the findings by region nor pre- versus post- EFNEP participation. Themes are summarized below.

Removing extra words added clarity. Terms such as "on most days" and "in a typical day" were removed because they confused participants, were interpreted differently across participants, and perceived as unnecessary. For example, participants recommended shortening "On most days, how many times..." to "How many times a day..." The number of foods used as examples were shortened per participant recommendations to ease reading.

Time frames improved recall accuracy. Including specific time frames to both questions and response categories helped with the cognitive tasks of recalling food intake or behaviors. Without time frames, respondents answered "not very often," or "all the time," and were confused about whether to recount eating behaviors over the past day, week, or month. Participants recommended adding time frames at the beginning of questions when possible – "*because it simplifies it to me in my brain*." One exception was the question "How many different kinds of vegetables do you eat a day," in which the timeframe is at the end. Participants noted that because the question asked about vegetable variety rather than frequency of intake, it was easier to understand when the question began with "How many different kinds…"

Examples improved food recall. Participants preferred having a list of examples (fruits or vegetables) included with questions, as it clarified and prompted their recall memory. Participants recommended shortening the list of examples to the most commonly-consumed foods, yet still retain a variety of foods to help with recall – *"it makes sense to keep the list not too long*." For the fruit and vegetable questions, participants recommended separating the examples from questions, and listing the examples before questions.

Response options should reflect consumption patterns. Without specific response options that matched reported intake, participants chose more socially desirable options that varied from their reported behaviors by overestimating healthy foods (fruit and vegetable intake),

and underestimating unhealthy beverages (sugar-sweetened beverages). Participants with low frequency of intake of foods/beverages suggested adding response options for less than daily consumption to more accurately capture actual intake. Due to differences in eating patterns on weekends versus weekdays, participants recommended the response option "6 or 7 days a week" rather than being forced to choose either "6 days a week" or "7 days a week" when they were not certain.

Based on participant intake patterns and DGA consumption goals,[23,37] questions related to fruit/vegetable and milk intake, resulted in times/day response options (refer to Table 5.3 for questions). Questions related to eating at home, vegetable variety, and other dairy intake resulted in days/week response options. Sugar-sweetened beverages questions resulted in a combination of times/week and times/day response options. Participants reported no problems transitioning between daily versus weekly consumption if they were prompted at the beginning of questions with a time frame. Consequently, the final version lists time frames in bold font at the beginning of most questions. Sugar-sweetened beverages questions did not include time frames to accommodate the varied response options (weekly and daily) recommended by participants.

Many food concepts were universally understood. Participants understood the intended meaning of several concepts included in questions throughout three rounds of interviews. The concepts would cause problems with misreporting if respondents interpreted them differently. Universally understood concepts included: vegetables and fruits, different kinds of vegetables, regular soda, diet soda, energy drinks, sports drinks, cow's milk, soy milk, dinner (main meal of the day), ready to eat food from grocery stores, deli foods, food prepared outside your home, fast food, a week=7 days, and cook=preparing foods with different components using heat.

Many eating behaviors were consistent. Participants reported similar behaviors across 3 rounds of interviews. Regarding meals, many do not eat breakfast on a regular basis. The majority of participants reported eating lunch out compared to dinner – "*I mostly eat lunch out; lunch is my problem area*." Lunch foods were eaten on the go from fast food restaurants or convenience stores. Children ate breakfast and lunch at school or daycare. Participants also talked about when they eat out each day rather than focusing on eating dinner out - "*I can't afford to eat out more than once a day."* Participants misinterpreted the question about eating the evening meal or dinner out as whether they ate any meal out that day.

Regarding fruit intake, participants reported giving their children fruit because "*it's good for children to eat,"* but they did not think fruit was important for adults to eat. Regarding vegetable intake, participants reported trying to eat 1 vegetable per day (more common) or 2 kinds of vegetables (less common) with their evening meal. Those who ate dried beans and peas reported consuming them when participants had the time to cook beans from scratch. Participants misunderstood canned beans and peas as less healthy - "*they are not as good for your health*." For dairy intake, the cognitive tasks of recalling milk in cereal, versus drinking milk, versus consuming yogurt were all distinct due to the meal/time of day or days per week they were consumed. Most participants reported they ate cheese regularly and consumed it in large quantities when they had access to it. Some reported trying to decrease consumption of cheese to lose excess weight. Due to the reported high consumption of cheese, and the DGA emphasis on low-fat dairy intake,[23,38] the question assessing cheese intake was removed.

Sugar-sweetened beverages are widely consumed. Participants consumed different kinds of sugar-sweetened beverages during different events or times of the day, which influenced the cognitive task of recalling intake. Separate questions asking about specific sugar-sweetened

beverages improved total recall. Participants knew sodas were not healthy and either self-righteously stated they "*never*" drink them, or seemed embarrassed to report consuming them. Soda consumption patterns varied widely. Participants reported drinking sweet tea with meals, and sports drinks frequently in hot weather and at sporting events, even when they were not playing a sport. All participants reported sports drinks have electrolytes in them and "*help you stay hydrated*." Other sweetened beverages were interpreted as healthy – "*koolaid is not a bad thing to drink because it has water in it*." The overwhelming majority of participants reported never drinking energy drinks, but knew family members and friends who drink several per day. Those who reported consuming energy drinks used them to boost energy – "*I have a 17-month old daughter so a monster energy drink will get me through the day*." A 20-ounce can or bottle was the quantity most often consumed.

Test-Retest Reliability

Test-retest data were collected from 217 low-income adults in 7 states (Table 5.1). Reliability testing results are presented in Table 5.3. Spearman correlation coefficients (SCC) were similar to intra-class correlation coefficient (ICC) between the two administrations of the nutrition questions (SCC median=0.61, range=0.48-0.77; ICC median=0.59, range=0.43-0.77). All of the questions showed at the least moderate correlations (SCC>0.40) and fair agreement (ICC>0.41), with at least half the questions indicating strong (SCC>0.60) and moderate (ICC>0.61) correlations ($p<0.001$).

When question responses were stratified by age, the only differences observed were for the questions *cook dinner at home (days/week)*, and *eat out (days/week)*. The oldest age group (≥40 years) reported cooking at home significantly more often than the youngest (18-29 years) [4.86 (95% CI:4.52,5.21) versus 4.27 (95% CI:3.94,4.60), p=0.015]. Likewise, the youngest age group reported eating out significantly more often than both older age groups (30-39 and ≥40

years) [2.50 (95% CI:2.09,2.91) versus 1.72 (95% CI:1.33,2.11) and 1.68 (95% CI:1.26,2.10), p=0.007], respectively. When stratified by race/ethnicity, Blacks reported significantly higher *fruit intake (times/day)* compared to whites [2.98 (95% CI:2.66,3.32) versus 2.33 (95% CI:2.07,2.58), p=0.002], and more frequent intake of *other sweet drinks (times/day)* compared to Hispanics or whites [2.11 (95% CI:1.685,2.54) versus 1.28 (95% CI:0.65,1.90) and 1.45 (95% CI:1.12,1.78), p=0.031 and p=0.017], respectively. Hispanics reported eating more *beans and peas (days/week)* than whites [2.86 (95% CI:2.35,3.38) versus 1.77 (95% CI:1.50,2.04), p=0.028]. No other differences were observed.

Nominal difference scores for each question showed >70% of adults reported similar responses for all questions between time 1 and 2 administrations (median=80.6%, range=72.4%-94.4%). Paired t-tests showed no statistically significant differences in the means for any question between time 1 and 2 administration.

Factor Analysis

For both time 1 and time 2 exploratory factor analysis resulted in 4 scales: cooking versus eating out, vegetable, dairy and sugar-sweetened beverages, shown in Table 5.3 (factor loadings >0.50). The question assessing beans and peas intake grouped more closely to cooking at home questions (0.49) than to vegetables (0.36) at time 1, however, beans and peas grouped with vegetables at time 2 (0.56). The results may indicate higher bean consumption with higher cooking at home.

The question assessing fruit intake grouped with vegetable questions at time 1 (0.72), and grouped with milk/yogurt questions at time 2 (0.53), even though fruit was determined to be one of six distinct content areas to evaluate. These results may be due to a single fruit-related question versus multiple vegetable or dairy questions, those who eat vegetables may also eat more fruit, and/or fruit was consumed with yogurt or milk in smoothies. Scale correlations

between time 1 and time 2 showed moderate agreement for each scale (>0.63, p<0.01). Paired t-tests showed no statistically significant differences between time 1 and 2 for any of the nutrition question scales.

Discussion

The evaluation of nutrition education programs can lead to erroneous conclusions unless valid and reliable tools are employed that align with program goals and are tested with the target population.[10] This is the first known study demonstrating the results of a nationally-developed dietary assessment instrument for a federal nutrition education program serving low-income adults. Results of this research produced dietary assessment questions that measure 6 nutrition content areas with face and content validity and good test-retest reliability (ICC=0.43-0.77, SCC=0.48-0.77, nominal difference scores=72.4%-94.4%). Exploratory factor analysis demonstrated that instrument questions aligned with nutrition behaviors the EFNEP expert panel determined should be evaluated in EFNEP (factor loadings>0.5) and the scales exhibited good reliability (ICC=0.63-0.8, SCC=0.67-0.77).

The dietary assessment questions were based on what should be taught and evaluated in EFNEP according to different groups of national experts.[25] This approach was taken due to the national scope of the evaluation questions, which must accommodate multiple curricula used by state EFNEP programs with considerable variability in nutrition content.[25] This approach contrasts with other studies in which dietary assessment instruments were developed for a specific curriculum,[19,20] or state nutrition education program[33,39] for low income adults.

Cognitive interview testing was done using three rounds of interviews with racially/ethnically diverse groups of EFNEP participants in 7 states (n=111), which established the questions' cross-regional and cultural equivalence.[40] In contrast, cognitive interview testing was either a missing component to nutrition questionnaire development for low-income

adults,[33,41] or included only 1 round of testing using a small number of subjects (n=<30).[42,44] Additionally, test-retest assessment was conducted nationally using a large sample (n=217) of diverse low-income adults from 7 states. Yaroch et al., used test-retest assessment with a national sample of adults (n=335) to evaluate the reliability of 3 short dietary assessment instruments that measured fruit and vegetable intake. Their results showed slightly higher reliability for questions assessing fruit intake (ICC=0.59-0.67) and similar reliability for questions assessing vegetable intake (ICC=0.60-0.65), compared to the results from this study.[45] The national sample of adults, however, were older and had a higher level of education than the study participants used to test the reliability of the dietary assessment questions for EFNEP. The lack of nationally-tested dietary assessment measures for low-income adults limits the comparison of this research to other studies.

Strengths and Limitations of the Study

Strengths of this research include the systematic approach used to develop the dietary assessment questions.[10,31,32] Another strength of this research was the pretesting of questions through multiple rounds of cognitive interviews, which established appropriateness of the questions with the target low-income population.[46] Both cognitive interview and reliability testing involved collecting data in multiple states from a diverse group of low-income adults that represent the primary EFNEP racial/ethnic groups (Black, White, Hispanic).

Limitations of this research include using convenience samples of low-income EFNEP or EFNEP-eligible participants to test the instrument questions. With both testing phases, however, a diverse group of participants were recruited from several states representing different regions of the US. Another limitation of this research is the reduced number of questions per scale, which limits the stability of each scale to comprehensively measure specific foods or dietary behaviors.[30] This is an example of the compromises necessary to accommodate the time and

resource constraints of a national nutrition education program and the low-income participants it serves.

Implications for Research and Practice

Programs, policy makers, and researchers can use the dietary assessment instrument to evaluate nutrition interventions targeting low-income adults. EFNEP can incorporate the instrument questions into the program's new national evaluation questionnaire, or include them in a bank of optional questions that EFNEP state programs may use in addition to the required questionnaire. Other nutrition education programs may also use the dietary assessment instrument, as the resources and time needed to develop and test their own instrument may not be a feasible option. Nutrition education programs or interventions can also use the methods outlined to develop their own dietary assessment instrument. Further research is needed to assess the instrument's sensitivity to change and construct or comparative validity, using methods appropriate for the target population and the specific behaviors measured in the instrument.

Table 5.1. Characteristics of low-income adults according to stage of testing a dietary assessment instrument for the EFNEP.[a]

Demographic Characteristics	Cognitive Testing (n=111)	Test-Retest Reliability (n=217)[a]	EFNEP National Data FY2015 (n=119,351)[b]
States involved in testing[c]	CO KY ME NC OK VA WA	CO FL KS NJ PN TN WA	n/a
	% (n)		
Female	89 (99)	99 (215)	86 (102,793)
Education			
< High school graduate	22 (24)	5 (11)	29 (25,941)
High school graduate or GED	38 (42)	32 (69)	39 (34,935)
Some college	24 (27)	34 (72)	18 (15,971)
Community college graduate(2y)	2 (2)	14 (30)	6 (5,306)
College graduate (≥4y)	14 (16)	15 (33)	8 (7,019)
Age (y)			
18-29	28 (31)	33 (72)	33 (35,635)
30-39	28 (31)	36 (78)	33 (35,371)
≥ 40	44 (49)	31 (66)	35 (37,366)
Race/Ethnicity			
Hispanic	24 (27)	13 (29)	42 (48,429)
White, non-Hispanic	42 (47)	49 (105)	27 (30,664)
Black, non-Hispanic	20 (22)	31 (66)	23 (26,668)
Other, non-Hispanic	14 (15)	7 (16)	8 (8,927)

[a]Due to missing values: education n=215, age n=216, ethnicity/race n=216.
[b]Due to missing values: age n=108,372, education n=89,172, ethnicity/race n=114,688
[c]State institutions involved with data collection (US EFNEP region): CO=Colorado State University (Western), KS=Kansas State University (North Central), KY=Kentucky State University (Southern), PN=Pennsylvania State University (Northeast), NJ=Rutgers University (Northeast), FL=University of Florida (Southern), ME=University of Maine (Northeast), NC=North Carolina State University (Southern), OK=Oklahoma State University (Southern), TN=University of Tennessee (Southern), VA=Virginia Tech (Southern), and WA=Washington State University (Western).

Overarching Recommendations
• Focus on nutrient-dense foods, including vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood and fish, lean meats, poultry, eggs, beans and peas, and nuts and seeds
• Cook and eat more meals at home
Specific Recommendations
• Increase vegetable and fruit intake. Eat a variety of vegetables
• Consume at least half of all grains as whole grains
• Increase intake of low-fat dairy or fortified soy products
• Eat a variety of protein foods, including beans, legumes, nuts and seeds, eggs, seafood, and lean meats and poultry
• Develop skills in reading the Nutrition Facts panel to identify portion size and calorie intake for packaged foods
• Prepare, serve, and consume smaller portions of food and beverages
• Reduce intake of foods such as chips and crackers and sweets such as cookies, cakes, pie, muffins, doughnuts, and pastries
• Limit the intake of sugar-sweetened beverages

Figure 5.1. Nutrition messages critical to teach low-income adults from the 2010 Dietary Guidelines for Americans, based on expert panel opinion.[25]

Table 5.2. Nutrition question wording changes from 3 rounds of cognitive interviews with a national sample of low-income adults participating in EFNEP (n=111).

Version 1 (n=34)	**Version 2 (n=45)**	**Version 3 (n=32)**	**Final Version**
Most weeks, how often do you cook meals at home?	How often do you cook dinner (or your main meal) at home?	How many days a week do you cook dinner (your main meal) at home?	How many **days a week** do you cook dinner (your main meal) at home?
How many days in a week do you eat breakfast prepared outside of your home? (include fast food, restaurant food, or food from gas station or corner stores)	Dropped question because most adults reported not eating breakfast on a regular basis, and a low frequency of eating out for those who eat breakfast. Children eat breakfast at school/daycare.		
How many days in a week do you eat lunch prepared outside of your home? (include fast food, restaurant food, or food from gas stations or corner stores)	Dropped question because of varied interpretations and responses for eating lunch out. Participants reported purchasing snacks or lunch on the go when they have money. Children eat lunch at school/daycare.		
How many days in a week do you eat your evening meal prepared outside of you home? (include fast food, restaurant food, or food from gas stations or corner stores)	How often do you eat dinner (or your main meal) prepared outside of your home? (include fast food, restaurant food, and food from grocery store delis, gas stations or corner stores) Revised question because participants interpreted it as "how often you go out for meals." The vast majority reported eating only one meal out per day and usually that is lunch on the go.	How many days a week do you eat meals prepared outside of your home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)	How many **days a week** do you eat meals prepared outside of you home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)

Version 1 (n=34)	**Version 2 (n=45)**	**Version 3 (n=32)**	**Final Version**
Fruits include things like apples, bananas, oranges, grapes, raisins, melon, peaches, pears, nectarines, grapefruit, papaya, pineapple, strawberries, and other berries. Count fresh, frozen, dried, or canned fruit. Do not count any juice. On most days, how many times do you eat fruit?	Fruits include apples, bananas, oranges, grapes, raisins, melon, and berries. Count fresh, frozen, dried or canned fruit. Do not count fruit juices. How often do you eat fruit?	Examples of fruits are apples, bananas, oranges, grapes raisins, melon and berries. Count fresh, frozen, dried or canned fruit. Do not count fruit juices. How many times in a day do you eat fruit?	Examples of **fruits** are apples, bananas, oranges, grapes, raisins, melon and berries. Include fresh, frozen, dried, or canned fruit. **Do not include juice**. How many **times a day** do you eat fruit?
How many pieces of fruit do you eat most days?	Dropped this question due to confusion about the term pieces or similar terms (servings, portions) and frustration from participants that this questions was asking the same thing as the earlier question. Those who reported eating fruit ate no more than one serving of fruit (about a cup or a medium piece of fruit) per eating occasion.		
Vegetables include things like leafy salad, corn, green beans, peas, potatoes (do not count french fries or potato chips) carrots, broccoli, cauliflower, onions, tomato, cucumber, mushrooms, cabbage, spinach, edamame, sugar	Some examples of vegetables are green salad, corn, green beans, peas, and potatoes (do not count French fries or potato chips) greens and squash. Count fresh, canned and frozen vegetables. Do not count rice.	Examples of vegetables are green salad, corn, green beans, peas, carrots, potatoes, greens and squash. Count fresh, canned and frozen vegetables. Do not count French fries, potato chips, or rice.	Examples of **vegetables** are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned and frozen vegetables. **Do not count french fries, potato chips, or rice**.

Version 1 (n=34)	**Version 2 (n=45)**	**Version 3 (n=32)**	**Final Version**
snap peas, and salsa. Do not count rice. Count fresh, canned and frozen vegetables. Do not count any vegetable juice. On most days, how many times do you eat vegetables?	How many times per day do you eat vegetables?	How many times in a day do you eat vegetables?	How many **times a day** do you eat vegetables?
How many different types of vegetables do you eat in a typical day?	How many different kinds of vegetables do you eat in a typical day?	How many different kinds of vegetables do you eat in a day?	How many different kinds of vegetables do you usually eat **a day**?
On most days, how many different vegetables do you eat?	Dropped question as earlier question was easier to understand and answer.		
Over the last week, how many days did you eat red and orange vegetables, like tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin?	Keep question as is.	Examples of red or orange vegetables are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin. Over the last week, how many days did you eat red and orange vegetables?	Examples of **red or orange vegetables** are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin. Over the last week, **how many days** did you eat red and orange vegetables?
Over the last week, how many days did you eat dark green vegetables, like broccoli, spinach, green lettuce, collard or turnip or mustard greens?	Over the last week, how many days did you eat dark green vegetables , like broccoli, Brussels sprouts, spinach, leafy greens, collard turnip or mustard greens?	Examples of dark green vegetables are broccoli, spinach, dark green lettuce, turnip greens or mustard greens. Over the last week, how many days did you eat dark green vegetables?	Examples of **dark green vegetables** are broccoli, spinach, dark green lettuce, turnip greens, or mustard greens. Over the last week, **how many days** did you eat dark green vegetables?

Version 1 (n=34)	**Version 2 (n=45)**	**Version 3 (n=32)**	**Final Version**
Dried beans and peas include pinto beans, black beans, red beans, navy beans, chili beans, lima beans, split peas, black eyed peas, lentils, refried beans, pork and beans, bean soup, soy beans, and barbeque beans. Count canned, dried, and frozen beans and peas. Over the last week, how many days did you eat dried cooked beans?	Keep question and revise description to: Dried beans and peas include canned or bagged dried pinto beans, black beans, navy beans, chili beans, lima beans, split peas, black eyed peas, lentils, refried beans, pork and beans, bean soup, and barbeque beans.	Examples of beans and peas include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. Count beans from a can or cooked from dry. Over the last week, how many days did you eat beans or peas?	Examples of **beans and peas** include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. **Include beans from a can or cooked from dry.** Over the last week, **how many days** did you eat beans and peas?
On most days, how often do you drink milk or soymilk?	How often do you drink milk or soymilk? Do not count almond milk or coconut milk.	How many times in a day do you drink milk or soymilk? (do not count almond or coconut milk)	How many **times a day** do you drink milk or soymilk? (Do not count almond or coconut milk, or milk with cereal)
How often do you eat yogurt or drink smoothies with yogurt?	Keep question as is and revise response options to reflect intake.	Over the last week, how many days did you eat yogurt or drink smoothies with yogurt?	Over the last week, **how many days** did you eat yogurt or drink smoothies with yogurt?
How often do you eat cereal with milk?	Keep question as is and revise response options to reflect intake.	Over the last week, how many days did you eat cereal with milk?	Over the last week, **how many days** did you eat cereal with milk?
How often do you eat cheese? Do not count cream cheese.	Dropped question due to reported high cheese intake and to align with 2015-2020 DGA recommendations emphasizing intake of low-fat dairy products.[a]		

Version 1 (n=34)	**Version 2 (n=45)**	**Version 3 (n=32)**	**Final Version**
On most days, how often do you drink regular sodas (not diet)? Include all kinds such as Coke, Pepsi, 7-up, Sprite, root beer.	How often do you drink regular sodas (not diet)? Include all kinds such as Coke, Pepsi, 7-up, Sprite, root beer.[b]	How often do you drink regular sodas (not diet)?	How often do you drink regular sodas (not diet)?
On most days, how often do you drink fruit punch, fruit drinks or sweet tea? (such as Snapple, flavored teas, Capri sun, vitamin Water, or Kool-Aid)	How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks? (such as Gatorade, PowerAde, Propel, Snapple, flavored teas, Capri Sun, Vitamin Water, or Kool-Aid).	How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?	How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?
On most days, how often do you drink sports drinks? (such as Gatorade, PowerAde, or Propel)	Collapse sports drinks into fruit drinks question due to lack of emerging theme and to decrease the total number of questions.		
On most days, how often do you drink energy drinks? (such as Rockstar, Red Bull, Monster, and Full Throttle)	How often do you drink energy drinks? (such as Rockstar, Red Bull, Monster, and Full Throttle).	How often do you drink energy drinks?	How often do you drink energy drinks?

[a]2015-2020 Dietary Guidelines for Americans state "increasing the proportion of dairy intake that is fat-free or low-fat milk or yogurt and decreasing the proportion that is cheese would decrease saturated fats and sodium and increase potassium, vitamin A, and Vitamin D provided from the dairy group" https://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf.

[b]EFNEP does not use brand names so dropped these examples.

Table 5.3. Test-retest reliability assessments of new EFNEP dietary assessment questions among a national convenience sample of low-income adults.

Question	Spearman Correlation Coefficient n = 181[a]	Intraclass Correlation n = 181[a]	Nominal Difference Scores[b] % = 0 n = 181[a]
1. How many days a week do you cook dinner (your main meal) at home?[c]	0.76	0.77	91.2%
2. How many days a week do you eat meals prepared outside of your home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)[c]	0.57	0.49	79.6%
3. How many times a day do you eat fruit?[d]	0.48	0.50	76.2%
4. How many times a day do you eat vegetables?[d]	0.58	0.58	86.2%
5. How many different kinds of vegetables do you usually eat a day?[e]	0.60	0.62	92.2%
6. Over the last week, how many days did you eat red and orange vegetables?[f]	0.48	0.46	72.4%
7. Over the last week, how many days did you eat dark green vegetables?[f]	0.55	0.55	75.7%
8. Over the last week, how many days did you eat beans and peas?[f]	0.54	0.56	76.8%
9. How many times a day do you drink milk or soymilk?[g]	0.76	0.75	89.0%
10. Over the last week, how many days did you eat yogurt or drink smoothies with yogurt?[f]	0.63	0.65	74.0%
11. Over the last week, how many days did you eat cereal with milk?[f]	0.74	0.73	82.3%
12. How often do you drink regular sodas (not diet)?[h]	0.77	0.75	84.5%
13. How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?[h]	0.61	0.59	78.9%
14. How often do you drink energy drinks?[h]	0.67	0.43	94.4%
Scales			
Total cooking at home (questions 1 and 2)	0.67	0.70	
Total vegetables (questions 4 – 8)	0.69	0.71	
Total dairy (questions 9 – 11)	0.77	0.80	
Total sugar sweetened beverages (questions 12 – 14)	0.68	0.63	

[a]n=Matched time 1 and time 2 responses used for calculations. Number range was 179 – 181 due to missing responses for test or retest questions.
[b]Subtracted retest scores from test scores and collapsed to: (-1 = -6 to -2); (0 = -1, 0 and +1); (1 = 2 to 6). This provides a sense of how many adults reported lower, similar, or higher scores on the retest.
[c]Response options: Rarely, 1 day a week, 2 days a week, 3 days a week, 4 days a week, 5 days a week, 6 or 7 days a week.
[d]Response options: Rarely, less than 1 time a day (a couple times per week), 1 time a day, 2 times a day, 3 times a day, 4 or more times a day.
[e]Response options: I rarely eat vegetables, 1 kind a day, 2 kinds a day, 3 kinds a day, 4 or more kinds a day.
[f]Response options: I did not eat (type of food), 1 day a week, 2 days a week, 3 days a week, 4 days a week, 5 days a week, 6 or 7 days a week.
[g]Response options: I do not drink milk, I rarely drink milk, 1 time a day, 2 times a day, 3 or more times a day.
[h]Response options: Never, 1 – 3 times a week, 4 – 6 times a week, 1 time a day, 2 times a day, 3 times a day, 4 or more times a day.

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CHAPTER 6. CONCLUSIONS AND IMPLICATIONS

The aim of this research was to develop and test dietary assessment measures that researchers, policy makers, and program administrators can use nationally to evaluate the effectiveness of the Expanded Food and Nutrition Education Program (EFNEP). This research was part of a United States Department of Agriculture, Agricultural Experiment Station multi-state research project (NC2169).[1] Researchers working at land grant universities across the US, involved in NC2169, are developing a new EFNEP national evaluation questionnaire - the *EFNEP Food and Physical Activity Behaviors Questionnaire*. The dietary assessment measures (questions) will either be incorporated into the new questionnaire or included in a bank of evaluation questions that EFNEP state programs may use in addition to the required questionnaire. Appendix N lists the developed and tested dietary assessment questions for EFNEP.

This applied research project must fulfill EFNEP requirements for a national evaluation instrument and be appropriate for the target low-income population the program serves.[2] EFNEP administrative requirements include a paper questionnaire format that paraprofessional educators administer within group or one-on-one settings at program enrollment and completion. The dietary assessment questions should reflect EFNEP's objectives to "choose and eat foods of adequate variety and appropriate quantity to improve health and reduce the risk of chronic disease"[2] and comply with national nutrition recommendations – the Dietary Guidelines for Americans.[3] The questions need to exhibit reliability and validity nationally within the EFNEP population. Finally, improvements in dietary behaviors should be measured using as few questions as possible within EFNEP's new national evaluation questionnaire, which will evaluate

5 core areas with fewer than 25 items: diet quality, physical activity, food resource management, food safety, and food security.

There were many challenges involved with creating dietary assessment questions that satisfied EFNEP's administrative requirements and met the needs of low-income participants. These challenges included developing questions that reflected EFNEP's educational content based on the then current Dietary Guidelines for Americans,[4] while recognizing the limited duration and power of the EFNEP intervention to address diet quality.[2] Another challenge was creating valid questions that met the needs of the EFNEP population, including those with lower literacy. The questions needed to be simple to understand and use, with low participant burden, and sensitive enough to detect behavior change.[5–7] EFNEP's requirement for a small number of questions reduced participant and program burden, however, the ability to create comprehensive scales to assess diet quality was compromised.[8]

A lack of resources available to develop and test a new evaluation tool added a layer of complexity throughout the research process. EFNEP program funds cannot be used for research purposes. Limited research resources created significant delays with recruiting state EFNEP coordinators to volunteer for different phases of question testing. This resulted in delays or complications with completing the IRB application process, receiving training in research protocols, recruitment and coordination of study participants, and data collection. This lack of resources also contributed to methodical challenges with the last phase of question testing to assess construct validity.

Question Development

A mixed methods, multiphase research design was used to develop and test the dietary assessment questions nationally for EFNEP.[5,9,10] Results from this research established face and

content validity as well as temporal stability reliability of the dietary assessment questions (Appendix O).

The first study in this research process involved a content analysis of curricula most broadly used by EFNEP.[11] The purpose of the content analysis was to determine what nutrition education information was taught on a national scale to EFNEP participants, and to compare this information to the Dietary Guidelines for Americans.[4] This was the first known published nutrition content analysis of a federally-funded nutrition education program for adults, and included developing and testing a data recording instrument to accurately capture nutrition content from each of the curricula (Appendix A). The researchers also developed a protocol for the content analysis that used independent reviewers to establish reliability of the findings (Appendix B). The instrument and protocol can be used by nutrition education programs when developing or evaluating their nutrition education curricula.

Findings from the nutrition education content analysis demonstrated most of the Dietary Guidelines for Americans nutrition recommendations were included in curricula.[11] However, there was considerable variability in both the frequency of certain nutrition content and the depth of educational instruction provided, depending on the curricula used to teach EFNEP participants. Due to the variability across curricula, and the limited time available within EFNEP to teach nutrition content, further research was needed to determine the most critical nutrition content to include in nutrition education programs for low-income adults, and the content areas most important to evaluate in EFNEP.

The second study involved assembling a panel of experts to prioritize the nutrition recommendations from the Dietary Guidelines for Americans that were most important to *teach* low-income adults – to achieve the goals of improved health and reduced chronic disease risk.[12]

The experts prioritized a set of two overarching and eight specific nutrition recommendations for nutrition education program to teach low-income adults. These prioritized recommendations can be used by EFNEP administrators and other nutrition educators and program administrators to guide development of nutrition education program content for low-income adults. Additionally, nutrition educators can use the protocol described in the published paper as a framework for obtaining expert panel feedback.

A second expert panel was convened to further prioritize which nutrition recommendations from the first expert panel were most critical to *evaluate* in EFNEP. The second expert panel consisted of NC2169 multi-state researchers. The researchers determined the following 6 diet quality content areas were important to evaluate in EFNEP using a national questionnaire:

- Cook and eat more meals at home
- Eat more fruit, with the emphasis on whole fruit intake
- Eat more vegetables
- Eat a wider variety of vegetables
- Increase dairy or fortified soy product intake
- Limit sugar sweetened beverages

The combined content areas are components of healthy eating patterns and address the under consumed nutrients of public health concern listed in the 2015-2020 Dietary Guidelines for Americans.[3]

The researcher conducted a literature review to identify dietary assessment questions from validated instruments that addressed the 6 nutrition content areas to evaluate in EFNEP. A time-consuming challenge with the process was finding the actual questions and response

options from the research literature. Government websites provided another avenue to locate validated dietary assessment questions. Examples of instruments available through websites included the National Cancer Institute register of validated instruments[13] the California Health Interview Surveys[14] and Eating at America's Table Study surveys.[15] To organize questions gleaned from different sources, the researcher created a spreadsheet that listed each question and related information (source, validation, target population, response options), and matched each question to the Dietary Guidelines nutrition recommendations. This method of organizing questions helped expedite the identification of appropriate questions from validated instruments for the 6 content areas EFNEP experts determined were important to evaluate.

After identifying evaluation questions, an important next step was assessing the questions' clarity, representativeness to the 6 diet quality content areas, and appropriateness for an EFNEP evaluation questionnaire. This assessment was done by EFNEP program administrators from different regions of the country (content validity expert panel). The expert panel provided feedback so that questions reflected behaviors from the Dietary Guidelines that 1) could be measured in a way that does not require specificity of serving size/food amounts, and 2) addressed EFNEP's goals to improve diet quality. The experts suggested adding specific foods and time frames to each question, and using frequency of intake (times per week, times per day) to assess incorporating more healthy foods into an overall eating pattern.

An assessment tool was developed for the content validity process (Appendix F). This tool can be adapted for use by other nutrition interventions to evaluate the content validity of their dietary assessment questions.

Question Testing

Pretesting the questions and response options through cognitive interviews with EFNEP participants across several states and three rounds of revisions confirmed the questions were

simple to understand and interpreted as intended, and response options were able to discern differences in participant behaviors. The cognitive interview protocols are included in Appendices J – L). The content validity expert panel comments were used to develop scripted probing questions for the first round of cognitive interviews. For example, the experts suggested including response options with both types frequencies (times per day and times per week) for each question with probing questions to help get a realistic picture of intake from EFNEP participants. The use of scripted probing questions was an essential component of the interview process, because the probes provided consistency with data collection across interviews in several states about participants' thought processes.

Another essential component of the interviews was that participants were asked to read each question aloud, and provide internally-generated responses prior to showing participants the response options. Important information was gleaned from this process about ease of reading/literacy level and how participants thought about food and recalled intake of specific foods. Participants were encouraged to share their opinions about the way questions were worded and the most appropriate response options given their own intakes.

A final important component to the cognitive interview process was that all interviews were audio recorded. The researcher listened to, and transcribed detailed notes from all interviews. The ability to listen to all 111 cognitive interviews gave the researcher a comprehensive understanding of any issues participants had with question wording and understanding. All notes, themes, and recommendations for question revisions were reviewed by a committee to ensure independent confirmation.

Cognitive interview testing resulted in a 14-item dietary assessment instrument, measuring 6 diet quality content areas, which moved forward to reliability and construct validity

testing (Appendix N). Question response options were based on participants' reported intake and comply with the Dietary Guidelines for Americans recommendations for healthy eating patterns and consumer messages to increase healthy foods in meals and snacks.[3,16]

Test-retest reliability testing confirmed the dietary assessment questions' temporal stability. All questions showed at least moderate correlations (intraclass correlation coefficients [ICC] > 0.41), and over half the questions had strong correlations (ICC > 0.61). An unexpected finding from both the reliability and cognitive interview testing were comments from study participants that the questions themselves provided guidelines for *what* and *how* people should eat. For example, when asked whether study participants had any questions, the participants often responded by saying they did not know they needed to eat fruit throughout the day or the different kinds of vegetables listed throughout the day and week. They were interested in discussing how to incorporate the foods into their day and week. Clearly, study participants used the questions and responses as a learning tool.

Construct Validity Testing

The mean from three, 24-hour food recalls was used to assess construct validity of the questions, as this method is widely used to validate food frequency questionnaires.[17] The same participants were asked to complete the dietary assessment questions and three, 24-hour food recalls at both EFNEP enrollment and program completion. Colorado State University's Institutional Review Board approval for construct validity testing is included in Appendix P, and Appendix Q lists the letter of intent for Penn State to collect 24-hour food recall data. Both sets of recalls were supposed to be collected within the same time frame (within 1 week using 2 week days and 1 weekend day) of completing the nutrition questions, using a computer-assisted telephone system by the Penn State University Diet Assessment Center.[18]

Data were collected from 60 EFNEP participants in 8 states at program enrollment, and from 30 participants at program completion. Appendix R includes the data collection protocol for construct validity testing. Briefly, food recall data from each day were grouped into similar foods, beverages, and behaviors measured by each dietary assessment question, then frequency of intake was averaged across days and assigned a numeric score (1 = one time a day, 2 = 2 times per day, etc.) to capture the mean frequency of intake. Appendix S lists the statistical analysis plan for construct validity testing.

Results from construct validity testing confirmed highly significant differences (Wilcoxon signed rank test $p = < 0.05$) and low or no correlations for the dietary assessment questions compared to the mean intake from two, or three, 24-hour food recalls at program enrollment (Spearman correlation coefficient $r = 0.01 – 0.44$) and completion (Spearman correlation coefficient $r = 0.00 – 0.44$). Appendix T lists the construct validity testing results at program enrollment, and Appendix U lists the results at program completion. Due to the overall lack of significant correlations, the Bland-Altman method of assessing agreement was not pursued. Construct validity of the questions was not established.

These results, however, are likely attributed to the methods used to assess construct validity, and a constellation of factors that contributed to measurement errors, rather than a lack of association between the two measures (Appendix V). For example, Penn State University's Dietary Assessment Center interviewers did not ask previously-agreed upon probing questions to better align food recall data collection to the dietary assessment questions. Also, the data system Penn State used captured detailed servings of specific foods and beverages, which had to be converted to frequency of intake per day, then converted to days per week for comparison with the dietary assessment questions. These factors may have attenuated the correlations between

the food recall data and the dietary assessment questions. The researchers concluded that different sources of error influenced the failure to reject the null hypothesis of lack of correlations between the two measures of diet quality.

An overview of the literature by Willett showed 24-hour recalls have been widely used to assess the validity of food frequency questionnaires, however, the questionnaires consisted primarily of multiple, semi-quantitative items (>100) that assessed long-term intake (over 6 months to a year).[19] Short dietary assessment questionnaires have used 24-hour food recalls to assess validity, however, the instruments included portion sizes,[20,21] compared a combined set of questions assessing the same behaviors (healthy dietary changes) to foods or nutrients from the food recall data (sodium intake),[22,23] or demonstrated low correlations when tested with low-income adults ($r = < 0.32$).[22–24] The construct validity of short dietary assessment instruments have also been assessed by comparing to food frequency questionnaires which measure the same constructs but more comprehensively.[25–27]

Implications of Dissertation Results

The implications of this research are a set of nationally-tested dietary assessment questions that researchers, policy makers, and program administrators can use to evaluate the effectiveness of EFNEP at changing dietary behaviors. The dietary assessment instrument is the only known dietary evaluation tool developed and tested for national use in a federally-funded nutrition education program serving low-income adults. The instrument questions meet EFNEP objectives for an evaluation tool and address a prioritized set of Dietary Guidelines for Americans nutrition recommendations. This research has implications that extend beyond EFNEP, as few valid dietary assessment instruments exist for national nutrition education programs serving low-income adults. Therefore, other nutrition education programs or interventions serving low-income adults may use the dietary assessment instrument questions to

evaluate their programs. Additionally, nutrition education programs may use the Dietary Guidelines expert panel recommendations to guide the development of nutrition education content to teach low-income adults. Nutrition education programs may also adopt the methods and tools from this research to assess the content of nutrition education taught within their programs, conduct expert panels, or to develop and test their own dietary assessment instrument.

Future Research Directions

Testing may be needed to further establish validity of the dietary assessment instrument using methods appropriate for the specific foods, behaviors, and response options addressed in the 14 questions. The dietary assessment questions could be compared to health outcome measures, such as body mass index or blood pressure,[28] or to dietary measures that provide less biased estimates of intake, such as food records.[29] Food records that measure the appropriate time interval for comparison with food frequency questionnaires are considered a rigorous method for validity testing, however, this may be difficult to achieve with lower-literacy or low-motivation study participants.[19]

A seven-day food record, modified to better accommodate EFNEP participants with literacy or numeracy challenges,[30] may be an appropriate method to assess the dietary assessment questions' comparative/construct validity. To reduce participant burden, the modified food record could include a list of behaviors in which participants check the frequency of behaviors for each day (eat fruit, prepare dinner at home, drink soda) along with other information (timing and location of meals and snacks, sources of food and beverages). Seven-days of food records are needed for comparison to the majority of dietary assessment questions developed for EFNEP, which assess intake over a week.

In-person training of participants about how to complete a food record may improve the accuracy of data collection, especially for less motivated or lower-literacy populations.[30]

Additionally, using a registered dietitian nutritionist to review completed food records with participants to obtain more detailed information about dietary intake has been shown to improve the accuracy of food records, resulting in less measurement error.[31] The dietary assessment instrument should be administered to the same study participants two or more times over the same time period as the comparison method (7-day food record).[32] The repeated observations of dietary intake can be averaged to adjust for within-person error.[32]

Testing the dietary assessment questions sensitivity to change is another way to assess construct validity,[10] and has been used to assess the validity of short dietary assessment instruments.[23,33,34] The recommended method for evaluating sensitivity to change involves comparing mean changes in responses from the dietary assessment instrument between adults who received the EFNEP intervention (pre- and post-intervention) and a control group of low-income adults who did not participate in EFNEP.[10] The mean changes can be used to assess the questions' sensitivity to detect behavior changes from the EFNEP intervention.

Summary

The purpose of this research project was to develop and test dietary assessment measures (questions) to evaluate EFNEP nationally. This research was part of a larger Agricultural Experiment Station multi-state research project for EFNEP that is developing a new national evaluation questionnaire for EFNEP. A mixed-methods, multiphase approach was used to establish the evaluation questions' content and face validity, and temporal stability reliability. Though tested, construct validity was not established. Other nutrition education programs or interventions serving low-income adults may use the dietary assessment instrument to evaluate behavior changes. Future research needs include testing sensitivity to change and/or establishing validity of the instrument though the use of appropriate comparison measures.

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APPENDIX A. NUTRITION EDUCATION CURRICULA CONTENT ANALYSIS INSTRUMENT

EFNEP Multistate Adult Curricula Review
Diet Quality and Nutrition Behavior Change Content

Overview: This research project is an assessment of nutrition-related content contained in adult EFNEP curricula. You will review each lesson in a specific EFNEP adult curriculum for nutrition related content. You will use this form to compare nutrition content found in each lesson to the U.S. Dietary Guidelines for Americans, and assess the content by answering specific questions. Thank you for your involvement in this important research project. Your expertise and thorough review of the EFNEP curricula is appreciated.

Directions: Please write the name of the curriculum and lesson being reviewed in the space below. Please complete all sections of this form for each lesson. You should read through the entire lesson, then use the form to comment **only on the nutrition-related content in the lesson**. Other topic areas covered in the lesson are not related to this research project. The first statement on this form relates to the specific type of nutrition content covered in the lesson. Please refer to the U.S. Dietary Guidelines messages listed on the back of this page to identify the guidelines the lesson addresses. If the lesson covers a nutrition topic not listed on the back page, please add that information to the "Comments" column. Please be as thorough as possible. For all of the statements on the form, check the column that most corresponds with your level of agreement with the statement. A symbol key for each column is listed below and at the top of each page for your reference. Next, substantiate your choice by giving specific descriptions or evidence from the lesson in the "Comments" column.

Symbol Key: **SA** = Strongly Agree; **A**= Agree;
N= Neither Agree Nor Disagree;
D= Disagree; **SD** = Strongly Disagree

If you have any other comments about the nutrition content from the lesson, please include those on the last page of this form. If you have any questions about the curricula review process, please contact Erin Murray at erin.murray@colostate.edu or 303-807-1912.

Name of Reviewer:

Date of Review:

Title of Curriculum:

Lesson Plan Title (and number if appropriate):

Nutrition Messages from the 2010 U.S. Dietary Guidelines

1. Consume foods low in calorie density.

2. Monitor food intake. Use the Nutrition Facts label found on food packages to monitor food intake. Also monitor body weight.

3. When eating out, choose smaller portions or lower-calorie options. Cook and eat more meals at home.

4. Prepare, serve, and consume smaller portions of foods and beverages, especially those high in calories.

5. Eat a nutrient dense breakfast. Encourage children to eat a nutrient dense breakfast.

6. Reduce sodium intake to less than 2,300 mg (1,500 if African American, diabetic, hypertensive).

7. Consume less than 10% of calories from saturated fatty acids; replace with mono and polyunsaturated oils.

8. Consume less than 300 mg per day of dietary cholesterol.

9. Keep trans fatty acid intake as low as possible; limit foods with artificial trans fatty acids, such as, partially hydrogenated oils, and limit other solid fats.

10. Reduce intake of solid fats and added sugars.

11. Reduce intake of refined grains, especially if they contain solid fats, added sugars and sodium.

12. If alcohol is consumed, drink in moderation – one drink per day for women, two drinks for men.

13. Increase vegetable and fruit intake.

14. Eat a variety of vegetables, especially dark green, orange and yellow vegetables, and beans and peas.

15. Consume at least half of all grains as whole grains; replace refined grains with whole grains.

16. Increase intake of fat free and low-fat dairy products or fortified soy products.

17. Choose a variety of protein foods; choose seafood, lean meat, eggs, beans, soy products, and nuts and seeds.

18. Increase seafood consumption; choose seafood in place of some meat and poultry.

19. Replace protein foods that are higher in solid fats with those lower in solid fats and calories.

20. Use oils to replace solid fats whenever possible.

21. Choose foods that provide more potassium, dietary fiber, calcium, and vitamin D, which are nutrients of concern. These foods include vegetables, fruits, whole grains, and milk or milk products. Focus on nutrient-dense foods prepared without added solid fats, sugars, starches, and sodium.

22. Remember that beverages count and contribute substantially to overall calorie intake.

Nutrition Content of Lesson Plan	**SA**	**A**	**N**	**D**	**SD**	**Comments**
1. Refer to the 2010 Dietary Guidelines for Americans on the opposite page. List each dietary guideline taught in this lesson by number, and how well the teaching reflects the guidelines taught in the lesson, by using the symbol key (SA-SD).						
2. Refer to the 2010 Dietary Guidelines for Americans on the opposite page. List each dietary guideline not covered in the lesson that should be included or emphasized more, based on the nutrition education objectives of the lesson.						
3. Nutrition content in the lesson is current and relevant to the 2010 Dietary Guidelines for Americans.						
4. The nutrition content is free of sponsor/product bias.						
5. The lesson plan includes clear nutrition-related learning and behavioral objectives.						

6. Activities, including food or tasting activities, reinforce the learning and behavioral objectives and/or nutrition education content.						
7. The lesson plan is easy to understand, accurate, and sufficiently detailed for paraprofessional educators.						
8. Background information is easy to understand, accurate, and sufficiently detailed for paraprofessional educators.						
9. All materials and information needed to teach the content is included, such as visuals, props to activities, recipes for food activities, etc. The curriculum should include clear instructions on what is needed and where to purchase or how to make the materials if they are not included.						
10. The content is addressed using a variety of formats: *please circle all that apply* • Lecture • Learner-centered dialogue – approach to learning • Food activity • Kinesthetic activity • Group discussion • Other:						
11. The lesson content uses language appropriate for the adult EFNEP audience (limits technical terms, uses easy to understand concepts and clear language).						

12. Handouts or other support material are visually appealing and aid in reader comprehension (adequate white space, appropriate font)						
13. The nutrition content reflects the diversity of the EFNEP audience (cultural, ethnic, racial) in handouts and other educational materials.						
14. The nutrition lesson promotes behavior change (includes some of the following: a goal setting activity, asks how likely participants are to adopt this change, follows up on goals, or the nutrition content and activities reinforce behavior change).						
15. Lesson enhancements (free items) are designed to reinforce the learning objective(s).						
16. Which of the behavior checklist questions are linked to nutrition education content in the lesson? See the behavior checklist questions listed below.						
17. Create behavior checklist questions that reflect the Dietary Guidelines for Americans and the learning objectives and nutrition education provided in this lesson.						

National EFNEP Behavior Checklist Nutrition Domain Questions

Circle the response that best describes how you usually do things.					
1. How often do you plan meals ahead of time?	Never	Seldom	Sometimes	Most of the time	Almost always
2. When deciding what to feed your family, how often do you think about healthy food choices?	Never	Seldom	Sometimes	Most of the time	Almost always
3. How often have you prepared foods without adding salt?	Never	Seldom	Sometimes	Most of the time	Almost always
4. How often do you use the "Nutrition Facts" on the food label to make food choices?	Never	Seldom	Sometimes	Most of the time	Almost always
5. How often do your children eat something in the morning within 2 hours of waking up?	Never	Seldom	Sometimes	Most of the time	Almost always

Use the space below for additional comments:

APPENDIX B. PROCEDURES FOR THE EFNEP CURRICULA CONTENT ANALYSIS PILOT STUDY AND MULTISTATE CURRICULA REVIEW

Procedures for the EFNEP Curricula Content Analysis Pilot Study and Multistate Curricula Review

Diet Quality and Nutrition Behavior Change Content

January 3, 2013

Pilot Study:

1. Identify a curriculum that will not be part of the multistate curricula review.
2. Randomly select one lesson with nutrition content to test the curricula review tool.
3. Ruth Inglis-Widrick and Erin Murray meet to discuss the process and review the key messages from the U.S. dietary guidelines.
4. We each separately review the lesson using the curricula review tool.
5. We meet to discuss our findings and the level of agreement in our findings.
6. Revise tool as needed.
7. If there is lack of agreement with the first lesson's review, we separately test the revised tool with another randomly selected lesson from the same curriculum that includes nutrition content.
8. We meet to discuss our findings.
9. We meet with Dr. Baker and Auld to discuss our findings.
10. Revise the curricula review tool as needed.

Multistate Curricula Review:

1. Choose the least-frequently used curricula for the first review.
2. Both Ruth and Erin separately read the introduction for the curriculum and complete a review of lesson 1.
3. Meet to discuss our findings.
4. Separately complete a review of each lesson of a curriculum.
5. Meet to discuss our findings.
6. Meet with Drs. Baker and Auld to discuss our findings.
7. Choose the next least-used curriculum for the second review.
8. Repeat steps 2-6
9. Choose the next least-used curriculum for the third review.
10. Repeat steps 2-6.
11. Summarize all findings into content themes across curriculum.
12. Meet with Drs. Baker and Auld to discuss nutrition content themes that emerged from the review and other overall findings.

APPENDIX C. DIETARY GUIDELINES EXPERT PANEL PROJECT OVERVIEW AND TIMELINE

Dietary Guidelines Expert Panel for EFNEP

Project Overview

You have been asked to serve on an expert panel to prioritize the educational content of the Expanded Food and Nutrition Education Program (EFNEP) related to the U.S. Dietary Guidelines. EFNEP is a national nutrition education program that serves low-income families in all 50 states and U.S. territories. Additional information about EFNEP is provided in this packet.

Though EFNEP classes include content in nutrition, physical activity, food safety, food security, and food resource management, this project will focus on prioritizing only nutrition content. EFNEP is required to use the most current U.S. Dietary Guidelines as the basis for its nutrition content. The low-income families EFNEP serves receive this information on average via eight to ten one-to-two hour group classes over a two-to-three month period. Due to the challenges of multiple content areas taught, the limited number of lessons, and the special needs of low-income adult participants, the program needs to prioritize the most important Dietary Guidelines to teach nationally (time with not allow all the Dietary Guidelines related to nutrition to be included).

The nutrition content taught to EFNEP participants typically focuses on concrete nutrition recommendations. These recommendations are more fully represented through the principles listed under the "Key Recommendations" sections of the 2010 U.S. Dietary Guidelines. The specific nutrition content you will prioritize for use in ENFEP, therefore, come from both *key recommendations* and specific *principles* under the recommendations from the 2010 U.S. Dietary Guidelines.

Your expertise is critical to this process as the nutrition content chosen will have major national implications for:

- ENFEP nutrition education curriculum content. The information will be used to guide changes to nutrition education priority areas in EFNEP curricula nationally. EFNEP serves over 130,000 adults and nearly 400,000 family members annually to improve the health of limited resource families through practical lessons on basic nutrition and healthy lifestyles, food resources management, and food safety,
- EFNEP evaluation criteria, and
- other nutrition education programs throughout the country, such as the Supplemental Nutrition Assistance Program-Education (SNAP-Ed) and Cooking Matters. These programs serve thousands of limited resource families annually and often use EFNEP curricula and/or EFNEP nutrition behavior evaluation tools.

The expert panel's work is part of a multi-state research project. The primary project outcome will be a set of valid measure that evaluate diet quality and nutrient-related behavior change among all adults who participate in EFNEP. Priority areas identified by the expert panel will be used to develop questions which will ultimately be used to assess the program's effectiveness at improving the nutritional status of program participants.

Project Timeline and Tasks

Participation as an expert panel member should take about 3-5 hours of your time over a two-month period.

Timeline and tasks:

1. August 1st at 2:00 p.m. (MDT) – 10:00 a.m.(HAST), 1:00 p.m.(PDT), 3:00 p.m.(CDT), 4:00 p.m.(EDT)
   Initial expert panel call. Call 970-491-1205.
   The purpose of the call is to introduce the expert panel members and discuss specific project tasks, timeline, and outcomes.

2. Due August 11th
   Complete the form titled 2010 U.S. Dietary Guidelines Nutrition Recommendations Grouped by Priority for Teaching Low-Income Adult Participants in EFNEP. **Complete this form and return it by August 11th in the envelope included with this packet, or fax it to (970) 491-8729 attn: Erin Murray. You may also scan the document and email to erin.murray@colostate.edu.**

3. Second expert panel call (date to be determine during our first call).
   The purpose of this call is to review and discuss differences among your individually prioritized Dietary Guidelines recommendations.

4. You will receive a report of the outcomes of the expert panel via email from Erin Murray (erin.murray@colostate.edu) shortly after the second expert panel call. You will be able to provide feedback related to this report to Erin Murray.

APPENDIX D. SPECIFIC NUTRITION RECOMMENDATIONS FROM THE 2010 U.S. DIETARY GUIDELINES

Specific Nutrition Recommendations from the 2010 U.S. Dietary Guidelines*

Balancing Calories to Manage Weight, Principles for Promoting Calorie Balance and Weight Management

1. Focus on total calories consumed. Consuming an eating pattern low in calorie density may help reduce calorie intake and improve body weight outcomes and overall health.

2. Monitor food intake. The Nutrition Facts label on food packaging provides calorie information for each serving of food or beverage and can assist consumers in monitoring their intake. Also monitor body weight.

3. When eating out, choose smaller portions or lower-calorie options. When possible, order a small-sized option, share a meal, or take home part of the meal. Or instead of eating out, cook and eat more meals at home.

4. Prepare, serve, and consume smaller portions of foods and beverages, especially those high in calories. Individuals eat and drink more when provided larger portions.

5. Eat a nutrient-dense breakfast. Not eating breakfast is associated with excess body weight, especially among children and adolescents.

Foods and Food Components to Reduce

6. Reduce sodium intake to less than 2,300 mg and further reduce intake to 1,500 mg among African Americans or those who have hypertension, diabetes, or chronic kidney disease.

7. Consume less than 10 percent of calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids.

8. Consume less than 300 mg per day of dietary cholesterol.

9. Keep trans fatty acid consumption as low as possible by limiting foods that contain synthetic sources of trans fats, such as partially hydrogenated oils, and by limited other solid fats.

10. Reduce intake of calories from solid fats and added sugars.

11. Limit the consumption of foods that contain refined grains, especially refined grain foods that contain solid fats, added sugars, and sodium.

12. If alcohol is consumed, it should be consumed in moderation – up to one drink per day for women and two drinks per day for men.

Specific Nutrition Recommendations from the 2010 U.S. Dietary Guidelines*

Foods and Nutrients to Increase

13. Increase vegetable and fruit intake.

14. Eat a variety of vegetables, especially dark-green and red and orange vegetables and beans and peas.

15. Consume at least half of all grains as whole grains. Increase whole-grain intake by replacing refined grains with whole grains.

16. Increase intake of fat-free or low-fat milk and milk products, such as milk, yogurt, cheese, or fortified soy beverages.

17. Choose a variety of protein foods, which include seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds.

18. Increase the amount and variety of seafood consumed by choosing seafood in place of some meat and poultry.

19. Replace protein foods that are higher in solid fats with choices that are lower in solid fats and calories and/or are sources of oils.

20. Use oils to replace solid fats where possible.

21. Choose foods that provide more potassium, dietary fiber, calcium, and vitamin D, which are nutrients of concern in American diets. These foods include vegetables, fruits, whole grains, and milk and milk products.

Building Healthy Eating Patterns, Principles for Achieving a Healthy Eating Pattern

22. Focus on nutrient-dense foods. Healthy eating patterns focus on nutrient-dense foods – vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, lean meats and poultry, seafood, eggs, beans and peas, and nuts and seeds that are prepared without added solid fats, sugars, starches, and sodium.

23. Remember that beverages count. Beverages contribute substantially to overall dietary and calorie intake for most Americans.

*The nutrition content taught to low-income adults who participate in EFNEP typically focuses on concrete nutrition recommendations, which are more fully represented through the principles listed under some of the "Key Recommendations" sections of the 2010 U.S. Dietary Guidelines. The specific guidelines you will prioritize, therefore, come from both the *Key Recommendations* and *Principles* listed under the recommendations.

APPENDIX E. DIETARY GUIDELINES EXPERT PANEL RATING FORM

2010 U.S. Dietary Guidelines Nutrition Recommendations
Grouped by Priority Category for Teaching Low-Income Participants in EFNEP

To complete this form, please follow these steps.

1. Refer to the two-page list included in this packet *Specific Nutrition Recommendations from the 2010 U.S. Dietary Guidelines*, which are listed numerically.
2. Using the numbers associated with each nutrition recommendation, please list which of the Dietary Guidelines should be taught nationally to adults participating in EFNEP in the table below as "critical to include," "good to include," or "nice to know" information.
3. Return this information in the envelope provided by August 11, 2014**.**
4. Please contact Susan Baker susan.baker@colostate.edu or Erin Murray erin.murray@colostate.edu if you have questions about this form or the materials in this packet.

Thank you!

Nutrition Recommendations for a U.S. Adult Low-Income Population, by Priority
Critical to Include
Good to Include
Nice to Know

APPENDIX F. CONTENT VALIDITY EXPERT PANEL FORM

Instructions for Reviewing Nutrition Domain Behavior Checklist Questions

The purpose of this review is to evaluate the content validity of nutrition domain (ND) questions available from WebNEERs and the current research literature. The results from this review will be used to determine ND questions for cognitive interview testing with EFNEP participants in several areas of the country.

Background. Several steps were accomplished prior to this review that determined the selection of questions. First, a curricula review was completed which compared nutrition content included in the most-frequently used EFNEP curricula to the U.S. Dietary Guidelines. Second, an expert panel prioritized which of the 23 specific nutrition recommendations from the Dietary Guidelines should be taught to the low-income audience EFNEP targets. Third, NC2169 used the expert panel opinion to determine which nutrition content areas to evaluate nationally for EFNEP. Fourth, items were identified for each content area from the bank of optional EFNEP questions and the research literature. The questions were revised to better meet the needs of EFNEP participants.

Instructions. Please complete this form and send it to Erin Murray erin.murray@colostate.edu, cell: 303-807-1912. You may print this form and complete by hand, scan and email it to Erin at the email above. Or feel free to complete it electronically and email it.
Please rate each item as follows:

- Rate the level of representativeness, that is how well does the question represent one or more of the nutrition content areas listed in the last column. Please rate on a scale of 1-4, with 4 being the most representative. Space is provided for you to comment on the item or to suggest revisions.
- Indicate the level of clarity for each item, also on a four-point scale, 4 being the most clear. Again, please make comments in the space provided.
- Indicate to which factor the item belongs. The factors are listed along with a number that represents them. You may select more than one factor. If you do not think the item belongs with any factor specified, please circle number "7" and write in a factor that may be more suitable.
- Evaluate which questions should advance to cognitive testing by circling them or highlighting them in a color.
- The last two pages have response categories. Please review these for clarity on the chart provided. Add any additional response categories that you would like to see tested.
- If you questions about how to complete this form, please contact Erin Murray at erin.murray@colostate.edu or 303-807-1912.

Example:

Questions	***Representativeness*** 1=Question is not representative 2=Question needs major revision to be representative 3=Question needs minor revision to be representative 4=Question is representative	***Clarity*** 1=Question is not clear 2=Question needs major revision to be clear 3=Question needs minor revisions to be clear 4= Question is clear	***Nutrition Content Areas*** 1=Cook and eat more meals at home 2=Eat more fruit 3=Eat more vegetables 4=Eat a wider variety of vegetables 5=Increase dairy and fortified soy products 6=Avoid sugar-sweetened beverages 7=other, specify
How often do you plan meals ahead of time?	1 2 3 4 Comments: Could use additional information about time frame or number of days	1 2 3 4 Comments: Does not provide any time frame; could be interpreted as planning a meal when you are standing in the kitchen before you make it.	(1) 2 3 4 5 6 7_____ Comments:

Questions	***Representativeness*** 1=Question is not representative 2=Question needs major revision to be representative 3=Question needs minor revision to be representative 4=Question is representative	***Clarity*** 1=Question is not clear 2=Question needs major revision to be clear 3=Question needs minor revisions to be clear 4= Question is clear	***Nutrition Content Areas*** 1=Cook and eat more meals at home 2=Eat more fruit 3=Eat more vegetables 4=Eat a wider variety of vegetables 5=Increase dairy and fortified soy products 6=Avoid sugar-sweetened beverages 7=other, specify
1. Most weeks, how often do you cook evening meals at home?	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
2. How many times in a week do you eat breakfast prepared away from home, including fast food? (such as McDonalds, Burger King, Wendys, Arbys, Pizza Hut, KFC, and food from gas stations or corner stores)	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
3. How many times in a week do you eat your mid-day meal prepared away from home, including fast food? (such as McDonalds, Burger King, Wendys, Arbys, Pizza Hut, KFC, and food from gas stations or corner stores)	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
4. How many times in a week do you eat your evening meal prepared away from home, including fast food? (such as McDonalds, Burger King, Wendys,	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:

Arbys, Pizza Hut, KFC, and food from gas stations or corner stores)			
5. On most days, how many times do you eat fruit?	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
6. How many pieces of fruit did you eat yesterday? (or a typical day?)	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
7. On most days, how many times do you eat vegetables?	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
8. On most days, how many different vegetables do you eat?	1 2 3 4 Comments:	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
9. Do you eat more than one type of vegetable each day?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
10. How many different types of vegetables do you eat in a typical day?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
11. On most days, how often did you eat red and orange vegetables, like tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
12. On most days, how often did you eat dark green vegetables, like broccoli, spinach, green lettuce, collard or turnip or mustard greens?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:

13. Most weeks, how many times do you eat dried beans?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
14. How often do you eat dried beans?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
15. How often did you drink milk or soymilk?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
16. How often do you eat yogurt or drink yogurt in smoothies?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
17. How often do you eat cold cereal?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
18. How often do you eat cheese?	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
19. How many regular sodas (not diet), pop, or soft drinks did you drink? Include all kinds such as Coke, Pepsi, 7-Up, Sprite, root beer	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
20. How often did you drink fruit punch and fruit drinks or sweet tea? (such as Snapple, flavored teas, Capri Sun, vitamin water, and Kool-Aid)	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
21. How often did you drink sports drinks? (such as Gatorade, PowerAde, or Propel)	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:
22. How often did you drink energy drinks? (such as Rockstar, Red Bull, Monster and Full Throttle)	1 2 3 4 Comments	1 2 3 4 Comments	1 2 3 4 5 6 7_____ Comments:

Response Categories

The Scales below were used in validated dietary assessment instruments from the research literature. Some of the scales are appropriate for specific items, which we will test during cognitive interviews. Please give your overall opinions about the response categories <u>for use with EFNEP participants</u>.

Responses	***Clarity*** **1=Response is <u>not</u> clear** **2= Response <u>needs major revision</u> to be clear** **3= Response <u>needs minor revisions</u> to be clear** **4= Response is <u>clear</u>**
Less than 1 day a week 1-2 days a week 3-4 days a week 5-6 days a week Every day	1 2 3 4 Comments:
Less than 1 time a week 1 time a week 2 times a week 3 times a week 4 times a week 5 or more times a week Always	1 2 3 4 Comments:
Less than 1 time a day 1 time a day 2 times a day 3 times a day 4 times a day 5 or more times a day	1 2 3 4 Comments:
I do not eat (fruit) most days 1 a day 2 a day 3 a day 4 a day 5 or more a day	1 2 3 4 Comments:
Less than 1 time a day 1 time a day 2 times a day 3 or more times a day	1 2 3 4 Comments:

APPENDIX G. COLORADO STATE UNIVERSITY IRB APPROVAL FOR COGNITIVE INTERVIEW TESTING

Colorado State University
Knowledge to Go Places

Research Integrity & Compliance Review Office
Office of the Vice President for Research
321 General Services Building - Campus Delivery 2011 Fort Collins, CO
TEL: (970) 491-1553
FAX: (970) 491-2293

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:	January 02, 2015	
TO:	Baker, Susan, Food Sci. & Human Nutrition	
	Melby, Chris, Food Sci. & Human Nutrition, McGirr, Kathryn, Food Sci. & Human Nutrition	
FROM:	Swiss, Evelyn, Coordinator, CSU IRB 1	
PROTOCOL TITLE:	Expanded Food & Nutrition Education Program	
FUNDING SOURCE:	Funding - Grants/Contracts	
PROTOCOL NUMBER:	09-861H	
APPROVAL PERIOD:	Approval Date: December 31, 2014	Expiration Date: April 30, 2015

The CSU Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Expanded Food & Nutrition Education Program. The project has been approved for the procedures and subjects described in the protocol. This protocol must be reviewed for renewal on a yearly basis for as long as the research remains active. Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

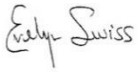
If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.

This approval is issued under Colorado State University's Federal Wide Assurance 00000647 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under CSU's Assurance, please do not hesitate to contact us.

Please direct any questions about the IRB's actions on this project to:

IRB Office - (970) 491-1553; RICRO_IRB@mail.Colostate.edu
Evelyn Swiss, IRB Coordinator - (970) 491-1381; Evelyn.Swiss@Colostate.edu

Swiss, Evelyn



Swiss, Evelyn

Amendment is approved to interview 300 EFNEP participants. Approved documents include: Cognitive Interview Consent, dated 12/31/2014; EFNEP Nutrition Domain Behavior Checklist Questions, dated 12/19/2014; Cognitive Interview Recruitment Script CSU Nutrition Questions, dated 12/19/2014.

Approval Period:	December 31, 2014 through April 30, 2015
Review Type:	EXPEDITED
IRB Number:	00000202
Funding:	US Department of Agriculture, AES

APPENDIX H. COLORADO STATE UNIVERSITY IRB APPROVAL FOR TEST-RETEST RELIABILITY TESTING

Colorado State University
Knowledge to Go Places

PROTOCOL
Social, Behavioral & Education Research
Colorado State University

Protocol # 09-861H
Date Printed: 11/23/2015

Protocol Title:	Expanded Food & Nutrition Education Program
Protocol Status:	SUBMITTED
Date Submitted:	11/20/2015
Approval Period:	Draft
Important Note:	This Print View may not reflect all comments and contingencies for approval. Please check the comments section of the online protocol. Questions that appear to not have been answered may not have been required for this submission. Please see the system application for more details.

* * * Amendment * * *

Amendment (Please note: Input N/A if not applicable)

1. **Summarize the proposed changes to the protocol in lay terms.**

This is an amendment of the previous amendment (amendment 21). Attachments have changed slightly.

EFNEP program leaders want to establish the reliability of newly developed questions for the EFNEP reporting system through test/retest methods. We will work with CSU housing and dining to recruit 40 state classified, entry level staff (similar to EFNEP target population but not currently participants) to complete a questionnaire on 2 different occasions. Recruitment script, consent form, protocol and questionnaires are attached.

Proceed to the appropriate section(s) in the protocol and make your changes.

Make necessary changes in the Consent Form(s) or Alteration of Consent Form(s) (i.e., Cover Letter or Verbal Script), or other attachments, if applicable.

2. **Indicate Level of Risk involved with the changes proposed. (If level of risk has changed, please update the "Risks" section in the protocol form.)**

No Change

3. **List of Protocol Sections (and questions) that have been changed/modified**

APPENDIX I. COLORADO STATE UNIVERSITY IRB APPROVAL FOR CONSTRUCT VALIDITY TESTING

Colorado State University

Knowledge to Go Places

PROTOCOL
Social, Behavioral & Education Research
Colorado State University

Protocol # 15-6071H
Date Printed: 03/01/2016

Protocol Title:	Regional Nutrition Education Center of Excellence West: Testing the Feasibility of Phone 24 Hour Recalls
Protocol Status:	APPROVED
Date Submitted:	02/16/2016
Approval Period:	02/29/2016-10/07/2016
Important Note:	This Print View may not reflect all comments and contingencies for approval. Please check the comments section of the online protocol. Questions that appear to not have been answered may not have been required for this submission. Please see the system application for more details.

* * * Amendment * * *

Amendment (Please note: Input N/A if not applicable)

1. **Summarize the proposed changes to the protocol in lay terms.**

   We would like to add one additional survey to this project. It is attached in the attachment section as "nutrition questionnaire form."

Proceed to the appropriate section(s) in the protocol and make your changes.

Make necessary changes in the Consent Form(s) or Alteration of Consent Form(s) (i.e., Cover Letter or Verbal Script), or other attachments, if applicable.

2. **Indicate Level of Risk involved with the changes proposed. (If level of risk has changed, please update the "Risks" section in the protocol form.)**

No Change

3. **List of Protocol Sections (and questions) that have been changed/modified**

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* * * Personnel Information * * *

IMPORTANT NOTE: Mandatory Personnel on a protocol are: Principal Investigator and Department Head. Only the Principal Investigator can submit the protocol; although other personnel listed on the protocol can create the protocol. Human Subjects Protection Training is mandatory for Principal Investigator, Co-Principal Investigator, and Key Personnel (as defined by NIH). Training must be updated every three (3) years.

Principal Investigator Mandatory

Name of Principal Investigator (Faculty, Staff or Postdoc)	Degree	Title
Auld, Garry		Professor
Email	**Phone**	**Fax**

APPENDIX J. COGNITIVE INTERVIEW PROTOCOL AND REQUIRED DOCUMENTS: ROUND 1

Cognitive Interview Protocol
EFNEP Adult Behavior Checklist – Nutrition Domain Questions

This protocol was adapted from the following sources:

Willis, G. B. (1999). Cognitive Interviewing: A "How To" Guide. Reducing Survey Error through Research on the Cognitive and Decision Processes in Surveys; A short course given at the meeting of the American Statistical Association. R. A. Caspar, J. T. Lessler and G. B. Willis. Chapel Hill, NC, Research Triangle Institute. http://appliedresearch.cancer.gov/areas/cognitive/interview.pdf

Shafer and Lohse "How to Conduct a Cognitive Interview: A Nutrition Education Example". Retrieved May 15th, 2010 from: http://www.au.af.mil/au/awc/awcgate/usda/cog_interview.pdf.

King, T.C. & Laitusis, C.C. (2008). *Sample Cognitive Interview Protocol.* Princeton, NJ: Educational Testing Service

Santiago, O. (2012) *Cognitive Interview Protocol to Pretest Questionnaires with Children.* EFNEP Youth Evaluation Committee.

Additional References:

De Leeuw, E., Borgers, N., & Smits, A. (2004). Pretesting questionnaires for children and adolescents. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, J. Martin & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* (pp. 423-429). Hoboken, New Jersey: John Wiley & Sons. Inc.

Willis, G. B., P. Royston, et al. (1991). "The use of verbal report methods in the development and testing of survey questionnaires." Applied Cognitive Psychology **5**: 251-267.

Alaimo, K., C. Olson, et al. (1999). "Importance of cognitive testing for survey items: An example from food security questionnaires." Journal of Nutrition Education **31**(5): 269-275.

Conducting the Cognitive Interview: Instructions

One - Two Weeks Prior to Conducting the Cognitive Interview

Dwayne Watson will facilitate scheduling with supervisors to recruit participants from EFNEP or other similar classes. **Please respond to Dwayne as quickly as possible when he sends you an email to schedule the cognitive interviews.**

Three - Five Days Prior to Conducting the Cognitive Interview

Dwayne will coordinate with supervisors about sending reminders 3 – 5 days before the interviews. **Confirm location, directions, contact person, and number of interviews with Erin Murray and/or Dwayne Watson.**

One - Two Days Prior to Conducting the Cognitive Interview

1. **Assemble the following materials: (Packets and materials will be located in back EFNEP office. Get gift cards from Erin Murray)**

_____ Stack of questions to test. Each question and response option will be on a single sheet of cardstock paper, so the participant only deals with one question at a time.
_____ List of additional general probes to use as appropriate for testing questions.
_____ Pens
_____ Consent Forms – have two forms per person, one for participant and one for our files (Appendix A). Return all consent forms to Erin.
_____ Demographic Form (Appendix B)
_____ Cognitive Interview Guide with Scripted interviewer probes (Appendix C)
_____ Additional General Probing Questions (Appendix D)
_____ Cognitive Interview Recording Form (Appendix E)
_____ Tape recorder
_____ Gift cards – **Get from Katie** (Bring enough for the number of interviews you will conduct)
_____ Gift card receipts (Appendix F). Bring the appropriate receipts - $20 or $30
_____ Clip boards (if needed)

2. **Make sure the recorder is working properly.** Practice recording in advance to verify that the tape recorder can adequately pick up another person's sound.

Attached forms:
Attachment A: Cognitive Interview Consent Form
Attachment B: Demographic Form
Attachment C: Cognitive Interview Guide
Attachment D: Additional General Probing Questions
Attachment E: Cognitive Interview Recording Form
Attachment F: $20 and $30 Gift Card Receipts
Day of the Cognitive Interview

1. Arrive at least 30 minutes early to set up materials and familiarize yourself with the interview location.
2. Test the functioning of the recorder to make sure it is working properly. If there is a problem, be very attentive to note taking.
3. Set up the table and chairs so the two chairs are perpendicular to one another. This perpendicular arrangement facilitates conversation.
4. Verify that you have the materials to be reviewed during the cognitive interview (consent forms, demographic form, gift card receipt forms, question sets, scripted probes, and recording form, and additional paper for taking notes as needed).
5. Set up equipment and materials so they are easily accessible to you.
6. Keep the gift cards in a secure location.
7. After the interview, complete the appropriate information on the consent, demographic, and cognitive interview recording forms. Make sure gift card receipts are signed. Secure tape recorder and all forms for Erin.
8. Review the interview tips below.

Interview Tips

"Cognitive interviews are used to investigate the total question-answer process and discover sources of confusion and misunderstanding" (De Leeu, Borges & Smits, 2004).

- Interview at least 2 adults prior to completing the cognitive interview. This will help you to get familiarized with the Cognitive Interview Guide. You will also learn to manage the time appropriately and improve your decision skills in terms of which or how many probing questions to ask for each questionnaire item.

- Your job is to be a detective who can find problems with questions or response options. Follow the Cognitive Interview Guide but remember not all situations are covered in the guide; you may need to improvise throughout the interview by looking for clues about questionnaire problems. Refer to the list of general probes or use other open-ended questions to gather more information. (This is known as an emergent or spontaneous probe)

- Use your own discretion on the number of anticipated probing questions you ask based on time constraints as well as the answers given by the interviewee.

- Allow enough time so that the cognitive interview is not rushed. Use an unhurried pace throughout the interview. More complete and in depth responses to fewer questions will be more useful than minimal or less in depth responses to more questions.

- Encourage the interviewee to provide specifics about what she/he is thinking.

- Provide non-verbal reinforcement and active listening techniques to let the interviewee know you are listening:
    - Nodding
    - Pausing after the interviewee makes a comment so to not rush them
    - Short verbal responses:

        - Yes, okay, uh huh
    - Additional-Probing questions:
        - "Could you give me an example of what you mean?"
        - "What does this word mean?"
        - "What do you think it means?"
        - "Tell me more."
        - "I'm not sure I understand - could you please explain further?"

- Listen to what the interviewee mentions so you can probe further on these items later on, if needed. For example, if the interviewee says she/he 'liked' a question or thought something was 'interesting,' but does not explain why, probe with additional questions.

- Keep in mind - and emphasize with interviewees - that although we are asking them to answer the questions as carefully as possible, we are primarily interested in the ways they arrive at their answers and any problems they had with the question.

Recommendations for the Cognitive Interview

Guidelines for the Interviewee's Arrival

1. Welcome and introduce yourself to the interviewee. Take time to make the interviewee feel at ease (establish rapport to reduce anxiety).
2. Briefly explain introductory aspects such as confidentiality and why the study is important, and that you are interested in hearing what she/he has to say about a questionnaire (refer to Cognitive Interview Guide).
3. Inform the interviewee that you will record the interview, but their name will not be attached to it and it will only be used for research purposes.
4. For a successful cognitive interview, clearly explain what the rules are and what is expected. In addition, give clear examples and practice the required tasks before the interview starts.
5. Complete the consent forms.
6. Answer any questions.
7. Start the recording device.
8. Begin the cognitive interview.

Recommendations for the Interview Itself

- Give the participant the first question.
- Ask the participant to read aloud each question and answer choice. (This is a very important moment to detect problems related to comprehension or readability).
- Probes to consider:
    - "Tell me what you think the question is asking."
    - "Tell me how you came to pick that answer."
    - "Tell me why you didn't pick the other answer choices."
    - "What did and didn't you like about the question?"
    - "Was this an easy or hard question for you?"
    - "What other factors influenced your decision?"
- Maintain eye contact with the participant.

Recommendations for Closing

- Let them know that was the last question and ask if they have additional comments.
- Pause to allow the interviewee time to share additional comments.
- Answer any questions and thank the interviewee for his/her participation.
- Give the interviewee a gift card and gift card receipt to sign.

After completing the cognitive interview

- Complete all information on the Cognitive Interview Recording Form.
- Record comments in the notes section of the Recording Form. List any additional notes, comments, or reactions you had about the cognitive interview, such as non-verbal communication from the interviewee, distractions, and any comments about specific questions listed by question number.
- If you had another researcher in the room with you, debrief with that person to make sure no information was missed, to discuss what went well, what could be improved, etc.
- Keep information for each interviewee in a secure file. This information includes:
    - Cognitive interview recording forms and notes
    - Cognitive interview tape recording
    - Signed consent forms
    - Signed gift card receipts
- As soon as possible, give all completed information to Erin Murray.

Attachment A
Cognitive Interview Consent Form

Colorado State University (CSU)

Improving the Expanded Food and Nutrition Education Program Behavior Checklist Questions

Consent Form

Investigators:
Susan Baker, Associate Professor, CSU (970) 491-5798

You are being asked to take part in a research study about a survey form. This will provide important information for changing the Expanded Food and Nutrition Program (EFNEP) Behavior Checklist form. This research study is being carried out by Associate Professor Susan Baker at Colorado State University CSU. This form explains the study and your part in it, if you decide to participate in the study.

Please read the form carefully. Take as much time as you need. Ask the investigator to explain anything you don't understand. You can decide not to participate in the interview. If you participate in the interview, you can change your mind quit at any time. You will receive $20 gift card for participating in the complete session. This study has been approved for human subject participation by the Colorado State University Institutional Review Board.

What is this study and this interview about?

This study is being done to understand what you think about the questions on a survey form. Your feedback will help us to develop better questions and response categories about nutrition and healthy eating habits.

You are being asked to take part in this interview because you are or have been participating in the nutrition education classes. It will take about one hour.

What will I be asked to do if I am in this interview?

If you take part in this interview, you will be asked to

- Read questions and answers about nutrition and healthy eating concepts.
- Describe what they mean to you.
- Suggest ways to make the questions and answers more clear.

There are no right or wrong answers. We are interested in your opinions.

Are there any benefits to me if I am in this interview?

There are no direct benefits to you for participating in the interview. The information from this interview will be used to decide how to ask questions on a new form. This will help program participants like you to see what changes they made as a result of our program. It will also help our program show if our classes improve healthy eating habits.

Are there any risks to me if I am in this study?

The potential risk from taking part in this study is that you might be more concerned about how you are eating and whether or not you are eating certain foods.

Will my information be kept private?

Your comments will be recorded. The recordings will be erased after the researcher takes notes. These notes will be available only to the researchers working on this project. No one will be identified by name in the notes or in any of the other materials collected during this session. All participants will be assigned a number in our records. This number list will be kept in a locked drawer in the CSU EFNEP state office in Fort Collins. Participants will be known by that number to the research team. All notes and other information collected during this session will be stored in a locked cabinet at the CSU EFNEP state office. Only the researcher will have access to this information. Once the study is completed, the information will be kept for 3 years and then destroyed. The only exceptions to this are if we are asked to share the research files for audit purposes with the CSU Institutional Review Board ethics committee, if necessary. In addition, for funded studies, the CSU financial management team may also request an audit of research expenditures. For financial audits, only the fact that you participated would be shared, not any research data.

Are there any costs or payments for being in this study?

There will be no costs to you for taking part in this study. You will receive a $20 gift card for completing the interview.

Who can I talk to if I have questions?

If you have questions about this interview or the information in this form, please contact the Susan Baker at (970) 491-5798.

If you have questions about your rights as an interview participant, or would like to report a concern or complaint about this study, please contact the Colorado State University Institutional Review Board at 970-491-1553, or RICRO_IRB@mail.colostate.edu; 970-491-1553.

What are my rights as a participant in this interview?

Your participation in this interview is completely voluntary. You may choose not to be a part of this interview. There will be no penalty to you if you choose not to take part. You may choose not to answer specific questions or to stop participating at any time.

What does my signature on this consent form mean?

- Your signature on this form means that:
- You understand the information given to you in this form.
- You have been able to ask the interviewer questions and state any concerns.
- The interviewer has responded to your questions and concerns.

- You believe you understand the purpose of this research study and the potential benefits and risks that are involved.

Statement of Consent

I give my voluntary consent to take part in this interview.

□ I understand it will be recorded.

I will be given a copy of this consent document for my records.

Signature of Participant	Date
Printed Name of Participant	
Signature of Researcher	Date
Printed Name of Researcher	

Attachment B
Demographic Form

Behavior Checklist Interview

ID_____

Date: _____ Location:_____

Age: _____ □ Female □ Male

Number of children at home: _____

Highest Grade completed

□ High School
□ Graduated High School or GED
□ Some college
□ Graduated 2 year college
□ Graduated college
□ Post Graduate

Check the ethnicity you identify with:

□ Hispanic/Latino □ Non-Hispanic/non-Latino

Check the race category you identify with:
(you may check more than one)

□ American Indian/Alaskan Native
□ Asian
□ Black or African American
□ Native Hawaiian or other Pacific Islander
□ White

Programs that you and your family participate in:
(check all that apply)

□ Free or reduced school lunch or breakfast
□ FDPIR (Food Distribution - Indian Reservations)
□ Supplemental Nutrition Assistance Program (SNAP, Food Stamps)
□ Head Start
□ TANF (Temporary Assistance for Needy Families)
□ TEFAP (Commodities)
□ WIC
□ Other_____

Attachment C
Cognitive Interview Guide
Nutrition Domain Questions

Cognitive Interview Introduction and Questions

Introduction

"Hello, my name is _____from Colorado State University. We are looking for better ways to ask some questions, and we think you can help. I will be asking you some questions. This should take an hour at the most. Your answers will help us learn how to ask better questions about healthy eating and food choices."

- Give the participant the consent form (Appendix A). You may read it to them.

"This information is a consent form. I will give you a copy that you can read here or I can read it to you. When you sign a copy you are giving us permission to use the information you give us. Your name will not be tied to the tape recording or any of the answers you give."

"What questions do you have about the consent form?"

- Answer any questions. Once the form is signed, continue.

"Now I would like to ask you to complete this short form about you and your family."

- Have the participant complete the Demographic Form (Appendix C).

"Thank you. Now we are ready to begin. I may take some notes while you are talking to help me remember what you said. Please remember that there are no wrong answers. Feel free to say what comes to your mind. We want your opinions and advice on how these questions and answer choices are worded and what the questions mean to you. I didn't write the questions, so don't worry about hurting my feelings if you criticize them. My job is to find out what's wrong with them."

"I am going to start the tape recorder now."

- Say the participant ID number and date on the recorder.
- Record the start time on the Cognitive Interview Recording Form.

Begin the Cognitive Interview - proceed to the questions.

Nutrition Domain Behavior Checklist Questions

"I am going to ask you to read some questions and answers about different behaviors."

Question 1

"Here is the first question."

- Hand Question 1 to the participant (single sheet of paper with one question and answer options).

"Please read the question and answer choices aloud, and tell me how you would answer it"
Most weeks, how often do you cook meals at home?

Ask the following scripted probing questions:

- What is this question saying to you?
- How would you answer this question?
- Which of these response groups is better for this question?
- What "meals" are you considering when you answer this?
- What is your main meal of the day?
- Is there a better way to ask this question to see how often you cook your main meal at home?
- What does the term "most weeks" mean to you?
- What does "cook" mean to you?

- Ask additional open-ended questions from the list of general probes as appropriate.
- Proceed to question 2 after the participant has provided his/her thoughts about the 1st question.
- Record any non-verbal communication or other comments, listed by question number, on the Recording Form.

Question 2

"Here is the next question."

- Hand Question 2 to the participant (single sheet of paper with one question and answer options).

"Please read the question and answer choices aloud, and tell me how you would answer it"

How many days in a week do you eat breakfast prepared outside of your home? (include fast food, restaurant food, or food from gas stations or corner stores)

Ask the following scripted probing questions:

- What is this question saying to you?
- How would you answer this question?
- What does the term "breakfast" mean to you?
- What does "fast food" mean to you?
- How do you define a week?
- What does the term "food prepared outside of your home" mean to you?
- Is there a better way to say this question?

- Ask additional open-ended questions from the list of general probes as appropriate.
- Proceed to question 3 after the participant has provided his/her thoughts about the 2nd question.
- Record any non-verbal communication or other comments, listed by question number, on the Recording Form.

(note: continue format for each question with scripted probes)

Response categories

- After the last question, put all response categories on the table for the interviewee to review.

"Now I would like your comments about these different ways to answer questions. Which one of them is most clear to you?
Which one is most difficult or confusing?
Are they specific enough for you to answer a question accurately?
Do you have any other comments about these responses to questions?"

End of the interview

"This is the end of the interview. Thank you for helping us with this activitiy. You were a lot of help! Please feel free to share any other comments that you haven't shared to this point."

- Pause to allow the interviewee time to share additional comments.

"Your input will be very helpful in developing our checklist. Do you have any questions?"

- Answer any questions and thank interviewee for his/her participation.
- Record the stop time of the interview on the Recording Form.
- Record comments in the notes section of the Recording Form. List any additional notes, comments, or reactions you had about the cognitive interview, such as non-verbal

communication from the interviewee, distractions, and any comments about specific questions listed by question number.

- If you had another researcher in the room with you, debrief with that person to make sure no information was missed, to discuss what went well, what could be improved, etc.
- Keep information for each interviewee in a secure file. This information includes:
    - Cognitive interview recording forms and notes.
    - Cognitive interview tape recording
    - Signed consent forms
    - Signed gift card receipts
- As soon as possible, give all completed information to Erin Murray.

Attachment D
Additional General Probing Questions
Nutrition Domain Questions

General Probing Questions
Keep these with you during the interview – you do not have to ask every probe

Comprehension of the Question or Words
"What do you think the question is asking?"
"Could you give me an example of what this means?"
"What do you think this word/question means?"

Decision Process &Retrieval from Memory
"How sure are you of your answer?"
"How did you count the number of times you ate/drank that?"
"What other factors influenced your answer?"

Answer Categories
"What do the answer choices mean to you?"
"Tell me how you came to pick that answer."
"Tell me why you didn't pick the other answer choices."
"What other ways could you answer this question."

Response Processes:
"How hard was this question for you to answer? What about it was hard to answer?"
"Are any words or phrases confusing to you? Is there any other way to ask the question to make it clearer and easier to answer?
"What did you like about the question? What did you not like about the question?"

Attachment E
Cognitive Interview Recording Form

Cognitive Interview Recording Form

Participant ID_____ Date:_____
Interviewer_____
Start Time:_____ Stop Time:_____

Participant Comments

Attachment F
$20 and $30 Gift Card Receipts

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $20 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

Signature Date

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $20 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

Signature Date

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $20 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

Signature Date

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $20 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

Signature Date

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $30 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

Signature Date

Receipt of Gift Card for Cognitive Interview of Nutrition Behavior Checklist Questions

I, ______________________________, received a $30 gift card for participating in a CSU cognitive interview about nutrition questions.

____ ______________________________

APPENDIX K. COGNITIVE INTERVIEW PROTOCOL: ROUND 2

Cognitive Interview Protocol

Introduction

"Hello, my name is _____from _____ University. We are looking for better ways to ask some questions, and we think you can help. I will be asking you some questions. This should take an hour at the most. Your answers will help us learn how to ask better questions about healthy eating and food choices."

- Give the participant the consent form. You may read it to them.

"This information is a consent form. I will give you a copy that you can read here or I can read it to you. When you sign a copy you are giving us permission to use the information you give us. Your name will not be tied to the tape recording or any of the answers you give."

"What questions do you have about the consent form?"

- Answer any questions. Once the form is signed, continue.

"Now I would like to ask you to complete this short form about you and your family."

- Have the participant complete the Demographic Form.

"Thank you. Now we are ready to begin. I may take some notes while you are talking to help me remember what you said. Please remember that there are no wrong answers. Feel free to say what comes to your mind. We want your opinions and advice on how these questions and answer choices are worded and what the questions mean to you. I didn't write the questions, so don't worry about hurting my feelings if you criticize them. My job is to find out what's wrong with them."

"I am going to start the tape recorder now."

- Say the participant ID number and date on the recorder.
- Record the start time on the Cognitive Interview Recording Form.

Begin the Cognitive Interview - proceed to the questions.

Round 2 Cognitive Interview Questions and Scripted Probing Questions (for Interviewers)

For each question please do the following –

- Ask the participant to read the question out loud while covering the responses (you can read the questions out loud if they have problems with reading).
- Ask the participant how they would answer the question.
- Uncover the responses and ask if any of the responses would match their answer. If so, why, If not, why.

1. How often do you cook dinner (or your main meal) at home?

   Less than 1 day a week
   1 day a week
   2 days a week
   3 days a week
   4 days a week
   5 days a week
   6 days a week
   Every day

Probing questions:
What is this question asking in your own words?
What is your main meal of the day?
Is there a better way to ask this question to see how often you cook your main meal at home?

2. How often do you eat dinner (or your main meal) prepared outside of your home? (include fast food, restaurant food, and food from grocery store delis, gas stations or corner stores)

   Less than 1 day a week
   1 day a week
   2 days a week
   3 days a week
   4 days a week
   5 days a week
   6 days a week
   Every day

Probing questions:
What do you think this question is asking using your own words?
Which meals are you most likely to eat out?
How do you choose where you will eat when you away from home?
Is there a better way to ask this question to see how often you eat food prepared outside of your home?

Are there better response options than the ones listed for this question?

Fruits include apples, bananas, oranges, grapes, raisins, melon, and berries. Count fresh, frozen, dried, or canned fruit. Do not count any juices.

3. How often do you eat fruit?

    Less than 1 time a day
    1 time a day
    2 times a day
    3 times a day
    4 or more times a day

Probing questions:
How difficult is it to answer this question?
How did you determine or count how often you ate fruit?
What time period did you use to determine your answer?
Is there another way to ask how much fruit you normally eat in a day? If so, how would that question be worded?

Are there better response options that you would suggest?
Does the list of fruit make it easier to answer the question?
Do you have suggestions for other fruits/or changes to the description?

Some examples of vegetables are green salad, corn, green beans, peas, potatoes (do not count french fries or potato chips) greens and squash. Count fresh, canned, and frozen vegetables. Do not count rice.

4. How many times per day do you eat vegetables?

    Less than 1 time a day
    1 time a day
    2 times a day
    3 times a day
    4 or more times a day

Probing questions:
Is it easier or more difficult to answer this question with the list of vegetables?
Do you have suggestions for a list of vegetables that would be helpful for answering this question?
How did you determine the number of times you ate vegetables?
Would you answer this question differently if it asked how many vegetables you eat each day?
Is there another way to ask this question to see how many vegetables you ate? If so, how should that question be worded?
Do you have suggestions to improve the response options listed?
Do you have any suggestions to make it easier to answer this question?

5. How many different kinds of vegetables do you eat in a typical day?

   None, I don't usually eat vegetables.
   1 kind of vegetable per day
   2 kinds of vegetables per day
   3 kinds of vegetables per day
   4 kinds of vegetables per day
   5 or more kinds of vegetables per day

Probing questions:
What is this question saying to you?
What does "different kinds of vegetables" mean to you?
How did you determine how many different kinds of vegetables you ate? How did you think through this process?
How difficult was it for you to answer this question?
Would it be easier to answer this question if you to have a list of vegetables to refer to?
What does the term "typical day" mean to you?
Is there a better way to ask this question?

6. Over the last week, how many days did you eat red and orange vegetables, like tomatoes, red peppers, carrots, beets, sweet potatoes, winter squash, and pumpkin?

   Less than 1 day a week
   1 day a week
   2 days a week
   3 days a week
   4 days a week
   5 days a week
   6 days a week
   Every day

Probing questions:
How did you determine your answer – what thought process did you use to count the days you ate these foods?
How difficult was it for you to answer this question?
Is the list of vegetables helpful?
Is there a better way to ask this question to find out how many red or orange vegetables you eat?

7. Over the last week, how many days did you eat dark green vegetables, like broccoli, spinach, Brussels sprouts, green lettuce, collard or turnip or mustard greens?
   Less than 1 day a week
   1 day a week
   2 days a week
   3 days a week
   4 days a week

5 days a week
6 days a week
Every day

Probing questions:
How difficult was it for you to answer this question – to determine your answer?
Is there are better way to ask about if you eat dark green vegetables and how much you eat?
Do you have suggestions to improve the response options?

Dried beans and peas include canned or bagged dried pinto beans, black beans, navy beans, chili beans, lima beans, split peas, black eyed peas, lentils, refried beans, pork and beans, bean soup, and barbeque beans.

8. Over the last week, how many days did you eat dried cooked beans?

Less than 1 day a week
1 day a week
2 days a week
3 days a week
4 days a week
5 or more days a week

Probing questions:
What is this question saying to you?
How does the description of dried cooked beans help you in answering the question?
What does the term "dried cooked beans" mean to you?
How did you determine how much you ate dried beans?
Is there a better way to ask this question to find out how much you eat either canned dried beans or beans made from scratch?
Do you have suggestions to make the question clearer?
Do the response options work for this question – are there better responses?

9. How often did you drink milk or soymilk? (Do not count almond or coconut milk)

Rarely
Less than 1 time a day
1 time a day
2 times a day
3 or more times a day

Probing questions:
When you think of how you answered the question – is it best to use the term "rarely" or "less than 1 time per day."
What does the term "rarely" mean to you versus "one time per day?"

How did you determine how often you drink milk?
Do you drink soymilk or any other kinds of milk?
How much do you drink at a time?

10. How often do you eat yogurt or drink smoothies with yogurt?

    Less than 1 day a week
    1-2 days a week
    3-4 days a week
    5-6 days a week
    Every day
    2 or more times a day

Probing questions:
How did you determine your answer – how did you count the number of times you had yogurt?
What kind of yogurt do you eat?
Do you have suggestions for a better way to ask a question to see how much yogurt you eat?
How do you eat yogurt? For example, in smoothies or another way?

11. How often do you eat cereal with milk?

    Less than 1 day a week
    1-2 days a week
    3-4 days a week
    5-6 days a week
    Every day

Probing questions:
How much milk do you include when you have cereal?
Do you eat cereal without milk?
What kind of milk do you use when you have it with cereal?
How much milk do you use?
Are there better responses for this question?

12. How often do you drink regular sodas (not diet)? Include all kinds such as Coke, Pepsi, 7-Up, Sprite, root beer.

    Never
    1-3 times a week
    4-6 times a week
    1 time a day
    2 times a day
    3 times a day

4 or more times a day

Probing questions:
What does the term "regular soda" mean to you?
Which response categories fit your answer? Why?
How did you determine or count the number of times you drink soda?
How much do you drink each time?
Is there a better way to ask this question?

13. How often do you drink fruit punch, fruit drinks, sweet tea or sports drinks? (Such as Gatorade, PowerAde, Propel, Snapple, flavored teas, Capri Sun, Vitamin Water, and Kool-Aid)

Never
1-3 times a week
4-6 times a week
1 time a day
2 times a day
3 times a day
4 or more times a day

Probing questions:
What do you think about all the drinks listed?
How did you determine how many times you drink these drinks?
Do the response fit with how you and other people would answer this question?
Do you drink fruit drinks, sweet tea, and sports drinks at different times or events? Please explain?
How much do you drink at one time?

14. How often do you drink energy drinks? (Such as Rockstar, Red Bull, Monster and Full Throttle)

Never
1-3 times a week
4-6 times a week
1 time a day
2 times a day
3 times a day
4 or more times a day

Probing questions:
What does the term "energy drinks" mean to you?
Are there times of the day or days of the week when you drink these drinks?

Are there other drinks not on this list that you drink?
Do the response options fit this question? If so (or not) why?

End of the interview

"This is the end of the interview. Thank you for helping us with this activity. You were a lot of help! Please feel free to share any other comments that you haven't shared to this point."

- Pause to allow the interviewee time to share additional comments.

"Your input will be very helpful in developing our checklist. Do you have any questions?"

- Answer any questions and thank interviewee for his/her participation.
- Record the stop time of the interview on the Recording Form.
- Record comments in the notes section of the Recording Form. List any additional notes, comments, or reactions you had about the cognitive interview, such as non-verbal communication from the interviewee, distractions, and any comments about specific questions listed by question number.
- Keep the signed consent forms for each interviewee in a secure file within your institution.
- Within the same day email the digital recording to erinmurrayrd@gmail.com
- Within 24 hours, mail all completed information to Erin Murray at CSU's EFNEP Office in the envelope provided in your packet.
    - Cognitive interview recording forms and notes.
    - Signed gift card receipts

APPENDIX L. COGNITIVE INTERVIEW PROTOCOL: ROUND 3

Cognitive Interview Protocol – Round 3 Nutrition Domain Questions

Introduction

"Hello, my name is _____from _____ University. We are looking for better ways to ask some questions, and we think you can help. I will be asking you some questions. This should take an hour at the most. Your answers will help us learn how to ask better questions about healthy eating and food choices."

- Give the participant the consent form (if you use a consent form). You may read it to them.

"This information is a consent form. I will give you a copy that you can read here or I can read it to you. When you sign a copy you are giving us permission to use the information you give us. Your name will not be tied to the tape recording or any of the answers you give."

"What questions do you have about the consent form?"

- Answer any questions. Once the form is signed, continue.

"Now I would like to ask you to complete this short form about you and your family."

- Have the participant complete the Demographic Form.

"Thank you. Now we are ready to begin. I may take some notes while you are talking to help me remember what you said. Please remember that there are no wrong answers. Feel free to say what comes to your mind. We want your opinions and advice on how these questions and answer choices are worded and what the questions mean to you. I didn't write the questions, so don't worry about hurting my feelings if you criticize them. My job is to find out what's wrong with them."

"I am going to start recording the interview now."

- Say the participant ID number and date on the recorder.
- Record the start time on the Cognitive Interview Recording Form.

Begin the Cognitive Interview - proceed to the questions.

Round 3 Cognitive Interview Questions and Scripted Probing Questions (for Interviewers)

For each question please do the following –

- Ask the participant to read the question out loud while covering the responses (you can read the questions out loud if they have problems with reading).
- Ask the participant how they would answer the question.
- Uncover the responses and ask if any of the responses would match their answer. If so, why, If not, why.

Question 1
How many days a week do you cook dinner (your main meal) at home?

I rarely cook dinner at home
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 or 7 days a week

Probing questions:
What is this question asking in your own words?
What is your main meal of the day?
Do you find a response option that matches how you would answer the question?

Question 2
How many days a week do you eat meals prepared outside of your home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)

I rarely eat meals prepared outside my home
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 or 7 days a week

Probing questions:
What do you think this question is asking using your own words?
Which meals are you most likely to eat out?
What does the term "ready to eat food from grocery stores" means to you?
Are there better response options than the ones listed for this question?

Question 3
Examples of fruits are apples, bananas, oranges, grapes, raisins, melon and berries. Count fresh, frozen, dried or canned fruit. Do not count any juices.

How many times in a day do you eat fruit?

I rarely eat fruit
1 time a day
2 times a day
3 times a day
4 or more times a day

Probing questions:
How difficult is it to answer this question?
How did you determine or count how often you ate fruit?
Is there another way to ask how much fruit you normally eat in a day? If so, how would that question be worded?
Are there better response options that you would suggest?

Question 4 – Note: Questions 4 and 5 are together because they refer to the same list of vegetables.

Examples of vegetables are green salad, corn, green beans, peas, carrots, potatoes, and greens and squash. Count fresh, canned and frozen vegetables. Do not count french fries, potato chips or rice.

How many times in a day do you eat vegetables?

I rarely eat vegetables
1 time a day
2 times a day
3 times a day
4 or more times a day

Probing questions:
Is it easier or more difficult to answer this question with the list of vegetables?
How did you determine the number of times you ate vegetables?
Is there another way to ask this question to see how many vegetables you ate? If so, how should that question be worded?
Do you have suggestions to improve the response options listed?

Question 5
Examples of vegetables are green salad, corn, green beans, peas, carrots, potatoes, and greens and squash. Count fresh, canned and frozen vegetables. Do not count french fries, potato chips or rice.

How many different kinds of vegetables do you eat in a day?

I rarely eat vegetables.
1 kind of vegetable a day
2 kinds of vegetables a day
3 kinds of vegetables a day
4 or more kinds of vegetables a day

Probing questions:
What is this question saying to you using your own words?
What does the term "rarely eat vegetables" mean to you?
How difficult was it for you to answer this question?
Is there a better way to ask this question?

Question 6

Examples of red or orange vegetables are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin?

Over the last week, how many days did you eat red and orange vegetables?

I rarely eat red and orange vegetables
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 or 7 days a week

Probing questions:
How difficult was it for you to answer this question?
How did the list of vegetables help with answering the question?
Is there a better way to ask this question to find out how many red or orange vegetables you eat?
How difficult was it to switch from asking how many times a day you eat certain foods to how many times a week you eat red or orange vegetables?

Question 7

Examples of dark green vegetables are broccoli, spinach, dark green lettuce, turnip greens or mustard greens.

Over the last week, how many days did you eat dark green vegetables?

I rarely eat dark green vegetables
1 day a week
2 days a week

3 days a week
4 days a week
5 days a week
6 or 7 days a week

Probing questions:
How difficult was it for you to answer this question – to determine your answer?
Is there are better way to ask about if you eat dark green vegetables and how much you eat?
Do you have suggestions to improve the response options?

Question 8

Examples of beans and peas include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. Count beans from a can or cooked from dry.

Over the last week, how many days did you eat beans or peas?

I rarely eat beans and peas
1 day a week
2 days a week
3 days a week
4 days a week
5 days a week
6 or 7 days a week

Probing questions:
What is this question saying to you?
What does the term "count beans from a can or cooked from dry" mean to you?
Do you count canned beans when you determined your answer?
How does the description of beans help you in answering the question?
Is there a better way to ask this question to find out how much you eat canned dried beans or beans made from scratch?
Do you have suggestions to make the question clearer?
Do the response options work for this question – are there better responses?

Question 9

How many times in a day do you drink milk or soymilk? (Do not count almond or coconut milk)

I do not drink milk
I rarely drink milk
1 time a day
2 times a day
3 or more times a day

Probing questions:
When you think of how you answered the question – is it best to use the term "rarely" or "less than 1 time per day."
What does the term "rarely" mean to you versus "one time per day?"
How did you determine how often you drink milk?
Do you drink soymilk or any other kinds of milk?
How much do you drink at a time?

Question 10

Over the last week, how many days did you eat yogurt or drink smoothies with yogurt?

I do not eat yogurt
I rarely eat yogurt
1 day a week
2 days a week
3 days a week
4 days a week
5 or more days a week

Probing questions:
How did you determine your answer – how did you count the number of times you had yogurt?
What kind of yogurt do you eat?
Do you have suggestions for a better way to ask a question to see how much yogurt you eat?

Question 11

Over the last week, how many days did you eat cereal with milk?

I do not eat cereal with milk
I rarely eat cereal with milk
1 day a week
2 days a week
3 days a week
4 days a week
5 or more days a week

Probing questions:
Do you eat cereal without milk?
What kind of milk do you use when you have it with cereal?
How much milk do you use?
Are there better responses for this question?

Question 12

How often do you drink regular sodas (not diet)?

Never
1-3 times a week
4-6 times a week
1 time a day
2 times a day
3 times a day
4 or more times a day
Probing questions:
What does the term "regular soda" mean to you?
Can you give examples of regular soda?
How difficult was it for you to answer this question?
Which response categories fit your answer? Why?
Is there a better way to ask this question?

Question 13

How often do you drink fruit punch, fruit drinks, sweet tea, flavored teas, or sports drinks?

Never
1-3 times a week
4-6 times a week
1 time a day
2 times a day
3 times a day
4 or more times a day

Probing questions:
Can you give me some examples of each of the drinks listed? For example, fruit drinks may be Capri Sun or Kool-aid?
What does the term "sports drinks" mean to you?
Which of these drinks do you like to drink?
How did you determine how many times you drink these drinks?
Do you drink fruit drinks, sweet tea, and sports drinks at different times or events?
How much do you drink at one time?

Question 14

How often do you drink energy drinks?

Never
1-3 times a week
4-6 times a week
1 time a day
2 times a day
3 times a day

4 or more times a day

Probing questions:
What does the term “energy drinks” mean to you?
Can you give me some examples of brand of energy drinks?
Are there times of the day or days of the week when you drink these drinks?
Do the response options fit this question? If so (or not) why?

End of the interview

"This is the end of the interview. Thank you for helping us with this activity. You were a lot of help! Please feel free to share any other comments that you haven't shared to this point."

- Pause to allow the interviewee time to share additional comments.

"Your input will be very helpful in developing our checklist. Do you have any questions?"

- Answer any questions and thank interviewee for his/her participation.
- Record the stop time of the interview on the Recording Form.
- Record comments in the notes section of the Recording Form (this is optional). List any additional notes, comments, or reactions you had about the cognitive interview, such as non-verbal communication from the interviewee, distractions, and any comments about specific questions listed by question number.
- Keep the signed consent forms for each interviewee in a secure file within your institution.
- Within the same day email the digital recording to erinmurrayrd@gmail.com
- Within 24 hours, mail all completed information to Erin Murray at CSU's EFNEP Office in the envelope provided in your packet.
    - Cognitive interview recording forms and notes.
    - Signed gift card receipts

THANK YOU!!!

APPENDIX M. TEST-RETEST PROTOCOL AND REQUIRED DOCUMENTS FOR TESTING

Test-Retest Reliability Assessment Protocol
Combined EFNEP Behavior Checklist Survey Questions

Background Information

Test-retest reliability is a method used to measure the consistently or temporal stability of a measure (behavior checklist questions) over time. To measure the test-retest reliability, we have to give the same set of questions to the same test respondents on two separate occasions. In this case, we are providing the same EFNEP behavior checklist survey **to the same workers one-month apart on the same week of the month**. Workers will receive a $10 gift card the first time they complete the survey, and a $15 gift card the second time they complete the same survey.

Steps to Complete

- ✓ Work with your university's on-campus dining managers to use the recruitment script and flyer to recruit 30 to 35 full-time employees to participate in the study. We are looking for employees who are not college students. The **same employees must be available one month apart on the same week of the month.**

- ✓ Work with your university's on-campus dining staff to schedule a time and conference room on the same week of the month for two consecutive months, with adequate table space for 30 to 35 employees. A time that might work is at the end of the work shift.

- ✓ For each date scheduled, send reminders to the on-campus dining manager about the scheduled times and to remind the employees – a group text message reminder to employees may be very helpful.

- ✓ For each date scheduled, take 35 packets to the site where you will administer the test-retest questionnaire. Each individual will be assigned a code and the same code must be used for the same individual at time 1 and time 2. Each packet will include the following items:

    - Two consent forms – one for the study subject to sign for your records; one for the subject to keep
    - Behavior checklist survey form (this includes demographic questions and the combined EFNEP behavior checklist questions)
    - $10 gift card ($15 gift cards for the second time)
    - Gift card receipt – study subject signs and you keep it for your records
    - A pen

- ✓ When all study subjects (workers) are present, read the instructions in the section below.

- ✓ For each study subject, collect the following forms, with their names and their assigned codes after they have been filled out:

    - Signed consent form
    - Completed behavior checklist survey
    - Signed gift card receipt

Instructions for Completing the Test-Retest Assessment

"Hello, my name is _____from _____ University. We are assessing questions that may be used by a nutrition education program, and we think you can help. I will be handing out packets to you to complete. The packets include a consent form for you to sign, a survey that includes questions about your health behaviors, and a receipt for a gift card. I will let you know how to fill out each form. This should take about 20 minutes at the most. You will not be graded or judged on how you answer the questions. Your answers will help us learn more about the questions. We do not care how you answer the questions, just that you answer them as honestly and correctly as you can. We are not assessing you – we are assessing the questions. You will receive a gift card from me today for participating in this research project."

- Ask the study subject to open their packets and get the consent form out.

"This information is a consent form. You have two copies of the form so you can sign one and keep one to take home. You can read it here or I can read it to you individually. The consent form states that you are participating in a research study. You are being asked to answer the same questions at two different periods of time – one month apart - because you are not or have not been participating in nutrition education classes. When you sign a copy you are giving us permission to use the information you give us. We will not report your names or any individual information about you, and all the information we collect is confidential."

"What questions do you have about the consent form?"

- Answer any questions. Ask all study subjects to initial and date the bottom of each page and sign and date the last page. Once the forms are signed, continue.

"Now I would like to ask you to sign and date the gift card receipt. I will give you a gift card when you turn in all your forms to me."

- Ask the study subjects to sign the gift card receipts.

"Thank you. Now we are ready to begin the survey. Please answer all the questions on the form as thoroughly as possible. Please remember that there are no wrong answers and you will not be graded or judged in any way for your responses. We just want to you to answer the questions as honestly as possible. Take your time and if you need help please let me know."

- Ask all the study subjects to pull out the survey and complete it.
- Let them know when they are done they can turn in the forms to you.
- Review each of the forms before giving out gift cards.

Attached documents for test-retest reliability testing:

Attachment A: Recruitment Scrip
Attachment B: Recruitment Flyer
Attachment C: Consent Form
Attachment D: Behavior Checklist Survey Form
Attachment E: Gift Card Receipt Forms

THANK YOU!!!

Attachment A: Recruitment Script

Script for Recruiting Workers for Test-Retest Assessment

Housing and Dining Manager doing the recruiting:
I would like to take a couple of minutes to talk with you about an opportunity I have available – and you would be given gift cards with this opportunity. Volunteers would participate in a research project for CSU by completing a survey _____(insert date) and again in one month on _____(insert date). If you are willing to stick around right after work and fill out this survey, you will receive $10 the first time and $15 the second time when you fill out the other survey. But, I need you to volunteer to do both surveys so I will need volunteers that will definitely be here those two dates. It should take about 20 minutes to complete the survey each time.

Attachment B: Recruitment Flyer

Do you want to get $25 in gift cards?

If you are female with children at home, read and write in English, *AND* are classified as Dining Services I or II *OR* Custodian I or II, you have an opportunity to earn King Soopers gift cards totaling $25 by participating in a research project for the Food Science and Human Nutrition Department here at CSU.

All you have to do is complete a survey two times, one month apart. Time options include:

- 1st survey on either February 2nd at 1:30 or Thursday February 4th at 12:30
- 2nd survey on either Tuesday March 1st at 1:30 or Thursday March 3rd at 12:30

You must be able to complete both the 1st and 2nd survey. It should take about 20 minutes. The survey is about your health and eating choices.

Interested? Please show up at Durrell Seminar Room B on Tuesday February 2nd at 1:30 *OR* at Alpine Hall Conference Room on Thursday February 4th at 12:30.

Questions? Contact Dwayne Watson at 491-2555.

All information will be confidential.

Attachment C: Consent Form

Colorado State University (CSU)

Improving the Expanded Food and Nutrition Education Program Behavior Checklist Questions

Consent Form

Investigators:
Susan Baker, Associate Professor, CSU (970) 491-5798

You are being asked to take part in a research study about a survey form. This will provide important information for changing the Expanded Food and Nutrition Program (EFNEP) Behavior Checklist form. This research study is being carried out by Associate Professor Susan Baker at Colorado State University CSU. This form explains the study and your part in it, if you decide to participate in the study.

Please read the form carefully. Take as much time as you need. Ask the investigator to explain anything you don't understand. You can decide not to participate in the interview. If you participate in the interview, you can change your mind quit at any time. You will receive two $10 gift cards for participating in the complete session. This study has been approved for human subject participation by the Colorado State University Institutional Review Board.

What is this study about?

This study is being done to understand the consistency of how you answer questions over a period of time. Your feedback will help us to develop better questions and response categories about nutrition and healthy eating habits.

You are being asked to answer the same questions at two different periods of time – a couple of weeks apart - because you are not or have not been participating in nutrition education classes. It will take about 20 to 30 minutes each time you complete the questions.

What will I be asked to do if I am answering the nutrition questions?

If you take part in this study answering survey questions, you will be asked to:

- Read questions and answers about eating habits.
- Answer each question about your eating habits as well as possible.
- Answer the same questions in a couple of weeks.

There are no right or wrong answers. We are interested in your opinions.

Are there any benefits to me if I answer the questions on the form?

There are no direct benefits to you for participating. The information from the questions you answer both times will be used to decide if the questions should be included on a new form. This will help a nutrition education program use the questions in the future to see what changes participants made as a result of the program. It will also help show if the nutrition education program improves healthy eating habits.

Are there any risks to me if I am in this study?

The potential risk from taking part in this study is that you might be more concerned about how you are eating and whether or not you are eating certain foods.

Will my information be kept private?

The forms with your answers will be collected and compared between the two different times you answered the questions. The forms will be kept in a locked file cabinet at CSU. The forms will be available only to the researchers working on this project. No one will be identified by name on the form you complete or in any of the other materials collected during this session. All study subjects will be assigned a number in our records. This number list will be kept in a locked drawer in the CSU EFNEP state office in Fort Collins. Study subjects will be known by that number to the research team. All notes and other information collected during this session will be stored in a locked cabinet at the CSU EFNEP state office. Only the researcher will have access to this information. Once the study is completed, the information will be kept for 3 years and then destroyed. The only exceptions to this are if we are asked to share the research files for audit purposes with the CSU Institutional Review Board ethics committee, if necessary. In addition, for funded studies, the CSU financial management team may also request an audit of research expenditures. For financial audits, only the fact that you participated would be shared, not any research data.

Are there any costs or payments for being in this study?

There will be no costs to you for taking part in this study. You are being asked to complete the same form at two different time periods about a couple of weeks apart. You will receive a $10 gift card each time you complete the form.

Who can I talk to if I have questions?

If you have questions about this interview or the information in this form, please contact the Susan Baker at (970) 491-5798.

If you have questions about your rights as an interview participant, or would like to report a concern or complaint about this study, please contact the Colorado State University Institutional Review Board at 970-491-1553, or RICRO_IRB@mail.colostate.edu; 970-491-1553.

What are my rights as a participant in this study?

Your participation in this study is completely voluntary. You may choose not to be a part of this study. There will be no penalty to you if you choose not to take part. You may choose not to answer specific questions or to stop participating at any time.

What does my signature on this consent form mean?

- Your signature on this form means that:
- You understand the information given to you in this form.
- You have been able to ask the interviewer questions and state any concerns.
- The interviewer has responded to your questions and concerns.
- You believe you understand the purpose of this research study and the potential benefits and risks that are involved.

Statement of Consent

I give my voluntary consent to take part in this study.

I will be given a copy of this consent document for my records.

_____ _____

Signature of Participant Date

_____

Printed Name of Participant

_____ _____

Signature of Researcher Date

_____

Printed Name of Researcher

Attachment D: Nutrition Questionnaire Form

Nutrition Questionnaire Form

Please complete all sections of this form. If you have any questions please ask.

Name _____

□ **Female** □ **Male**

Age _____

Number of children at home _____

Which describes your highest grade completed:
□ Less than high school or GED
□ Graduated High School or GED
□ Some college
□ Graduated 2 year college
□ Graduated college
□ Post Graduate

Check the ethnicity you identify with:
□ Hispanic/Latino □ Non-Hispanic/non-Latino

Check the race you identify with: (you may check more than one)
□ American Indian/Alaskan Native
□ Asian
□ Black or African American
□ Native Hawaiian or other Pacific Islander
□ White

Programs that you and your family participate in: (check all that apply)
□ Free or reduced school lunch or breakfast
□ Supplemental Nutrition Assistance Program (SNAP, Food Stamps)
□ Head Start
□ TANF (Temporary Assistance for Needy Families)
□ TEFAP (Commodities)
□ WIC
□ Other_____

Circle your answer to each question. Please take your time to think and determine a true answer. If you need help please ask!							
1) How many **days a week** do you cook dinner (your main meal) at home?	I rarely cook dinner at home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
2) How many **days a week** do you eat meals prepared outside of you home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)	I rarely eat meals prepared outside my home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **fruits** are apples, bananas, oranges, grapes, raisins, melon and berries. Include fresh, frozen, dried, or canned fruit. **Do not include juice**.							
3) How many **times a day** do you eat fruit?	I rarely eat fruit	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	

Please continue on the next page ⟶

Examples of **vegetables** are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned and frozen vegetables. **<u>Do not count french fries, potato chips, or rice</u>**.							
4) How many **times a day** do you eat vegetables?	I rarely eat vegetables	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	
5) How many different kinds of vegetables do you usually eat **a day**?	I rarely eat vegetables	1 kind a day	2 kinds a day	3 kinds a day	4 or more kinds a day		
Examples of **red or orange vegetables** are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin.							
6) Over the last week, **how many days** did you eat red and orange vegetables?	I did not eat red and orange vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **dark green vegetables** are broccoli, spinach, dark green lettuce, turnip greens, or mustard greens.							
7) Over the last week, **how many days** did you eat dark green vegetables?	I did not eat dark green vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **beans and peas** include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. **<u>Include beans from a can or cooked from dry.</u>**							
8) Over the last week, **how many days** did you eat beans and peas?	I did not eat beans and peas	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
9) How many **times a day** do you drink milk or soymilk? (Do not count almond or coconut milk, or milk with cereal)	I do not drink milk	I rarely drink milk	1 time a day	2 times a day	3 or more times a day		

10) Over the last week, **how many days** did you eat yogurt or drink smoothies with yogurt?	I did not eat yogurt	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
11) Over the last week, **how many days** did you eat cereal with milk?	I did not eat cereal with milk	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
12) How often do you drink regular sodas (not diet)?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
13) How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
14) How often do you drink energy drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day

Attachment E: Gift Card Receipt Form

Receipt of Gift Card for Reliability Assessment of Nutrition Questionnaire

I, _____, received a $10 gift card for taking a health behaviors survey at CSU.

_____
_____

Signature Date

APPENDIX N. DIETARY ASSESSMENT QUESTIONS FOR EFNEP

Dietary Assessment Questions for EFNEP

Circle the response that best describes how you usually do things.							
1) How many **days a week** do you cook dinner (your main meal) at home?	I rarely cook dinner at home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
2) How many **days a week** do you eat meals prepared outside of your home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)	I rarely eat meals prepared outside my home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **fruits** are apples, bananas, oranges, grapes, raisins, melon and berries. Include fresh, frozen, dried, or canned fruit. **Do not include juice**.							
3) How many **times a day** do you eat fruit?	I rarely eat fruit	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	

Please continue on the next page ⟶

Examples of **vegetables** are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned and frozen vegetables. **<u>Do not count french fries, potato chips, or rice</u>**.							
4) How many **times a day** do you eat vegetables?	I rarely eat vegetables	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	
5) How many different kinds of vegetables do you usually eat **a day**?	I rarely eat vegetables	1 kind a day	2 kinds a day	3 kinds a day	4 or more kinds a day		
Examples of **red or orange vegetables** are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin.							
6) Over the last week, **how many days** did you eat red and orange vegetables?	I did not eat red and orange vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **dark green vegetables** are broccoli, spinach, dark green lettuce, turnip greens, or mustard greens.							
7) Over the last week, **how many days** did you eat dark green vegetables?	I did not eat dark green vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **beans and peas** include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. **<u>Include beans from a can or cooked from dry.</u>**							
8) Over the last week, **how many days** did you eat beans and peas?	I did not eat beans and peas	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
9) How many **times a day** do you drink milk or soymilk? (Do not count almond or coconut milk, or milk with cereal)	I do not drink milk	I rarely drink milk	1 time a day	2 times a day	3 or more times a day		

10) Over the last week, **how many days** did you eat yogurt or drink smoothies with yogurt?	I did not eat yogurt	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
11) Over the last week, **how many days** did you eat cereal with milk?	I did not eat cereal with milk	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
12) How often do you drink regular sodas (not diet)?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
13) How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
14) How often do you drink energy drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day

APPENDIX O. PROCESS OF DEVELOPING AND TESTING DIETARY ASSESSMENT QUESTIONS FOR EFNEP

Process of Developing and Testing Dietary Assessment Questions for EFNEP

Phase	Methods	Purpose
Content selection/confirmation	Content analysis of nutrition education curricula used to teach EFNEP adults Comparison of nutrition content in curricula to the Dietary Guidelines for Americans (DGA)	Content validity
Question generation	National nutrition experts prioritized nutrition content from the DGA to teach low-income adults Expert panel identified the nutrition content to evaluate in EFNEP Identified validated questions from literature Expert panel rated questions for content	Content validity
Cognitive testing	Pre-test questions/response options with the target population Three rounds of question/response options testing and revisions	Face validity Ease of understanding and interpretation of questions/response options as intended
Test-retest assessment	Questionnaire developed from cognitive testing was administered one month apart to low-income non-EFNEP participants	Temporal stability reliability
Factor testing	Exploratory factor analysis	Scale assessment
Comparative validity testing	Questionnaire was administered to EFNEP participants along with a gold-standard measure (3 24-hour dietary recalls) to assess the questions' correlation and agreement	Construct validity

APPENDIX P. COLORADO STATE UNIVERSITY IRB APPROVAL FOR CONSTRUCT VALIDITY TESTING

Colorado State University

Knowledge to Go Places

PROTOCOL
Social, Behavioral & Education Research
Colorado State University

Protocol # 15-6071H
Date Printed: 03/01/2016

Protocol Title:	Regional Nutrition Education Center of Excellence West: Testing the Feasibility of Phone 24 Hour Recalls
Protocol Status:	APPROVED
Date Submitted:	02/16/2016
Approval Period:	02/29/2016-10/07/2016
Important Note:	This Print View may not reflect all comments and contingencies for approval. Please check the comments section of the online protocol. Questions that appear to not have been answered may not have been required for this submission. Please see the system application for more details.

* * * Amendment * * *

Amendment (Please note: Input N/A if not applicable)

1. **Summarize the proposed changes to the protocol in lay terms.**

   We would like to add one additional survey to this project. It is attached in the attachment section as "nutrition questionnaire form."

Proceed to the appropriate section(s) in the protocol and make your changes.

Make necessary changes in the Consent Form(s) or Alteration of Consent Form(s) (i.e., Cover Letter or Verbal Script), or other attachments, if applicable.

2. **Indicate Level of Risk involved with the changes proposed. (If level of risk has changed, please update the "Risks" section in the protocol form.)**

No Change

3. **List of Protocol Sections (and questions) that have been changed/modified**

---

* * * Personnel Information * * *

IMPORTANT NOTE: Mandatory Personnel on a protocol are: Principal Investigator and Department Head. Only the Principal Investigator can submit the protocol; although other personnel listed on the protocol can create the protocol. Human Subjects Protection Training is mandatory for Principal Investigator, Co-Principal Investigator, and Key Personnel (as defined by NIH). Training must be updated every three (3) years.

Principal Investigator Mandatory

Name of Principal Investigator (Faculty, Staff or Postdoc)	Degree	Title
Auld, Garry		Professor
Email	**Phone**	**Fax**

APPENDIX Q. LETTER OF INTENT FOR PENN STATE UNIVERSITY TO COLLECT 24-HOUR FOOD RECALL DATA FOR CONSTRUCT VALIDITY STUDY

February 4, 2016

To: Diane Mitchell
Senior Research Scientist
Director, Diet Assessment Center
Department of Nutritional Sciences
The Pennsylvania State University

From: Garry Auld, Professor
Susan Baker, Associate Professor
Department of Food Science and Human Nutrition
Colorado State University

RE: Colorado State University Request for Dietary Assessment Validity Study

To summarize our previous phone conversation on a validity study using Colorado EFNEP participants.

Population:

50 subjects with 6 recalls per subject - 3 after 1st class (pre) and 3 after 8th class (post)

All English speaking, from ideally 8 states throughout the US (6+ per state)

Ideally the 3 recalls will be taken in a one week period, particularly the pre

Dates of Study:

Start March – May

CSU tasks:

Obtain CSU IRB approval
recruit subjects and provide incentives
provide Food Amounts Booklets to subjects
collect contact information and preferred days and times for calls and send contact info to DAC
pay DAC ~ $70/recall collected

DAC tasks:

collect dietary information
share data with CSU including any challenges/difficulties collecting from EFNEP participants

Caveats:

We may need more than 50 subjects at pre as about 30% drop out, i.e., may need to start with ~ 65

CSU will contact DAC prior to recruitment to confirm timelines and protocols

APPENDIX R. DATA COLLECTION PROTOCOL FOR ASSESSING CONSTRUCT VALIDITY OF THE DIETARY ASSESSMENT INSTRUMENT

Data Collection Protocol for Assessing Construct Validity of the Dietary Assessment Instrument

Research Plan

The following packet of forms will be sent to EFNEP educators by Dwayne Watson at CSU:

- Recruitment script for Educator (Attachment A)
- Nutrition questionnaire form (Attachment B)
- Penn State University Dietary Assessment Center (PSDAC) convenient time schedule form (Attachment C)
- PSDAC recall explanation (Attachment D)
- PSDAC verbal consent form (Attachment E)

EFNEP educators will recruit participants at program enrollment using the recruitment script for educator. EFNEP volunteer participants will complete the 14-item nutrition questionnaire form and 3 telephone-administered 24-hour food recalls at two different times - program enrollment and program completion/graduation. EFNEP educators will administer the dietary assessment instruments. The Penn State University Dietary Assessment Center (PSDAC) will complete the 3, 24-hour food recalls.

EFNEP participants will complete the nutrition questionnaire and PSDAC's *Convenient Time Schedule* form. This form lists times over the week for PSDAC interviewers to call participants. Participants will also be given copies of *24-hr Recall Explanation for Participants* and *Sample Interview* forms. The forms describe the telephone-administered food recall interview process. PSDAC will obtain verbal consent using the verbal consent form prior to beginning the collect data over the phone from EFNEP participants.

Colorado State University (CSU) will collect all completed dietary assessment instruments. Responses to instrument questions will be assigned a score (1=1 time per week, 2=2 times per week). The PSDAC will collect food recall data through an automated system.

Recall Data Cleaning and Conversion

Food recall data from participants at EFNEP enrollment and completion will be cleaned and coded to align with each instrument question. Data from participants who completed either 2 or 3 days of food recalls will be included in the analyses.

Question 1: Dinner at home, days/week

Penn State will include the following meal location codes: 1=home, 10=friends home, and 11=community meal program. Some participants live with friends, relatives or in a group home setting. We will add justification in our manuscript as this implies home food prep. If the interviewer takes notes that the meal was in a group home we would like to collect this information for our reporting. The dataset will list the count over 3 days (0,1,2,3)

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the frequency over the 2 or 3 days of recalls.
- Create another column that converts the data by multiplying by 2.33 for 3 days of food recalls, and multiply by 3.5 for 2 days of recalls.

Question 2: Eating out, days/week

Penn State will include the following meal location codes: 6=deli/take-out/store, 7=restaurant/cafeteria/fast food, 13=other (with notes if possible), and 14=traveling. Include the meal code name 4=snack in addition to including the other meal location codes. This is due to participants sometimes eating one time per day and may call a meal eaten outside the home a snack (this information was realized through cognitive interview testing). Do not include meal location codes work or school because it is ambiguous whether the meal was previously prepared at home and taken to work/school or purchased.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the frequency over the 2 or 3 days of recalls.
- Create another column that converts the data by multiplying by 2.33 for 3 days of food recalls, and multiply by 3.5 for 2 days of recalls.

Question 3: frequency of fruit intake, times/day

Penn State will include food group codes: FRU0300 (citrus fruit), FRU0400 (fruit excluding citrus). Penn State will include all fruits eaten and serving sizes by eating occasion by day in a data file.

CSU Researcher, Erin Murray, will do the following:

- Count 1/2 serving (serving=1/2 cup or 1 medium piece) or more of fresh, frozen, dried, or canned fruit/eating occasion/day.
- Create a column that lists the mean frequency per day of fruit intake.
- Create another column that codes the mean frequency of intake to align with the FFQ response options 0, 1, 2, 3, 4, 5 (for analysis).
    - Mean intake (times/day), 0=0
    - Mean intake (times/day), .1-.99=1
    - Mean intake (times/day), 1-1.99=2
    - Mean intake (times/day), 2-2.99=3
    - Mean intake (times/day), 3-3.99=4
    - Mean intake (times/day), 4-4.99=5

Question 4: frequency of vegetable intake, times/day

Penn State will include food group codes: VEG0100 (dark green veg), VEG0200 (deep yellow veg), VEG0300 (tomato), VEG0400 (baked, boiled, canned white potatoes and in recipes), VEG0450 (other starchy veg excluding fried or breaded veg), VEG0700 (legumes including in recipes), VEG0600 (other veg including mixed veg), VEG0500 (100% veg juice). Include all vegetables eaten and serving sizes by eating occasion by day by participant ID in a data file.

CSU Researcher, Erin Murray, will do the following:

- Count 1/2 serving (serving=1/2 cup cooked or raw or tomato sauce, 1 c. leafy greens) or more of fresh, frozen or canned vegetables/eating occasion/day.
- Include veg in mixed dishes when ½ serving or more.
- Count vegetables that participants were intentional about eating or including with meals, such as veg mentioned in recipes, sides, salad, in smoothies, and on sandwiches.
- Do not count tomato sauce on commercially-prepared pizza, commercially-prepared lasagna, or vegetables in fast food burritos/sandwiches if the vegetables were not specifically mentioned by participants (Penn State probes for additional items in the food/meal) or vegetables in condiments/sauces (bbq sauce). This is a judgement call when information is ambiguous.
- Create a column that lists the mean frequency per day of vegetable intake.
- Create another column that codes the mean frequency of intake to align with the FFQ response options 0, 1, 2, 3, 4, 5 (for analysis).
    - Mean intake (times/day), 0=0
    - Mean intake (times/day), .1-.99=1
    - Mean intake (times/day), 1-1.99=2
    - Mean intake (times/day), 2-2.99=3
    - Mean intake (times/day), 3-3.99=4
    - Mean intake (times/day), 4-4.99=5

Question 5: different kinds of vegetables, kinds/day

Penn State will send a data file with different kinds of vegetables. Exclude french fries for other fried foods like potato chips. The initial list will include vegetable servings by vegetable name, by time of day, by date of intake, by participant ID.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the mean frequency per day of different kinds of vegetables.
- Count 1/2 serving (serving=1/2 cup cooked or raw or tomato sauce, 1 c. leafy greens) or more of fresh, frozen or canned vegetables/eating occasion/day.
- Include veg in mixed dishes when ½ serving or more.
- Count vegetables that participants were intentional about eating or including with meals, such as veg mentioned in recipes, sides, salad, in smoothies, and on sandwiches.
- Do not count tomato sauce on commercially-prepared pizza, commercially-prepared lasagna, or in fast food burritos/sandwiches if they were not specifically mentioned, or vegetables in condiments/sauces (bbq sauce). This is a judgment call when information is ambiguous.
- Create another column that codes the mean kinds of vegetables per day to align with the FFQ response options 0, 1, 2, 3, 4, 5 (for analysis).
    - Mean intake (kinds/day), 0-.99=0
    - Mean intake (kinds/day), 1-1.99=1
    - Mean intake (kinds/day), 2-2.99=2
    - Mean intake (kinds/day), 3-3.99=3
    - Mean intake (kinds/day), 4-4.99=4

Question 6: red and orange vegetables, days/week

Penn State will send a data file that include food group codes: VEG0200 (deep yellow veg) and VEG0300 (tomato) per eating occasion per day per participant ID.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the frequency of vegetables over the 3 days (0, 1, 2, 3).
- Count ½ serving or more of fresh frozen or canned vegetables.
- Do not count vegetables on commercially prepared pizza, or condiments.
- Convert the data by multiplying by 2.33 for 3 days of food recalls, and multiply by 3.5 for 2 days of recalls.

Question 7: dark green vegetables, days/week

Penn State will send a data file that include food group code VEG0100 (dark green veg) per eating occasion per day per participant ID.

- Follow protocol from Question 6.

Question 8: beans and peas, days/week

Penn State will send a data file that include food group code VEG0700 (legumes) per eating occasion per day per participant ID.

- Follow protocol from Question 6.

Question 9: drink milk and soy milk, times/day

Penn State will send a data file that include food group codes: DMN0100 (soy, rice, grain based milk), DMF0100 (whole milk), DMR0100 (reduced fat milk), DML0100 (low fat or fat free milk), DMF0200 (ready to drink flavored whole milk), DML0300 (sweetened flavored milk beverage powder with non-fat dry milk), and DML0400 (artificially sweetened flavored milk beverage powder with non-fat dry milk). The file will contain milk intake per eating occasion, per day, by serving size, per participant ID.

- Create a column that lists the mean frequency per day of drinking milk/soy milk.
- Count ¼ serving or more (serving = 1cup).
- Do not count rice, almond, or grain-based milk.
- Create another column that codes the mean frequency of intake to align with the FFQ response options 0, 1, 2, 3, 4 (for analysis).
    - Mean intake (times/day), 0=0
    - Mean intake (times/day), 1-.99=1
    - Mean intake (times/day), 1-1.99=2
    - Mean intake (times/day), 2-2.99=3
    - Mean intake (times/day), 3-3.99=4

Question 10: yogurt, days/week

Penn State will send a data file that include food group codes: DYF0100 (yogurt, sweetened, whole milk), DYR0100 (yogurt, sweetened, low fat), DYL0100 (yogurt, sweetened, fat free),

DYF0200 (yogurt, artificially sweetened, whole milk), DYR0200 (yogurt, artificially sweetened, low fat), DYL0200 (yogurt, artificially sweetened, fat free). The file will include yogurt per eating occasion per day per participant ID.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the frequency of yogurt over the 3 days (0, 1, 2, 3).
- Count ½ serving or more (serving=1 cup).
- Convert the data by multiplying by 2.33 for 3 days of food recalls, and multiply by 3.5 for 2 days of recalls.

Question 11: milk with cereal, days/week

Penn State will send a data file that includes cereal eaten with milk.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the frequency of milk with cereal over the 3 days (0, 1, 2, 3).
- Count any serving size of milk consumed with cereal.
- Convert the data by multiplying by 2.33 for 3 days of food recalls, and multiply by 3.5 for 2 days of recalls.

Question 12: drink soda, days/week and times/day

Penn State will send a data file that includes the food group code BVS0400 (sweetened soft drinks). The file will include sodas by eating/drinking occasion by serving by day by participant ID.

CSU Researcher, Erin Murray, will do the following:

- Create a column that lists the mean frequency of intake per day over the 2 days (0, .5, 1, 1.5, 2, 2,5, 3) or 3 days (0, .33, .67, 1, 1.33, 1.67, 2. 2.33, 2.67, 3).
- Count any serving size consumed.
- Create another column that codes the mean frequency of intake per day over the 2 or 3 days of intake to align with reverse coding (per Dr Betts) for the FFQ response options 0-6 (for analysis).
    - Intake (never), 0=6
    - Intake (1-3 times/week), .33, .5, .67=5
    - Intake (4-6 times/week), = could not code for this because only 2 or 3 days of recalls
    - Intake (times/day), 1-1.99=3
    - Intake (times/day), 2-2.99=2
    - Intake (times/day), 3-3.99=1
    - Intake (times/day), 4+=0
- Create another column that converts data to times/day to assess agreement using Bland-Altman.
    - Intake (never), 0=0
    - Intake (1-3 times/week), .33, .5, .67=2/7,=0.0286 times/day
    - Intake (4-6 times/week), = could not code for this because only 2 or 3 days of recalls
    - Intake (times/day), 1-1.99=1 time/day

- Intake (times/day), 2-2.99=2 times/day
- Intake (times/day), 3-3.99=3 times/day
- Intake (times/day), 4+=4 or more times/day

Question 13: sweetened fruit drinks, days/week and times/day

Penn State will need to code for this and pull out all non-soda sweetened drinks separately. The file will include sweetened beverages by eating/drinking occasion by serving by day by participant ID.

- Follow protocol from Question 12.

Question 14: energy drinks, days/week and times/day

Penn State will need to code for this and pull out all energy drinks separately. The file will include energy drinks by eating/drinking occasion by serving by day by participant ID.

- Follow protocol from Question 12.

Attachment A: Recruitment Script for Educator

Recruitment Script

Colorado State University is conducting a research study to assess questions that may be used in the future by EFNEP and we think you can help. The purpose of the study is to help CSU learn more about the questions in a survey. They have asked us to recruit interested participants into this study.

If you are interested, here is how the process will work:

- You will be asked to complete a short survey of 14 questions after this class and last EFNEP class.
- You will also be contacted 3 different times over the next week by an interviewer from the Interview Center at Penn State.
- During each call an interviewer will ask you what foods you have eaten on the previous day. These calls are random so we are not able to tell you what specific day we will be calling but the interviews will only take about 20 to 30 minutes.
- I will provide you with a food amounts booklet to take home that contains pictures of squares, circles, cups, bowls, circles, squares and rectangles and so forth. Please keep this booklet in an easily accessible location. You may need it during the interviews to help you estimate the amounts of foods you eat.
- After our last class, you will contacted 3 more times by an interviewer to complete 3 more phone 24 hour recalls.
- You will be mailed a $10 gift card for each phone 24 hour recall you complete. If you do all 6, you will receive $60.

Who is interested in participating in this project?

Next:

1. *For those interested, give them the following:*
    a. *Nutrition Questionnaire Form (blue for the first class; yellow for the last class)*
    b. *PSDAC convenient time schedule form*
    c. *PSDAC recall explanation*
    d. *Food Amounts Booklet*

2. *Have them complete the Nutrition Questionnaire Form and PSDAC convenient time schedule. The Penn State Interviewer will obtain verbal consent from participants at the time of each call.*
3. *Send the completed Nutrition Questionnaire Form and Convenient Time Schedule form to Dwayne Watson right after class.*
4. *At the last class, complete steps 1-3 listed above for **the same participants**! This is very important.*

Thank you!

Attachment B: Nutrition Questionnaire Form

Nutrition Questionnaire Form

Please complete all sections of this form. If you have any questions please ask.

Name _____
□ **Female** □ **Male**
Age _____
Number of children at home _____

Which describes your highest grade completed:
□ Less than high school or GED
□ Graduated High School or GED
□ Some college
□ Graduated 2 year college
□ Graduated college
□ Post Graduate

Check the ethnicity you identify with:
□ Hispanic/Latino □ Non-Hispanic/non-Latino

Check the race you identify with:
(you may check more than one)
□ American Indian/Alaskan Native
□ Asian
□ Black or African American
□ Native Hawaiian or other Pacific Islander
□ White

Programs that you and your family participate in:
(check all that apply)
□ Free or reduced school lunch or breakfast
□ Supplemental Nutrition Assistance Program (SNAP, Food Stamps)
□ Head Start
□ TANF (Temporary Assistance for Needy Families)
□ TEFAP (Commodities)
□ WIC
□ Other_____

OFFICE USE ONLY

Circle your answer to each question. Please take your time to think and determine a true answer. If you need help please ask!							
1. How many **days a week** do you cook dinner (your main meal) at home?	I rarely cook dinner at home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
2. How many **days a week** do you eat meals prepared outside of you home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)	I rarely eat meals prepared outside my home	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **fruits** are apples, bananas, oranges, grapes, raisins, melon and berries. Include fresh, frozen, dried, or canned fruit. **Do not include juice**.							
3. How many **times a day** do you eat fruit?	I rarely eat fruit	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	

Please continue on the next page ⟶

Examples of **vegetables** are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned and frozen vegetables. **<u>Do not count french fries, potato chips, or rice</u>**.							
4. How many **times a day** do you eat vegetables?	I rarely eat vegetables	Less than 1 time a day (a couple times a week)	1 time a day	2 times a day	3 times a day	4 or more times a day	
5. How many different kinds of vegetables do you usually eat **a day**?	I rarely eat vegetables	1 kind a day	2 kinds a day	3 kinds a day	4 or more kinds a day		
Examples of **red or orange vegetables** are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin.							
6. Over the last week, **how many days** did you eat red and orange vegetables?	I did not eat red and orange vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **dark green vegetables** are broccoli, spinach, dark green lettuce, turnip greens, or mustard greens.							
7. Over the last week, **how many days** did you eat dark green vegetables?	I did not eat dark green vegetables	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
Examples of **beans and peas** include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. **<u>Include beans from a can or cooked from dry.</u>**							
8. Over the last week, **how many days** did you eat beans and peas?	I did not eat beans and peas	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
9. How many **times a day** do you drink milk or soymilk? (Do not count almond or coconut milk, or milk with cereal)	I do not drink milk	I rarely drink milk	1 time a day	2 times a day	3 or more times a day		

10. Over the last week, **how many days** did you eat yogurt or drink smoothies with yogurt?	I did not eat yogurt	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
11. Over the last week, **how many days** did you eat cereal with milk?	I did not eat cereal with milk	1 day a week	2 days a week	3 days a week	4 days a week	5 days a week	6 or 7 days a week
12. How often do you drink regular sodas (not diet)?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
13. How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day
14. How often do you drink energy drinks?	Never	1 – 3 times a week	4 – 6 times a week	1 time a day	2 times a day	3 times a day	4 or more times a day

Attachment C: Penn State University Dietary Assessment Center (PSDAC) Convenient Time Schedule Form

Colorado EFNEP
Dietary Assessment Validity Study
Using Phone 24 Hour Recalls

Convenient Time Schedule

Please complete the following information:

Name *(print name)*:_____

Telephone: (_____)- _____ - _____

Indicate all possible times that you will be home for a 20-30 minute interview.

CHECK at least three time per day. We will try to call during those times.

	Mornings			Afternoons		Evenings			
DAY	9-10	10-11	11-12	1-2	2-3	3-4	4-5	6-7	7-8	8-9
Monday										
Tuesday										
Wednesday										
Thursday										
Friday										
Saturday										
Sunday										

Attachment D: Penn State University Dietary Assessment Center (PSDAC) Recall Explanation

Welcome to the **Dietary Assessment Study Using Phone 24 Hour Recalls.** You will be receiving 3 phone calls over the next week so that we can ask you about the foods you eat.

During each call an interviewer from our Interview Center will call to ask you what foods you have eaten on the previous day. These calls are random so we are not able to tell you what specific day we will be calling but the interviews will only take about 20 to 30 minutes. You have been provided by your EFNEP educator with a food amounts booklet that contains pictures of squares, circles, cups, bowls, circles, squares and rectangles and so forth. Please keep this booklet in an easily accessible location. You may need it during the interviews to help you estimate the amounts of foods you eat.

Each food interview will have 3 parts:

- First, the interviewer will ask for the **time, type of meal, place**, and a **brief list of foods** that you ate throughout the day.

- Next, you will be asked for more detail about the **ingredients, preparation**, and **amounts** of each food.

- Then, the **interviewer will repeat** what you have reported to make sure everything is correct. You can add or change the information during the interview.

You don't need to remember all of this. We just wanted to give you an idea what to expect.

We want to thank you for participating in this research project. The information you provide is confidential and is a very important part of the Dietary Assessment Study Using Phone 24 Hour Recalls.

Sincerely,

The Telephone Interview Staff at Penn State.

Attachment E: Penn State Verbal Consent Form

Penn State Verbal Consent Form

Introduction:

You were recruited by your EFNEP educator to participate in a research project being conducted by the Colorado State University. The purpose of the research is to test a nutrition questionnaire by completing some questions and also doing 24 hour recalls by phone.

Your participation in this study is voluntary, and you may stop the interview at any time or skip any interview question. If you decide to participate, the answers you give will be recorded in writing by the interviewer. The interview will take you approximately 20 to 30 minutes to complete.

If you participate in this project, there are no risks to you except for your time and inconvenience. There are no direct benefits to you, but the results of this project will help create a better tool to measure the benefits of participating in EFNEP. You will receive a $10 gift card for each completed phone 24 hour recall.

Confidentiality:

- Your name will be kept confidential by us and Colorado State University.
- Your name will be assigned a code after we collect all of your completed surveys and 24 hour recalls.
- Your information will be combined with information from other project participants in a database listed by a code and not by your name.
- We may publish the results of this study, but your name and contact information will remain confidential.
- All data associated with this project will be destroyed after 3 years.

If you have any questions about this project, please contact Susan Baker at 970-491-5798 (or e-mail susan.baker@colostate.edu). If you have any questions about your rights as a research participant, please contact Evelyn Swiss, at 970-491-1381.

Does participant consent? Yes or No

APPENDIX S. STATISTICAL ANALYSIS PLAN FOR CONSTRUCT VALIDITY TESTING

Statistical Analysis Plan
Validity Testing EFNEP Nutrition Questions (FFQ) Compared to 24-hour Dietary Recall Data

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
1. How many **days a week** do you cook dinner (your main meal) at home?	- I rarely cook dinner at home (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. main meal d/wk from FFQ b. main meal d/wk mean of three 24-hour recalls 2. Wilcoxon t-test comparing FFQ means to three 24-hour recalls means 3. Pearsons correlation coefficients for d/wk (both options 1 and 2 from 24-hour data column) 4. Spearman correlation coefficients for d/wk (both options 1 and 2 from 24-hour data) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 from 24-hour recall data 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
2. How many **days a week** do you eat meals prepared outside of you home? (include fast food, restaurants, ready to eat food from grocery stores, and food from gas stations or corner stores)	-I rarely eat meals prepared outside my home = 0 -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. main meal d/wk from FFQ b. main meal d/wk mean of three 24-hour recalls 2. Wilcoxon t-test comparing FFQ means to three 24-hour recalls means 3. Pearsons correlation coefficients for d/wk (both options 1 and 2 from 24-hour data) 4. Spearman correlation coefficients for d/wk (both options 1 and 2 from 24-hour data) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 from 24-hour recall data 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
Examples of **fruits** are apples, bananas, oranges, grapes, raisins, melon and berries. Include fresh, frozen, dried, or canned fruit. **Do not include juice**.	-I rarely eat fruit (0) -Less than 1 time a day (a couple times a week) (>0 and <1/day) -1 time a day (1)	1. The sum of the number of times a day fruits are eaten from each 24-hour food recall. Do not include juice. 2. The mean	1. Means and standard deviations for: a. Fruit t/d from FFQ b. Fruit t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearson correlation coefficients for

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
3. How many **times a day** do you eat fruit?	-2 times a day (2) -3 times a day (3) -4 or more times a day (4+)	number of times per day from the three 24-hour food recalls.	t/d 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ t/d to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
Examples of **vegetables** are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned and frozen vegetables. **Do not count 306rench fries, potato chips, or rice**. 4. How many **times a day** do you eat vegetables?	-I rarely eat vegetables (0) -Less than 1 time a day (a couple times a week) (>0 and <1/day) -1 time a day (1) -2 times a day (2) -3 times a day (3) -4 or more times a day (4+)	1. The sum of the number of times a day vegetables are eaten from each 24-hour food recall. Do not include French fries or potato chips. 2. The mean number of times per day from the three 24-hour food recalls.	1. Means and standard deviations for: a. veg t/d from FFQ b. veg t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearson correlation coefficients for t/d 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ t/d to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
5. How many different kinds of vegetables do you usually eat **a day**?	-I rarely eat vegetables (<1) -1 kind a day (1) -2 kinds a day (2) -3 kinds a day (3) -4 or more kinds a day (4+)	1. The sum of the different kinds of vegetables eaten from each 24-hour food recall. Do not include french fries or potato chips. 2. The mean number of different vegetables from the three 24-hour food recalls.	1. Means and standard deviations for: a. veg kinds/d from FFQ b. veg kinds/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearsons correlation coefficients for kinds/d 4. Spearman correlation coefficients for kinds/d 5. Bland-Altman plots* comparing FFQ kinds/d to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
Examples of **red or orange vegetables** are tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin.	- I did not eat red and orange vegetables (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply	1. Means and standard deviations for: a. Red/orange veg d/wk from FFQ b. Red/orange veg d/wk mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ means to three 24-

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
6. Over the last week, **how many days** did you eat red and orange vegetables?	-5 days a week (5) -6 or 7 days a week (6+)	responses by 2.33	hour recalls means 3. Pearsons correlation coefficients for d/wk (both options 1 and 2 from 24-hour data) 4. Spearman correlation coefficients for d/wk (both options 1 and 2 from 24-hour data) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 from 24-hour recalls 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
Examples of **dark green vegetables** are broccoli, spinach, dark green lettuce, turnip greens, or mustard greens. 7. Over the last week, **how many days** did you eat dark green vegetables?	- I did not eat dark green vegetables (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. Dark green veg d/wk from FFQ b. Dark green veg d/wk mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ means to three 24-hour recalls means 3. Pearson correlations coefficients d/w (options 1 and 2) 4. Spearman correlation coefficients for d/wk (options 1 and 2) 5. Bland-Altman plots* comparing FFQ to option #2 from 24-hour recalls 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
Examples of **beans and peas** include pinto beans, black beans, navy beans, chili beans, refried beans, pork and beans, bean soup, barbeque beans, chickpeas, split peas, and black eyed peas. **<u>Include beans from a can or cooked from dry.</u>** 8. Over the last week, **how many days** did you eat beans and peas?	- I did not eat beans and peas (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. Beans/peas d/wk from FFQ b. Beans/peas d/wk to the mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ means to three 24-hour recalls means 3. Pearsons correlation coefficients (both options 1 and 2) 4. Spearman correlation coefficients for d/wk (options 1 and 2) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 for three 24-hour recalls 6. Bland-Altman percent agreement from plots (same and adjacent quartile)

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
9. How many **times a day** do you drink milk or soymilk? (Do not count almond or coconut milk, or milk with cereal)	-I do not drink milk (0) - I rarely drink milk (>0 and <1) -1 time a day (1) -2 times a day (2) -3 or more times a day (3+)	1. The sum of milk or soymilk intake from each 24-hour food recall. Do not include almond or coconut milk, or milk with cereal. 2. The mean number of times milk or soymilk is consumed from the three 24-hour food recalls.	1. Means and standard deviations for: a. milk t/d from FFQ b. milk t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearsons correlation coefficients 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ t/d to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
10. Over the last week, **how many days** did you eat yogurt or drink smoothies with yogurt?	- I did not eat yogurt (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. yogurt d/wk from FFQ b. yogurt d/wk mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ means to three 24-hour recalls means 3. Pearsons correlation coefficients (options #1 and 2) 4. Spearman correlation coefficients for d/wk (options #1 and 2) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 from three 24-hour recalls 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
11. Over the last week, **how many days** did you eat cereal with milk?	- I did not eat cereal with milk (0) -1 day a week (1) -2 days a week (2) -3 days a week (3) -4 days a week (4) -5 days a week (5) -6 or 7 days a week (6+)	Options: 1. Using the three recalls, count how many days/wk (0,1, 2, or 3 days) 2. Multiply responses by 2.33	1. Means and standard deviations for: a. Milk in cereal d/wk from FFQ b. Milk in cereal d/wk mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ means to three 24-hour recalls means 3. Pearsons correlation coefficients (options 1 and 2 from 24-hr recalls) 4. Spearman correlation coefficients for d/wk (options 1 and 2 from 24-hr recalls) 5. Bland-Altman plots* comparing FFQ d/wk to option #2 from three 24-hour recalls 6. Bland-Altman percent agreement from plots (same and adjacent

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
			quartile)
12. How often do you drink regular sodas (not diet)?	-Never (0) -1 – 3 times a week (1) -4 – 6 times a week (2) -1 time a day (3) -2 times a day (4) -3 times a day (5) -4 or more times a day (6) Use converted scale for Pearsons correlation and Bland-Altman agreement: -Never (0) -1 – 3 times a week (0.286) -4 – 6 times a week (0.714) -1 time a day (1) -2 times a day (2) -3 times a day (3) -4 or more times a day (4)	1. The sum of regular soda intake from each 24-hour food recall. Do not include diet soda. 2. The mean number of times regular soda was consumed from the three 24-hour food recalls.	1. Means and standard deviations for: a. soda t/d from FFQ b. soda t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearson correlations using FFQ scale and converted scale t/d 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ converted scale t/d to average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)
13. How often do you drink fruit punch, fruit drinks, sweet tea, or sports drinks?	-Never (0) -1 – 3 times a week (1) -4 – 6 times a week (2) -1 time a day (3) -2 times a day (4) -3 times a day (5) -4 or more times a day (6) Use converted scale for Pearsons correlation and Bland-Altman agreement: -Never (0) -1 – 3 times a week (0.286) -4 – 6 times a week (0.714)	1. The sum of fruit punch, fruit drinks, sweet tea, and sports drink intake from each 24-hour food recall. 2. The mean number of times these drinks were consumed from the three 24-hour food recalls.	1. Means and standard deviations for: a. Sweet drinks t/d from FFQ b. Sweet drinks t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearsons correlations using the converted FFQ scale 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ converted scale to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)

Nutrition Questions	Response Options (code to compare to recall data)	How 24-Hour Recall Data will be Calculated (using 3 24-hr recalls)	Statistical Analyses Run each of these for "pre" and "post" groups
	-1 time a day (1) -2 times a day (2) -3 times a day (3) -4 or more times a day (4)		
14. How often do you drink energy drinks?	-Never (0) -1 – 3 times a week (1) -4 – 6 times a week (2) -1 time a day (3) -2 times a day (4) -3 times a day (5) -4 or more times a day (6) Use converted scale for Pearsons correlation and Bland-Altman agreement: -Never (0) -1 – 3 times a week (0.286) -4 – 6 times a week (0.714) -1 time a day (1) -2 times a day (2) -3 times a day (3) -4 or more times a day (4)	1. The sum of energy drink intake from each 24-hour food recall. 2. The mean number of times energy drinks were consumed from the three 24-hour food recalls.	1. Means and standard deviations for: a. Energy drinks t/d from FFQ b. Energy drinks t/d mean of three 24-hour recalls 2. Wilcoxon signed rank test comparing FFQ to the mean of three 24-hour recalls 3. Pearson correlations using the FFQ converted scale 4. Spearman correlation coefficients for t/d 5. Bland-Altman plots* comparing FFQ converted scale to the average of three 24-hour recalls t/d 6. Bland-Altman percent agreement from plots (same and adjacent quartile)

* Bland-Altman Plots: Used to determine agreement between different types of instruments measuring the same variable, and each instrument has potential for some measurement error. Bland-Altman plots provide the assessment of systematic error between measurements. Plots differences between the two measurements between the averages of the measurements. Example of Bland-Altman method:

1. Calculate the differences between the two measurements (fruit intake t/d from 24-hr recalls – fruit intake t/d from FFQ)
2. Calculate the means of the two measurements (e.g., fruit intake from 24-hr recalls + fruit intake from FFQ/2)
3. Calculate the mean difference and test whether there is a sig. difference between the difference and mean measurements (#1 and 2) using a one-sample t-test.
4. Construct a scatter plot to visualize data points with y-axis difference scores, and x-axis mean scores.

5. Add the mean difference score between the two measurements into the plot (reference line)
6. Determine confidence limits – take the $\pm$ 2 SD of mean difference and add to plot
7. Assess proportional bias by looking at the plot for a trend in a greater number of data points being above or below the mean difference line
8. Run a linear regression procedure to determine if there is linear trend in proportional bias. The difference score is the dependent variable, the mean score is the independent variable. Look at the level of significance in the t-score for the coefficient mean.
9. If there is a sig difference (proportional bias), calculate the natural logarithms of the two measurements and recalculate the differences and means. Plot with the new values and assess the level of agreement between the two measurements.
10. Assess whether the values within the 95% level of agreement are acceptable values of variability between the FFQ questions and the 24-hr recalls.

APPENDIX T. CONSTRUCT VALIDITY TESTING RESULTS FROM EFNEP PARTICIPANTS AT PROGRAM ENROLLMENT

Construct validity testing results from EFNEP participants at program enrollment. Mean Frequencies of Food Behaviors and Intake Among Low-Income Women Nationally, Spearman Correlations, and Percent Agreement Between the Dietary Assessment Instrument and 24 hour Recalls at EFNEP Program Enrollment (n=60).

Question	Nutrition FFQ Mean ± SD	24-hour recalls[a] Mean ± SD (Mean ± SD)[b]	P value[c] (p value)[b]	Spearman correlation coefficient (p value)	Pearson correlation coefficient (p value)
1. Cook dinner at home (days/wk)	4.00±2.07	2.28±0.72 (5.52±1.71)	0.00 (0.00)	-0.01 (0.96)	-0.02 (0.89)
2. Eat out (days/wk)	4.23±1.66	1.12±0.92 (2.72±2.22)	0.02 (0.00)	0.06 (0.65)	0.05 (0.71)
3. Eat fruit (times/d)	2.67±1.39	0.85±0.82	0.00	0.11 (0.42)	0.10 (0.43)
4. Eat vegetables (times/d)	2.70±1.25	1.53±0.70	0.00	0.08 (0.56)	0.10 (0.46)
5. Different vegetables (times/d)	1.95±0.98	0.97±0.97	0.00	0.06 (0.65)	0.02 (0.89)
6. Red/orange vegetables (days/wk)	2.30±1.69	2.08±2.01 (2.08±2.01)	0.00 (0.00)	0.23 (0.08)	0.24 (0.06)
7. Dark green vegetables (days/wk)	2.47±1.57	0.47±0.68 (1.13±1.69)	0.00 (0.00)	0.33* (0.01) -per Dr Betts this is most likely due to the low n (22/60; 22%) reporting dark green veg on recalls	0.31* (0.02)
8. Beans and peas (days/wk)	1.77±1.18	0.37±0.58 (0.85±1.35)	0.00 (0.00)	0.04 (0.74)	0.08 (0.56)
9. Drink milk (times/d)	1.70±1.54	0.54±0.60 (0.92±0.89)	0.00 (0.00)	0.21 (0.11)	0.25 (0.05)
10. Yogurt (days/wk)	1.58±1.82	0.20±0.48 (0.49±1.16)	0.00 (0.00)	0.31 (0.02) -per Dr Betts this is most likely due to the low n (10/60; 17%) reporting	0.34 (0.01)

Question	Nutrition FFQ Mean ± SD	24-hour recalls[a] Mean ± SD (Mean ± SD)[b]	P value[c] (p value)[b]	Spearman correlation coefficient (p value)	Pearson correlation coefficient (p value)
				yogurt on recalls	
11. Milk in cereal (days/wk)	1.88±1.58	0.67±0.91 (1.65±2.24)	0.00 (0.21) when*2.33)	0.35 (0.01)** -25/60 – 42% reported intake in recalls	0.34** (0.01)
12. Drink soda (times/wk)	4.05±1.87	4.82±1.49	0.00 (0.00)	0.44** (0.00) -33/60 – 55% reported drinking soda	0.49** (0.00)
13. Other sweet drinks (times/wk)	3.90±1.86	5.31±1.07	0.00 (0.00)	0.12 (0.36)	0.17 (0.19)
14. Energy drinks (times/wk, times/d)	n/a[d]	n/a	n/a	n/a	n/a

[a]Average of 2 (n=6) or 3 (n=54) 24-hour dietary recalls.
[b]Data were multiplied by 2.33 for 3 days of recalls (n = 54), and 3.5 for 2 days of recalls (n=6) to account for intake across the week.
[c]Wilcoxon signed rank test for differences between the FFQ and the average intake of related foods/beverages from 24-hour dietary recalls.
[d]Not run due to low number (n=3) reported drinking energy drinks on food recalls.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

APPENDIX U. CONSTRUCT VALIDITY TESTING RESULTS FROM EFNEP PARTICIPANTS AT PROGRAM COMPLETION

Construct Validity Testing Results from EFNEP Participants at Program Completion. Mean Frequencies of Food Behaviors and Intake Among Low-Income Women Nationally, Spearman Correlations, and Percent Agreement Between the Dietary Assessment Instrument and 24 hour Recalls at EFNEP Program Completion (n=30).

Question	Nutrition FFQ Mean ± SD	24-hour recalls[a] Mean ± SD (Mean ± SD)[b]	P value[c] (p value)[b]	Spearman correlation coefficient (p value)	Pearson correlation coefficient (p value)
1. Cook dinner at home (days/wk)	4.20±1.71	2.33±0.96 (5.55±2.20)	0.00 (0.01)	0.00 (0.99)	-0.03 (0.884)
2. Eat out (days/wk)	4.50±1.11	1.07±0.94 (2.56±2.21)	0.00 (0.00)	0.13 (0.50)	0.12 (0.55)
3. Eat fruit (times/d)	2.83±1.46	0.77±0.86	0.00	0.33 (0.07)	0.30 (0.11)
4. Eat vegetables (times/d)	3.30±1.18	1.47±0.82	0.00	0.11 (0.56)	0.14 (0.46)
5. Different vegetables (times/d)	2.07±0.83	1.13±1.22	0.00	0.10 (0.60)	0.06 (0.76)
6. Red/orange vegetables (days/wk)	2.70±1.58	1.17±1.05 (2.84±2.46)	0.00 (0.93)	0.44* (0.02)	0.44* (0.01)
7. Dark green vegetables (days/wk)	3.17±1.58	0.73±0.87 (1.71±2.02)	0.00 (0.00)	0.28 (0.14)	0.26 (0.17)
8. Beans and peas (days/wk)	2.30±1.29	0.33±0.61 (0.77±1.41)	0.00 (0.00)	0.05 (0.81)	0.09 (0.64)
9. Drink milk (times/d)	1.70±1.39	0.33±0.45 (0.67±0.71)	0.00 (0.00)	0.17 (0.38)	0.10 (0.58)
10. Yogurt (days/wk)	1.67±1.65	0.27±0.74 (0.62±1.72)	0.00 (0.01)	0.10 (0.61)	0.10 (0.59)
11. Milk in cereal (days/wk)	2.10±1.79	0.53±0.90 (1.28±2.13)	0.00 (0.03)	0.41* (0.03) Only 10 reported cereal with milk	0.37 (0.05)
12. Drink soda (times/wk)	4.77±1.74	1.93±2.16	0.00	0.36 (0.05)	0.52** (0.00)

Question	Nutrition FFQ Mean ± SD	24-hour recalls[a] Mean ± SD (Mean ± SD)[b]	P value[c] (p value)[b]	Spearman correlation coefficient (p value)	Pearson correlation coefficient (p value)
13. Other sweet drinks (times/wk)	4.57±1.70	1.87±2.11	0.000	0.19 (0.31)	0.11 (0.58)
14. Energy drinks (times/wk, times/d)	n/a[d]	n/a	n/a	n/a	n/a

[a]Average of 2 (n=3) or 3 (n=27) 24-hour dietary recalls.
[b]Data were multiplied by 2.33 for 3 days of recalls (n = 27), and 3.5 for 2 days of recalls (n=3) to account for intake across the week.
[c]Wilcoxon signed rank test for differences between the FFQ and the average intake of related foods/beverages from 24-hour dietary recalls.
[d]No one reported drinking energy drinks on food recalls.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

APPENDIX V. FACTORS ASSOCIATED WITH THE LACK OF CORRELATION BETWEEN THE DIETARY ASSESSMENT QUESTIONS AND 24-HOUR FOOD RECALL DATA

Factors Associated with the Lack of Correlation Between the Dietary Assessment Questions and 24-Hour Food Recall Data

1. Response options from the nutrition questions (number of times/day or number of times/week) were incompatible with 24-hour food recall data for the assessment of comparative validity. The majority of nutrition questions (10/14) included responses that assessed intake over a week. The 24-hour food recall data, comprised of 2- or 3-days of intake, were categorized into precise servings of food groups and nutrients, including from mixed dishes, using the Nutrition Data System for Research (NDSR). The researchers had to use special procedures to extract specific foods (dark green vegetables) from the recall data, count the frequency of intake of foods or eating behaviors (cook meals at home), and extrapolate the data to a week of intake to align with the dietary assessment question responses.

2. Penn State University's Dietary Assessment Center (PSDAC) interviewers, which collected the 24-hour recall data, did not ask specific probing questions to better align data collection with the dietary assessment questions. This resulted in missing information from the recall data. For example, Penn State staff were asked to confirm whether the main meal was cooked at home to assess nutrition question #1 "How many days a week do you cook dinner at home?" The researcher developed specific probing questions that were agreed upon by PSDAC prior to data collection. However, the probes were not asked.

3. The 24-hour food recall data collection did not align with the dietary assessment question data collection. EFNEP participants completed the dietary assessment questions, which assessed food intake over the prior week, *before* completing the 24-hour food recalls. Additionally, PSDAC reported difficulty reaching the volunteer EFNEP participants via telephone to complete the 24-hour recalls. That resulted in a wide time interval for collecting food recall data (6-32 days), compared to the recommended 1-week time range.

4. The PSDAC interviewers reported resistance from EFNEP participants when completing the 24-hour food recalls via telephone. This resistance may have resulted in under-reporting intake. Participants may have lacked trust in giving detailed, personal information to a stranger over the phone. Participants may have also misunderstood what the interviewers were asking, or were distracted by children or other obligations while completing the recalls over the phone.

5. Food insecurity may be a confounding factor in the lack of correlation between the food recall data and nutrition question data. Some participants reported to PSDAC that they ate one meal that day or did not eat more often because they did not have access to food. Participants may have reported food intake differentially, depending on the method (24-hour food recalls versus dietary assessment questions), due to food availability at the time of reported intake, with a potential overestimation of the frequency of food intake reported on the dietary assessment instrument.

6. Systematic error (bias) in reported intake may have attenuated the true relationship between the two measures (dietary assessment questions versus 24-hour food recalls). For example, social desirability bias is a type of systematic error common in food frequency questionnaires that is known to result in over-reporting healthy foods and under-reporting unhealthy foods, resulting in biased estimates of mean intake compared to 24-hour food recalls.

7. Within-person random error, caused by either the variability of intake of specific foods from the 24-hour recalls, or low/no intake of certain foods, may have attenuated the correlations between the two measures (dietary assessment questions versus 24-hour food recalls). This type of error may be further complicated by food insecurity and participant resistance with completing telephone-administered 24-hour food recalls.