DEVELOPMENT AND EVALUATION OF A HEALTH PROMOTION PROGRAM FOR OLDER ADULTS: JOURNEY THROUGH HEALTH

By

SEUNG EUN JUNG

Bachelor of Nutritional Sciences
Kyung Hee University
Seoul, Korea
2002

Master of Human Environmental Sciences
in Nutritional Science
Oklahoma State University
Stillwater, Oklahoma
2008

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF HUMAN SCIENCES
July, 2014

DEVELOPMENT AND EVALUATION OF A HEALTH PROMOTION PROGRAM FOR OLDER ADULTS: JOURNEY THROUGH HEALTH

Dissertation Approved:

Dr.Janice Hermann

Dissertation Adviser

Dr. Stephany Parker

Dr. Edralin Lucas

Dr. Alex Bishop

Name: SEUNG EUN JUNG

Date of Degree: JULY, 2014

Title of Study: DEVELOPMENT AND EVALUATION OF A HEALTH PROMOTION PROGRAM FOR OLDER ADULTS: JOURNEY THROUGH HEALTH

Major Field: NUTRITIONAL SCIENCES

Abstract: The “Journey through Health” program was developed using the Health Belief Model and provided information on how the overarching Dietary Guideline Consumer Brochure messages can positively influence nutrition and physical activity choices to prevent or delay age-related changes throughout the body. The program consisted of 12 posters, each with an educational script and handout. Results of the program evaluation with 142 older adults revealed the program was positively received and resulted in increased awareness of age-related changes and associated health risks, benefits of nutrition and physical activity in health promotion, and self-efficacy towards following the Dietary Guideline Consumer Brochure messages.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

CHAPTER I

INTRODUCTION

Adults, 65 years of age and older, represented 13% of the U.S. population in 2010 (Administration on Aging, 2012).The baby boomers, those who were born between 1946 and 1964, first began to reach age 65 in 2011. This population is expected to continue to grow significantly in the future. In fact, the number of adults 65 years of age and older is estimated to be 71 million by 2030, accounting for roughly 20% of the U.S. population (Administration on Aging, 2012). Increased life expectancy, due to improved health care, socioeconomic status and health behaviors, is a factor contributing to the increasing older adult population. The life expectancy for a 65-year-old of today is an additional 18.5 years, and the life expectancy for an 85-year-old is an additional 5.7 years for men and 6.8 years for women (Federal Interagency Forum on Aging-Related Statistics, 2010).

Although older adults' overall health is better than in previous decades, this population faces various age-related changes. These age-related changes involve a gradual decline in numerous physiological functions (Schiffman & Graham, 2000). In addition, the Centers for Disease Control and Prevention (CDC) recently reported approximately 80% of older adults in the U.S. suffer from at least one chronic disease (CDC, 2011). As a result, older adults often experience a decline in functional independence and health-related quality of life (CDC, 2011; Schiffman & Graham, 2000).

However, McNulty (2005) indicated older adults want to stay independent and live in their home, rather than moving to long-term care facilities (McNulty, 2005). In fact, 95% of older adults live independently in the community (Federal Interagency Forum on Aging-Related Statistics, 2010). Not only is the older population concerned about their independence, they are also concerned about health care expenditures. In 2007, health care expenditures for older adults were four times greater than for someone younger than 65 years of age. With the increasing number of older adults, prevalence of chronic disease, and increasing health care costs, there is a need for the nation's public health community to focus more on opportunities to support health promotion and prevent or reduce chronic health issues in the older adult population (Sahyoun, Pratt, & Anderson, 2004; Rice & Fineman, 2004).

It is clear that healthful eating and regular physical activity are vital for promoting overall health and lowering the risk of chronic disease. Although many older adults are aware of the importance of nutrition and physical activity in maintaining health and independence, not all older adults maintain healthful lifestyles (Ellis, Johnson, Fischer, & Hargrove, 2005; Fitzpatrick et al., 2008).

Nutrition and physical activity education can improve older adults' ability to maintain health and independence, prevent or delay health problems, improve quality of life, and reduce health care costs (Drewnowski & Evans, 2001; Johnson et al., 2008). Furthermore, health promotion related to nutrition and physical activity has been identified among older adults as a predominate educational preference (Kicklighter, 1991). Overall, nutrition and physical activity education can be part of health promotion, disease prevention, and food assistance for older adults.

Several characteristics have been identified that enhance older adult learning of complex physiological information. Sahyoun et al. (2004) indicated nutrition and physical activity education programs developed based on appropriate theories can improve behavior change (Sahyoun et al., 2004). The Health Belief Model (HBM) is based on the idea that individuals will participate in healthful behaviors when they feel they are susceptible to a condition, perceive the condition will

have severe consequences, feel certain actions and behaviors are beneficial, and believe the benefits of the actions and behaviors exceed the costs (Rosenstock, Strecher, & Becker, 1988). The HBM has been reported as an appropriate framework for the development of health promotion programs, especially for older adults because the model includes constructs which highlight the likelihood of health related conditions among older adults (Sahyoun et al., 2004). In addition, the HBM has been recommended for developing nutrition education programs to enhance awareness and motivation to take action to reduce health-related risks (Contento, 2007). Sahyoun et al. (2004) also recommended limiting the complexity and number of messages and instead using messages that are focused, practical, reinforced, and based on individual incentives (Sahyoun et al.,2004). A study by Parker et al. (2011) explored educational delivery preferences of older adults enrolled in Community Nutrition Education Programs (CNEP) in rural Oklahoma counties. Results from this study recommended incorporating multiple methods that provide opportunities for interaction along with supplemental education materials for at-home reinforcement (Parker, Powell, Hermann, Phelps, & Brown, 2011).

Cooperative Extension Service is positioned to address many issues older adults face and provides high quality education to promote healthy aging (Gerrior & Crocoll, 2008). Oklahoma Cooperative Extension Service Family and Consumer Science (OCES FCS) County educators have indicated the need for programs which could be used in a variety of ways and supportive large print handouts for older adults. In addition, many of the settings where OCES FCS County Educators provide education to older adults are not conducive to Power Point programs.

The primary objective of this study was to develop a health promotion program for older adults based on the HBM entitled "Journey through Health." The second objective was to conduct formative evaluation of the "Journey through Health" program using expert face validity and indigenous input. The final objective was to conduct outcome evaluation of the "Journey through Health" program as a one-time display on older adults' perceived threat of age-related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion and

self-efficacy toward following the Dietary Guideline Consumer Brochure messages was conducted using retrospective pre, post survey questions and older adults' comprehension and acceptance of the "Journey through Health" program using post survey questions.

Program Development Objective

O_1: To develop a health promotion educational program based on the HBM for older adults, "Journey through Health," consisting of a series of posters, each with a short educational script, and large print handout.

Formative Evaluation Objectives:

O_1: To conduct expert face validity of the "Journey through Health" program (posters, scripts, large print handouts, and evaluation instrument).

Outcome Evaluation Hypotheses:

Null Hypotheses

H_{01}: There will be no significant difference between retrospective pre and post perceived threat of age-related changes and associated health risks among older adults who participated in the "Journey through Health" program.

H_{02}: There will be no significant difference between retrospective pre and post perceived benefit of nutrition and physical activity in health promotion among older adult who participated in the "Journey through Health" program.

H_{03}: There will be no significant difference between retrospective pre and post self-efficacy toward following the Dietary Guideline Consumer Brochure message among older adults who participated in the "Journey through Health" program.

Outcome Evaluation Objective:

Q_1: To evaluate older adults' comprehension and acceptance of the "Journey through Health" program.

Assumptions

1. Older adults who participated in the "Journey through Health" program answered the retrospective pre, post survey honestly.

Limitations

1. The participants may not represent the views of all older adults because this study was limited to older adults in the state of Oklahoma.
2. Self-reported information using a retrospective pre and post design may be susceptible to social desirability in that participants may answer as they think the evaluator wants.
3. A retrospective pre, post design can be used to measure changes in knowledge, attitudes and intent to change, but it is not used for measuring actual behavior change.

CHAPTER II

REVIEW OF LITERATURE

Older Population in the United States

Adults, 65 years of age and older, are a rapidly increasing population group in America (Federal Interagency Forum on Aging-Related Statistics, 2010). The percentage of Americans, 65 years or older, more than tripled from approximately 4% in 1900 to 13% in 2010 (Administration on Aging, 2012). Furthermore, the number of adults 65 years of age and older is estimated to be 71 million by 2030, accounting for roughly 20% of the U.S. population (Administration on Aging, 2012). Increased life expectancy due to improved health care, socioeconomic status and health behaviors is a factor contributing to the increasing older adult population. The life expectancy of a 65-year-old of today is an additional 18.5 years, and the life expectancy for an 85-year-old is an additional 5.7 years for men and 6.8 years for women (Federal Interagency Forum on Aging-Related Statistics, 2010).Therefore, this population will continue to grow significantly in the future.

Although overall health for older adults is better than in previous decades, this population faces chronic health issues that can lead to limitations in daily activities and reduced health-related quality of life. In fact, the Centers for Disease Control and Prevention (CDC) reported approximately 80% of older adults in the U.S. suffer from at least one chronic disease (CDC, 2011). Chronic health issues among older adults vary by gender. Women have been reported to

have a higher incidence of arthritis and hypertension than men, while men have been reported to have a higher incidence of heart disease and cancer. In addition, differences exist in the incidence of certain chronic conditions among older adults by race and ethnicity. In 2007 and 2008, older adult Blacks reported higher levels of hypertension (71%) compared with non-Hispanic whites (54%). Blacks also reported the highest levels of diabetes (30%), followed by Hispanics (27%), and non-Hispanic whites (16%). However, Hispanics reported lower levels of arthritis (42%) compared with non-Hispanic whites (51%) (Federal Interagency Forum on Aging-Related Statistics 2010). As a result of these chronic health issues, older adults often experience a decline in functional independence and reduced health-related quality of life.

However, McNulty (2005) indicated older adults want to stay independent and live in their home, rather than in long-term care facilities (McNulty, 2005). In fact, 95% of older adults live independently in the community (Federal Interagency Forum on Aging-Related Statistics 2010). Not only is the older population concerned about their independence they are also concerned about health care expenditures. The CDC reported the average health care expenditures of individuals living in long-term care facilities were $57,022 compared to $12,383 of individuals living in the community. In addition, the nations' health care expenditures increased significantly among the older adults from 1992 to 2006. In 2007, the CDC reported that about one-third of all U.S. health care expenditures (36%) were for an estimated 13% of older adults, 65 years of age and older. Additionally, in 2007 health care expenditures for older adults were four times greater than someone younger than 65 years of age. Furthermore, it is projected that by 2030 health care expenditures will increase by 25% due to the growing number of the older adults and the increased prevalence of chronic disease in this population (CDC, 2007).

Dietary Guideline Consumer Brochure Messages

It is clear that healthful eating and regular physical activity are vital for promoting overall health and lowering the risk of chronic disease. The 2010 Dietary Guidelines for Americans (DGA) was released in 2011 to guide federal nutrition policy as well as to summarize evidence-based advice on healthful eating and physical activity for Americans ages 2 years and older, including individuals at higher risk of chronic disease. Based on the 2010 Dietary Guidelines for Americans, the Dietary Guideline Consumer Brochure called "Let's Eat for the Health of It" was developed which contains four overarching Dietary Guideline Consumer Brochure messages to help Americans put the Dietary Guideline recommendations into action (USDA, 2011). The four overarching Dietary Guideline Consumer Brochure messages are: 1) "Build a healthy plate", 2) "Cut back on foods high in solid fats, added sugar and salt", 3) "Eat the right amount of calories for you", and 4) "Be physically active your way"(USDA, 2011).

"Build a Healthy Plate"

The first Dietary Guideline Consumer Brochure message suggests a diet composed of nutrient dense foods without too many calories by increasing fruit and vegetables, choosing skim or 1% milk and milk products, choosing whole grains, and varying protein choices (USDA, 2011). According to the 2010 DGAs, the diets of older adults do not meet recommendations for vegetables, fruits, potassium, fiber, vitamin D, calcium, and vitamin B12.

The 2010 DGAs recommended increasing fruit and vegetable intake and eating a variety of vegetables, such as dark-green, red and orange vegetables along with beans and peas was recommended. Most fruits and vegetables are major source of many nutrients, which are not consumed in adequate amounts, including folate, magnesium, potassium, dietary fiber, and

vitamins A, C, and K. Additionally, fruits and vegetables are associated with lowering the risk of many chronic diseases. Specifically, evidence indicates consuming at least 2.5 cups of fruits and vegetables daily are associated with lowering the risk of cardiovascular disease. Furthermore, some fruits and vegetables may protect against certain types of cancer. Moreover, most fruits and vegetables, prepared without added sugars and fats are fairly low in calories (USDA & USDHHS, 2010).

The 2010 DGAs also recommended older adults increase their intake of whole grains by consuming at least half of their grains as whole grains. Whole grains provide nutrients such as iron, magnesium, selenium, B vitamins, and dietary fiber. Evidence indicates whole grains may lower the risk of cardiovascular disease and is associated with decreased body weight. Therefore, consuming adequate whole grains can assist in meeting nutrient needs and can provide additional health benefits especially for older adults (USDA & USDHHS, 2010).

The 2010 DGAs recommended older adults choose skim or 1% milk and milk products. These foods are an excellent source of calcium and vitamin D which are important for optimal bone health. Many older adults have low bone density, which is a risk factor for osteoporosis. This places older adults at increased risk of bone fractures**.** Evidence shows intake of milk and dairy products are associated with improved bone health for older adults. Evidence also indicates intake of milk and dairy products are associated with decreased risk of cardiovascular disease, type 2 diabetes, and high blood pressure among older adults. Fat-free and low-fat dairy products provides the same nutrients with less calories while they are good sources of potassium, vitamin A, and vitamin D. Selecting fat-free or low-fat milk and dairy products can provide the same nutrients with less fat and calories. As a result, increasing consumption of fat-free or low-fat milk and dairy products, such as milk, yogurt, cheese, or fortified soy beverages was recommended by the DGAs (USDA & USDHHS, 2010).

Consumption of seafood is also recommended by the 2010 DGAs. Evidence indicates seafood is a source of omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are associated with reduced cardiovascular related disease. Therefore, an intake of 8 or more ounces of seafood a week is recommended by the 2010 DGAs (USDA & USDHHS, 2010).

The DGAs also provided a special recommendation for older adults related to vitamin B12 since adults, 50 years of age and older, have a decreased ability to absorb the naturally occurring form of vitamin B12. Therefore, the DGAs recommend adults, 50 years of age and older, consume foods fortified with vitamin B12, such as fortified cereals, or take a vitamin supplements containing vitamin B12 (USDA & USDHHS, 2010).

"Cut Back on Foods High in Solid Fats, Added Sugar and Salt"

The second Dietary Guideline Consumer Brochure message suggests individuals need to lower their intake of foods high in solid fats, added sugars and salt. The DGAs recommend choosing foods and drinks with little or no added sugar, looking out for sodium in foods, and eating fewer foods high in solid fats. Consuming foods and drinks with minimal amounts of sugars, salt, and solid fat, consumers may lower the risk of obesity, heart disease, hypertension and diabetes (USDA, 2011).

The DGAs recommended a sodium intake of less than 2,300 milligrams a day and a further reduction in sodium to 1,500 mg a day for individuals, 51 years of age and older, African Americans, and individuals' with hypertension, diabetes, or chronic kidney disease. Evidence indicates lower sodium intake is associated with lower blood pressure. Lower blood pressure is associated with a lower risk of cardiovascular disease, congestive heart failure, and kidney disease. The DGAs recommended a variety of ways to reduce sodium intake such as reading the nutrition facts label for sodium content, purchasing foods lower in sodium, consuming more fresh

foods and less processed foods, which are often high in sodium, eating more food prepared home, using little or no salt or salt when cooking or eating foods, and asking that salt not be added to food when eating out (USDA & USDHHS, 2010).

The DGAs also recommend lowering the intake of solid fats. As such, the DGAs recommended adults consume less than 10 percent of calories from saturated fatty acids. In addition, consuming less than 300 mg dietary cholesterol per day was recommended. Keeping *trans* fatty acid intake as low as possible was also recommended, especially by lowering intake of partially hydrogenated oils, which are a synthetic source of trans fats. Furthermore, limiting intake of refined grains, especially those which are high in solid fats, added sugars, and sodium was recommended (USDA & USDHHS, 2010).

"Eat the Right Amount of Calories for You"

The third Dietary Guideline Consumer Brochure message suggests individuals need to maintain a healthy weight by consuming optimal calories for their personal needs. This could include enjoying foods by eating an adequate amount of calories, cooking at home to control nutritional intake, choosing lower calorie options when eating out, keeping track of intake by writing it down, and limiting daily alcohol consumption to 1 drink for women and 2 drinks for men (USDA, 2011).

Maintaining an appropriate body weight across the lifespan is important for sustaining good health and quality of life. Particularly, adults ages 65 years and older, those who are obese, and those who are at risk of cardiovascular disease are encouraged to lose weight due to the benefits related to reduced chronic disease risk and associated disabilities. Therefore, balancing calories between the amount of calories consumed from food and beverages and calories used for body functions and physical activity is important. In general, older adults need to decrease their calorie intake due to decreases in the basal metabolic rate that naturally occurred with aging

(USDA & USDHHS, 2010). The DGAs recommended calorie levels are based on the estimated energy requirements (EER). The DGAs estimated calorie needs by age, gender and physical activity level for males, 65 years of age and older, range from 2,000 (sedentary) to 2,600 (active). For females, 65 years of age and older, the estimated calorie needs by range from 1,600 (sedentary) to 2,000 (active) (USDA & USDHHS, 2010).

"Be Physically Active Your way"

Finally, the Dietary Guideline Consumer Brochure message suggests individuals should participate in physical activities to maintain a healthy body weight and to improve overall health (USDA, 2011). It is clear that regular physical activity provides adults with substantial health benefits and these benefits continue throughout the life span. The 2008 Physical Activity Guidelines for Americans (PAGAs) recommend adults, including older adults, engage in 150 minutes of moderately-intense or 75 minutes of vigorously-intense aerobic physical activity per week. The PAGAs also recommend adults include muscle-strengthening activities two or more days per weeks.

However, many older adults experience a decreased in physical fitness with age. In addition, many older adults have one or more chronic conditions. As a result, older adults are less likely to participate in physical activity than any other group. Less than five percent of older adults have been reported to participate in 30 minutes of physical activity daily, which is slightly more than the recommended 150 minutes of moderately-intense physical activity a week. Therefore, the 2008 PAGAs recommend older adults who cannot perform 150 minute of moderately-intense aerobic activity a week should be as active as their abilities allow. In addition, the PGAs recommend older adults participate in exercises that maintain or improve balance if they are at risk of falling (USDHHS, 2008).

Overall, the Dietary Guideline Consumer Brochure messages recommend older adults:1) "Build a healthy plate", 2) "Cut back on foods high in solid fats, added sugar and salt", 3) "Eat the right amount of calories for you", and 4) "Be physically active your way" (USDA, 2011).

Age-related Physiological Changes and Role of Nutrition and Physical Activity

Various physiological changes occur with age. These age-related changes involve a gradual decline in numerous physiological functions (Schiffman & Graham, 2000). However, nutrition and physical activity can make a significant contribution to maintaining and delaying age-associated-declines in physiological function (Drewnowski & Evans, 2001). The four overarching Dietary Guideline Consumer Brochure messages provide a manageable set of nutrition and physical activity messages which can have a powerful impact on health promotion throughout the body.

Eyes

Age-related eye diseases and visual loss are prevalent among older adults. Cataract, which is defined as opacity in the lens, is the most common age-related eye problem among older adults (The Eye Diseases Prevalence Research Group, 2004). In 2000, more than 15 million older adults, 65 years of age and older, had a cataract in one or both eyes. It is estimated that more than 30 million adults, 40 years of age and older, will have a cataract by 2020 (The Eye Diseases Prevalence Research Group 2004). Age-related macular degeneration (AMD) is also a major contributor to vision loss among older adults (CDC, 2011). AMD affects the central part of the retina that allows the eye to see fine detail such as during reading and driving (CDC, 2011). In 2010, 9.1 million older adults, 50 years of age and older, had AMD and the incidence of AMD is projected to be 17.8 million by 2050 (Rein et al., 2009). Older adults with vision loss are more likely to have diabetes, heart diseases, and stroke than those without vision loss. In 2005, the prevalence of diabetic retinopathy among older adults, 65 years of age and older, was 9.9 million,

and the incidence of diabetic retinopathy is expected to quadruple to 2.5 million by 2050 (Saaddine et al., 2008). In addition, medical expenses for older adults with visual impairment are estimated at $8.3 billion annually in U.S. (Rein et al., 2006).

Visual impairment is strongly associated with poor nutritional intake and decreased physical activity. Due to vision loss, older adults may have a harder time; driving to the grocery store, grocery shopping, and preparing food which may result in poor nutritional intake. Visual impairment may also increase older adults' risk of foodborne illnesses if they are less able to visually observe expiration dates and food spoilage. Furthermore, visual impairment may influence the level of physical activity among older adults. Fear of falling due to visual loss may result in older adults being less likely to engage in physical activity (Crews & Campbell, 2004).

Even though most age-related eye impairments are irreversible, a healthy diet may help to delay vision loss. Many studies have indicated increasing intake of antioxidant nutrients including beta-carotene, vitamin C, vitamin E, and zinc may lower the risk of developing visual impairment (Coleman & Chew, 2007). Fruits, vegetables and whole-grains provide many antioxidant nutrients. Recommendations to increase fruits, vegetables and whole-grains are in adherence with the 2010 DGAs recommendation that older adults should consume a diet high in fruits and vegetables. In addition, for individuals with diabetes, keeping blood glucose in control, through a balanced diet and regular physical activity, can help delay or prevent diabetic complications including diabetic retinopathy (DeFronzo & Abdul-Ghani, 2011).

Mouth, Teeth, and Gums

Oral health is important for older adults in maintaining overall well-being. However, many older adults suffer from poor oral health. In 2006, approximately 25% of older adults, 60 years of old and older, have been reported to not have any natural teeth (CDC, 2006). Furthermore, in 2008, 43% of older adults, 65 years of age and older, had lost six or more teeth due to tooth decay or gum disease (CDC, 2008).

Older adults are at increased risk of poor oral health due to age related changes and use of multiple medications. With age, many older adults suffer from tooth decay and gum disease, which can cause tooth loss. In addition, saliva production tends to decrease with age. Use of multiple medications can also result in decrease saliva. Decreased saliva can increase the risk of tooth decay and infections in the mouth. This is because saliva naturally contains many antimicrobial components and minerals that can help rebuild tooth enamel (CDC, 2006). Dry mouth, also known as xerostomia, is common among older adults, and can also be caused by decreased saliva and use of multiple medications (CDC, 2006).

Poor oral health can make tasting, chewing, and swallowing difficulty. Therefore, older adults with poor oral health tend to often select easy to chew foods, which can result in a decreased intake of muscle meats and fresh fruits and vegetables. Limited food choices can result in inappropriate and inadequate nutrient intakes (Marshall, Warren, Hand, Xie & Stumbo, 2002).

To maintain oral health and help prevent tooth decay and dry mouth, older adults are recommended to practice good oral hygiene; have regular dental examinations; reduce their intake of sugar, caffeine, and alcohol; and drink plenty of water, including fluoridated water (CDC, 2006).

Stomach

Another age related age change is decreased secretion of hydrochloric acid in the stomach. Decreased stomach acidity can increase older adults' risk of foodborne illness (Gettings & Kiernan, 2001). In addition, older adults are at increased risk of atrophic gastritis, which is a chronic inflammation of the stomach characterized by inadequate hydrochloric acid and intrinsic factors that play a key role in vitamin B12 absorption (Whitney & Rolfes, 2010). As a result older adults with atrophic gastritis have a lower ability to absorb naturally occurring vitamin B12 in food. In addition, atrophic gastritis contributes to increased growth of naturally occuring intestinal bacteria which use vitamin B12, further lowering the amount of vitamin B12 available.

In fact, approximately 20% of adults, 60 years of age and older, suffer from atrophic gastritis (Krasinski et al., 1986). However, older adults are better able to absorb the synthetic form of vitamin B12 found in fortified foods and dietary supplements. Thus, the 2010 Dietary Guidelines for Americans and the Institute of Medicine (IOM) recommend adults 50 years of age and older consume vitamin B12 from fortified foods, such as ready-to-eat breakfast cereals, or vitamin supplements (Institute of Medicine, 1998). Older adults should also include foods that are an excellent source of vitamin B12 such as lean meats, poultry, fish, beans, eggs, nuts, fish, milk and dairy products (USDA & USDHHS, 2010).

In addition, due to older adults increased susceptibility to food-borne illness, the DGAs recommend older adults follow four food safety principles, which include; cleaning, separating, cooking and chilling, to lower the risk of food borne illnesses. The food safety guideline suggests individuals should wash their hands for 20 seconds under running water before and after preparing food. The food safety guideline also suggests individuals should rinse produce thoroughly, particularly vegetables and fruits which will be eaten raw. However, the food safety guidelines indicate individuals should not rinse raw seafood, meat, and poultry to prevent the spread of bacteria. Separating raw, cooked and ready-to-eat foods when shopping, storing and preparing foods is recommended to prevent cross-contamination. Finally, individuals should keep foods at safe internal temperatures, and refrigerate leftovers and takeout foods within 2 hours, storing them at 40°F or below to prevent food safety problems (USDA & USDHHS, 2010).

Intestines

Constipation, which is defined as fewer than three bowel movements per week, is a common complaint among older adults (Hsieh, 2005). Many age-related problems such as changes in diet; decreased intestinal strength and flexibility, which causes slower motility; and increased medication use may contribute to the increased prevalence of constipation among older adults (Hsieh, 2005). The estimated prevalence of constipation among the general population is as

high as 28%. Those reporting constipation most often are women and older adults, 65 years of age and older (Higgins & Johanson, 2004). The prevalence of constipation results in 2.5 million physician visits per year with more than $800 million dollars spent on laxatives (Borum, 2001).

A low-fiber diet is a common risk factor for constipation among older adults. In general, constipation can be treated or prevented by increasing the amount and variety of fiber-containing foods. Recommended dietary fiber intakes are 25 g dietary fiber a day for women and 38 g dietary fiber a day for men. However, the average dietary fiber intake among older adults is only 15 g a day. Older adults often consume inadequate dietary fiber due to age-related problems such as difficulties with chewing or swallowing. As a result, older adults are more likely to eat softer, processed foods that are low in fiber (National Center for Health Statistics, 2002). The 2010 DGAs recommend Americans increase their intake of foods with naturally occurring fibers such as beans and peas, vegetables, fruits, and whole grains (USDA & USDHHS, 2010).

Inadequate fluid intake is also considered an important risk factor for constipation among older adults (Horwath, 1991). Increasing liquid intake is frequently recommended for constipation although the effect of fluid intake on constipation has not been fully studied (Mu¨ ller-Lissner, Kamm, Scarpignato, & Wald, 2005). In addition, older adults are susceptible to dehydration because of age-related changes and self-restriction of fluid intake to prevent frequent trips to the bathroom due to impaired mobility or problems with incontinence. Recommended fluid intake for older adults is 6 to 8 ounce glasses of fluids daily (Bernstein & Luggen, 2010).

In addition, lack of physical activity is another risk factor for constipation among older adults. Due to age-related loss of muscle mass, older adults are at increased risk of falls which may cause older adults to limit regular physical activities (Janssen, Baumgartner & Ross, 2004). Low physical activity may contribute to constipation as the intestinal and abdominal muscles become weak from lack of use (Simrén, 2002). Therefore, older adults are encouraged to be as physically active as possible. The 2008 PAGAs recommend older adults participate in 150

minutes of moderatly-intense physical activity or 75 minutes of vigorous-intensity physical activity a week (USDHHS, 2008).

Blood Vessels

High blood pressure (HBP), which is defined as a systolic pressure greater than 140 mm Hg or a diastolic pressure greater than 90 mm Hg, is prevalent among older adults. Hypertension is a serious health problem which increases the risk of coronary heart disease (CHD), stroke, and kidney disease. Over half of adults, 60 years of age and older, have high blood pressure in the U.S. (NHLBI, 2010). Data from NHANES from 2005 to 2006 indicated 67% of adults, 60 years of age and older, have been reported to have high blood pressure, while only 7% of adults ages 18 to 39 had high blood pressure (Ostchega, Yoon, Hughes & Louis, 2008). In 2008, a total of $47.3 billion was spent on treatment of hypertension among adults. Furthermore, the mean medical expenditure for adults, 65 years of age and older, was higher ($1,002) than for adults ages 45 to 64 ($744) (Davis, 2011).

There are several risk factors for developing hypertension, including age, diet, overweight, and low level of physical activity. In general, blood pressure tends to rise with age; therefore, older adults are more likely to have high blood pressure compared to those who are younger. Atherosclerosis, thickening of the blood vessels due to the build-up of plaque, is a major risk factor for high blood pressure. Dietary factors which increase the risk of atherosclerosis include high intakes of saturated fat, *trans* fat, and dietary cholesterol as well as low intakes of antioxidant nutrients from fruits and vegetables (Gale, Ashurst, Powers & Martyn, 2001; Ferrari, Radaelli & Centola, 2003). High blood sodium level is another risk factor for high blood pressure because excess sodium in the blood can result in water retention which can lead to increased blood volume resulting in high blood pressure. Excessive sodium intake is a common problem for older adults; a recent study reported only 5.5% of adults meet the DGAs recommended sodium

intake of less than 1,500 mg a day. In addition, approximately two-thirds of older adults are sodium sensitive due to age related decreases in the kidney's ability to excrete sodium, which can increase risk of high blood pressure (Bernstein & Luggen, 2010). Lower consumption of potassium, magnesium and calcium has been linked to increased risk of high blood pressure (Appel et al., 2006).

A healthy diet can lower the risk of high blood pressure, the DGAs recommend adults, 51 years of age and older, reduce sodium intake to less than 1,500 mg a day (USA & USDHHS, 2010). In addition, the DGAs recommend reducing fat intake. Specific DGAs recommendations are total fat intake 20 to 35% of total calories, saturated fat less than 10% of total calories, *trans* fat as low as possible, and dietary cholesterol intake less than 300 mg a day. Furthermore, the DGAs recommend increasing antioxidants as well as potassium, magnesium, and calcium intake from fruits, vegetables, whole-grains and low-fat dairy to prevent high blood pressure (Bernstein & Luggen, 2010). Therefore, two dietary patterns recommended by the DGAs include the USDA Daily Food Plan and the Dietary Approaches to Stop Hypertension (DASH) diet. These dietary approaches encourage increased consumption of fruits, vegetables, whole grains, and low-fat dairy which often are lower in fat, saturated fat, cholesterol, and sodium and higher in potassium, magnesium, and calcium. As a result, these dietary approaches can help to lower the risk of high blood pressure (USDA & USDHHS, 2010).

Being overweight is also a risk factor for hypertension. Since 1988, the percentage of adults, age 65 and over, who are obese has risen. In 2007 to 2008, 32% of adults, 65 years of age and older, were classified as obese compared to 22% in 1988 to 1994 (Federal Interagency Forum on Aging-Related Statistics, 2010). A weight loss of 10 kg has been reported to be associated with a 5-20 mm Hg reduction in systolic pressure (He, Whelton, Appel, Charleston & Klag, 2000).Therefore, maintaining a healthy body weight is another important way to prevent high blood pressure. In particular, older adults who are overweight are encouraged to maintain and not

gain additional weight. This can be attained by consuming fewer calories, participating in regular physical activities or a combination of the two.

However, due to the natural decrease in the basal metabolic rate, which occurs with aging, older adults' calorie needs generally decrease. The 2010 Dietary Guideline for Americans recommended older adults choose nutrient dense food choices, foods with little or no solid fats and added sugars, and choose appropriate portion sizes. In addition, the 2010 DGAs recommended older adults should participate in regular physical activities (USDA & USDHHS, 2010). The 2008 PAGAs recommend older adults participate in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity a week.

Although overweight and obesity are issues for older adults, a significant proportion of older adults continue to be either underweight or experience unintentional weight loss. Rapid unintentional weight loss among older adults can result in poor health outcomes such as sarcopenic obesity, which is the coexistence of decreased lean mass and increased fat mass. As a result, older adults with unintentional weight loss and loss of lean mass are at increased risk of functional impairment for independent living (Stenholm et al., 2008). Furthermore, unintentional weight loss and low BMI have been indicated as predictors for increased risk of mortality among older adults (Miller & Wolfe, 2008). Even though weight loss is recommended to improve overall health for the general population, for older adults the health benefits of weight loss are uncertain. Thus, unintentional weight loss among older adults contributes to loss of functional capacity and an increased risk of mortality (Wallace & Schwartz, 2002).

One major cause of underweight or unintentional weight loss among older adults is a reduced food intake due to physiological changes such as loss of appetite, poor oral health, alterations in taste and smell, and medication effects. In addition, psychological, economic, and social factors can contribute to unintentional weight loss among older adults. Previous research indicates enhancing food appeal can increase older adults' food intake and help combat malnutrition. Adding artificial flavor to nutritious foods was also successful in increasing older

adults' appetite. Therefore, in addition to choosing nutrient dense foods, providing appealing foods is important for older adults who are at risk of unintentional weight loss to prevent poor health outcomes (Bales & Ritchie, 2002).

In addition to a healthy diet, physical activity may help lower the risk of high blood pressure among older adults. However, lack of physical activity is a common problem among older adults. From 2007 to 2008, only 22% of adults, 65 years of age and older, engaged in regular physical activity (Federal Interagency Forum on Aging-Related Statistics, 2010). Physical activity provides several health benefits which can decrease the risk of high blood pressure; including maintaining a healthy body weight, strengthening the heart muscle, and increasing the flexibility of arteries (Thompson et al., 2003; Moyna & Thompson, 2004). As a result, older adults are encouraged to be as physically active as possible. The 2008 PAGAs recommends older adults participate in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity per week, in addition to participating in strengthening activities 2 days per week (USDHHS, 2008).

Heart

Coronary heart disease (CHD) is the major cause of death among older adults (Federal Interagency Forum on Aging-Related Statistics, 2010). CHD is caused by atherosclerosis, which decreases blood and oxygen supply to the heart due to narrowing of the blood vessels. Heart attack is caused when blood vessels to the heart are blocked due to atherosclerosis or a blood clot. Stroke is caused by a blockage in a blood vessel to the brain and is the third leading cause of death in the United States (Heron et al., 2009). In addition to being the leading causes of death, heart disease and stroke result in high medical expenses. In 2008, the highest medical expenditures among older adults were for care and treatment of heart conditions, totaling $48.4 billion (Soni & Roemer, 2011).

Several factors can influence the development of coronary heart disease. An atherosclerotic diet, which is high in dietary cholesterol, saturated fat, *trans* fat, and sodium, increases the risk of coronary heart disease, by raising blood cholesterol levels, promoting atherosclerosis, and increasing blood pressure levels. However, previous studies have indicated diets high in fruits, vegetables and whole grains which provide antioxidant nutrients are associated with decreased coronary heart disease risk by inhibiting low-density lipoproteins (LDL) oxidation (Tribble, 1999; Hu & Willett, 2002).

Furthermore, overweight and low physical activity are related to the development of coronary heart disease as well as the development of hypertension (Ferrari et al., 2003). High blood pressure in itself is also a risk for the development of coronary heart disease. High blood pressure can damage blood vessels which can initiate atherosclerosis. In addition, atherosclerosis can accelerate high blood pressure. Thus, atherosclerosis and high blood pressure have a synergistic effect on the development of coronary heart disease (Alexander, 1995). Thus, adopting lifestyle behaviors which help to prevent or control hypertension are crucial to reducing the risk of coronary heart disease (He et al., 2000; Ferrari et al., 2003). Diabetes is another contributing factor for heart disease. Diabetes is a metabolic disease in which blood glucose levels are above normal due to defects in insulin production, insulin action, or both. Over time, high blood glucose can damage large blood vessels which can increase the risk of high blood pressure, heart disease, and stroke. In fact, approximately 67% of older adults with diabetes have high blood pressure. As a result, nearly two-thirds of older adults with diabetes die of heart disease or stroke (American Diabetes Association, 2011). Older adults are encouraged to adopt lifestyles behaviors to control or reduce the risk of developing type 2 diabetes.

In sum, older adults are recommended to adopt healthy lifestyle behaviors such as decreasing dietary cholesterol, saturated fat, *trans* fat, and sodium intake; increasing physical activity; consuming a balanced diet with an increased intake of antioxidant-rich fruits and

vegetables and whole grains; and maintaining a healthy body weight to lower the risk of heart disease (He et al., 2000; Ferrari et al., 2003).

Muscles

Aging is associated with decreased muscle mass which is referred to as sarcopenia. In 2004, approximately 35% of older adults in the U.S. were reported to have a moderate degree of sarcopeneia and 10% had a severe degree of sarcopenia (Janssen et al., 2004). Age-related loss of lean muscle mass not only leads to decreased strength but also increases the risk of falls and prevalence of physical disabilities resulting in a reduced quality of life.

According to the Centers for Disease Control (CDC), one-third of older adults, 65 years of age and older, experience a fall each year and these falls are the leading cause of nonfatal and fatal injuries. The risk of fall related injuries increases with age. In 2009, fall injuries for adults 85 years of age and older were nearly 4 times higher than that of adults ages 65 to 74 (CDC, 2010). Twenty to thirty percent of people who fall suffer from serious injuries, such as hip fractures, which can decrease independence and increase risk of early death (CDC, 2010). In 2007, the CDC reported 81% of fall-related deaths occurred among adults 65 years of age and older. In addition, physical disabilities resulting from fall injuries are associated with increased risk of hospital admission and healthcare expenditure (Janssen et al., 2004). Furthermore, many individuals experiencing a fall, even if they are not injured, they can develop a fear of falling. Fear of falling can cause older adults to limit their activities. This can lead to a further reduction in mobility and physical fitness, which in turn can increase their actual risk of falling (Vellas, Wayne, Romero, Baumgartner & Garry., 1997).

Inadequate calories and protein are associated with muscle loss (Thomas, 2007). However, calorie needs decline with ageing due to decreased metabolic rate. Therefore, the 2010

Dietary Guidelines for Americans recommended that older adults should decrease their calorie intake while the need for other nutrients remains relatively unchanged. Overall, the diet should contain adequate nutrients within an appropriate energy level (USDA & USDHHS, 2010). This places an emphasis on older adults selecting nutrient dense foods.

Regular physical activity, particularly weight training, is vital for preserving and increasing muscle mass. Therefore, in addition to the 150 minutes of moderately-intense or 75 minutes of vigorously-intense aerobic physical activity a week, the 2008 Physical Activity Guidelines for Americans also recommend at least 2 days a week older adults participate in muscle-strengthening activities (e.g. lifting, weights, carrying groceries). For older adults who are particularly at risk of falling, the PAGs recommended participating in balance and muscle-strengthening physical activities at least 3 days a week, in addition to moderately-intense walking for about an hour a week, for a total of 90 minutes. Examples of these balance activities include backwards walking, Tai chi, sideways walking, heel walking, toe walking, and standing from a sitting position. The 2008 PAGs also recommend older adults participate in stretching activities on at least 3 days a week, which can help older adults maintain or increase flexibility (USDHHS, 2008).

Bones

Older adults are more susceptible to bone loss. In particular, women tend to lose bone mass at an accelerated rate after menopause. Loss of bone mass can increase the risk of osteoporosis which is the most significant and well-known risk factor for hip fractures (CDC, 2010). The National Osteoporosis Foundation (NOF) reported there were approximately 12 million older adults with low bone mass in 2010 and estimated there will be approximately 14 million by 2020. The NOF denoted that approximately one in two women and one in four men, over age 50, will suffer from a bone fracture due to osteoporosis (National Osteoporosis Foundation, 2011). Therefore, age-related loss of bone mass can lead to fractures, resulting in

long periods of functional impairment, hospitalization, and increased mortality, all of which affect the quality of life (CDC, 2010).

However, loss of bone mass can be reduced by consuming adequate amount of calcium, vitamin D, and participating in regular physical activities. The 2010 Dietary Guideline for Americans indicated older adults did not consume adequate amount of calcium and vitamin D. Adequate calcium and vitamin D status are vital for healthy bone health. Milk and dairy products are excellent sources of calcium and vitamin D. For instance, evidence indicates milk and dairy products are associated with improved bone health. Therefore, the DGAs recommend increased intake of fat-free or low-fat milk and dairy products such as milk, yogurt, cheese, or fortified soy beverages (USDA & USDHHS, 2010).

Along with proper calcium and vitamin D intake, adequate weight-bearing physical activity also has been associated with positive bone health among older adults. Falls are the leading cause of fractures among older adults (CDC, 2011). Evidence indicates regular physical activity can lower the risk of falls in frail, older adults by approximately 25%, which in turn helps to prevent fractures (USDHHS, 2008). However, in 2007 to 2008, only 22% of adults 65 years of age and above reported engaging in regular physical activity (Federal Interagency Forum on Aging-Related Statistics, 2010). Furthermore, the percent of adults participating in regular physical activities has been reported to be lower in older age groups, ranging from 25% among adults aged 65 to 74 to 11% among adults aged 85 and over. Therefore, the 2008 Physical Activity Guidelines for Americans (PAGAs) recommended adults engage in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity a week. In addition, the Physical Activity Guidelines for Americans recommended older adults engage in muscle-strengthening activities at least 2 days a week (e.g. lifting, weights, carrying groceries). Particularly those with a higher risk of falling are recommended to perform balance and muscle-strengthening physical activities at least 3 days a week (USDHHS,2008).

Pancreas

The risk of developing type 2 diabetes increases with age (Miller, Edwards, Kissling & Sanville, 2002). Aging can result in decreased pancreatic β-cell insulin secretion and increased insulin resistance, which can increase the risk of developing type 2 diabetes (Meneilly, 2001). Obesity is also prevalent among older adults due to age-related increases in total body fat and visceral adiposity, which can also increase the risk of insulin resistance and type 2 diabetes (Hayashi et al., 2003). It has been estimated that there are approximately 20 million adults in the U. S. diagnosed with diabetes, and 5 million adults who remain undiagnosed (Gambert & Pinkstaff, 2006). In 2010, 11 million or 26.9% of adults, 65 years of age and older, were diagnosed with diabetes and the highest prevalence was among those 80 years of age and older (American Diabetes Association, 2011). The number of adults, 60 years of age and older, with diabetes is projected to be 40 million by 2050 (Gambert & Pinkstaff, 2006).

Diabetes is associated with serious health consequences, and is the sixth leading cause of death in the United States. Diabetes is a major risk factor for the development of coronary heart disease (CHD), stroke, and high blood pressure. In fact, approximately 67% of older adults with diabetes have a high blood pressure. In addition, older adults with diabetes have approximately 2 to 4 times higher heart disease death rate than those without diabetes (American Diabetes Association 2011). Diabetes is also the leading cause of blindness, kidney failure, and non-traumatic amputations (Schulze & Hu, 2005). Older adults diagnosed with diabetes, 60 years of age and older have been reported to have reduced life expectancy and quality-of-life years of 9.5 and 13.8 years, respectively, for women; and 7.3 and 11.1 years, respectively, for men (Narayan, Boyle, Thompson, Sorensen & Williamson, 2003). Furthermore, the financial burden of diabetes is extreme. In 2007, health care costs associated with diabetes were 174 billion dollars, including direct and indirect costs such as disability, lost productivity, and premature mortality (American Diabetes Association, 2011).

Obesity and low physical activity are the biggest risk factors for developing type 2 diabetes; therefore, maintaining a healthy body weight and avoiding additional weight gain through healthful diet and regular physical activity are recommended to lower the risk of type 2 diabetes. Among obese older adults, weight loss has been shown to play an important role in improving insulin sensitivity, which can reduce the risk of type 2 diabetes (Schulze & Hu, 2005). Calorie needs decrease with age due to age related reductions in basal metabolic rate. As a result, the 2010 Dietary Guidelines for Americans recommended older adults make nutrient dense food choices, choose food with little or no solid fats and added sugars, and choose appropriate portion sizes. In addition, the 2010 DGAs recommended older adults participate in regular physical activity to maintain a healthy body weight (USDA & USDHHS, 2010). Regular physical activity not only helps with maintaining a healthy body weight, it also improves insulin sensitivity. Therefore, older adults are encouraged to be as physically active as possible. The 2008 PAGAs recommend older adults participate in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity a week. The 2008 PAGAs also recommend older adults participate in muscle-strengthening activities at least 2 days a week (USDHHS, 2008).

Kidneys

Adequate fluid balance is an important aspect of health among older adults. However, dehydration, which is defined as a fluid imbalance caused by inadequate fluid intake or excessive fluid loss, is a common occurrence among older adults. Many factors may have a role in older adults increased risk of dehydration.

First of all, age-related changes in body composition including decreased lean body mass and increased body fat result in a decline in total body water (Sheehy, Perry & Cromwell, 1999). As a result, percent body water declines from approximately 60% in young adults to only 40% among older adults (O'Donnell, 1995). Therefore, the proportion of body water is smaller among older adults.

Older adults may also be susceptible to dehydration due to diminished thirst mechanism (Sheehy et al., 1999). Thirst, which is stimulated by increased plasma osmolality, is the major signal for an individual to drink. However, with age, the thirst sensation is delayed and reduced compared to that of a younger individual (Bernstein & Luggen, 2010).

Declined kidney function is another risk factor for dehydration among older adults. With age, the kidneys decrease in size and function. The number of nephrons also decline and the membranes thicken, decreasing the ability of substances to pass through (Rifkin et al., 2008). Therefore, the aged kidney has a reduced urinary-concentrating ability, leading to reduced ability to conserve water (Bernstein & Luggen, 2010).

Furthermore, many medications commonly used by older adults, such as diuretics and laxatives, can increase water output (Bernstein & Luggen, 2010). In addition, due to the effects of diabetic complications on large and small blood vessels, older adults with diabetes are particularly at risk for dehydration and diabetics who develop infections are at an even greater risk. Altered cognitive status such as dementia, can also lead to a decrease in fluid intake as a result of forgetfulness or deliberate fluid restriction. Moreover, older adults may self-limit their fluid intake in an attempt to prevent urinary incontinence or frequent trips to the bathroom due to impaired mobility (Bernstein & Luggen, 2010).

Inadequate fluid can lead to rapid dehydration among older adults. Potential complications include constipation, falls, adverse effects from medications, respiratory infections and urinary tract, hypo and hyperthermia, delirium, seizure, and renal failure. Among older adults with existing health problems, dehydration can precipitate emergency or repeated hospitalizations and increased mortality. In fact, dehydration was reported to be one of the most frequent causes of hospitalization among older adults ages 65 to 75 (Russo, Wier & Elixhauser, 2009). Data from the 2000 National Hospital Discharge Survey indicated 261,000 older adults were discharged from the hospital with a primary diagnosis of dehydration (Hall & Owings, 2002).

Previous studies have indicated adequate fluid intake was associated with fewer falls, less constipation, reduced risk of bladder cancer in men and lower rates of colon cancer among older adults (Shannon, 1996). Therefore, getting adequate fluid every day is vital for older adults who are most vulnerable to fluid imbalance. However, more than one-third of older adults have been reported to have inadequate fluid intake (Juan & Basiotis, 2002).

To prevent dehydration, generally, 6 to 8 ounce glasses of fluids a day are recommended for older adults; however, additional fluid intake above this level may be needed in extreme heat. In addition to drinking adequate fluids daily, consuming foods that have high water content such as fruits or vegetable is recommended to increase total water consumption (Bernstein & Luggen, 2010).

Immune System

The immune system is designed to protect the body from foreign organisms. The immune system is composed of many different organs (bone marrow, thymus and lymph nodes) and cells (lymphocytes including T cells, B cells, and natural killer cells; leukocytes, macrophages; and dendritic cells). The bone marrow and the thymus are responsible for synthesis and maturation of T cells, B cells, and natural killer cells; while the lymph nodes are sites that recognize and respond to foreign antigens. Therefore, the bone marrow produces B cells and natural killer cells, and the thymus is where T cells mature. In the lymph nodes, T cells, B cells, macrophage, and dendritic cells are activated and released in response to a foreign antigen. In the process of responding to antigens, these cells communicate with one another by releasing and responding to chemical messengers which are called cytokines (National Institute of Allergy and Infectious Diseases, 2007).

A healthy immune system is important in aging to prevent illness and help maintain health. However, aging is associated with a decline in immune function. With age, there is a decrease in thymus size and T cell generation (Farley, McLafferty, & Hendry, 2011).

Furthermore, B cell production of antibodies also decreases with age (Dorshkind, Montecino-Rodriguez & Singer, 2009). An impaired immune system can increase the risk of infectious disease and other immune disorders such as cancer and inflammatory conditions (Rita, 2007; Farley et al., 2011). As a result, older adults are more susceptible to infections and have higher risks of cancer. In addition, an impaired immune system can reduce the body's ability to respond to vaccinations. This is a concern because the fifth most common cause of death among older adults is influenza or pneumonia (Sahyoun, Lentzner, Hoyert & Robinson, 2001).

Adequate nutrition plays an important role in maintaining the immune system (Molls, Ahluwalia, Mastro, Smiciklas-Wright & Handte, 2005). Several nutrients, particularly antioxidants such as vitamin C, vitamin E, carotenes and zinc have beneficial roles in improving immune function by increasing cytokine production and T cell function (Prasad et al., 2007). For example, vitamin E and vitamin C supplementation was found to improve immune function in older adults by protecting lymphocytes from oxidative stress (Pallast, Schouten & de Waart, 1999). In addition, dietary fat may also have a role in immune function. A high fat diet has been shown to suppress lymphocyte proliferation; whereas, a low fat diet increased lymphocyte proliferation and natural killer cell function (Gershwin, German & Keen, 2000). Therefore, a diet low in fat and rich in antioxidants from a variety of fruits and vegetables are recommended to maintain a healthy immune system (Kubena & McMurray, 1996). Recommendations to increase fruits, vegetables and whole-grains and to decrease high fat diet are in adherence with the 2010 DGAs recommendation that older adults should consume a diet rich in fruits and vegetables and consume a diet low in in saturated fat, *trans* fat, cholesterol (USDA & USDHHS, 2010).

Physical activity is also beneficial for immune function (Bruunsgaard & Pedersen, 2000). Regular and moderate aerobic physical activities have been shown to favorably modulate the immune system among older adults (Fondell et al., 2011). The 2008 Physical Activity Guidelines

for Americans (PAGAs) recommends adults engage in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity a week (USDHHS, 2008).

Brain

An age-related decline in cognitive function is common concern among older adults. Dementia, which is defined as the loss of cognitive functioning and behavioral abilities, is an irreversible, progressive brain disease that affects a person's daily activities (National Institute on Aging, 2011). Among older adults, Alzheimer's disease is a common cause of age-related dementia. Age is the most significant known risk factor for Alzheimer's disease. In 2010, approximately 5 million Americans suffered from Alzheimer's disease and it was ranked as the 5th leading cause of death for older adults 65 years of age and older (CDC, 2010). By 2050, it is estimated that as many as 16 million people might suffer from Alzheimer's disease. Furthermore, in 2011, the healthcare expenditure with Alzheimer's disease was 183 billion dollars. It is projected that by 2050, health care spending will increase by 1.1 trillion dollars due to the growing number of the older adults and the increased prevalence of Alzheimer disease in this population (CDC, 2011).

However, along with physical and emotional well-being, optimal cognitive functioning is a vital aspect of a person's overall health. Previous studies have indicated that engaging in regular physical activity was associated with less impairment in cognitive function among older adults. In addition, consuming foods containing antioxidants may also be beneficial in delaying cognitive decline among older adults (Grodstein, Chen &Willett, 2003). Therefore, being physically active and consuming foods rich in antioxidants are recommended to maintain brain health. The 2008 PAGAs recommend older adults participate in 150 minutes of moderately-intense physical activity or 75 minutes of vigorously-intense physical activity a week (USDHHS, 2008). In addition, the 2010 DGAs recommended consuming a diet emphasizing fruits, vegetables, whole

grains and fat-free or low-fat milk; including lean meats, poultry, fish, beans, eggs and nuts; and low in saturated fat, trans fat, cholesterol, salt and added sugar (USDA & USDHHS, 2010).

Importance of Nutrition and Physical Activity Education for Older Adults

With the increasing number of older adults, prevalence of chronic disease and rising health care costs there is a need for the nation's public health community to focus more on opportunities to support health promotion and prevent or reduce chronic health issues in the older adult population (Nadine, Charlotte & Amy, 2004; Rice & Rineman, 2004). Health promotion may also help lower health care expenditures and decrease health disparities (CDC, 2007).

Nutrition and physical activity education can improve older adults' ability to maintain health and independence, delay or prevent health problems, improve quality of life, and reduce health care expenditures (Drewnowski & Evans, 2001; Johnson et al., 2008). Furthermore, health promotion related to nutrition and physical activity has been identified among older adults as a predominate educational preference (Kicklighter, 1991). Overall, nutrition and physical activity education could be part of all aspects of health promotion, disease prevention, and food assistance for older adults.

Education Model: Health Belief Model

The Health Belief Model (HBM), which was developed by Rosenstock and Hochbaum in 1966, has been commonly used as a framework to guide a variety of health education and health promotion programs (Glanz, Rimer, & Lweis, 2008; Janz & Becker, 1984). According to the HBM, changes in health behavior are based on perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy. The construct of perceived severity is an individual's perception about the severity of a condition. Another

construct, perceived susceptibility is a person's belief of the likelihood of getting a condition (Contento, 2007). The combination of perceived susceptibility and perceived severity is defined as perceived threat (Glanz et al., 2008). The construct perceived benefits are perceptions that recommended actions are likely to be beneficial or effective in reducing the threat. Perceived barriers are perceptions regarding difficulties performing the recommended actions (Contento, 2007). Additionally, cues to action serves as reminders about the recommended actions, such as posters, billboards and media campaigns. The construct, self-efficacy is a person's belief in their ability to perform the recommended actions (Contento, 2007). Therefore, the principle concept of this model is that individuals will participate in healthful behaviors when they believe they are susceptible to a condition, perceive the condition will have serious consequences, believe certain actions and behaviors are beneficial, believe the benefits of the actions and behaviors exceed the costs, and believe their capability of achieving the desired outcome (Rosenstock et al., 1988).

The HBM has been reported as an appropriate framework for health promotion programs, especially, for older adults because the inclusion of constructs of the model highlighted the likelihood of health related conditions among older adults (Sahyoun et al., 2004). Several health promotion programs developed based on the HBM have been effective in changing healthful behaviors among older adults. A health promotion program focusing on whole grain foods developed based on the HBM in order to improve intake and behaviors related to whole grain foods among congregate meal site recipients in north Georgia. Perceived threat was addressed by emphasizing health conditions that occur frequently among older adults due to low intake of whole grain foods. Perceived benefit was explained by describing the role of whole grain foods in decreasing the risk of certain health conditions. Perceived barrier was addressed by teaching label reading skills in order to correct misinformation about whole grain foods. Cues-to-action was addressed by distributing information on how to incorporate whole grain foods into various meals. Self-efficacy was addressed by reinforcing simple key messages throughout the program. The whole grain foods health promotion program developed based on the HBM significantly

increased participants' perceptions that whole grains could lower the risk of chronic disease, significantly increased participants' intakes of whole grain bread, whole grain cereal, and whole grain crackers and significantly increased the number of participants who were able to recognize whole grain foods (Ellis et al., 2005).

Another older adult health promotion program developed based on the HBM focusing on improving intake and behaviors related to fruits and vegetables. In this program, the HBM constructs were addressed by emphasizing the age-related chronic health conditions, addressing positive benefits of fruits and vegetables associated with reduction risk for chronic conditions, teaching misinformation about fruits and vegetables, providing tips to include fruits and vegetables in various meals and snacks, and reinforcing various ways to include fruits and vegetables. The health promotion program significantly increased participants' knowledge of recommended fruit and vegetable intake, significantly decreased participants' perceived barriers to fruit and vegetable intake, and significantly increased participants' fruits and vegetable intake (Hendrix et al., 2008).

Similarly, Speer et al. (2008) also developed a health promotion program based on the HBM in order to improve diabetes self-management and decrease A1c among older adults. Following the program, a significant decrease in mean A1c and improvement in several diabetes self-management behaviors were observed among participants (Speer et al., 2008). The HBM was also used as a conceptual framework for the development of a physical activity promotion program for older adults (Fitzpatrick et al., 2008). The older adult physical activity promotion program successfully improved participants' physical function and significantly increased minutes of physical activity and step counts. Moreover, the program was effective in decreasing some barriers to physical activity (Fitzpatrick et al., 2008).

Successful Characteristics of Education Programs for Older Adults

Several characteristics have been identified that enhance older adult learning of complex physiological information. Sahyoun et al. (2004) indicated nutrition and physical activity education programs developed based on appropriate theories can improve behavior change. Sahyoun et al. (2004) also recommended limiting the number and complexity of messages and nutrition and physical activity education programs should encourage older adults to set personal goals and maintain regular contact with health professionals (Sahyoun et al., 2004). In addition, frequently repeating and reinforcing simple messages has been recommended to successfully reach older adults (Miller et al., 2002). Another recommendation was the use of visual aids for designing effective older adult educational programs to enhance communication (Gillen, Wilken & Jump, 2003). Furthermore, nutrition and physical activity education programs including tailored messages for older adults were reported to be more effective (Higgins & Barkley, 2003).

A study by Parker et al. (2011) explored educational delivery preferences of older adults enrolled in Community Nutrition Education Programs (CNEP) in rural Oklahoma counties. Results from this study indicated older adults preferred the video medium the most, which stimulated their sense; followed by PowerPoint presentation, which provided opportunities for social interaction; and lastly handout. Even though the handout was the least preferred, older adults desired handouts because they helped them remember information following educational sessions. Therefore, in order to increase the quality of education for older adults, it was recommended to incorporate multiple methods that provide opportunities for interaction along with supplemental education materials for at-home reinforcement (Parker et al., 2011).

CHAPTER III

METHODS

The purpose of this study was to develop and conduct formative and outcome evaluation of a health promotion educational program based on the HBM for older adults, entitled “Journey through Health.” The “Journey through Health” program consisted of a series of posters, each with a short educational script, and large print handout. Formative evaluation of the “Journey through Health” program was conducted using expert face validity and indigenous input. Outcome evaluation of the “Journey through Health" program as a one-time display on older adults’ perceived threat of age related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion and self-efficacy toward following the Dietary Guideline Consumer Brochure messages was conducted using retrospective pre, post survey questions. Outcome evaluation of older adults’ comprehension and acceptance of the “Journey through Health” program was conducted using post survey questions.

Program Development

Previously, eight focus groups were conducted using the social marketing principles by the researchers to explore rural older Oklahomans’ perceptions of health in order to inform the development of an older adult health promotion program. Results indicated older adults living in Oklahoma identified nutrition and physical activity as actions in promoting health. However, age- related limitations, lack of motivation, and lack of knowledge were identified as barriers

to eat healthy and be physically active. Findings from the focus groups suggested the development of a health promotion program providing evidence-based nutrition and physical activity messages could empower older adults to eat healthfully and be physically active (Jung, Hermann, Parker, Shin & Phelps, 2013).

As a result, a health promotion program, "Journey through Health" was developed based on the HBM utilizing the four overarching 2010 Dietary Guideline Consumer Brochure messages: 1) "Build a healthy plate", 2) "Cut back on foods high in solid fats, added sugar and salt", 3) "Eat the right amount of calories for you", and 4) "Be physically active your way" (USDA, 2011). The objectives of the educational program based on the HBM were to 1) educate older adults about the age related changes and associated health risks (perceived threat), 2) educate older adults about the benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure message (perceived benefit), and 3) improve older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages (self-efficacy).

The "Journey through Health" program initially consisted of 11 posters, each with an educational script and handout. Each poster represented a key body site affected by aging which could be positively influenced by nutrition and physical activity. The 11 body sites included the eye; mouth, teeth, and gums; stomach, intestines, heart and blood vessels, muscles, bones, pancreas, kidneys, immune system, and brain. The educational script and handout for each body site was developed using the HBM as the framework and addressed specific age related changes and associated health risks, the benefit of nutrition and physical activity in health promotion, and how the overarching Dietary Guideline Consumer Brochure messages provide a management set of nutrition and physical activity recommendations which could have a powerful impact on health promotion. Therefore, the "Journey through Health" program focused on age-related changes and associated risk factors relevant to older adults for each body site, and provided older adult oriented recommendations based on the Dietary Guideline Consumer Brochure messages.

The "Journey through Health" program also incorporated recommendations from previous studies relative to successful older adult education. The use of visual aids to enhance communication was recommended for designing effective older adult educational programs (Gillen et al., 2003). The "Journey through Health" program included posters with visual images of older adults including different genders and racial groups, and key body sites to clarify and reinforce the role of the overarching Dietary Guideline Consumer Brochure messages in health promotion. In addition, Sahyoun et al. (2004) indicated older adult health promotion programs with a limited number and complexity of messages were more likely to be successful in changing health behaviors; therefore, the "Journey through Health" program used bulleted points to emphasize the simple four overarching Dietary Guideline Consumer Brochure messages (Appendix A). Furthermore, frequently repeating and reinforcing simple messages has been recommended to successfully reach older adults (Miller et al., 2002); therefore, the "Journey through Health" program repeated how the overarching Dietary Guideline Consume Brochure messages could have a powerful impact on health promotion within multiple systems throughout the body. Large print handouts that are easy to read have also been recommended because they can be read at participants' convenience, and help participants remember information following educational sessions (Taylor-Davis et al., 2000; Higgins & Barkley, 2004; Parker et al., 2011). The "Journey through Health" program included large print handouts with good contrast between text and background, and plenty of whitespace. Having active interaction between program participants and health professionals has also been recommended (Miller et al., 2002; Sahyoun et al., 2004; Parker et al., 2011). In order to increase interaction in the "Journey through Health" program, the program provided opportunities for participants to ask questions following the program.

Formative Evaluation

Expert face validity was conducted on the "Journey through Health" program content (posters, large print handouts, educational scripts, and evaluation instrument) using a panel of four experts in the Department of Nutritional Sciences from Oklahoma State University. Each expert was emailed the content and asked to respond with comments related to accuracy, readability, and suitability for older adults. Based on the suggestions from the panel of four experts the posters, large print handouts, educational scripts and evaluation instrument content were revised. Expert face validity was also conducted on the "Journey through Health" program (posters, large print handouts, and educational scripts) with a panel of twenty-eight Oklahoma Cooperative Extension Service (OCES) County Educators. Educators were presented the program and then asked in an oral discussion to provide input on the program content, posters, large print handouts and educational scripts. Notes were taken at the educational event and used to make improvements based on their suggestions. As a result of the expert face validity with the OCES County Educators, an introductory poster with an educational script and handout were added to provide a detailed introduction of the four overarching Dietary Guideline Consumer Brochure messages and a visual image of the MyPlate, so that the revised "Journey through Health" program consisted of 12 posters. In addition, the educational scripts were revised so that they were more conversational and included more practical examples.

Indigenous input was collected on the revised "Journey through Health" program (implementation) using a panel of eight adults, 65 years of age and older. The adults were presented the program and asked to make suggestions related to implementation improvements. Recommendations were made on speaking louder or using a microphone due to hearing difficulties. As a result, the "Journey through Health" program was implemented using a microphone.

Program Evaluation Instrument

A program evaluation instrument was developed by the researchers based on the Health Belief Model. Due to characteristics of older learners, the program evaluation instrument was designed to be short, use large print, and written at the sixth grade reading level. The evaluation instrument included two demographic questions on gender and age range; less than 60 years, 60 to 64 years, 65 to 69 years, 70 to 74 years, 75 to 79 years, 80 to 84 years, 85 to 89 years, and 90 years and above. The evaluation instrument also included six retrospective pre, post evaluation questions to evaluate the outcome of the "Journey through Health" program using a 5-point Likert scale; strongly agree, agree, neither agree or disagree, disagree, and strongly disagree. The retrospective pre, post design has been reported to be a reliable and valid method for measuring program impact, particularly when participants may have limited subject knowledge at the beginning of a program (Rockwell & Kohn., 1989; Davis, 2003). One retrospective pre, post evaluation question evaluated older adults' perceived threat of age related changes and associated health risks (*Changes occur with aging which can increase my risk of health problems)*. Four retrospective pre, post evaluation questions evaluated older adults' perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages (*Building a healthy plate can provide health benefits as I age; Cutting back on foods high in solid fats, added sugars, and salt can provide health benefits as I age; Eating the right amount of calories for you can provide health benefits as I age; Being physical active your way can provide health benefits as I age).* In addition, older adults' self-efficacy toward following the Dietary Guidelines Consumer Brochure messages was evaluated using one retrospective pre, post question (*The Dietary Guidelines are a manageable set of messages I feel I can follow)*. Furthermore, the instrument included three questions evaluating on older adults' comprehension and acceptance of the "Journey through Health" program using the same 5-point Likert scale; strongly agree, agree, neither agree or disagree, disagree, and strongly

disagree (*Was the program educational, Was the program easy to understand, and Was the program enjoyable)*. (Appendix B).

Participants

Participants in this study consisted of a convenience sample of adults, 65 years of age and older, in the state of Oklahoma. The estimated sample size for Wilcoxon paired signed rank test with $\alpha = 0.05$, power = 0.8 and effect size of .25 was calculated to be 128 (Bruin, 2006).

In order to reach participants, the researchers contacted local older adult program directors and Oklahoma Cooperative Extension Service County Educators to inquire about their interest in having the "Journey through Health" program presented as a one-time display at their location. In the process, the researchers provided a brief description of the "Journey through Health" program, a visual of the 12 posters, space and time requirements, and an overview of the program evaluation. Older adult program directors and County Educators who agreed to host the "Journey through Health" program as a one-time display were instrumental in organizing and advertising the "Journey through Health" program through news releases and announcements. The "Journey through Health" program was presented at the following eight locations two Oklahoma Cooperative Extension Service sites, one Senior Center, two Older American Act Nutrition Program sites, two retirement community centers, and one older adult faith based group.

Oklahoma State University Institutional Review Board Approval

The program evaluation instrument, participant informed consent, and program evaluation procedure for this study were approved by the Oklahoma State University Institutional Review Board for Human Subjects prior to data collection (Appendix C).

Procedure

The "Journey through Health" program as a one-time display lasted approximately 60 minutes, including explanation of the program evaluation, presentation of the "Journey through Health" program, and completion of the program evaluation instrument.

As participants arrived they were provided with a folder containing a Participant Information form (Appendix D), describing the purpose and procedure of the program evaluation and the "Journey through Health" program handouts. Prior to presenting the "Journey through Health" program the researcher read a script describing the purpose and procedure of the program evaluation (Appendix E). Participants were advised that completion of the program evaluation instrument was voluntary. After the description of the purpose and procedure of the program evaluation, two researchers presented the "Journey through Health" program as a one-time display and participants' questions were answered. Following the question and answer session, participants were reminded that completion of the program evaluation instrument was voluntary, and where to turn in the completed evaluation instrument if they chose to participate. All participants were provided with a free Oklahoma Cooperative Extension Service reusable shopping bag.

Data Analysis

Likert scale response options were coded as: strongly agree = 5, agree = 4, neither agree or disagree = 3, disagree = 2 and strongly disagree = 1. Data were analyzed using PC SAS for Windows, Version 9.1 (SAS Institute, Cary, NC). Significance level was set at $P < 0.05$.

Demographic data were analyzed using frequency procedure. For each retrospective pre, post evaluation question, data were only included in the analyses if rankings for both the retrospective pre and post were provided. Differences in mean question rankings from retrospective pre to post were analyzed using Wilcoxon matched-pairs signed-ranks test.

The Wilcoxon matched-pairs signed-ranks test has been used when there is one independent group and two or more levels of dependent ordinal variables to rank the differences (Bruin, 2006). The percent of participants who increased evaluation question rankings from retrospective pre to post were analyzed using frequency procedure. Participant rankings for the comprehension and acceptance evaluations questions of the "Journey through Health" program were also analyzed using frequency procedures.

Although it was not an objective of the study, differences in mean question rankings from retrospective pre to post by gender were analyzed using Wilcoxon matched-pairs signed-ranks test and differences in the amount of change from retrospective pre to post between genders were analyzed using t-test. In addition, the six age ranges for 65 years of age and above were collapsed into three age groups; 65 to 74 years, 75 to 84 years, and 85 years and above. Differences in mean question rankings from retrospective pre to post by age range were analyzed using Wilcoxon matched-pairs signed-ranks test and differences in the amount of change from retrospective pre to post between age ranges were analyzed using general linear models and Duncan's mean separation.

CHAPTER IV

RESULTS AND DISCUSSION

Results

Of the 167 participants who completed the "Journey through Health" program evaluation instrument, 142 (85%) were 65 years of age or older. Because the purpose of this study was to evaluate the "Journey through Health" program among adults, 65 years of age and older, the 25 evaluation instruments from participants less than 65 years of age were excluded from the data analyses. Thus, 142 evaluation instruments were included in the data analysis. Participants' gender and age ranges are presented in Table 1. Participants were predominately female (68.4%) and ages ranged from 65 to over 90 (Table 1).

Table 1. Demographic Characteristics of "Journey through Health Program" Participants

	n	%
Gender (n= 136)		
Female	93	68.4
Male	43	31.6
Age range (n=142)		
65-69	23	16.2
70-74	33	23.2
75-79	26	18.3
80-84	33	23.2
85-89	15	10.6
≥ 90	12	8.5

Differences in mean question rankings from retrospective pre to post following the "Journey through Health" program are presented in Table 2. A significant difference was observed in the mean question ranking evaluating older adults' perceived threat of age related changes and associated health risks (*Changes occur with aging which can increase my risk of health problems)*. Significant differences were also observed in the four mean question rankings evaluating older adults' perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages (*Building a healthy plate can provide health benefits as I age; Cutting back on foods high in solid fats, added sugars, and salt can provide health benefits as I age; Eating the right amount of calories for you can provide health benefits as I age; Being physical active your way can provide health benefits as I age).* In addition, a significant difference was observed in the mean question ranking evaluating older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages was evaluated using one post, retrospective pre question (*The Dietary Guidelines are a manageable set of messages I feel I can follow).*

The percent of participants who increased question rankings from retrospective pre to post following the "Journey through Health" program are also presented in Table 2. Following the "Journey through Health" program, 61% of participants increased their ranking on the question evaluating older adults' perceived threat of age related changes and associated health risks (*Changes occur with aging which can increase my risk of health problems)* from retrospective pre to post.

A similar percent of participants increased their rankings of the four questions evaluating older adults' perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages from retrospective pre to post; 43%, 42%, 43%, and 45%, respectively (*Building a healthy plate can provide health benefits as I age; Cutting back on foods high in solid fats, added sugars, and salt can provide health benefits as I age; Eating the right amount of calories for you can provide health benefits*

as I age; Being physical active your way can provide health benefits as I age).

In addition, 51% of participants increased their ranking of the question evaluating older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages from retrospective pre to post (*The Dietary Guidelines are a manageable set of messages I feel I can follow).*

Table 2. Differences in Mean Question Rankings and Percent of Participants Who Increased Question Rankings from Retrospective Pre to Post Following the" Journey through Health" Program

Questionnaire Items	n	Retrospective-Pre (Mean* ± SE)	Post (Mean* ± SE)	P value	Increased Ranking (%)
Changes occur with aging which can increase my risk of health problems?	134	4.31± 0.05	4.77±0.03	< 0.0001	61%
Building a healthy plate can provide health benefits as I age?	134	4.34±0.05	4.79±0.03	< 0.0001	43%
Cutting back on foods high in solid fats, added sugars and salt can provide health benefits as I age?	134	4.34±0.06	4.79±0.04	< 0.0001	42%
Eating the right amount of calories for you can provide health benefits as I age?	134	4.29±0.05	4.75±0.04	< 0.0001	43%
Being physically active your way can provide health benefits as I age?	134	4.31±0.06	4.81±0.03	< 0.0001	45%
The Dietary Guidelines are a manageable set of messages I feel I can follow?	127	4.01±0.07	4.62±0.05	< 0.0001	51%

*Strongly agree = 5, Agree = 4, Neither agree or disagree = 3, Disagree = 2, Strongly agree = 1

Differences in the mean question rankings from retrospective pre to post by gender are presented in Table 3. Significant differences in the mean question rankings from retrospective pre to post evaluating older adults' perceived threat of age related changes and associated health risk, perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages, and self-efficacy toward following the Dietary Guideline Consumer Brochure messages were observed for both males and females.

Table 3. Differences in Mean Question Rankings from Retrospective Pre to Post Following the "Journey through Health" Program by Gender.

Questionnaire Items	Females (n=93)				Males (n=43)			
	n	Retrospective-Pre (Mean* ± SE)	Post (Mean* ± SE)	P value	n	Retrospective-Pre (Mean* ± SE)	Post (Mean* ± SE)	P value
Changes occur with aging which can increase my risk of health problems?	86	4.28± 0.07	4.79±0.05	< 0.0001	42	4.36± 0.09	4.69±0.07	= 0.0005
Building a healthy plate can provide health benefits as I age?	86	4.29±0.07	4.83±0.04	< 0.0001	42	4.43±0.09	4.71±0.07	= 0.0034
Cutting back on foods high in solid fats, added sugars and salt can provide health benefits as I age?	86	4.36±0.07	4.84±0.04	< 0.0001	42	4.29±0.09	4.67±0.07	= 0.0003
Eating the right amount of calories for you can provide health benefits as I age?	86	4.29±0.07	4.78±0.05	< 0.0001	42	4.31±0.09	4.69±0.07	= 0.0001
Being physically active your way can provide health benefits as I age?	86	4.29±0.08	4.83±0.04	< 0.0001	42	4.36±0.09	4.76±0.07	< 0.0001
The Dietary Guidelines are a manageable set of messages I feel I can follow?	83	3.98±0.08	4.69±0.05	< 0.0001	39	4.03±0.13	4.46±0.14	= 0.0003

*Strongly agree = 5, Agree = 4, Neither agree or disagree = 3, Disagree = 2, Strongly agree = 1

In addition, two significant differences in the mean change in question rankings from retrospective pre to post were observed between genders (Table 4). Compared to males, females had a significantly greater change in evaluating the perceived benefit of building a healthy plate ($p < 0.05$) and in self-efficacy toward following the Dietary Guideline Consumer Brochure messages ($p < 0.05$).

Table 4. Differences in the Mean Change in Question Rankings from Retrospective Pre to Post Following the "Journey through Health Program" between Genders

	Females Mean Change ± SD	Males Mean Change ± SD	P value
Changes occur with aging which can increase my risk of health problems?	0.51 ± 0.70	0.33 ± 0.57	0.1535
Building a healthy plate can provide health benefits as I age?	0.53 ± 0.66	0.29 ± 0.60	0.0414*
Cutting back on foods high in solid fats, added sugars and salt can provide health benefits as I age?	0.48 ± 0.07	0.38 ± 0.62	0.4441
Eating the right amount of calories for you can provide health benefits as I age?	0.49 ± 0.61	0.38 ± 0.58	0.3436
Being physically active your way can provide health benefits as I age?	0.53 ± 0.69	0.40 ± 0.59	0.2997
The Dietary Guidelines are a manageable set of messages I feel I can follow?	0.71 ± 0.71	0.44 ± 0.68	0.0450*

*P value < 0.05

Similarly, significant differences in the mean question rankings from retrospective pre to post evaluating older adults' perceived threat of age related changes and associated health risk, older adults' perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages, and older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages were observed for all age groups (data not shown).

In addition, a significant difference in the mean change in question rankings from

retrospective pre to post was observed between age groups (Table 5). Participants 75 to 85 years of age had a significantly greater change in perceived threat of age-related changes and associated health risk compared to participants 85 years of age and older ($p < 0.05$).

Table 5. Differences in the Mean Change in Question Rankings from Retrospective Pre to Post Following the "Journey through Health Program" between Age Groups

	65-74 years Mean Change ± SE	75-84 years Mean Change ± SE	85+ years Mean Change ± SE	P value
Changes occur with aging which can increase my risk of health problems?	0.44 ± 0.08 [a,b]	0.58 ± 0.10 [a]	0.17 ± 0.08 [b]	0.0423*
Building a healthy plate can provide health benefits as I age?	0.44 ± 0.07	0.53 ± 0.10	0.32 ± 0.12	0.3962
Cutting back on foods high in solid fats, added sugars and salt can provide health benefits as I age?	0.44 ± 0.08	0.53 ± 0.10	0.27 ± 0.12	0.2794
Eating the right amount of calories for you can provide health benefits as I age?	0.48 ± 0.07	0.48 ± 0.09	0.32 ± 0.10	0.5020
Being physically active your way can provide health benefits as I age?	0.43 ± 0.07	0.57 ± 0.10	0.50 ± 0.14	0.5194
The Dietary Guidelines are a manageable set of messages I feel I can follow?	0.63 ± 0.10	0.69 ± 0.10	0.38 ± 0.15	0.2344

*P value < 0.05. Means in a row with different subscripts are significantly different, $P \leq 0.05$.

Results of the three questions evaluating participants' comprehension and acceptance of the "Journey through Health" program are presented in Table 6. Approximately 97% participants either "strongly agreed" or "agreed" that the "Journey through Health" program was educational, easy to understand, and enjoyable.

Table 6. Evaluation of Participants Comprehension and Acceptance of the "Journey through Health" Program

Was the Program:	Strongly Agree n (%)*	Agree n (%)*	Neither Agree or Disagree n (%)*	Disagree n (%)*	Strongly Disagree n (%)*
Educational	103 (73%)	34 (24%)	4 (3%)	-	-
Easy to Understand	102 (72%)	35 (25%)	2 (1%)	2 (1%)	-
Enjoyable	99 (71%)	35 (25%)	4 (3%)	-	1 (1%)

*Percents may not total to 100 due to rounding.

Discussion

Major findings from the "Journey through Health" program evaluation were that there was a significant increase in older adults' perceived threat of age related changes and associated health risks and perceived benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure messages. In addition, there was a significant increase in older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages.

These findings are consistent with previous studies that indicate the use of the HBM in the development of health promotion programs can be successful in increasing older adults' perceived threat, perceived benefit and self-efficacy. An older adult whole grain foods health promotion program developed based on the HBM significantly increased participants' perceptions that whole grains could reduce the risk of chronic disease, significantly increased participants' intakes of whole grain bread, whole grain cereal, and whole grain crackers and significantly increased the number of participants who were able to recognize whole grain foods (Ellis et al., 2005). Another older adult health promotion program developed based on the HBM focusing on improving intake and behaviors related to fruits and vegetables significantly increased participants' knowledge of recommended fruit and vegetable intake, significantly decreased participants' perceived barriers to fruit and vegetable intake, and significantly

increased participants' fruits and vegetable intake (Hendrix et al., 2008). Speer et al. (2008) examined the effectiveness of health promotion program based on the HBM on improving diabetes self-management and decreasing A1c among older adults. Following the program, a significant decrease in mean A1c and improvement in several diabetes self-management behaviors were observed among participants (Speer et al., 2008). The HBM was also used as a conceptual framework for the development of a physical activity promotion program for older adults (Fitzpatrick et al., 2008). The older adult physical activity promotion program successfully improved participants' physical function and significantly increased minutes of physical activity and step counts (Fitzpatrick et al., 2008). Moreover, the program was effective in decreasing some barriers to physical activity (Fitzpatrick et al., 2008). These findings confirmed the use of HBM for the "Journey through Health" program was an appropriate framework for health promotion programs especially, for older adults because the inclusion of constructs of the model highlighted the likelihood of health related conditions among older adults (Sahyoun et al., 2004).

Although significant increases in perceived threat of age related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion, and self-efficacy toward following the Dietary Guideline Consumer Brochure messages were observed for both females and males, in the study reported here females had a significantly greater change in evaluating the perceived benefit of building a healthy plate compared to males. The "Journey through Health" program emphasized the importance of a diet composed of nutrient dense foods such as fruits and vegetables in the Dietary Guideline Consumer Brochure message "Build a Healthy Plate." Similarly, a study examining gender differences in fruit and vegetable intake among older adults indicated males consumed less fruits and vegetables than females due to lower awareness of benefit of diet in health promotion compared to females (Baker & Wardle, 2003). In addition, in the study reported here, females also had a significantly greater change in self-efficacy toward following the Dietary Guidelines Consumer Brochure messages than males. This finding is consistent with a study indicating older adults engaged in nutrition and physical

activities in order to maintain health; however, older females were more likely to have better health behaviors than older males (Brown & McCreedy, 1986). These gender differences may have associated with females reporting a higher frequency of preparing and cooking meals than males (Hook, 2010). These findings highlight the need for health promotion programs to consider gender differences in factors influencing older adults' motivation to engage in health behaviors. Gender specific approaches may need to be considered in planning health promotion programs.

Although significant increases in perceived threat of age-related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion, and self-efficacy toward following the Dietary Guideline Consumer Brochure messages were observed for all age group, in the study reported here participants 75 to 85 years of age had a significantly greater change in perceived threat of age-related changes and associated health risk compared to participants 85 years of age and older. This observation may imply participants 75 to 84 years of age were less likely to have experienced age-related changes compared to those who were over 85 years of age. This may explain the lower awareness of age-related threat among participants 75 to 84 years of age at the beginning of the "Journey through Health" program compared to those over 85 years of age. However, the program had a greater impact on the awareness of age-related changes and associated health risks among participants 75 to 84 years of age compared to those over 85 years of age.

Not only did the "Journey through Health" program use a theory-driven approach incorporating principles from the HBM, the program also incorporated recommendations from previous studies relative to successful older adult education. To effectively reach older adults, establishing a partnership with community organizations has been recommended (Gillen et al., 2003). Therefore, local older adult program directors and Oklahoma Cooperative Extension Service County Educators who worked with older adults were contacted in order to reach participants with the "Journey through Health" program. Another recommendation for designing effective older adult educational programs was the use of visual aids to enhance communication

(Gillen et al., 2003). The "Journey through Health" program included posters with visual images of older adults including different genders and racial groups, key body sites, and MyPlate to clarify and reinforce the role of the overarching Dietary Guideline Consumer Brochure messages in health promotion. In addition, Sahyoun et al. (2004) indicated older adult health promotion programs with a limited number and complexity of messages were more likely to be successful in changing health behaviors; therefore, the "Journey through Health" program used bulleted points to emphasize the simple four overarching Dietary Guideline Consumer Brochure messages. Furthermore, frequently repeating and reinforcing simple messages has been recommended to successfully reach older adults (Miller et al., 2002); therefore, the "Journey through Health" program repeated how the overarching Dietary Guideline Consumer Brochure messages can have a powerful impact on health promotion within multiple systems throughout the body. In addition, health promotion programs including tailored messages for older adults were reported to be more effective (Higgins & Barkley, 2003). Therefore, the "Journey through Health" program focused on age-related changes and associated risk factors relevant to older adults, and provided older adult oriented recommendations based on the Dietary Guideline Consumer Brochure messages. Large print handouts that are easy to read have also been recommended because they can be read at participants' convenience, and help participants remember information following educational sessions (Taylor-Davis et al., 2000; Higgins & Barkley, 2004; Parker et al., 2011). The "Journey through Health" program included large print handouts with good contrast between text and background, and plenty of whitespace. Having active interaction between program participants and health professionals has also been recommended (Miller et al., 2002; Sahyoun et al., 2004; Parker et al., 2011). In order to increase interaction in the "Journey through Health" program, the program provided opportunities for participants to ask questions following the program.

A unique aspect of the "Journey through Health" program was it addressed older adults' health through a combination of body systems. The need for comprehensive health promotion programs addressing the aging process, and demonstrating behavior changes can be possible and

have a positive impact on health have been recommended (Chernoff, 2001). The "Journey through Health" program illustrated the relationship between key body systems affected by aging and the benefits of nutrition and physical activity. The program provided information on how the four overarching Dietary Guideline Consumer Brochure messages can positively influence nutrition and physical activity choices to prevent or delay age-related changes. By repeating how a manageable set of nutrition and physical activity actions consistent with the four overarching Dietary Guideline Consumer Brochure messages can have a powerful impact on health promotion within multiple systems throughout the body, the program increased participants' self-efficacy.

An additional strength of the "Journey through Health" program was that insights gained from focus groups evaluating older adults' nutrition and physical activity needs and concerns were addressed in the program development. Understanding and addressing the target audiences' needs and concerns have been reported to be important steps in developing effective health promotion programs (Jung et al., 2013; Pierce, Sheehan, & Ferris, 2002; Sahyoun et al., 2004).

In this study, the "Journey through Health" program was evaluated as a one-time program display. As a result, changes in behavior were not measured; however, a significant increase in older adults' perceived threat, perceived benefit and self-efficacy were observed, which can increase the likelihood of positive behavior changes in the future. According to the HBM, individuals are more likely to participate in healthful behaviors when they believe they are susceptible to a condition, perceive the condition will have serious consequences, believe certain actions and behaviors are beneficial, believe the benefits of the actions and behaviors exceed the costs, and believe their capability of achieving the desired outcome. Increased self-efficacy following the health promotion programs has been reported to increase the likelihood of positive behavioral changes (Rosenstock et al., 1988).

Although the evaluation of the "Journey through Health" program provides evidence that a theory based health promotion program can improve older adults' perceived threat, perceived benefit and self-efficacy, there are some program limitations. One limitation is that the

participants' education level was not assessed. Although the program evaluation instrument was designed to be short, use large print, and written at the sixth grade reading level, participants' educational level may have affected their ability to complete the program evaluation instrument. Another limitation is that the participants' cognitive abilities were not officially assessed, which also could have affected their ability to complete the program evaluation instrument. The short duration of the program is another limitation. The "Journey through Health" program was evaluated as a one-time program display using short educational scripts for each poster, which did not allow adequate time to expand on "how to" make healthy food and physical activity choices based on the Dietary Guideline Consumer Brochure messages. The greater increase in perceived benefit and self-efficacy in females compared to males may be explained by the need for more "how to" information in the "Journey through Health" program. In addition, to the short educational scripts for each poster, longer education lessons were also developed including hand's on activities for each poster. Evaluation of the "Journey through Health" program presented as a weekly series utilizing the longer education lessons would allow participants' more detailed information and the opportunity to engage in hands on activities which could result in increased self-efficacy and behavior changes in the future.

CHAPTER V

CONCLUSIONS

Summary

The objectives of this study were to: 1) develop a health promotion educational program based on the HBM for older adults, "Journey through Health," consisting of a series of posters, each with a short educational script, and large print, 2) conduct formative evaluation of the "Journey through Health" program using expert face validity and indigenous input, 3) evaluate the "Journey through Health" program as a one-time display on older adults' perceived threat of age-related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion and self-efficacy toward following the Dietary Guideline Consumer Brochure messages using retrospective pre, post survey questions, and 4) evaluate older adults' comprehension and acceptance of the "Journey through Health" program conducted using post survey questions.

As a result of insight from the previously conducted a qualitative focus group study (Jung et al., 2013), expert face validity, and indigenous input, a health promotion program, "Journey through Health" was developed using the HBM as a framework to 1) educate older adults about the age related changes and associated health risks, 2) educate older adults about the benefit of nutrition and physical activity in health promotion consistent with the four overarching Dietary Guideline Consumer Brochure message, and 3) improve older adults' self-efficacy toward following the Dietary Guideline Consumer Brochure messages.

The "Journey through Health" program consisted of 12 posters, each with and educational script and handout. The 12 posters included and introduction over the four overarching Dietary Guideline Consumer messages and MyPlate and 11 body sites including the eye; mouth, teeth, and gums; stomach, intestines, heart and blood vessels; muscles; bones; pancreas; kidneys; immune system; and brain. For each body site poster, the shorter educational script covered specific age related changes and associated health risks related to the body site (perceived threat), and the role of nutrition and physical activity in health promotion related to the body site consistent with the Dietary Guideline Consumer Brochure messages (perceived benefit). By repeating how the overarching Dietary Guideline Consumer Brochure messages can provide a management set of nutrition and physical activity recommendations which can have a powerful impact on health promotion throughout the body, the program aimed to increase participants' self-efficacy.

Evaluation of the "Journey through Health" program as a one-time display revealed the program was positively received by older adults and resulted in a significant increase in older adults' perceived threat of age related changes and associated health risks, perceived benefit of nutrition and physical activity in health promotion consistent with the Dietary Guideline Consumer Brochure messages, and self-efficacy toward following the Dietary Guideline Consumer Brochure messages.

Implication and Future Research

Although both genders had significant increases in perceived benefit of building a healthy plate in health promotion and self-efficacy toward following the Dietary Guidelines, females had a significantly greater increase in perceived benefit and self-efficacy compared to males. This finding highlights the need for health promotion programs to consider gender differences in factors influencing older adults' motivation and self-efficacy to engage in health behaviors. Gender specific approaches may need to be considered in planning health promotion programs.

Developing health promotion programs including more detailed "how to" advice could benefit older males in increasing their motivation and self-efficacy to participate in healthful behaviors.

The "Journey through Health" program successfully added a body of evidence that theory based health promotion program can improve older adults' perceived threat, perceived benefit and self-efficacy when developed based on an in-depth understanding of target-audiences' concerns and needs. Furthermore, adopting recommendations from previous studies relative to effective older adult education can contribute to program success.

These findings are meaningful because the "Journey through Health" program is the first comprehensive health promotion program for older adults utilizing the four overarching Dietary Guideline Consumer Brochure messages demonstrating how a manageable set of nutrition and physical activity messages can have a positive impact on health promotion throughout the body. Even though the "Journey through Health" program evaluation did not measure changes in behavior, a significant increase in older adults' perceived threat, perceived benefit and self-efficacy can increase the likelihood of positive behavior changes in the future. In fact, many participants indicated the program motivated them to change their behaviors and reminded them of an important role of nutrition and physical activity in preventing or delaying age-related changes and associated health problems. Further evaluation of the "Journey through Health" program presented as a weekly series utilizing the longer education lessons would allow participants' more detailed information and the opportunity to engage in hands on activities and provide an opportunity to evaluate behavior change.

Although participants' additional comments on the "Journey through Health" program were not documented, many older adults expressed appreciation of receiving the health promotion programs at their community locations. Participants also mentioned they wished they would have received this type of health promotion education at an early stage of their life, which would have helped them develop lifelong healthy lifestyle. Therefore, an implication for future

research would be to modify and evaluate the “Journey through Health” program targeting middle aged adults.

REFERENCES

Administration on Aging. (2012). Aging Statistics 2012, from http://www.aoa.gov/AoARoot/Aging_Statistics/index.aspx

Alexander, R.W. (1995). Hypertension and the Pathogenesis of Atherosclerosis: Oxidative Stress and the Mediation of Arterial Inflammatory Response: A New Perspective. *Hypertension,* 25(2), 155-161.

American Diabetes Association. (2011).The 2011 National Diabetes Fact Sheet: Diabetes Statistics. from http://www.diabetes.org/diabetes-basics/diabetes-statistics/

American Diabetes Association. (2011). Data from the 2011 National Diabetes Fact Sheet from http://www.diabetes.org/diabetes-basics/diabetes-statistics/

Appel, L. J., Brands, M. W., Daniels, S. R., Karanja, N., Elmer, P. J., & Sacks, F. M. (2006). Dietary Approaches to Prevent and Treat Hypertension. *Hypertension*, 47(2), 296-308.

Baker, A. H., & Wardle, J. (2003). Sex differences in fruit and vegetable intake in older adults. *Appetite,* 40(3), 269-275. doi: http://dx.doi.org/10.1016/S0195-6663(03)00014-X

Bales, C. W., & Ritchie, C. S. (2002). Sarcopenia, weight loss, and nutritional frailty in the elderly. *Annual Review of Nutrition,* 22(1), 309-323.

Bernstein, M., & Luggen, A. S. (2010). Nutrition for the older adult. Sudburry, MA: Jones and Bartlett Publishers.

Borum, M. L. (2001). Constipation: evaluation and management. Primary Care, 28, 577-590.

Brown, J. S., & McCreedy, M. (1986). The hale elderly: health behavior and its correlates. *Research in Nursing & Health*, 9(4), 317-329.

Bruin, J. (2006). Introduction to SAS. Retrieved December 19 2013, from http://www.ats.ucla.edu/stat/spss/whatstat/whatstat.htm#wilcsign

Bruunsgaard, H., & Pedersen, B. K. (2000). Effects of exercise on the immune system in the elderly population. *Immunology & Cell Biology*, 78(5), 523-531.

CDC. (2006). Oral Health for Older Americans. from http://www.cdc.gov/oralhealth/publications/factsheets/adult_older.htm

CDC. (2007). The State of Aging and Health in America 2007. from The Merck Company Foundation www.cdc.gov/aging

CDC. (2010). Falls among Older Adults: An Overview. Retrieved Aug,2011 http://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html

CDC. (2011). Healthy Aging 2014, from http://www.cdc.gov/chronicdisease/resources/publications/AAG/aging.htm

CDC. (2011). The State of Vision, Aging, and Public Health in America Retrieved from http://www.cdc.gov/visionhealth

Chernoff, R. (2001). Nutrition and Health Promotion in Older Adults. *The Journals of Gerontology Series A*: Biological Sciences and Medical Sciences, 56(suppl 2), 47-53.

Coleman, H., & Chew, E. (2007). Nutritional Supplementation in Age-related Macular Degeneration Medical Retina. In F. G. Holz & R. F. Spaide (Eds.), 105-111: Springer Berlin Heidelberg.

Contento, I. R. (2007). Nutrition education: linking research, theory, and practice Missisauga, Canada. : Jones and Bartlett Publishers

Crews, J. E., & Campbell, V. A. (2004). Vision Impairment and Hearing Loss Among Community-Dwelling Older Americans: Implications for Health and Functioning. *American Journal of Public Health*, 94(5), 823-829.

David R, T. (2007). Loss of skeletal muscle mass in aging: Examining the relationship of starvation, sarcopenia and cachexia. *Clinical Nutrition*, 26(4), 389-399.

Davis, G. A. (2003). Using a retrospective pre-post questionnaire to determine program impact *Journal of Extension*, 41(4).

Davis, K. (2011). Expenditures for Treatment of Hypertension among Adults 18 and Older, 2008: Estimates for the U.S. Civilian Noninstitutionalized Population. Vol. Statistical Brief #337.

DeFronzo, R. A., & Abdul-Ghani, M. (2011). Type 2 Diabetes Can Be Prevented With Early Pharmacological Intervention. *Diabetes Care*, 34(Supplement 2), S202-S209.

Dorshkind, K., Montecino-Rodriguez, E., & Signer, R. A. J. (2009). The ageing immune system: is it ever too old to become young again? *Nature Reviews Immunology*, 9(1), 57-62.

Drewnowski, A., & Evans, W. J. (2001). Nutrition, Physical Activity, and Quality of Life in Older Adults. *The Journals of Gerontology Series A*: Biological Sciences and Medical Sciences, 56 (suppl 2), 89-94.

Ellis, J., Johnson, M. A., Fischer, J. G., & Hargrove, J. L. (2005). Nutrition and health education intervention for whole grain foods in the Georgia older Americans nutrition programs. *Journal of Nutrition for the Elderly*, 24(3), 67-83.

Farley, A., McLafferty,E., & Hendry C. (2011). The Physiological Effects of Ageing. *Wiley-Blackwell*, The Atrium, Southern Gate, Chichester, West Susses, PO198S1, United Kindgom.

Federal Interagency Forum on Aging-Related Statistics. (2010). Older American 2010:Key Indicators of Well-Being. Washington, DC: U.S. Government Printing Office.

Ferrari, A. U., Radaelli, A., & Centola, M. (2003). Invited Review: Aging and the cardiovascular system. *Journal of Applied Physiology*, 95(6), 2591-2597.

Fitzpatrick, S. E., Reddy, S., Lommel, T. S., Fischer, J. G., Speer, E. M., Stephens, H., Johnson, M. A. (2008). Physical Activity and Physical Function Improved Following a

Community-based Intervention in Older Adults in Georgia Senior Centers. *Journal of Nutrition for the Elderly*, 27(1-2), 135-154.

Fondell, E., Lagerros, Y. T., Sundberg, C. J., Lekander, M., Balter, O., Rothman, K. J., & Balter, K. (2011). Physical Activity, Stress, and Self-Reported Upper Respiratory Tract Infection. *Medicine & Science in Sports & Exercise*, 43(2), 272-279

Gale, C. R., Ashurst, H. E., Powers, H. J., & Martyn, C. N. (2001). Antioxidant vitamin status and carotid atherosclerosis in the elderly. *The American Journal of Clinical Nutrition*, 74(3), 402-408.

Gambert, S. R., & Pinkstaff, S. (2006). Emerging Epidemic: Diabetes in Older Adults: Demography, Economic Impact, and Pathophysiology. *Diabetes Spectrum*, 19(4), 221-228.

Gershwin, M. E., German, J. B., & Keen, C. L. (2000). Nutrition and immunology: principles and practice. Tolowa, New Jersey Humana Press Inc.

Gettings, M. A., & Kiernan, N. E. (2001). Practices and Perceptions of Food Safety Among Seniors Who Prepare Meals at Home. *Journal of Nutrition Education*, 33(3), 148-154.

Gillen, M., Wilken, C., & Jump, J. (2003). Aging in the 21st Century Designing Educational Programs for Older Adults (Vol. 2013): Department of Family, Youth and Community Sciences, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Glanz, K., Rimer, B. K., & Lewis, F. M. (2008). Health Behavior and Health Education: Theory, Research, and Practice. San Francisco, CA Jossey-Bass.

Grodstein, F., Chen, J., & Willett, W. C. (2003). High-dose antioxidant supplements and cognitive function in community-dwelling elderly women. *American Journal of Clinical Nutrition*, 77 (4), 975-984.

Hall, M. J., & Owings, M. F. (2002). 2000 National Hospital Discharge Survey. *Advance Data*, 19(329), 1-18.

Hayashi, T., Boyko, E. J., Leonetti, D. L., McNeely, M. J., Newell-Morris, L., Kahn, S. E., & Fujimoto, W. Y. (2003). Visceral Adiposity and the Risk of Impaired Glucose Tolerance. *Diabetes Care*, 26(3), 650-655.

He, J., Whelton, P. K., Appel, L. J., Charleston, J., & Klag, M. J. (2000). Long-Term Effects of Weight Loss and Dietary Sodium Reduction on Incidence of Hypertension. *Hypertension*, 35(2), 544-549.

Hendrix, S. J., Fischer, J. G., Reddy, S., Lommel, T. S., Speer, E. M., Stephens, H., Johnson, M. A. (2008). Fruit and Vegetable Intake and Knowledge Increased Following a Community-based Intervention in Older Adults in Georgia Senior Centers. *Journal of Nutrition for the Elderly*, 27(1-2), 155-178.

Heron, M. P., Hoyert, D. L., Murphy, S. L., Xu, J. Q., Kochanek, K. D., & Tejada-Vera, B. (2009). Deaths: Final data for 2006 National Vital Statistics Reports, 57(14), 1-15.

Higgins, D. R., & Johanson, J. F. (2004). Epidemiology of constipation in North America: a systematic review. *American Journal of Gastroenterology* (99), 750-759.

Higgins, M. M., & Barkley, M. C. (2003). Tailoring Nutrition Education Intervention Programs to Meet Needs and Interests of Older Adults. *Journal of Nutrition for the Elderly*, 23(1), 59-79.

Higgins, M. M., & Barkley, M. C. (2004). Improving Effectiveness of Nutrition Education Resources for Older Adults. *Journal of Nutrition for the Elderly*, 23(3), 19-54.

Hook J. L. (2010). Gender inequality in the welfare state: Sex segregation in housework, 1965-2003. *American Journal of Sociology*, 115, 1480–1523.

Horwath, C. C. (1991). Nutrition Goals for Older Adults: A Review. *The Gerontologist*, 31(6), 811-821.

Hsieh, C. (2005). Treatment of Constipation in Older Adults. *American Family Physician*, 72(11), 2277-2284.

Hu, F. B., & Willett, W. C. (2002). Optimal Diets for Prevention of Coronary Heart Disease.

The Journal of the American Medical Association, 288(20), 2569-2578. Institute of Medicine. (1998). Food and Nutrition Board. Dietary Reference Intakes. Washington, DC: National Academy Press.

Janssen, I., Baumgartner, R. N., & Ross, R. (2004). Skeletal muscle cutpoints associated with elevated physical disability risk in older men and women. *American Journal of Epidemiology*, 159, 413-421.

Janssen, I., Shepard, D. S., Katzmarzyk, P. T., & Roubenoff, R. (2004). The Healthcare Costs of Sarcopenia in the United States. *Journal of American Geriatrics Society*, 52, 80-85.

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A Decade Later. *Health Education & Behavior*, 11(1), 1-47.

Johnson, M. A., Park, S., Penn, D., McClelland, J. W., Brown, K., & Adler, A. (2008). Nutrition Education Issues for Older Adults. *The Forum for Family and Consumer Issues*, 13 (3).

Juan, W. Y., & Basiotis, P. P. (2002). Nutrition insights: More Than One in Three Older Americans May Not Drink Enough Water from USDA:The Center for Nutrition Policy and Promotion www.cnpp.usda.gov

Jung, S. E., Hermann, J., Parker, S., Shin, Y. H., & Phelps, J. (2013). Formative Assessment using Social Marketing Principles to Identify Rural Older Oklahomans' Perspectives of Health. *Journal of Nutrition Education and Behavior*, 45(4 Supplement), S32.

Kicklighter, J. (1991). Characteristics of older adult learners: a guide for dietetics practitioners. *J Am Diet Assoc*, 91(11), 1418-1422.

Krasinski, S. D., Russell, R. M., Samloff, I. M., Jacob, R. A., Dallal, G. E., McGandy, R. B., & Hartz, S. C. (1986). Fundic atrophic gastritis in an elderly population: effect on hemoglobin and several serum nutritional indicators. *J Am Ger Soc*, 34, 800-806.

Kubena, K. S., & McMurray, D. N. (1996). Nutrition and the Immune System: A Review of Nutrient–Nutrient Interactions. *Journal of the American Dietetic Association*, 96(11), 1156-1164.

Marshall, T. A., Warren, J. J., Hand, J. S., Xie, X.-J., & Stumbo, P. J. (2002). Oral health, nutrient intake and dietary quality in the very old. *Journal of American Dentist Association* 133(10), 1369-1379.

McNulty, R. H. (2005). Livable Communities & Aging In Place. Retrieved from http://www.aarp.org/research/international/gra/gra_special_05/aging_in_place.html.

Meneilly, G. S. (2001). Pathophysiology of diabetes in the elderly. In Diabetes in Old Age. Chichester, U.K.: John Wiley & Sons.

Miller, C. K., Edwards, L., Kissling, G., & Sanville, L. (2002). Evaluation of a Theory-based Nutrition Intervention for Older Adults With Diabetes Mellitus. *Journal of the American Dietetic Association,* 102(8), 1069-1081.

Miller, C. K., Edwards, L., Kissling, G., & Sanville, L. (2002). Nutrition Education Improves Metabolic Outcomes among Older Adults with Diabetes Mellitus: Results from a Randomized Controlled Trial. *Preventive Medicine*, 34(2), 252-259.

Molls, R. R., Ahluwalia, N., Mastro, A. M., Smiciklas-Wright, H., & Handte, G. C. (2005). Nutritional Status Predicts Primary Subclasses of T Cells and the Lymphocyte Proliferation Response in Healthy Older Women. *The Journal of Nutrition*, 135(11), 2644-2650.

Moyna, N. M., & Thompson, P. D. (2004). The effect of physical activity on endothelial function in man. *Acta Physiologica Scandinavica*, 180(2), 113-123.

Mu¨ ller-Lissner, S. A., Kamm, M. A., Scarpignato, C., & Wald, A. (2005). Myths and misconceptions about chronic constipation. *American Journal of Gastroenterology*, 100, 232-242.

Nadine, R. S., Charlotte, A. P., & Amy, A. (2004). Evaluation of nutrition education interventions for older adults: a proposed framework. *Journal of the American Dietetic Association*, 104(1), 58-69.

Narayan, K. M. V., Boyle, J. P., Thompson, T. J., Sorensen, S. W., & Williamson, D. F. (2003).

Lifetime Risk for Diabetes Mellitus in the United States. *The Journal of the American Medical Association*, 290(14), 1884-1890.

National Center for Health Statistics. (2002). Dietary Intake of Macronutrients, Micronutrients, and Other Dietary Constituents: United States, 1988-94. Vital and Health Statistics, 11, 245.

National Institute of Allergy and Infectious Diseases. (2007). Understanding the Immune System: How it works

National Osteoporosis Foundation. (2011). About Osteoporosis. http://www.nof.org/aboutosteoporosis

NHLBI. (2010). High Blood Pressure from http://www.nhlbi.nih.gov/health/health-topics/topics/hbp/

O'Donnell, M. E. (1995). Assessing Fluid and Electrolyte Balance in Elders. *The American Journal of Nursing*, 95(11), 41-45.

Ostchega, Y., Yoon, S. S., Hughes, J., & Louis, T. (2008). Hypertension awareness, treatment, and control continued disparities in adults: United States, 2005-2006., from National Center for Health Statistics

Pallast, E. B., Schouten, E. G., & de Waart, F. G.(1999). Effect of 50- and 100-mg vitamin E supplements on cellular immune function in noninstitutionalized elderly persons. *American Journal of Clinical Nutrition*, 69, 1273-1281.

Parker, S., Powell, L., Hermann, J., Phelps, J., & Brown, B. (2011). Preferred Educational Delivery Strategies Among Limited Income Older Adults Enrolled in Community Nutrition Education Program. *Journal of Extension*, 49(11), 1FEA8.

Pierce, M. B., Sheehan, N. W., & Ferris, A. M. (2002). Nutrition Concerns of Low-Income Elderly Women and Related Social Support. *Journal of Nutrition for the Elderly*, 21(3), 37-53.

Prasad, A. S., Beck, F. W., Bao, B., Fitzgerald, J. T., Snell, D. C., Steinberg, J. D., & Cardozo, L.

J. (2007). Zinc supplementation decreases incidence of infections in the elderly: effect of zinc on generation of cytokines and oxidative stress. *The American Journal of Clinical Nutrition*, 85(3), 837-844.

Rein, D. B., Wittenborn, J. S., Zhang, X., Honeycutt, A. A., Lesesne, S. B., & Saaddine, J. (2009). Forecasting age-related macular degeneration through the year 2050: the potential impact of new treatments. *Archives of Ophthalmology*, 127(4), 533-540.

Rein, D. B., Zhang, P., Wirth, K. E., Lee, P. P., Hoerger, T. J., & McCall, N., et al. (2006). The economic burden of major adult visual disorders in the United States. *Archives of Ophthalmology*, 124, 1754-1760.

Rice, D. P., & Fineman, N. (2004). Economic implications of increased longevity in the United states. *Annual Review of Public Health*, 25, 457-473.

Rifkin, D. E., Shlipak, M. G., Katz, R., Fried, L. F., Siscovick, D., Chonchol, M., Sarnak, M. J. (2008). Rapid Kidney Function Decline and Mortality Risk in Older Adults. *Archives of InternalMedicine*, 168(20), 2212-2218.

Rockwell, K. S., & Kohn., H. (1989). Post-Then-Pre Evaluation. *Journal of Extension*, 27(2).

Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs*, 2, 328-335.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social Learning Theory and the Health Belief Model. *Health Education & Behavior*, 15(2), 175-183.

Russo, A., Wier, L. M., & Elixhauser, A. (2009). Statistical Brief #79:Hospital Utilization Among Near-Elderly Adults, Ages 55 to 64 Years,2007. Rockville, MD: Agency for Health Care Policy and Research (U.S.).

Saaddine, J. B., Honeycutt, A. A., Venkat Narayan, K. M., Zhang, X., Klein, R., & Boyle, J. P. (2008). Projection of Diabetic Retinopathy and Other Major Eye Diseases Among People With Diabetes Mellitus United States, 2005-2050. *Archeive of Ophthalmology*, 126(12), 1740-1747.

Sahyoun, N. R., Lentzner, H., Hoyert, D., & Robinson, K. N.(2001). Trends in Causes of Death Among the Elderly. (Vol. Aging Trends; No.1). Hyattsville, Maryland: National Center for Health Statistics.

Sahyoun, N. R., Pratt, C. A., & Anderson, A. (2004). Evaluation of nutrition education interventions for older adults: a proposed framework. *Journal of the American Dietetic Association*, 104(1), 58-69.

Schiffman, S. S., & Graham, B. G. (2000). Taste and smell perception affect appetite and immunity in the elderly. *European Journal of Clinical Nutrition*, 54(Suppl 3), S54-S63.

Schulze, M. B., & Hu, F. B. (2005). PRIMARY PREVENTION OF DIABETES: What Can Be Done and How Much Can Be Prevented? *Annual Review of Public Health*, 26(1), 445-467.

Shannon, J., et al. (1996). Relationship of Food Groups and Water Intake to Colon Cancer Risk. Cancer Epidemiology: *Biomarkers and Prevention*, 5, 495-502.

Sheehy, C. M., Perry, P. A., & Cromwell, S. L. (1999). Dehydration: Biological Considerations, Age-Related Changes, and Risk Factors in Older Adults. *Biological Research For Nursing*, 1(1), 30-37.

Simrén, M. (2002). Physical activity and the gastrointestinal tract. *European Journal of Gastroenterology and Hepatology*, 14(10), 1053-1056.

Soni, A., & Roemer, M. (2011). Top Five Most Costly Conditions among the Elderly, Age 65 and Older, 2008 Statistical Brief #327. from Agency for Healthcare Research and Quality http://www.meps.ahrq.gov/mepsweb/data_files/publications/st327/stat327.pdf

Speer, E. M., Reddy, S., Lommel, T. S., Fischer, J. G., Stephens, H., Park, S., & Johnson, M. A. (2008). Diabetes Self-management Behaviors and A1c Improved Following a Community-based Intervention in Older Adults in Georgia Senior Centers. *Journal of Nutrition for the Elderly*, 27(1-2), 179-200.

Stenholm, S., Harris, T. B., Rantanen, T., Visser, M., Kritchevsky, S. B., & Ferrucci, L. Curr

(2008). Sarcopenic obesity - definition, etiology and consequences. *Clinical Nutrition and Metabolic Care*. 11(6),693–700.

Taylor-Davis, S., Smiciklas-Wright, H., Warland, R. E. X., Achterberg, C., Jensen, G., Sayer, A., & Shannon, B. (2000). Responses of Older Adults to Theory-Based Nutrition Newsletters. *Journal of the American Dietetic Association*, 100(6), 656-664.

The Eye Diseases Prevalence Research Group. (2004). Prevalence of Cataract and Pseudophakia/Aphakia Among Adults in the United States. *Archives of Ophthalmology*, 122(4), 487-494.

Thompson, P. D., Buchner, D., Piña, I. L., Balady, G. J., Williams, M. A., & Marcus, B. H.(2003). Exercise and Physical Activity in the Prevention and Treatment of Atherosclerotic Cardiovascular Disease. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 23(8), e42-e49.

Tribble, D. L. (1999). Antioxidant Consumption and Risk of Coronary Heart Disease: Emphasis on Vitamin C, Vitamin E, and ß-Carotene : A Statement for Healthcare Professionals From the American Heart Association. Circulation, 99(4), 591-595.

U.S Census, B. (2009). Census Bureau Reports World's Older Population Projected to Triple by 2050. http://www.census.gov/Press-Release/www/releases/archives/international_population/013882.html

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2010). Dietary Guidelines for Americans, 2010 (7th Edition ed.). Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services. (2008). 2008 Physical Activity Guidelines for Americans. Washington, D.C: ODPHP publication

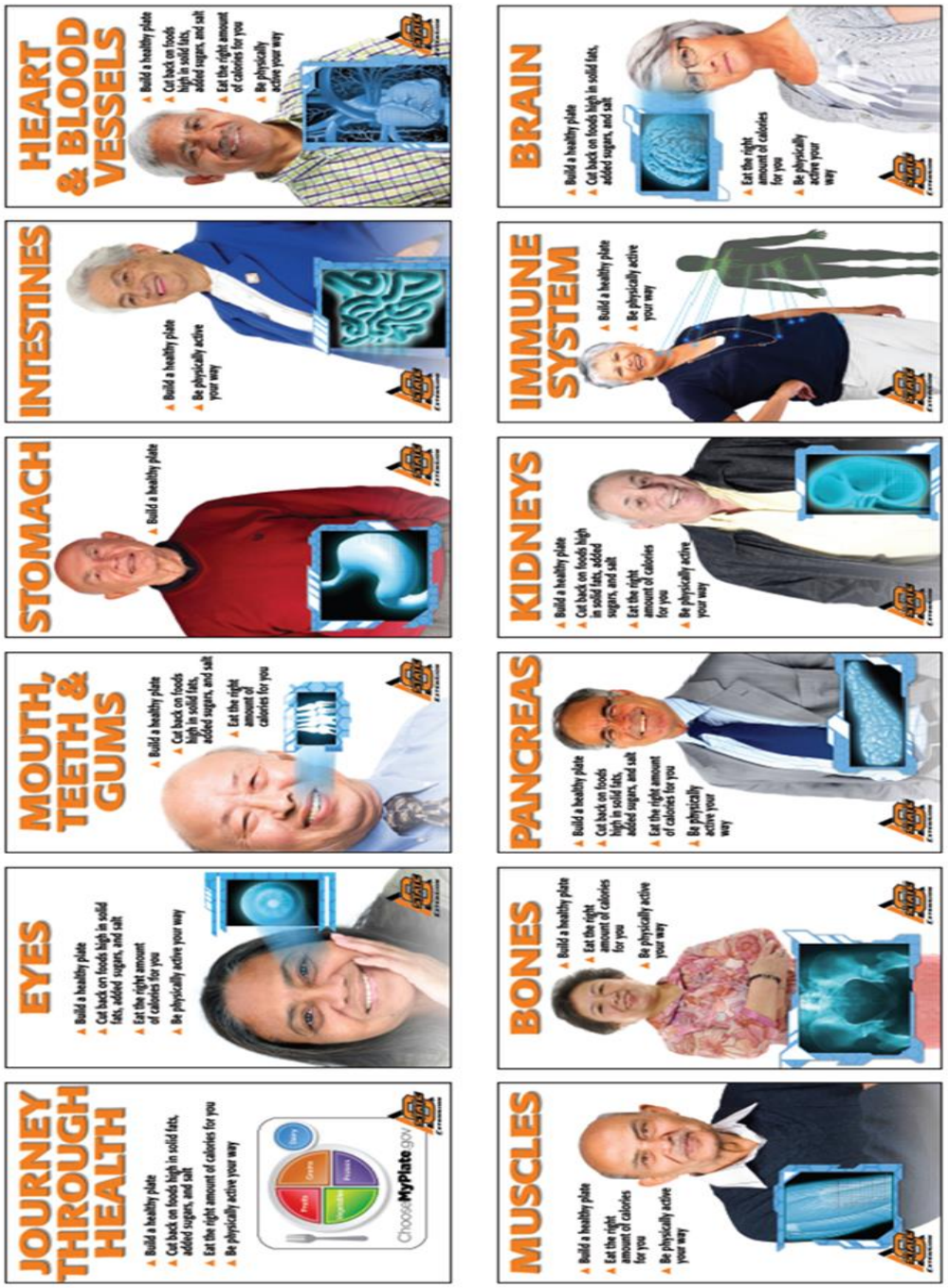
USDA. (2011). Let's eat for the health of it.: USDA Publication.

Vellas, B. J., Wayne, S. J., Romero, L. J., Baumgartner, R. N., & Garry, P. J. (1997). Fear of falling and restriction of mobility in elderly fallers. *Age and Ageing*, 26, 189-193.

Wallace, J. I., & Schwartz, R. S. (2002). Epidemiology of weight loss in humans with special reference to wasting in the elderly. *International Journal of Cardiology*, 85(1), 15-21.

Whitney, E., & Rolfes, S. R. (2010). Understanding Nutrition CA, USA Wadsworth.

APPENDIX A


JOURNEY THROUGH HEALTH
EYES
MOUTH, TEETH & GUMS
STOMACH
INTESTINES
HEART & BLOOD VESSELS
MUSCLES
BONES
PANCREAS
KIDNEYS
IMMUNE SYSTEM
BRAIN

Journey through Health Evaluation Survey

Gender: ___ female ___ male

Age range: ___ < 60 ___ 60-64 ___ 65-69 ___ 70-74 ___ 75-79 ___ 80-84 ___ 85-89 ___ 90+

Answer how you felt BEFORE the program						Answer how you felt AFTER the program				
Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree		Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
					Changes occur with aging which can increase my risk of health problems?					
					Building a healthy plate can provide health benefits as I age?					
					Cutting back on foods high in solid fats, added sugars, and salt can provide health benefits as I age?					
					Eating the right amount of calories for you can provide health benefits as I age?					
					Being physically active your way can provide health benefits as I age?					
					The Dietary Guidelines are a manageable set of messages I feel I can follow?					

Was the program:	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
Educational					
Easy to understand					
Enjoyable					

APPENDIX C

Oklahoma State University Institutional Review Board

Date:	Thursday, February 21, 2013
IRB Application No	HE1312
Proposal Title:	Evaluation of the Journey through Health Program
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 2/20/2014

Principal Investigator(s):

Seung Eun Jung
419 HES
Stillwater, OK 74078

Janice R. Hermann
315 HES
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI, advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Sheila H. Kennison

Sheila Kennison, Chair
Institutional Review Board

PARTICIPANT INFORMATION
OKLAHOMA STATE UNIVERSITY

Title: Evaluation of the Journey through Health program

Investigator(s): Janice Hermann, Ph.D., R.D./L.D., Professor and Oklahoma Cooperative Extension Service Adult and Older Adult Nutrition Specialist and Seung Eun Jung, M.S., Department of Nutritional Sciences graduate student, Oklahoma State University.

Purpose: The purpose of this study is to evaluate the Journey through Health program. This evaluation will help us to determine if the program increases consumer knowledge of 1) age-related changes, 2) the role of diet, physical activity, and safe food handling in health promotion, and 3) how the Dietary Guidelines for Americans can promote health. This evaluation will also help us to see if consumers understand and enjoy the program.

What to Expect: Participation in this study will involve completing a program evaluation survey regarding the Journey through Health program. You may skip any questions you do not wish to answer. It should take you about five to ten minutes to complete the program evaluation survey.

Risks: There are no risks associated with this study which are expected to be greater than those ordinarily encountered in daily life.

Benefits: This evaluation will help us to determine if consumers understand and enjoy the Journey through Health program and if the program increases consumer knowledge of 1) age-related changes, 2) the role of diet, physical activity, and safe food handling on health promotion, and 3) how the Dietary Guidelines for Americans can promote health.

Compensation: There is no compensation for completing the program evaluation survey.

Your Rights: Your participation in this study is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this study at any time, without penalty.

Confidentiality: Your name is not collected on the program evaluation survey. We will be evaluating the program evaluation surveys as group. Program evaluation surveys will be stored securely and only individuals responsible for the study oversight will have access to the surveys.

Contacts: You may contact Janice Hermann, Oklahoma Cooperative Extension Service Adult and Older Adult Nutrition Specialist, 301 Human Sciences, Department of Nutritional Sciences, Oklahoma State University, Stillwater, OK 74078, 405-744-460 should you desire to discuss your participation in the study and/or request information about the results of the study. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

If you choose to participate: Turning in your completed program evaluation survey indicates your willingness to participate in this study.

Okla. State Univ.
IRB
Approved 2-21-13
Expires 2-20-14
IRB # HE-1312

APPENDIX E

Introduction Script

Thank you for coming to the Journey through Health program. This is a new Oklahoma Cooperative Extension Service program and as such we would like to evaluate it. In order for us to do this we would like to ask you to participate in a program evaluation study.

As you came in you were provided with a "Participant Information" sheet, which you may keep, describing the program evaluation study. Please note there are information contacts at the bottom of the sheet if you have any questions.

Participation in this study will involve completing a program evaluation survey following the Journey through Health program *(hold up program evaluation survey)*. As we pass out the program evaluation survey, I would like to explain a few points:

- Please note your name is not recorded on the survey.
- At the top we would like you to mark your gender and age-range.
- Next there are 6 questions. We would like you to answer each of questions on the **left** "how you felt **before** the program" and on the right "how you felt **after** the program."
- Then on the bottom there are 3 questions asking how you would evaluate the program.

You may skip any question you do not wish to answer. We estimate it will take you five to ten minutes to complete the program evaluation survey.

There are no risks associated with this study greater than those ordinarily encountered in daily life.

Your participation in this program evaluation study is voluntary. Turning in your completed program evaluation survey indicates your willingness to participate in this study.

Does anyone have any questions?

VITA

Seung Eun Jung

Candidate for the Degree of

Doctor of Human Sciences

Thesis: DEVELOPMENT AND EVALUATION OF A HEALTH PROMOTION PROGRAM FOR OLDER ADULTS: JOURNEY THROUGH HEALTH

Major Field: NUTRITIONAL SCIENCES

Biographical:

Education:

Completed the requirements for the Doctor of Human Sciences in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in July, 2014.

Completed the requirements for the Master of Human Environmental Sciences in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in 2008.

Completed the requirements for the Bachelor of Human Environmental Sciences in Nutritional Sciences at Kyung Hee University, Seoul, Korea in 2002.

Experience:

Registered Dietitian in Samsung Everland, Food and Distribution Division, Yongin, Korea 2002-2005; Graduate Research Assistant, Oklahoma State University, Stillwater, Oklahoma, 2006-2008; Graduate Research Assistant/Graduate Teaching Assistant, Oklahoma State University, Stillwater, Oklahoma, 2009-2014.

Professional Membership: The Society for Nutrition Education and Behavior (SNEB)