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There are approximately 1.5 million residents living in nursing homes in the United States. For those living in this environment, opportunities to participate in health promoting behaviors, such as physical activity, have been limited (Kayser-Jones, 2009). The use of video game technology is now being used related to health and health benefits with older adults (Primack et al., 2012). Because there have been limited research studies conducted in long-term care environments related to physical activity and health promotion, current research is needed to further explore these phenomena. The purposes of this study were as follows: (1) to describe the use of video game technology, specifically the Nintendo Wii, with older adults living in long term care facilities; (2) to determine if there is a relationship among personal factors, perceived barriers, perceived benefits, perceived self-efficacy, and physical activity; and (3) to examine the effects of this video game technology perceived barriers, perceived benefits, and perceived self-efficacy for physical activity using a 6-week intervention with nursing home residents. Pender's Promotion Model was used as a guiding framework for this study.

Twenty-four participants, primarily Caucasian (n=20, 83.3%) women (n=16, 66.7%) were recruited from four nursing homes in and around central North Carolina. Prior to the start of the intervention, data were collected by face to face interviews on current self-reported level of physical activity and prior use of a technological device, as well as other pre-intervention measures. The majority of the sample reported being very physically active and had prior experience using a technological device. The intervention

period lasted for 6 weeks, meeting twice per week for 45 minute sessions. The sessions included a 15 minute educational component followed by 30 minutes of Nintendo Wii game play.

From the data gathered prior to the intervention, it was ascertained that the majority of the study participants reported currently engaging in physical activity (87.4%). Many of the participants (83.3%) reported prior use of a technological device, with the computer being the most commonly reported. Using the scores from the multiple regression analysis ($F(6, 22) = 2.49$, $p = .07$, $R^2 = .48$, R^2Adjusted = .29) revealed no significant predictors of physical activity at posttest. Paired *t*-tests revealed no significant change in key variables between before and after intervention.

Although the study the findings were not statistically significant, the intervention provided some useful clinical information that can be used in the development of future physical activity programs for residents in long-term care facilities. The use of video games with older adults is a feasible, inexpensive method to assist them in physical activity maintenance. Initiating interventions that are tailored to older adults, focused on health promoting behaviors such as physical activity, within long-term care facilities can help reduce to maintain the functional ability of residents in long-term care.

THE EFFECT OF VIDEO GAMING ON PHYSICAL ACTIVITY AMONG NURSING HOME RESIDENTS

by

Tomika M. Williams

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Approved by

_____
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To my mother, Juanita Williams for your love, support, and encouragement. To Drs. Carol Blue and Lynn Buettner for believing in me and my ideas and supporting my efforts. Your impact will never be forgotten.

APPROVAL PAGE

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Philippians 1:6—"Being confident of this very thing….."

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CHAPTER I

INTRODUCTION

The population of persons age 65 or older in the United States of America (USA) is expected to rise to nearly 89 million by 2050 (Administration on Aging [AOA], 2013). The number of older women is greater than that of older men, with 24.3 million to 18.8 million respectively. Those reaching age 65 are expected to have a life expectancy of an additional 19.2 years (AOA, 2013). In 2012, this age group comprised 1.5 million of the USA population with 3.5% of those in this group living in some type of institutional setting (AOA, 2013). The National Nursing Home Survey (NNHS) (Centers for Disease Control [CDC] (Jones, Dwyer, Bercovitz, & Strahan, 2009) revealed that in the United States there are 16,100 nursing homes, with an occupancy rate of 86%, and approximately 1.5 million residents.

Examination of the health promoting behaviors of nursing home residents has indicated that past health promoting behavior has a strong positive relationship with current health promoting behavior and residents who conceptualize health as wellness tend to report more health promoting behaviors (Kayser-Jones, 2009) as opposed to those who do not have that perspective of health. For those residing in long-term care (LTC) facilities, resources are often limited for maintaining health behaviors (Chen, 2010). There are often constraints on time, space, and staffing (Benjamin, Edwards, & Caswell, 2009). Unless a concerted effort is made to develop strategies and interventions to

eliminate barriers, health promoting behaviors such as physical activity among residents in facilities will continue to be hampered and ultimately affect their health.

Physical activity is one of several health promoting behaviors. Health promoting behaviors can vary (Pascucci, 2012) among older adults. Physical activity initiation and maintenance occur in this age group if there is sufficient self-efficacy towards the activity. Cohen-Mansfield (2010) et al. examined the factors influencing engagement in physical activity over time of persons between the ages of 75-94. They found that higher functional and cognitive status predicts initiation and maintenance of physical activity. The benefits of consistent physical activity are apparent in this population with declines in functional disability and improved overall health (Chodzko-Zajko, et al., 2009).

There is a paucity of research available specifically focused on health promotion in LTC facilities (Kayser-Jones, 2009). Historically, LTC facilities were thought of as terminal placement for individuals with functional impairment and multiple chronic conditions. During recent years of examination of LTC environments there remains a lack of consistent opportunities for health promoting behaviors such as physical activity (Kayser-Jones, 2009). Because of the complexities surrounding the issue of health promotion within these facilities, LTC facilities have developed a reputation as dependency-promoting environments, rather than health promoting ones (Kayser-Jones, 2009).

Research on physical activity among nursing home residents is sparse. Donovan, Stewart, McCloskey, and Donovan (2014) found that residents spent as much as 85% of their time in their rooms and when they were outside of their rooms, they were generally

observers rather than participants in the activities around them. Fear of falling (Phillips & Flesner, 2013), lack of staffing (Resnick et al., 2008), and lack of adequate space (Benjamin et al., 2009) are barriers that have been reported. As the need for LTC services become more apparent among the aging population, interventions will need to be developed to facilitate physical activity in this vulnerable population, with the hopes of warding off the potential sequela of prolonged inactivity.

The use of video games has been introduced as an intervention to promote health promotion activities. Video games have been in existence since the 1970s advent of the video arcade (Shubert, 2010). Over the years this technology has improved and people enjoy games in the privacy of their homes. Video games have been used by all ages and have begun to show some therapeutic and health benefits in certain patient populations (Primack et al., 2012). Exergames, or games that include an informal exercise component, are on the rise (Ulbrecht, Wagner, & Gräbel, 2012). These games allow players to use their entire bodies to play. The most widely used and most researched gaming system to date is the Nintendo Wii™ (Wii) developed in 2006. The Wii console has other attachable parts that allow players to be active while playing the games, predominantly using a small device held in the hand with a secure wrist strap. The effectiveness of this gaming system cannot be generalized due to the small sample sizes used in most studies. Few intervention studies have been conducted using the Wii to test its effects on nursing home residents (Clark & Kraemer, 2009; Hsu et al., 2011; Ulbrecht, Wagner, & Gräbel, 2012).

Study Purposes

The purposes of this study were as follows: (1) to describe the use of video game technology, specifically the Nintendo Wii, with older adults living in long term care facilities; (2) to determine if there is a relationship among personal factors, perceived barriers, perceived benefits, perceived self-efficacy, and physical activity; and (3) to examine the effects of this video game technology perceived barriers, perceived benefits, and perceived self-efficacy for physical activity.

Significance

According to the State of Aging and Health in America 2013 report, 31.4% of older adults reported no leisure-time activity within the past month. Inactivity can cause negative effects on the physical and cognitive functions of individuals, such as reduced cardiorespiratory fitness, reduced strength, and poorer body morphology (Kruger, Ham, & Sanker, 2008). Habitual activity, which is defined as non-exercise movement comprised primarily of mobility-related activities occurring throughout the day, is common with older adults (Niklas et al., 2016). Older adults are the population group with the highest level of sedentary time (Matthews et al., 2008), with approximately 11% participating in leisure-time aerobic and muscle strengthening activities (Federal Interagency Forum on Aging-Related Statistics, 2012), and having an increased risk of developing conditions such as metabolic syndrome due to high levels of TV watching and sitting (Gardiner et al., 2011). Within nursing homes, inactivity has been linked to past activity level (Chen, 2010), present physical health or changes in health (Chen,

2010), environmental restrictions (Benjamin et al., 2009; Chen, 2010), and staffing concerns (Benjamin et al., 2009; Buckwalter et al., 2009).

Research has shown that maintaining physical activity as age advances improves function and survival (Fern, 2009; Intiso et al., 2009; Stressman, Hammerman-Rozenberg, Cohen, Elin-Mor, E, & Jacobs, 2009; Wang, Yeh, Wang, Wang, & Lin, 2011). The use of video games can be considered a means to facilitate this activity. It has been hypothesized that video games may have a place in the therapeutic health arena (Vance, McNees, & Meneses, 2009). The use of video games as a tool for physical activity can be accomplished at low cost and has the potential to provide similar benefits of traditional physical activity or physical therapy regimens (Burstin & Brown, 2010; Lange et al., 2012). Additionally, the use of video games with older adults can provide benefits of improved quality of life and increased socialization (Hall, Chavarria, Maneeranta, Chaney, & Bernhardt, 2012; Suttie, 2009).

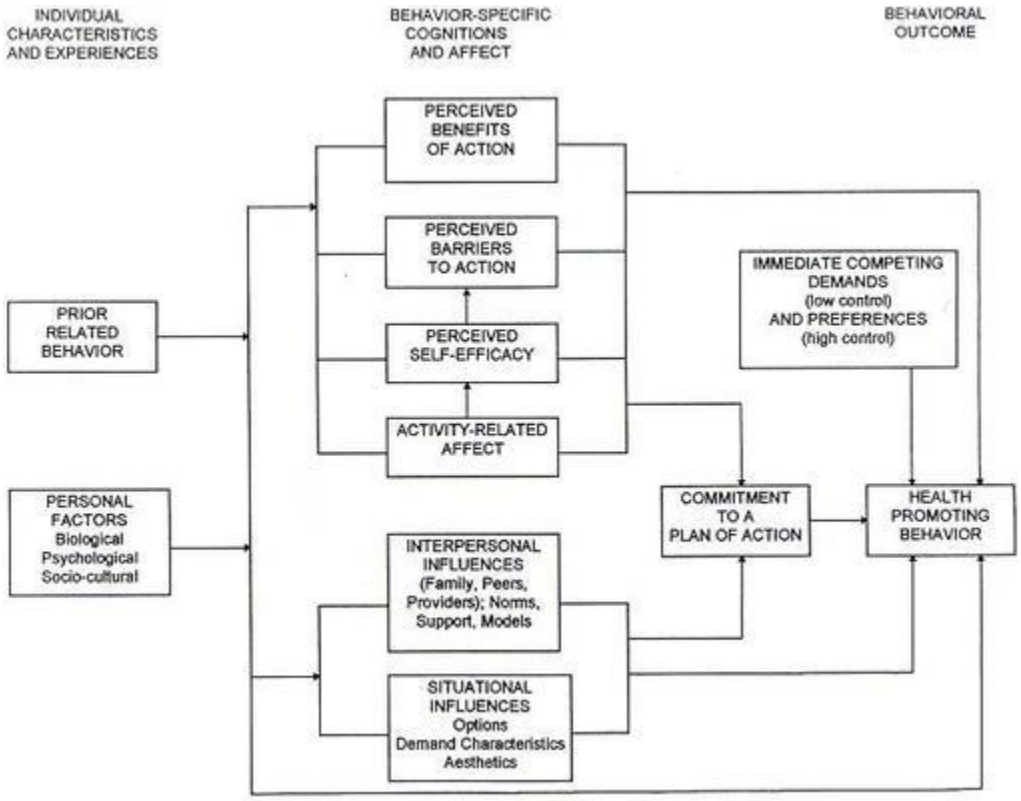
The nursing home environment has its own challenges (Buckwalter et al., 2009). Nursing homes, rather than promoting health, have been labeled as dependency promoting environments (Kayser-Jones, 2009). Due to the challenges of staffing, fiscal problems, and lack of education, health promotion activities and interventions have not been priority (Benjamin et al., 2009). Health promoting interventions can provide opportunities for physical activity that could diminish the susceptibility to physical complications that might occur over time without such strategies (Turk, Elci, Resnick, & Kalarchian, 2016; Rolland et al., 2007). Persons with disabilities that engaged in health promoting behaviors exhibit better health related outcomes (Colon-Emeric, Whitson,

Pavon, & Hoenig, 2013). Therefore, the development of interventions within the LTC environment can aide in improving health outcomes.

Conceptual Framework

The Health Promotion Model (HPM), originally developed by Nola Pender in 1982, is a model that provides understanding of the many factors that affect health behaviors of individuals and families and can offer insight into specific nursing strategies for providing prevention and health promotion services to clients (Pender, 1982). The concept of health promoting behavior is directed towards sustaining or increasing the level of well-being, self-actualization, and fulfillment of a given group or individual. The model was developed from an increasing awareness of the lack of health promotion in health care at that time, which was mostly disease focused. Figure 1 represents a schematic of the model in its entirety.

Figure 1. Pender's Revised Health Promotion Model



Source: Pender, Murdaugh, & Parsons, 2006 pg. 50

The HPM's basics were derived from the Health Belief Model, a framework for examining why people do or do not seek disease prevention (Becker 1974). For the Health Belief Model to be applicable, an individual has to believe he was susceptible to a disease (perceived susceptibility), that disease occurrence would at least moderate severity on some component of his/her life (perceived severity and threat), and that taking a particular action (cues to action) would in fact be beneficial by decreasing susceptibility or reducing severity and not cause overwhelming psychological barriers (Becker, 1974).

The model is effective in outlining a plan once an illness was identified but does not address health promotion (i.e., what to do prior to illness occurring).

According to the Health Belief Model, multiple interacting beliefs influence behavior. Health decisions are made based on attitudes and beliefs. Application of the model assumes that the desired outcome for individuals is the acquisition and maintenance of a positive state of health (Becker, 1974). Additionally the model encouraged individuals to receive vaccinations as a means to prevent certain illnesses. The model did not cover the aspects of health prior to illness; what we now term health promotion.

While Pender's work in health promotion has grown and evolved, prior to the first edition of her text there was no framework that presented her ideas concerning factors that promoted optimal health. Dishman and colleagues' (1985) were some of the early researchers looking at determinants of physical activity and exercise. Their work was primarily in exercise adherence. Intention, reinforcement, commitment, and behavioral skills are listed as determinants and feelings, knowledge, attitude, and beliefs about health and physical activity are influences to a person's adoption or maintenance of physical activity (Dishman, Sallis & Orenstien, 1985). The portion of their work that examined feelings and attitude was similar to certain concepts of the Health Belief Model, which include perceived barriers to a preventive action and perceived susceptibility to disease which are the most common dimensions of the model in explaining preventative behaviors.

Model Description

The HPM is a framework designed as a guide for detailing factors that influence health behaviors. There are three main components of the HPM which are further divided into narrow, more specific concepts. The main components are individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome (Pender et al., 2011). Individual characteristics and experiences include prior related behaviors and personal factors that encompass biological, psychological, and sociocultural factors. These factors may directly and indirectly affect future health behavior. Behavior-specific cognition and affect are the variables that can be modified through interventions. Perceived benefits and barriers to action, perceived self-efficacy, activity-related affect, interpersonal influences, and situational influences are all included in this component of the model (Pender et al., 2011). Additionally, the commitment to action and the immediate competing demands or preferences are also included in this portion of the framework. The commitment to action is the beginning of change for the individual. Alternative behaviors that may influence the course of action are the immediate competing demands and preferences. Lastly, the behavioral outcome component identifies and explains the health promoting behavior (Pender et al., 2011).

Model Assumptions

Approaches to health behaviors propose that one's choice of behavior is formed from a rational decision-making process (Ajzen, 1988). In other words, humans regulate their own behavior through cognitive thought processes. Therefore, behavior that is goal-directed is guided by forethought of positive or negative outcomes of the behavior.

Another assumption is that behavior is a function of a person's interaction with his or her environment, such as emotion, biological feedback, and cognition. Additionally, individuals seek to actively regulate their own behavior. People value growth that is positively directed and will attempt to achieve personally acceptable balance between change and stability (Pender et al., 2011).

The HPM is based on the following assumptions that are reflective of both nursing and behavioral science perspectives (Pender, Murdaugh, & Parsons, 2006):

1. Persons seek to create conditions of living through which they can express their unique human health potential.
2. Persons have the capacity for reflective self-awareness, including assessment of their own competencies.
3. Persons value growth in directions viewed as positive and attempt to achieve a personally acceptable balance between change and stability
4. Individuals seek to actively regulate their own behavior.
5. Individuals in all their biopsychosocial complexity interact with the environment, progressively transforming the environment and being transformed over time.
6. Health professionals constitute a part of the interpersonal environment, which exerts influence on persons throughout their lifespan.
7. Self-initiated reconfiguration of person-environment interactive patterns is essential to behavior change.

Variables and Definitions

The original HPM was revised in 1996. The three new variables added to the model were activity-related affect, commitment to a plan of action, and immediate competing demands and preferences (Pender, 1996). Activity-related affect is defined as the subjective feeling states or emotions occurring prior to, during, and following a specific health behavior (Pender, 2011). This variable is included under the second section of the model entitled behavior-specific cognitions and affect, which also includes perceived barriers, perceived benefits, perceived self-efficacy, interpersonal and situational influences. Perceived benefits to action are perceptions of the positive or reinforcing consequences of a behavior. Perceived barriers are the perceptions of the blocks, hurdles, and personal costs of undertaking a health behavior. Perceived self-efficacy is the judgment of personal capability to organize and execute a particular health behavior (Pender et al., 2011).

Interpersonal influences can include family, peer, or providers. These are described as the perceptions concerning the behaviors, beliefs, or attitudes of relevant others in regard to engaging in a specific health behavior. Situational influences are inclusive of the perceptions of the compatibility of life context or the environment with engaging in a specific health behavior. These variables are modifiable through interventions (Pender et al., 2011).

Individual characteristics and experiences include the variables prior related behavior and personal factors. Prior related behavior is defined as the frequency of the same or similar behavior in the past. Personal factors, which include biological,

psychological, and sociocultural factors, are characteristics of the individual that influence or predict health behavior. Some examples are age, body mass index, self-esteem, self-motivation, race, education, and socioeconomic status (Pender et al., 2011).

The last component of the model is the behavioral outcome section. The commitment to a plan of action is simply the intention to carry out a particular health behavior, and is inclusive of specific strategies for success. Immediate competing demands and preferences are the alternative behaviors that intrude into consciousness as possible course of action just prior to the intended occurrence of a health behavior (Pender et al., 2011). These may be difficult to overcome depending on the individual's ability to sustain attention and avoid disruption in their intended health behavior. Lastly the end point of the HPM is the health promoting behavior. This behavior is directed toward attaining positive health outcomes for any client.

Although there are several theories and conceptual frameworks that have been used to predict behavior, the HPM was chosen as the framework for this research because it examines factors that promote health, which is a worthwhile goal for older adults. The comprehensiveness of the model allows for the study of multiple variables, making it ideal for examining the contributing factors that are related to healthy behaviors such as physical activity. The model best "fits" this research project in regards to health promoting behavior of older adults within nursing facilities, which has been understudied. The HPM includes prior related behavior that is proposed to shape all of the variables listed under the behavior-specific cognitions portion of the model (Pender et al., 2011). Prior behavior has been reported to be the best predictor of future behavior

(Ajzen, 1991). While the HPM has been used in some research studies with older adults (Bryam-Williams, 2006), it has not been used to target physical activity in older adults (Shin, 2008) nor specifically with older adults living in LTC facilities.

Because of the complexity of the model, the variables that are amenable to change and consistent predictors of health behaviors have been studied most often (Pender et al., 2011). These include perceived self-efficacy, perceived benefits, perceived barriers, and activity-related affect. The components of the model that will be used in this intervention include prior related behavior and personal factors, which includes an assessment of biological (age), psychological (cognitive status), and sociocultural (educational level and race) factors, perceived benefits and barriers, perceived self-efficacy, and the health promoting behavior (physical activity). The intervention using the Wii video game will aim at demonstrating an improvement in physical activity as the health promoting behavior in the proposed study.

Research Questions

1. What are the percentages of older adults living in a long term care facility who report being currently physically active and have previous experience using some form of technology (computer, video games, etc.)?
2. What is the relationships among personal factors, perceived barriers, perceived benefits, self-efficacy and the health promoting behavior (physical activity) among nursing home residents?
3. Do prior related behaviors, personal factors, perceived benefits, barriers, and self-efficacy predict physical activity at baseline in nursing home residents?

4. What are the effects of a 6-week intervention using Wii-Video gaming on perceived benefits, barriers of exercise, self-efficacy and physical activity among nursing home residents?

Conceptual and Operational Definitions

1. Physical activity: Body movement that is produced by the contraction of skeletal muscles and increases energy expenditure (Chodzko-Zajko et al., 2009). For this study physical activity was operationalized as the score on the Rapid Assessment of Physical Activity (RAPA) scale (Topolski, et al., 2006).
2. Nintendo Wii™ technology: Video game technology that provides active body movements to engage in play.
3. Prior related behavior: Any prior related physical activity (Pender et al., 2011). For this study, prior related behavior was operationalized as the answer to specific questions on the demographic form (current level and time spent in physical activity).
4. Personal factors: Any factor categorized as biological, psychological, and socio-cultural (Pender et al., 2011). Biological factors were operationalized as age. Depression is defined as feelings of sadness for >6 weeks, without episodes of mania. (Mitchell, Bird, Rizzo, & Meader, 2010). Psychological factors were operationalized as the score on the Geriatric Depression Scale (GDS). Socio-cultural factors were operationalized as race and education level.
5. Health promoting behavior: Behavior directed toward attaining positive health outcomes for a client (Pender et al., 2011).

6. Perceived self-efficacy: The judgment of personal capability to organize and carry out a particular course of action (Pender et al., 2011). Perceived self-efficacy was operationalized as the score on the Self-Efficacy for Exercise scale (Resnick & Jenkins, 2000).
7. Perceived benefits: Mental representations of the positive or reinforcing consequences of a behavior (Pender et al., 2011). Perceived benefits was operationalized as the score on the Exercise Benefits and Barriers Scale (Sechrist, Walker, & Pender, 1987)
8. Perceived barriers: Perceptions about the unavailability, inconvenience, expense, difficulty, or time-consuming nature of a particular action (Pender et al., 2011). Perceived barriers was operationalized as the score on the Exercise Benefits and Barriers Scale (Sechrist, Walker, & Pender, 1987)

Summary

The aging population is growing at a rapid rate. Along with the increasing numbers of older adults is the increasing need for long-term care. The risks associated with inactivity are heightened in this age group. For those residing in LTC facilities, physical activity opportunities are limited. The recent development of interactive video games has opened a new avenue for consideration regarding physical activity. Current research has supported that the use of these games can provide some health benefits (Hall, et al., 2012; Martson & Stuart, 2012). Pender's Health Promotion Model (HPM) has been used to guide the development of this study.

CHAPTER II

LITERATURE REVIEW

The world's population of people 60 years and older is expected to reach 2 billion by 2050 (World Health Organization, 2012). Additionally the number of people not able to care for themselves independently thus needing long-term care is forecast to quadruple by 2050 (World Health Organization, 2012). In the United States, the number of people age 65 and over are expected to grow to 72 million by 2030 (Federal Interagency Forum on Aging-Related Statistics, 2012). Considering these alarming statistics, care for older adults has become an important health topic.

Healthy People 2020 is a set of national objectives created by lead federal agencies to help improve the health of citizens of the US. There are sets of objectives specifically for older adults and recommendations for physical activity for older adults. However despite these recommendations, older adults remain highly sedentary (Matthews et al., 2008). Further, for those residing in long-term care facilities, physical activity and exercise are met with many barriers. The need for appropriate interventions for this vulnerable population is paramount to aid in decreasing health care costs and slowing the progression of functional decline.

In this review, an overview of what is known about physical activity for older adults, including benefits of and the barriers to physical activity is presented. Also included is a review of the Health Promotion Model, the conceptual framework for the

study, and its use with the older adult population. For this study, a modification of the HPM was used focusing on prior related behavior and personal factors, perceived benefits, perceived barriers, and self-efficacy, and the health promoting behavior (physical activity). Finally, a discussion of interventions which are possible for individuals in LTC facilities, specifically the use of video game technology and its potential impact on physical activity, is presented.

Physical Activity

Physical activity positively benefits the health of the individual (Chodizko-Zaiko et al., 2009). According to the Centers for Disease Control and Prevention's (CDC) Division of Nutrition, Physical Activity, and Obesity (2010), some of these benefits of regular physical activity include a lower risk of chronic conditions such as coronary artery disease, stroke, hypertension, and diabetes. Physical activity can also prevent unwanted weight gain or loss, improve balance, reduce depression (Musich, Wang, Hawkins, & Greame, 2016), and facilitate better brain function (Williamson et al., 2009). In *Healthy People 2020*, the CDC lists the following as one of the physical activity objectives: "increase the proportion of adults who engage in aerobic physical activity of at least moderate intensity for at least 150 minutes per week, or 75 minutes per week of vigorous intensity, or an equivalent combination" (Physical activity, objectives, para. 2). The CDC's Division of Nutrition, Physical Activity, and Obesity's Guidelines for Older Adults (2010) state that for there to be substantial benefits, adults need to do at least 2 hours and 30 minutes of moderate intensity aerobic exercise per week. Intensity is defined as the level of effort required to do an activity- persons performing moderately

intense activity can talk, but not sing, while engaged in the activity. These same recommendations apply to older adults.

Physical Activity in Older Adults

Several researchers have noted that older adults who have multiple comorbidities are often prohibited from beginning, participating, or sustaining physical activity plans (Mercer, Smith, Wyke, O'Dowd, & Watt, 2009; Valderas, Starfield, Sibbald, Salisbury, & Roland, 2009). Exercise programs for older adults generally consist of four major components: strength, endurance, balance, and flexibility (Frankel, Bean, & Frontera, 2006; Lee, Chan, Chiu, Lee, & Lam, 2015).

Strength. Strength is defined as the instantaneous maximal force generated by a muscle or group of synergistic muscles at a given velocity of movement. As the body ages, strength decreases. Age-related decline in muscle mass can lead to inactivity. To help slow this decline, physical activity plans for older adults should include strength training.

In a randomized control trial conducted by Jorgensen et al. (2013), community dwelling older adults were evaluated pre- and post- 10 weeks using biofeedback based Nintendo Wii training or daily use of ethylene vinyl acetate polymer insoles. The primary endpoints in this study were maximal muscle strength (maximum voluntary contraction) and center of pressure velocity moment during bilateral static stance. The data revealed that the Wii group had higher maximum voluntary contraction strength (18%) than the control group at follow-up. These findings support the use of the Wii in strength training with older adults.

Endurance. Endurance is the ability to maintain a given level of exercise over time or to perform a given task repeatedly without fatigue that prevents further such activity (Frankel, Bean, & Frontera, 2006). As the body ages, a decline occurs in maximum aerobic capacity (V02max) and skeletal muscle performance (Chodzko-Zajko, 2009). Research has shown that conditions such as cardiovascular disease (Gary, 2012) decrease endurance in older adults. Exercise plans must therefore incorporate activities that will promote endurance.

Inactivity is one of the strongest predictors of functional limitations. Kruger, Ham, and Sanker (2008) analyzed data from the 2005 Behavior Risk Factor Surveillance System (BRFSS) for correlates of inactivity among older adults during leisure time. Trained BRFSS staff members interviewed adults 18 years of age or older via telephone in each state using a random-digit dialing method, a standardized questionnaire and computer-assisted telephone procedures. The total BRFSS sample size was 349,901 in 2005; after excluding respondents who did not answer the leisure-time physical activity questions (Kruger et al., 2008). The researchers reported that the overall prevalence of physical inactivity among older adults was 30%, with the highest percentage (42.4%) among women, and noted higher rates of inactivity in those of lower socioeconomic status (49.9%).

Balance and flexibility. Most of the research conducted on balance issues in older adults has been done on falls (Arnold & Faulkner, 2009; Muir, Berg, Chesworth, Klar, & Speechley, 2010). Balance is defined as the ability to maintain an upright posture during both static and dynamic tasks. Age and chronic disease may lead to a

decrease in balance (Frankel, Bean, & Frontera, 2006), which in turn may result in an increased risk of falls (Piirtola & Era, 2006).

Flexibility describes the range of motion (ROM) around a joint or joints in the body (Frankel, Bean, & Frontera, 2006). Ceceil and colleagues (2009) investigated whether regular ROM exercises would have a beneficial effect on balance and flexibility simultaneously in older adults. They reported that daily flexibility group exercise increased ROM and had some effect on improvement on balance as well. Given that the aging process can cause loss of elasticity of connective tissue and reductions in ROM, ROM exercises done regularly can increase flexibility of the trunk and improve functional reach (Ceceil, Gökoğlu, Köybaşi, Çiçek, & Yorgancioğlu, 2009).

The recommendations promulgated from the American College of Sports Medicine [ACSM] (Chodzko-Zajko et al., 2009) for balance with older adults suggest incorporating strength and balance exercises to reduce the risk of falls. There are no specific guidelines for the types, frequency, or duration of these exercises, but there is a recommendation (for flexibility) of at least ten minutes per exercise routine, which would cover static stretch for major muscle and tendon groups (Nelson et al., 2007).

Strength, endurance, balance, and flexibility are all important aspects of physical activity for older adults. For this study, the Nintendo Wii was used as the method to facilitate physical activity among the study participants. The Wii system includes games that allow players to participate in balance and flexibility, and strength training such as the Wii Fit program (Agmon et al., 2011; Daniel, 2012). The Wii Sports package of games was used for this activity intervention. These games allowed the participants to be

in active play, using at least their upper extremities and their lower extremities if able. This particular game package was selected due to its ability to support simultaneous play with more than two players on several games. By engaging in video game play, the participants will be positively affected in their physical activity participation.

Prior Related Behavior

Past researchers have reported that the strongest predictor of exercise behavior is prior related behavior (also referred to as prior exercise behavior) (Ajzen, 1991), with recent researchers agreeing with their findings (Ruppar & Schneider, 2007). Pender et al. (2011) demonstrated that prior related behavior directly affects current health promoting behaviors by stimulating habit formation. Habits gain strength as individuals repetitively practice them over time. Indirectly, prior related behavior also influences current health promoting behavior through perceptions of self-efficacy, perceived barriers, and perceived benefits (Pender et al., 2011).

According to Guerin and colleagues, a history of sedentary lifestyle may result in a decline in regular physical activity (Guerin, Mackintosh, & Fryer, 2008). Ruppar and Schneider (2007) examined the relationship between exercise training and interpretations of 215 community-dwelling older adults by conducting a secondary analysis of a larger randomized controlled trial evaluating cognitive-behavior therapy. The exercise training, which involved flexibility, strength, endurance, and balance exercises, was performed 3 times per week for weeks. During week 2, after the exercise sessions, participants completed the Episode-Specific Interpretations of Exercise Inventory (ESIE). The ESIE contains twenty-nine 9-point bipolar scales assessing perceptions, thoughts, and feelings

about participants' most recent exercise episode. Ruppar and Schnieder found that older adults who reported more exercise behavior scored more positively on the ESIE than those who reported less exercise behavior. Those who had greater exercise experience (high exercisers) reported better perceptions of energy (p=.021), life enhancement (p=.023), and overall psychological outlook (p=.003) than those with less exercise experience (low exercisers).

Barriers to Physical Activity for Older Adults

A barrier is defined as anything that restrains or obstructs progress, access, etc. (Barrier, n.d.). For older adults, barriers are present in many forms regarding their physical activity. Although there are national recommendations in place regarding the frequency of physical activity for this population, they remain among the most sedentary (Chodzko-Zajko et al., 2009). New recommendations for physical activity for older adults living in LTC facilities highlight the complexities of the environment and challenges that are barriers for these older adults (de Souto Barreto, et al., 2016). The new recommendations are listed in two tiers: increasing overall physical activity levels in daily life and exercise training for residents dependent in basic activities of daily living but capable of ambulating/rising from a chair. Under each tier includes five specific recommendations. Recommendations for twice per week exercise training, in sessions that last 35-45 minutes each, are similar to what was done in this current intervention study. The exercise training should include strength training and aerobic exercise.

One of the most common barriers identified in this population is chronic illnesses (Matthews et al., 2010; Patel, Schofield, Kolt, & Keog, 2013; Stathi, Gilbert, Fox,

Coulson, Davis & Thompson, 2012). One in four adults has two or more chronic health conditions (Ward, Schiller, & Goodman, 2014). The impact that these conditions can have on physical activity varies from person to person. However, despite the variation in impact, the mere fact that the illness is present can be seen as reasonable reason to avoid activity. Fear of pain in the chest related to heart disease, fear of falling related to balance issues, and fear of generalized pain due to arthritis are frequently verbalized as physical activity barriers. Multiple chronic diseases are often precursors to disability. One of the most common chronic signs of underlying illness that can affect physical performance is anemia. Among older adults, anemia is significantly prevalent (Sabol, Resnick, Galik, Gruber-Baldini, Morton, & Hicks, 2010). Treating the cause of the anemia will likely improve their physical activity by increasing their blood oxygen supply thereby lessening fatigue.

Another common barrier to physical activity among older adults is the lack of motivation, defined as the act or an instance of motivating; a desire to do or interest or drive (Motivation, n.d.). Some older adults feel that physical activity was a part of their past therefore it doesn't have importance in the present (Matthews, et. al, 2010; Stathi et. al, 2012). Dacey, Baltzel, and Zaichkowsky (2008) examined the differences in intrinsic and extrinsic motives in older adults categorized in three physical activity levels (inactive, active, and sustained maintainers). They recruited 645 community dwelling adults between the ages of 50 and 79 from two primary care practices over a two month period. Written questionnaires, including the Exercise Stage-of-Change scale (which classifies participants into categories based on the trantheoretical model), were completed

during outpatient visits. The researchers found that motivation differentiates activity levels.

Fear of falling remains a common barrier reported among older adults (Matthews, et al., 2010). Thoughts of sustaining a fall and being alone may be difficult to mentally overcome for this population. The injuries that may occur as a result of the fall can also be physically limiting (Resnick, Galik, Gruber-Baldini, & Zimmerman, 2012). Consequently, older adults may be less willing to participate in social activities and thereby self-limit their physical activities (Ruthig, Chipperfield, Newall, Perry, & Hall, 2007). Fear of falling due to poor eyesight and balance often means that exercise is seen as too risky of an activity (Phillips & Flesner, 2013).

In addition to those barriers reported by community-dwelling older adults, the more frequently reported barriers for LTC residents include a lack of adequate staffing (Benjamin et al., 2011)-possibly due to funding cuts (Benjamin et al., 2009)-or lack of time to incorporate residents' physical activity into their routine (Resnick et al., 2008), and a lack of space for physical activity (Benjamin, Edwards, Ploeg, & Legault, 2014). The latter lack together with other environmental constraints (i.e., poor lighting, lack of space for equipment, and lack of corridor seating) have been reported by several researchers (Benjamin et al., 2009; Benjamin et al., 2014; Chen, 2010, Kalinowski et al., 2012; & Phillips & Flesner, 2013), who also noted that several facilities used multipurpose rooms for physical activities which required staff to adjust furniture for these classes. Benjamin et al. (2009) also reported that a lack of a spacious hallway

design to facilitate residents navigating the space posed additional blocks to physical activity.

Resident health status poses an additional barrier in long-term care (Chen, 2010; Guerin et al., 2008). Families will at times not encourage activities due to their fear of causing pain or shortness of breath to the resident (Resnick et al., 2006). Nursing assistants often encounter anxiety and agitation from residents which may cause them to avoid suggesting physical activity (Galik et al., 2009). Sedentary activities are sometimes encouraged to help facilitate completion of personal work, thus preventing physical activity (Galik, et al., 2009). This type of behavior over time can lead to further functional decline and disability.

Benefits of Physical Activity

Reducing the risk of chronic disease and their complications is one of the main benefits of regular physical activity (Nelson et al., 2007). Vogel et al. (2009) suggested that physical activity has a therapeutic effect on coronary heart disease and hypertension. Various researchers have shown that physical activity improves or slows the progression of diseases such as lipid disorders (Halverstadt et al., 2007), diabetes (Jeon, Lokken, Hu & van Dam, 2007), stroke, and dementia (Larson et al., 2006). The benefits of physical activity are numerous for all age groups. For those living in LTC facilities, the benefits of physical activity are varied. Research has shown that physical activity among these residents can improve their ability to perform activities of daily living (ADLs), have positive effects on depressive symptoms, and improve strength and physical function in older adults (de Souto Barreto, et al., 2016).

Mammen and Faulkner (2013) suggested that physical activity improves depression. Physical activity also acts as a protective factor for older adults with depression (Lee et al., 2014). Gaboda et al. (2011) suggested that depression is underdiagnosed and undertreated among nursing home residents. Ku and colleagues (2012) examined the reciprocal relationship between changes in physical activity and depressive symptoms in Taiwanese older adults over an 11-year period. They reported that physical activity in later life is associated with a lower risk of depressive symptoms.

Regular exercise has been shown to reduce the risk for or delay the onset of dementia in older adults (Rolland, Abellan van Kam, & Vellas, 2008). Researchers found that resistance training improved global cognitive function with maintenance of executive function over an 18 month period (Fiatarone-Singh et al., 2014). Exercise also can reduce agitation in those with cognitive impairments (Aman & Thomas, 2009).

Disability is defined as the inability and or limitations in performing social roles and activities encountered in daily life. According to Fern (2009), another benefit of physical activity for older adults is a delay in disability, although the effect of physical activity on functional limitations often depends on baseline function (Baruth et al., 2011). The literature thus suggests that, in older adults, the effect of physical activity is to prevent worsening of functional ability.

The Health Promotion Model

The Health Promotion Model (HPM) has been used in many research studies spanning several years. Various researchers have used the HPM to examine health promoting behaviors among Korean elderly women (Shin, Kang, Park, Cho, &

Heitkemper, 2008), adolescents (Srof & Velso-Friedrich, 2006), and with older Chinese people (Kwong & Kwan, 2007). The characteristics and results of these selected studies are summarized to provide a brief overview of how the model has been used to frame research. The following section will give further details regarding the use of the HPM with older adults.

Health Promotion Model and Physical Activity in Older Adults

The HPM is a widely accepted model for predicting health promoting behavior (Pender et al., 2011); however, the model has not been used as extensively with older adults. Six studies were identified that used the HPM when examining older adults' health behaviors (Anderson & Pullen, 2013; Bryam-Williams & Salyer, 2010; Kwong & Kwan, 2007; Morowatisharifabad, Ghofranipour, Heidarnia, Ruchi, & Ehrampoush, 2006; Padula & Sullivan 2006; Shin et al., 2008). Anderson and Pullen (2013) conducted research examining whether the cognitive-based Physical Activity with Spiritual Strategies (PASS) intervention (which used spiritual strategies) would increase physical activity behaviors (compared with a control group) in African American women ages 60 and older from four faith communities. The intervention consisted of a weekly 90 minute session over 12 weeks during which the participants discussed one of the HPM concepts, set goals, and used the walking and muscle strength activities in the investigator-developed workbook, "PASS to Better Health." Participants were given "contract calendars" to track their time spent in physical activity. Anderson and Pullen reported significant between-group findings favoring their intervention in muscle strength activity (minutes per week, $z=-3.269$, $p=.001$; days per week, $z=-3.384$, $p=.001$) and in the

reduction of barriers, (z=-2.184, p=.029). Their results demonstrated that older women with varying functional levels who completed the PASS intervention had more improvements in physical activity

Bryam-Williams and Salyer's (2010) study examined factors influencing the health-related lifestyle of 130 community-dwelling men and women 65 years of age and older in a congregate meal program to gain information that would guide future interventions to encourage healthy lifestyle changes. Participants took a self-administered questionnaire comprised of five measures, including a demographic instrument: the Perceived Health Competence Scale, the Barrier Scale, the Lubben Social Network Scale, and the Health Promoting Lifestyle Profile II. Although the investigators found no significant differences in healthy lifestyle between age groups (F=1.02, p=.36), race (t=-0.22, p=0.83), or educational level (F=0.559, p=0.73), they did note that women reported more healthy lifestyles than men, and those who reported high self-efficacy practiced a healthier lifestyle, corroborating the associations between these constructs.

Kwong and Kwan (2007) used the HPM to determine factors affecting the health-promoting behaviors and barriers to those health-promoting behaviors in a sample of 896 community-dwelling older Chinese people in Hong Kong. The investigators measured the factors (constructs) of perceived self-efficacy, perceived benefits, and individual characteristics using individual face-to-face interviews and three questionnaires – the Heath-Promoting Behavior Scale (HPBS), the Health-Promoting Behavior Self-Efficacy Scale (HPBSES), and the health-Promoting Behavior Benefit Scale. The HPBS was

created from a modified Health Promotion Lifestyle Profile II and the HPBBS was developed from a modified Exercise Benefits Scale. Kwong et al. found that self-efficacy ($r=0.57$, $p=<0.001$) and perceived benefits ($r=0.31$, $p=<0.001$) were positively related to health promoting behavior in this population and that Chinese women were more likely to participate in health promoting behaviors than their male counterparts. However, they noted that 62% of the total variance in health promoting behavior remained unexplained in this group and recommended further research on barriers to health promoting behavior.

Morowatisharifabad, Ghofranipour, Heidarnia, Ruchi, and Ehrampoush (2006) examined the relationship between self-efficacy and health promotion behaviors of 102 Iranian older adults living in their own homes using the HPM as a guide. They conducted face-to-face interviews using the Health-Promoting Lifestyle Profile II and the Self-rated Abilities for Health Practices Scale. Corroborating other reports on self-efficacy as a strong predictor of engagement in health promotion, Morowatisharifabad et al. found a significant relationship between self-efficacy and the health promotion behaviors of older Iranian adults ($r=0.76$).

Padula and Sullivan (2006) examined the effects of perceived barriers, self-efficacy, social support, and relationship quality and the dependent variable of health promoting behavior using a sample population of 40 older adult long-term married couples (80 individuals). The investigators defined a long-term marriage as one of 30 years' duration or longer (the study average was 44 years). Study measures included the Barriers to Health Promoting Activities Scale, the Self-Rated Abilities for Health

Practices Instrument, the Social Relationship Scale, the Quality of Marriage Index, and the Health Promotion Activities of Older Adults tool. The investigator conducted the study over a 9-month period; participants completed questionnaires separately (usually in separate rooms) in their homes. Consistent with other reports they found that perceived barriers (p=.0041) and self-efficacy (p=.0338) independently predicted 21% of the variance in participation in health promotion. Relationship quality (p=.042) and social support (p=.025) independently predicted 11% of the variance on participation in health promotion activities.

Shin et al. (2008) tested the use of the HPM with low income Korean elderly women. According to the Korea National Statistical Office (2001), the prevalence of chronic illness among elderly Korean women aged 65 and above is 92.2%, compared to 74.4% in Korean men. Their sample of 389 low income women was recruited from two public health centers. The researchers conducted one time face-to-face interviews with study participants that lasted 20-30 minutes each. Study measures included the Prior Health-Related Behavior Scale, the Self-Esteem Scale (Korean version), the revised Kim's Scale, the revised Seo's Scale, the revised Youn and Kim's Scale, the Park Social Support Scale, and the revised Health Promoting Lifestyle Profile II (Korean version). Shin et al., using structural equation modeling, found that 73% of the variance in health promoting behaviors of Korean elderly women was explained by prior health-related behaviors, biological, psychological and sociocultural factors, behavior-specific cognitions and affect, environmental influences, and commitment to a plan of action.

Although only a few studies have specifically used the HPM with older adults, the literature does suggest that the model is feasible for use with older adults. Self-efficacy, perceived benefits and barriers, and social support are frequently used constructs in the model and predictors for health behavior (Pender et al., 2011). Among older adults, self-efficacy appears to be the most common construct evaluated. Health promotion activities can help older adults prevent or control health problems, decrease disability, and improve well-being.

Self-Efficacy

Pender et al. (2011) defined self-efficacy as the individual's judgments of personal capability to carry out a particular course of action. Derived from the Social Cognitive Theory (SCT), self-efficacy is a complex construct that also influences participation in various activities and determines the amount of effort exerted in seeking out the activity (Du, Everett, Newton, Salamonson, & Davidson, 2011). The influence of self-efficacy on any health promoting behavior is well known (Bandura, 1997).

According to Bandura (1997), self-efficacy has four main influences: (1) mastery experiences, which results from the individual's positive experiences and successes produced by acquiring the needed tools for creating and executing appropriate courses of action; (2) vicarious experiences of others similar to the individual succeed by persistent effort; (3) social persuasion of the individual by others through verbal encouragement highlighting of the individual's capabilities and, (4) the individual's physiologic and emotional state and the effect that it has on the behavior. To build a sense of self-

efficacy, a person must develop the skills to influence their own motivation and behavior (Bandura, 1997).

Self-efficacy has strong predictive value with respect to physical activity (McAuley et al., 2011a; Srof & Velsor-Friedrich, 2006). Self-efficacy has been frequently examined in the context of older adults and physical activity (Dattilo, Martire, Gottschall, & Weybright, 2014; Liu, Galik, & Resnick, 2015; McAuley et al., 2006; Mullen, McAuley, Satariano, Kealey, & Prohaska, 2012; Resnick, Luisi, & Vogel, 2008). Dattilo and colleagues (2014) recently conducted a small (n=6) study of the feasibility of an eight week walking program (three 90-minute sessions per week) among ambulatory older adults, four women and two men from a retirement village, who had a fear of falling. The program, which used a multidimensional approach to promoting lifestyle changes, included the B-Active educational program, which is designed to teach older adults how to become more self-efficacious and self-determined so that they enjoy being physically active by walking. Results from this study indicated that the B-Active program was feasible and acceptable to older adults, with an average participant attendance of 83% (20 sessions). Participants responded positively on the interview questions regarding the B-Active program (reporting unanimous support of pedometer use, indicating increases in walking self-efficacy and gait performance) and walking duration. Self-efficacy scores increased pre- to post-test ($Z=2.02$, $p<.05$).

Mullen and colleagues (2012) used data from the Healthy Aging Network Study to examine the relationships among physical activity, self-efficacy, functional performance, and limitations in 884 older adults in 4 geographic regions across the

United States. They assessed walking behavior and self-efficacy, way finding self-efficacy, functional performance, functional limitations, and demographic characteristics. The way-finding self-efficacy construct was based on two items (used in wellness assessments at one of collaborating institutions) reflecting participants' confidence in their capability to (a) find their way on foot to places they wanted to go in their neighborhood and (b) to find their way on foot if they encountered detours or obstacles. Using structural equation modeling, they found that walking more frequently and for longer durations was positively associated with participants' beliefs in their capability to find their way in compromised environments and walking incrementally further distances [overall model fit=(X^2=71.933 (64), p=.232)]. Walking self-efficacy was positively associated with having better lower extremity function and fewer lower body function limitations.

The Senior Exercise Self-Efficacy Project (SESEP) is an example of an intervention designed with the knowledge of the influences of self-efficacy (Resnick, Luisi, & Vogel, 2008). The SESEP, which was a feasibility study using a randomized controlled trial design, included 166 minority urban dwelling older adults in the Brooklyn or South Bronx/Upper Manhattan areas of New York, and combined physical activity and efficacy-enhancing education for all participants. Classes were held twice a week for 1-1.5 hours over a 12 week intervention period, with the efficacy-enhancing component given once per week during the first class of the week for 30 minutes. Topics included the four influences of self-efficacy as well as information on positive outcome expectations. The physical activity component was facilitated by two non-professional

exercise trainers who were trained by the interventionist. Participation in the SESEP classes was an average of 77% and 62% participation in follow-up testing. Resnick et al., reported a significant increase (p=.02) in outcome expectations (defined as the associated physical and mental health benefits of exercise) for exercise and increased time spent in exercise.

Self-efficacy and physical activity have been shown to have indirect effects on quality of life (McAuley et al., 2006), can be influenced by spousal characteristics (Ayotte, Margrett, & Patrick, 2013), and have been used in empowerment interventions with other ethnic groups of older adults (Chang, Fritschi, & Kim, 2013). Bandura (1997) states that lifelong health habits are formed during childhood and adolescence and are rooted in familial practices. Pender et al. (2011) includes self-efficacy as a variable within the HPM.

Physical Activity Interventions in Long-Term Care

Various researchers have conducted physical activity intervention studies in LTC facilities (Chen, Hsu, Chen, & Tseng, 2007; Jansen, Claben, Hauer, Diegelmann, & Wahl; 2014; Keogh, Power, Wooller, Lucas, & Whatman, 2014; Liu & Hu, 2015; Mulasso, Roppolo, Liubicich, Settani, & Rabaglietti, 2015). Because most residents in nursing homes spend a great deal of time idle (Chen et al., 2007), interventions need to be focused on the residents' needs and preferences to reduce functional decline and increase health. While the improvement in social functioning is a positive outcome of certain interventions (Chen et al., 2007), there are certain technologies, such as pedometers, that are used in the community that may not be applicable to this vulnerable population.

Evidence has shown that gait speed, which is notably slower in resident of long-term care facilities, can compromise pedometer accuracy. Thus, innovative and tailored interventions, such as those using video games, are needed to enhance physical activity in those residing in nursing homes.

Restorative care (Res-Care), now called Function Focused Care 4 (FCC), is a philosophy which views physical function as a dynamic process in which clinicians can help residents with functional limitations compensate so that progress to disability is slowed (Resnick, Galik, & Boltz, 2013). For residents in LTC facilities, maintaining function and physical activity can positively affect quality of life and physical health (Resnick, et al, 2009). The interventional form of the Res-Care philosophy is a two-tiered self-efficacy based approach that focuses on the following: Tier 1: teaching the nursing assistants (NA) the philosophy of and skills associated with Res-Care (weekly 30-minute educational sessions conducted by advanced practice nurses over six weeks); Tier 2: motivational intervention and directions given to the NAs by the Res-Care nurse coordinator (RCN) "champion," who assists them in motivating and engaging residents in functional and physical activities (20 hours per week with facility staff for the 12 month study period) (Resnick et al., 2009).

The Res-Care intervention has been used in long-term care (Resnick et al., 2009), assisted living (Resnick, Galik, Gruber-Baldini, & Zimmerman, 2009), and with cognitively impaired residents (Galik et al., 2008; Galik, Resnick, Hammersla, & Brightwater, 2013). In the assisted living environment, which typically has more functionally independent residents, this intervention demonstrated improvements in

participation in functional tasks and increases in social support for exercise (Resnick et al., 2008). For those that are cognitively impaired, exposure to this type of care resulted in improvements in function and increased time of physical activity (Galik et al., 2013). Consistent use of this care philosophy will not only ensure positive outcomes for residents but will improve workload for facility staff.

Generally residents in the assisted living environment are more ambulatory and have less comorbidity. Pope and colleagues tested a strength and balance program on frail elders in ALF over a 10 month period (Pope, Lane, Tolma, & Cornman, 2008). Participants received the Placemat Strength Training Program (PSTP) intervention 3 times per week. The PSTP intervention included printed visuals of the place mat as an exercise guide for participants. The front of the laminated place mat continued written instructions that explained the benefits of improving functional fitness: the back of the mat had a check box for each day of the week so that users could check off the days they completed the exercises (Pope et al., 2008). The researchers determined the need for more appropriate measures of functional status within the assisted living population. Giuliani et al. (2008) examined the relationships between resident and facility level characteristics and physical performance and its role as a predictor of adverse outcomes in the ALF setting and found 57% of participants were independent in all seven activities of daily living (ADL), indicating positive results for physical performance. Data were analyzed from the Collaborative Studies of Long-Term Care (CS-LTC), a study of 2078 residents in 193 residential care/assisted living facilities in Florida, Maryland, New Jersey, and North Carolina.

Pomery and colleagues (2011) investigated the impact of person-environment fit (P-E Fit) on the physical activity and functional performance of residents living in traditional nursing homes and in "Welcome Homes" (WH). (Welcome Home is the label for a culture-change initiative at a specific facility which strives to mirror living in a home environment). They used a repeated measures design (data obtained at baseline and four months) that included participants from the WH units matched with a control group of residents from the traditional nursing home (TNH) (total of 27 residents with a mean age of 87.4 years). The results of their study revealed that a better P-E Fit was associated with more physical activity and more independent function.

Maintaining physical activity among nursing home residents should be a focus of facility administrators, medical providers, and therapists. Since prolonged inactivity can result in permanent disability, older adults need to be educated on the importance of remaining active. Resistance and functional skills training conducted twice weekly can improve fitness and performance of residents of nursing homes (Chin A Paw, van Poppel, Twisk, & van Mechelen, 2006). In Phillips and Flesner's (2013) study of the perspectives and experiences of elders' physical activity in LTC, participants indicated that exercise helped to maintain function. What remains uncertain is how to develop appropriate programs within this environment that are cost effective, feasible, and that yield positive physical activity outcomes for the residents.

Newly formed recommendations for physical activity and exercise for older adults living in LTC were presented by a task force of experts in LTC and geriatrics (de Souto Barreto et al., 2016). These recommendations are presented in two tiers: how to

decrease sedentary time among residents and incorporate exercise training for specified groups within the facilities. To decrease the amount of sedentary time in these residents, the recommendations include the following task to facilitate increasing overall physical activity levels daily: including motivation and pleasure in overall activity, including break times at lease 2-3 times per day to break up sedentary time, using strategies to facilitate resident movement, organizing group activities that are motivating and pleasant, and including innovative solutions, such as animal interventions or new technologies, to increase resident overall physical activity. To implement these recommendations, suggestions were made for assessing resident's desires and preferences toward physical activity, involving the leadership of the LTC facilities in the decisions regarding how to implement, using volunteers to assist in meeting the physical activity goals for the residents, and promoting the benefits of physical activity on the resident's overall health.

Nintendo Wii ™ Use as a Physical Activity Intervention

Video games have been in existence since the advent of the video arcade in the 1970s (Shubert, 2010). Over the years the technology has improved and people are now able to enjoy games in the privacy of their homes. Video games initially consisted of consoles and controllers, but today many video games include more physical activity. Exergames, or games that include an informal exercise component (Ulbrecht, Wagner, & Gräbel, 2012), allow a player to use his/her entire body to play if needed. Health games have been developed recently to encourage participants to engage in healthy behaviors.

The most widely used and most researched gaming system to date is the Nintendo Wii™, developed in 2006. The Nintendo Corporation introduced the Nintendo Wii™ as

their seventh generation gaming console, distinguished from other video gaming systems by its wireless motion-sensitive controllers. The Wii console also has other attachable parts that allow the players to be active while playing the game. Since that time the Wii console has been used by all ages and has begun to show some therapeutic and health benefits in certain patient populations.

Several studies have used the Nintendo Wii™ with varying outcome results. This video game system has been used in clients post- cerebral vascular accident (Drexler, 2009), clients with fall risk (Clark & Kraemer, 2009), clients with balance deficits (Bainbridge, Bevans, Keely, & Oriel, 2011), frail older adults (Daniel, 2012) and patients with upper extremity dysfunction (Hsu et al., 2011). Effectiveness of this gaming system cannot be generalized due to small sample sizes in most studies. Further research needs to be conducted to test the system's effectiveness with different populations in randomized control trials.

Use of Wii with Older Adults

Twenty-four studies from the literature published between 2009 and 2014, which used the Nintendo Wii with older adults, were reviewed. The studies varied in their description of the sample characteristics, setting, research design, intervention dose, and study focus. The following is an overview of the findings.

Sample characteristics. Convenience sampling was used in the majority of the studies; participants were recruited from independent living apartments, continuing care retirement communities, nursing homes, senior centers, assisted living facilities, and community dwelling older adults. Participant's ages ranged from 60 to 95 years. Sample

sizes ranged from *n* = 1 (Clark & Kraemer, 2009; Drexler, 2009) to *n* = 79 (Ulbrecht, Wagner, & Grabel, 2012). Five studies recruited only females (Clark & Kraemer, 2009; Taylor, 2012; Ulbrecht et al., 2012; Wollersheim et al., 2010; and Yamada et al., 2011). One study reported race and ethnicity (Daniel, 2012).

Research design. The majority of the studies used pre-posttest designs (Agmon et al., 2011; Bainbridge et al., 2011; Chao, Scherer, Wu, Lucke, & Montgomery, 2013; Griffin, McCormick, Taylor, Shawis, & Impson, 2012; Heick, 2012; Hsu et al., 2011; Kahlbaugh et al., 2011; Rendon et al., 2012; Taylor, McCormick, Griffin, Shawis, & Ewins, 2012; Ulbrecht et al., 2012; Williams et al., 2011). Two studies were case reports (Clark & Kraemer, 2009; Drexler, 2009) and three studies were pilot studies (Daniel, 2012; Rosenberg et al., 2010; Wollersheim et al., 2010). Two studies used mixed methods quasi experimental design (Keogh, Power, Wooller, Lucas, & Whatman, 2012; Keogh et al., 2014). Five studies did not explicitly identify their research design. Only one study (Chao et al., 2013) identified a theoretical framework (Bandura's Self-Efficacy theory).

Intervention duration and dose. The interventions were conducted over periods ranging from 2 weeks (Clark & Kraemer, 2009) to 24 weeks (Reed-Jones, Dorgo, Hitchings, & Bader, 2012). The dosage of the interventions ranged from once per week (Ulbrecht, Wagner, Grabel, 2012) to three times per week (Agmon et al., 2011; Bateni, 2012; Clark & Kraemer, 2009; Daniel, 2012; Drexler, 2009; Rendon, et al., 2012; Rosenberg et al., 2010; Williams et al., 2011). The standard dose for the majority of studies was three 30-minute sessions per week.

Study focus. Much of the use of the Nintendo Wii™ with older adults has been focused on balance issues (Agmon, et al., 2011; Bainbridge, et al., 2011; Bateni, 2012; Heick, et al., 2012; Reed-Jones, et al., 2012; Rendon, et al., 2012; Taylor, 2011; Williams, et al., 2011; Young, Ferguson, Brault, & Craig, 2011). The balance board feature, (part of the Wii Fit software package), is the most frequently used component of this game experience. The balance board has been shown to be safe for use with older adults (Agmon, et al., 2011) and effective for increasing balance in elderly with no significant medical conditions (Williams, et al., 2011). A few researchers have used the measure of the Berg Balance Score (BBS) with their Wii intervention and found no significant change in the BBS (Bainbridge, et al., 2011) but Bateni (2012) reported an increase in the BBS reported as medians and interquartile ranges [47 (37-50)]. Heick, et al. (2012) found a statistically significant improvement in the Timed Up and Go (TUG) test (used to assess fall risk in older adults [Picone, 2013]) and the Functional Reach Test (FRT) (measures fall risk in older adults).

Drexler (2009) reported improvements in a post cerebral vascular accident patient's fine motor dexterity as a result of the use of the Wii, together with care from a therapist. Daniel (2012) conducted a randomized controlled trial over a 15 week period aimed at decreasing indices related to frailty in older adults. Participants were placed into one of three groups: control, seated exercise, or Wii-fit. The physical activity measures included the Senior Fitness Test, which includes chair stands, arms curls, six minute walk, sit and reach, and the TUG, and the CHAMPS questionnaire. Daniel noted improvement in the Wii-fit group with respect to the physical performance scores on

several measures of the Senior Fit Test as well as caloric expenditure and balance confidence (Daniel, 2012). Rosenberg et al. (2010) examined the use of Wii with community dwelling older adults with subsyndromal depression. Their study confirmed improvement in depressive symptoms, mental health-related quality of life, and cognitive performance. Ray, Melton, Ramirez, and Keller (2012) compared the impact of a traditional group fitness class with that of a Wii fitness program (both consisting of three sessions per week for 15 weeks) on older adults' ability to maintain postural control with an environmental distractor. They found that both the traditional and the Wii fitness programs were successful at improving postural control and fitness. Ulbrecht, Wagner, and Grabel's (2012) examined whether their sample of 79 nursing home residents with dementia would accept the exergames (Wii) and get to know their characteristics. They conducted the game play intervention once a week for eight weeks and measured cognitive function using the Mini-Mental State Examination (MMSE). The researchers discovered that those subjects who accepted the exergames were younger, had less cognitive impairment, and had increased interest in more hobbies. Finally, Wii play has also been shown to decrease loneliness and increase positive mood among older adults (Kahlbaugh, et al., 2011).

Despite the numerous ways in which the Wii is used in this population, it is not without problems. The condition termed "wiiitis" was developed after prolonged participation in video game play (Nett, Collins, & Sperling, 2008). Overuse of video game play can cause swelling in the arm resulting in shoulder and upper arm tendonitis (Bonis, 2007). Additional Wii related injuries include epistaxis, clavicular fracture,

patellar dislocation (‘Wii knee’), multiple lacerations, quadriceps sprain, and ankle sprains (Sparks, Chase & Couglin, 2009). However, since the majority of injuries reported have occurred in younger adults, the use of Wii with older adults continues to have potential. Over the past few years more research interventions using the Wii have been published. Outcomes vary depending on the studies’ variables.

Summary

The literature review presented describes an overview of physical activity among older adults, including those residing in LTC facilities. The HPM is the conceptual framework used to examine the influence of barriers, benefits, and self-efficacy on physical activity. The HPM contains the variables that will be tested in my study. The model contains a variable for prior related behavior, not presented in other health behavior theories, which is known to influence current health behavior. Furthermore, the lack of studies conducted in LTC facilities that explore health promotion within this environment was made evident. Therefore future research needs to be done within LTC facilities that examine these variables.

The use of video game technology among older adults has been identified as a possible avenue for health related benefits. Although its use has been fairly recent, video games such as the Nintendo Wii have been shown to have positive health outcomes (Chao et al., 2013). Interventions have been conducted among older adults in long-term care that demonstrate the feasibility of its use (Agmon et al., 2011; Rendon et al., 2012). This research study was different from other interventions because it presented data using video game technology with skilled nursing home residents that was guided by a

conceptual model. Further, this research adds to what is currently known about the use of video games with older adults and its influence on physical activity.

CHAPTER III

METHODS

The following chapter presents the methodology for the current study. A description of the research design and setting is given. The sample for this study included older adult residents living in LTC facilities. The intervention procedure is detailed as well as the measures for the study outcomes. This intervention was designed to address the following questions:

1. What are the percentages of older adults living in a long term care facility who report being currently physically active and have previous experience using some form of technology (computer, video games, etc)?
2. What are the relationships among personal factors, perceived barriers, perceived benefits, self-efficacy and the health promoting behavior (physical activity)?
3. Do prior related behaviors, personal factors, perceived benefits, barriers, and self-efficacy predict physical activity at baseline in nursing home residents?
4. What are the effects of a 6-week intervention using Wii-Video gaming on perceived benefits, barriers of exercise, self-efficacy and physical activity among nursing home residents?

Design

The research design selected for this intervention study was a one group pretest posttest quasi-experimental design. Quasi-experimental design, unlike randomized

experimental design, does not include random assignment of its participants (Gliner, Morgan, & Leech, 2009). It is similar to randomized experimental design in that the independent variable is active and usually has multiple levels (Gliner et al., 2009). Quasi-experimental designs manipulate the treatment to force it to occur before the effect. Data were collected at pre and post intervention. The health promoting behavior for this study was defined as physical activity and operationalized using a self-report survey. The treatment for this study was the education guided physical activity intervention using a video game, the Nintendo Wii. The educational portion of this study was adapted from the National Institute of Aging's *Go4Life* Exercise and Physical Activity guide.

Setting

This intervention study was conducted in four long-term care (LTC) facilities in and around the city of Greensboro, North Carolina (within a 40 mile radius). These LTC facilities identified were contacted by the researcher for study approval. Each facility provided short-term rehab and long-term care to its residents, along with semi-private and private patient rooms. Each facility contained a dedicated space with a television in where the intervention took place. This space was identified by the staff liaison, who was the activity director of the facility. One facility did not have a Nintendo Wii onsite, so the PI brought the video game to the facility for use during the intervention period.

Sample

The sample consisted of residents living in the long-term care facilities selected for this intervention. Convenience sampling was used for the recruitment of participants who met these inclusion criteria:

1. Age 55 years old and above
2. Been a nursing home resident for six months or more and planning to continue to reside there (long-stay residents)
3. English speaking
4. Cognitively intact as evidenced by Mini-Cog Cognitive Assessment score (cutoff score of ≥3 indicative of negative screen for dementia)
5. Cardiac stability as evidenced by clearance from attending physician or associate
6. Anticipated length of stay of 6 weeks (intervention period) or longer
7. Ability to use at least their hands, fingers, and upper extremities without limitation (for game play)
8. Ability to ambulate or be seated in a chair/wheelchair independently

An *a priori* power analysis was conducted using G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the appropriate sample size. To detect a medium to large effect size of 0.62 using a two-sided paired t-test, an alpha level of 0.05, and 80% power this study needed at least 24 participants total after accounting for 20% attrition.

Recruitment

All residents of the LTC facilities who met inclusion criteria were approached by the liaison for interest in participating. The role of the facility liaison as mediator between the PI, the intervention participants, and facility staff in whatever capacity was needed. Additionally, recruitment flyers were distributed to all liaisons and announcements about the intervention were made at the resident council meetings, if applicable to that facility. The facility liaison compiled a list of residents' names that met study criteria, asked if they were interested, and notified the researcher of their interest. The PI then met with each potential participant, explained the study, and answered any questions. Information sessions were held at the facility for residents and staff at least 2 weeks prior to the start of the 6 week intervention period. During this session, the researcher provided an overview of the intervention and answered any questions regarding the study. Bias was minimized by selecting every accessible person who met the criteria (Hulley et al., 2007). Those who indicated a willingness to participate were put on a list for obtaining consent. Consent was obtained from those who met the study criteria in a private face-to-face meeting with the PI. Data were collected during a face-to-face interview with participants in their assigned rooms within the facility.

Data Collection Procedure

After obtaining consent, demographic sheets were completed for each qualifying participant. Data collection was conducted during a pre-intervention appointment scheduled at least one week prior to the start of the intervention. Post- intervention appointments were conducted one to two weeks following the 6 week intervention

period. The PI read and completed all measurement tools for each participant. Each pre-intervention data collection session lasted approximately 30-45 minutes. Each post-intervention data collection session lasted approximately 30 minutes.

Intervention Protocol

Intervention Purpose

The purpose of this intervention was to examine the use of video gaming with residents within long-term care and examine its effects on physical activity, perceived barriers and benefits, and self-efficacy. The intervention was specifically for older adults living in skilled nursing facilities. The Nintendo Wii was the video game of choice for this intervention. Additionally, age specific education on physical activity was provided in each session using the NIA *G04Life* Exercise & Physical Activity guide (NIA, 2011).

Intervention Description

Participants were divided into groups of four. The Wii Sports game was used for this study. The Wii Sports package contains five games: Tennis, Bowling, Boxing, Golf and Baseball. For this study participants had the option to choose between tennis, bowling, and golf because these are the only games in which up to four players can play simultaneously. At each facility, bowling was the game of choice selected. Participants began each play session with range of motion (warm-up) exercises (5 minutes) based on the National Institute on Aging recommendations for physical activity for older adults and then proceeded to play. The intervention sessions were 45 minutes in length,

including a 15 minute educational component each session. Overall participants remained engaged in the sessions throughout the intervention.

The PI demonstrated to the participants the common motions used in bowling. The bowling game allowed for simultaneous play of four participants at a time. Each player used the wireless controller to roll the bowling ball down the lane using an under hand throw. To roll the ball down the lane, participants had to press and release the "B" button on the controller as their arm swing was in process. Each participant had the opportunity to roll twice during their turn in game play. Game play sessions ended when ten frames of bowling were complete or the session time ended.

At the beginning of the bi-weekly sessions, education was provided to participants based on materials developed from the National Institute on Aging (NIA, 2011). The NIA has implemented a national campaign entitled *Go4Life* designed to assist older adults with incorporating exercise and physical activity into their daily lives (NIA, 2011). *Go4Life* also provides information for professionals to help older adults overcome barriers to physical activity (NIA, 2011). This intervention used this educational resource as a guide for communicating the need for physical activity to the study participants.

Each week a different educational topic was presented. Table 1 outlines the education based upon the HPM concepts. Topics discussed included an introduction to the Nintendo Wii and goal setting, a discussion of the types of physical activity, safety with physical activity, benefits of physical activity, barriers of physical activity, and intervention accomplishments.

Table 1. Educational Components of Intervention Based on Health Promotion Model

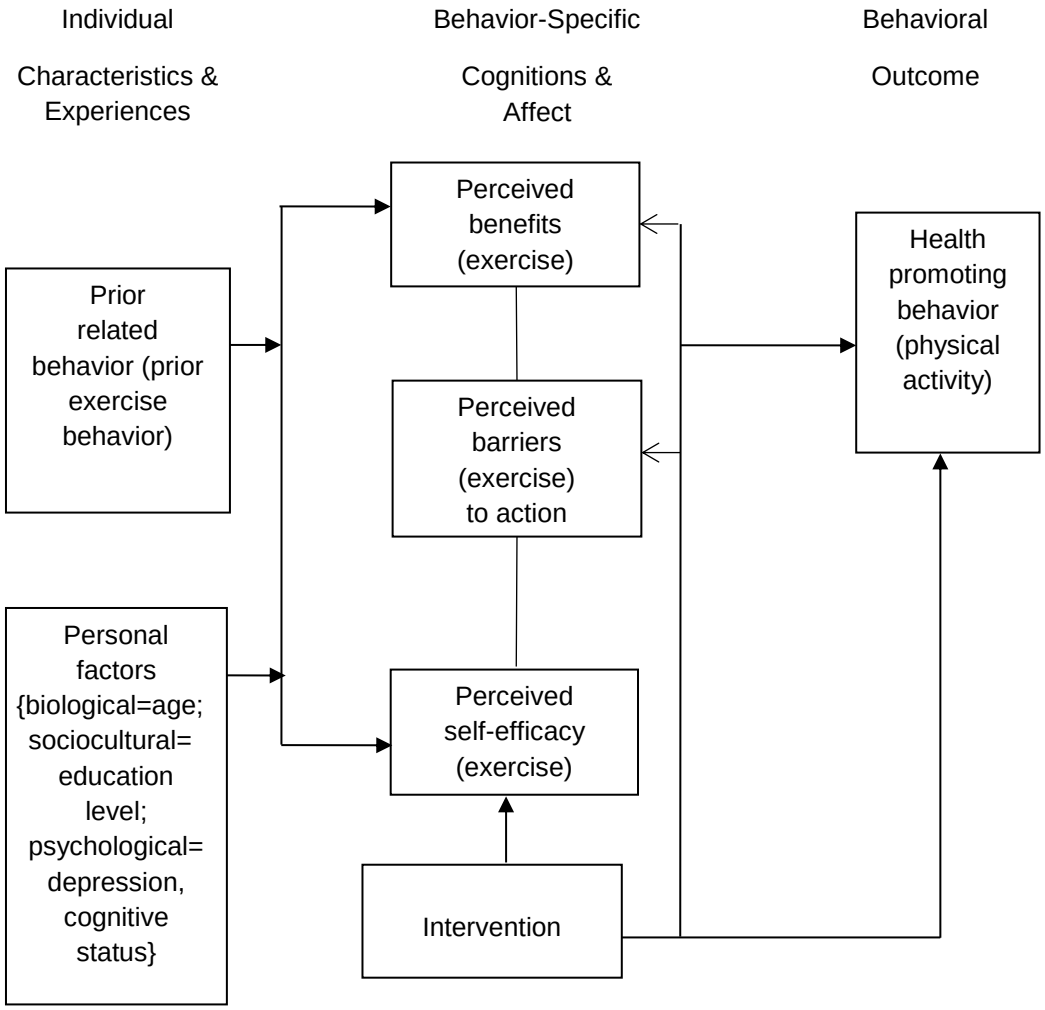
Components of HPM	Week	Health Education Topic	Intervention Strategies	Teaching Methods	Standards of Physical Activity for Older Adults
	Pre-screening	Pre-intervention surveys, demographics	1.Discuss prior exercise behavior and current exercise performance	Discussion Question and Answers	
	Week 1	Introduction to the Wii	Education on the Wii and the how it is used 1.Goal setting (short/long) for exercise	Demonstration Group Discussion	Goal Setting pg. 18-19 *Go4Life* Exercise and Physical Activity Manual
Health Promoting Outcome (Physical Activity)	Week 3	Staying safe and preventing injury while participating in physical activity	1. PI to monitor participants for pain or other symptoms associated with exercise 2.Discuss the need for rest breaks if pain or fatigue experienced with exercise 3.Wii Game Play	Group Discussion Question and Answers	Safety pg. 33 *Go4Life* Exercise and Physical Activity Manual
Perceived Barriers	Week 4	Identifying barriers to physical activity	1.Using information from the NIA booklet to discuss exercise barriers 2. Allow for participant discussion of personal obstacle with physical activity 3.Wii Game Play	Group Discussion Question and Answers	Barriers Pg 28-29 *Go4Life* Exercise and Physical Activity Manual

Perceived Benefits	Week 5	Identifying benefits to physical activity Types: Endurance Strength Balance Flexibility	1.Using information from the NIA discuss exercise benefits 2. Allow for participant discussion of personal victories relating to physical activity 3.Wii Game Play	Group Discussion Question and Answers	Benefits Pg 11, 31, 36-37 *Go4Life* Exercise and Physical Activity Manual
Health Promoting Outcome (Physical Activity)	Week 6	Open discussion of accomplishments since starting the program	1. Allow for participant discussion regarding accomplishments	Group Discussion	Keep going! 91-93, 101 *Go4Life* Exercise and Physical Activity Manual
	Post-screening	Post-intervention surveys			

The theoretical framework that guided this intervention was the Health Promotion Model (Figure 2). The constructs of the model and the corresponding measures used in this study are outlined in Table 2. The independent variables include prior related activity, personal factors, perceived benefits and barriers, and self-efficacy. The dependent variable identified for this study is the health promoting behavior, which is physical activity.

Figure 2. Intervention Diagram based on the Health Promotion Model

(study variables included under model variables)



Source: Adapted the revised Health Promotion Model (Pender, Murdaugh, & Parsons, 2006 pg. 50)

Table 2. Constructs of the Health Promotion Model with Corresponding Measurements

Concept	Variable	Measure	Data Collection
Behavior-Specific Cognitions and Affect	Benefits to physical activity	Exercise Benefits/Barriers Scale (1987)	Pre-test, Post-test
Behavior-Specific Cognitions and Affect	Barriers to physical activity	Exercise Benefits/Barriers Scale (1987)	Pre-test, Post-test
Behavior-Specific Cognitions and Affect	Self-Efficacy for physical activity	Self-Efficacy for Exercise Scale (2000)	Pre-test, Post-test
Individual Characteristics and Experiences	Personal Factors (biological, psychological, sociocultural)	Geriatric Depression Scale (1983) Mini-Cog Cognitive Assessment (2000)	Pre-test, Post-test Pre-test
Behavioral Outcome	Health Promoting Behavior	Rapid Assessment of Physical Activity (2006)	Pre-test, Post-test
Individual Characteristics and Experiences	Prior Related Behavior	Questions on Demographic Form	Pre-test

Dosage and Time Frame

The intervention was led by the principal investigator (PI), an adult/gerontological nurse practitioner. It occurred twice a week for 6 weeks in each facility. Each session lasted 45 minutes each, with the first 15 minutes covering the educational materials and the last 30 minutes for Wii play. Each week the educational topic changed based upon topics in the NIA workbook. The intervention took place during daylight hours; times

were arranged per recommendations from the facility liaison to meet participant needs. Participants engaged in play in groups of four. Participants could terminate sessions at any point. Termination of a session was documented in total minutes completed. Participants had to remain in active play for at least 15 minutes for a session to be counted as complete.

Intervention Fidelity

This intervention addressed the five domains of fidelity for interventions as outlined by Resnick, et al. (2009): study design, training of providers, delivery of treatment, receipt of treatment, and enactment of treatment. This study was designed for participants to engage in the intervention twice per week for a total of six weeks. Treatment sessions were facilitated by the PI. The PI kept a log of all treatment session encounters.

Delivery of the intervention was assessed by monitoring the participants' feedback. The researcher worked closely with facility liaison, maintaining open communication regarding the intervention progress. Receipt of treatment is defined as the ability of participants to demonstrate that they understand and can perform the behavioral skills or cognitive strategies that have been presented to them (Horner, 2012) during the intervention period. Therefore during the pre-intervention interview, the intervention process and study measures were explained. The PI read to all participants to facilitate completion of the study measures to eliminate pressure from those who may have had difficulty reading and to assist with comprehension of the intervention subject matter.

Lastly, enactment of treatment skills was addressed by the use of self-report regarding achievement of goals by participants. During each intervention session, each of the participant's skills were discussed. For example, if a participant was able to bowl and not have their ball go in the gutter, the discussion that followed was about the skill it takes to roll the ball correctly down the lane. Documentation of all treatment sessions occurred during the study period in a log kept by the PI. The PI arranged for post intervention follow-up with participants to discuss their overall evaluation. The post intervention follow-up included face-to-face interviews approximately 2 weeks after the intervention period ended.

Retention Strategies

Participants were thanked for agreeing to participate in this study and their names put in a box for a raffle drawing at the completion of the intervention. Weekly reminders of the study were given per the facility liaison. The incentive structure for this intervention included a water bottle, resistance band, and workbook from the NIA on physical activity for older adults for each participant given at week #1, $5 gift card to Wal-Mart at week #3, and $5 cash incentive given at completion of the intervention. One gift card ($10 Domino's Pizza Card) was raffled off at the end of the intervention at each facility. Certificates of completion and refreshments were given to each participant at the post-intervention celebration. The PI confirmed that all incentives were approved by the facility. According to Klein and Karlawish (2010), incentives for older adults that incorporate frequent small rewards have shown promise in sustaining interest in behavior change.

Human Subjects Protection

This study was approved by the Institutional Review Board (IRB) of The University of North Carolina at Greensboro. Permission to conduct the intervention was obtained from each of the long-term care facilities. All participants were fully informed of the study purposes, risk, and expectations. A written consent form was obtained from each participant prior to beginning the intervention. A copy of the consent form was given to each participant. Participants were required to verbalize an understanding of the intervention procedures prior to signing the consent form. The researcher allowed time for explanations of any questions from the participants. Participants understood that participation was solely their choice and that they could withdraw at any time without consequences. Coercion was minimized as recruitment of participants was conducted at facilities in which the researcher did not have a direct working relationship.

The level of risk for participation in the intervention was minimal and was discussed with each participant. Potential risks included specific game related injuries that may have developed resulting from required movements during game play. To minimize risk, participants were given time to practice the game prior to beginning the intervention until they felt that they had understanding of how to play the game. If a participant experienced chest pain or increased shortness of breath at any time during a session they were asked to discontinue their participation in that session. If warranted the information was reported to the nurse, so that further assessment and follow-up of the participant's condition could be completed. Data were kept confidential by coding forms that would exclude personal identifiers. A master list of names was kept separate from

the data. Forms were kept in a locked box with the researcher, considering data cannot be left at the facilities.

Measures

Survey data were collected using the following measures: (a) The Demographic Form, (b) The Geriatric Depression Scale; the fifteen item version, (c) The Self-Efficacy for Exercise Scale (d) The Rapid Assessment of Physical Activity, (e) The Exercise Benefits and Barriers Scale, and (f) the Mini-Cog.

The Demographic Form

The Demographic Form, developed by the researcher, was used to collect data regarding age, gender, race/ethnicity, educational level, comorbidities and medications. The length of the form was 11 items. The length of time the participant had lived in the nursing home was identified. Lastly, this form assessed the participant's history with a technological devices and their current state of physical activity. The form took approximately 10-15 minutes to complete (Appendix A).

The Geriatric Depression Scale

The Geriatric Depression Scale (Yesavage et al., 1983) was used to assess whether the participants have depression. The short version, fifteen item, form was used as it has been shown to be the preferred version of the scale used in nursing homes (Mitchell, Bird, Rizzo, and Meader, 2010). The 15-item tool asks yes-no questions assessing feelings and symptoms of depression. Depression is indicated if 10 of the 15 questions are answered positively and when the additional 5 questions are answered negatively (Sheikh & Yesavage, 1986). Scores of 0-5 are considered normal. Scores of

6-8 indicate mild depression, with scores of 9 and above indicative of moderate to severe depression. The tool has an alpha coefficient of 0.94 suggesting a high degree of internal consistency; split-half reliability is 0.94 and test-retest reliability is identified by a correlation of 0.85. Convergent validity was established between the GDS and similar depression scales with correlation scores of 0.84 and 0.83. This scale has been used with older adults in nursing homes (Drageset, Eide, & Ranhoff, 2011; Drageset, Espehaug, & Kirkevold, 2012; Kane, Yochim, & Lichtenberg, 2010). For this study, depression scores were categorized into 3 categories: 1=normal, scores 0-5; 2=suggestive of depression, scores 6-9; 3=depression, scores ≥10 (Appendix B).

The Self Efficacy for Exercise Scale

The original Self Efficacy for Exercise Scale (SEE) is a 9-item scale that measures self-efficacy related to the ability to continue to exercise (Resnick & Jenkins, 2000). Participants are instructed to listen to each statement as it is read during face-to-face interview and rate his or her confidence to engage in 20 minutes of exercise three times per week. Confidence is measured on a scale from 0-10 with 0 meaning not confident and 10 meaning very confident. The SEE is scored by summing the ratings and dividing by the number of ratings responded to (Resnick, Luisi, Vogel, & Junaleepa, 2004). The higher the score, the higher the efficacy expectations. Initial reliability and validity was tested among community dwelling older adults from a continuing care retirement community. Evidence of internal consistency (alpha=0.92) and the use of squared multiple correlation coefficient using structural equation modeling (R^2 range=0.38-0.76) indicated sufficient reliability (Resnick & Jenkins, 2000). Permission

for use of the tool was granted by personal communication with the author, who sent an 11-item version for use. Modification of the original 9-item scale to an 11-item measure has been noted and has been used with patients who have experienced a cardiac event necessitating a cardiac rehab referral (Krisko-Hagel, 2009). The scoring of the 11-item version is the same as the original version (personal communication, Resnick, 2014.) Validity was evidenced by hypothesis testing and Lambda X estimates in structural equation modeling (estimates >=0.81). This measure also has been used with chronically ill older veterans (Ehiemua-Pope, 2012) (Appendix C).

The Rapid Assessment of Physical Activity

The Rapid Assessment of Physical Activity (RAPA) was used to collect data regarding the participant's level of physical activity (Topolski et al., 2006). This tool was specifically designed to be used with adults over the age of 50 years. The tool is a nine-item questionnaire with response options of yes or no to questions related to their self-determined level of physical activity. Criterion validity of the RAPA was evidenced by calculating Spearman rank-order correlation coefficients between the RAPA, the Patient-centered Assessment and Counseling for Exercise (PACE) questionnaire, the Behavioral Risk Factor Surveillance System (BRFSS) physical activity questions, and the Community Healthy Activities Model Program for Seniors (CHAMPS). The RAPA (r=0.54) was more highly correlated with the CHAMPS moderate calories and total calories than the BRFSS (r=0.40) or the PACE (r=0.44). The RAPA had the sensitivity of 81% and negative predictive value of 75% compared to the other three questionnaires. This measure has been used in LTC with older adult participants in an activity

intervention study (Keogh, et al., 2014) and with hemodialysis patients (Lopez, et al., 2014) (Appendix D).

The Exercise Benefits and Barriers Scale

The Exercise Benefits and Barriers Scale (EBBS) is a 43-item survey that contains two subscales, benefits and barriers (Sechrist, Walker, & Pender, 1987). The tool was developed using the responses of 664 adults living in northern Illinois ranging in age from 18-88 years. The questions structured on this Likert scale are answered using a four-point response system that includes a range from 4 (strongly agree) to 1 (strongly disagree). The 2 scales may be scored and used together or separately. Barrier scale items are reverse scored unless the tool is used alone. The scores can range from 43-172 when the total instrument is used. Cronbach's alpha was calculated as .952 for the 43-item instrument, indicating the tool's internal consistency. Test-retest reliability was accomplished using a two week interval on 63 adult individuals. Test-retest reliability scores were .89 for the total instrument, .89 on the benefits scale, and .77 on the barriers scale. These scores indicate the stability of the instrument using correlations of the scores on repeated administrations (Sechrist, Walker, & Pender, 1987). The instrument was examined for content validity by four nurse researchers. Congruence of items with concepts of perceived benefits and barriers was examined and validated. This scale has been used with older adults in the community (Foley, Hillier, & Barnard, 2011). A recent study done by Liu and Hu (2015) found that this scale is appropriate for use with nursing home residents in China with a Cronbach's alpha for both the Exercise Benefits and Barriers Scales at 0.91 and 0.84 respectively. For the purposes of this study, Benefits and

Barriers scores were used separately. The higher the score, the more positively the individual perceives exercise (Sechrist, Walker, & Pender, 1987) (Appendix E).

The Mini-Cog

The Mini-Cog (Borson, Scanlan, Brush, Vitaliano, & Dokmak, 2000) assessment was used to examine the cognitive abilities of each participant. This assessment is a composite of a three-item recall and a clock drawing test (CDT). It is considered a screening measure. Administration of the measure entails asking the patient to listen, remember, and repeat three unrelated words to the examiner. Next, the patient is asked to draw the face of a clock on a blank sheet of paper, as well as draw the hands of the clock so that it indicates a specific time (Doerflinger, 2007). Lastly the examiner asks the patient to repeat those three words again. The measure is scored with 1 point for every correct word recalled and for the correct drawing of the clock face and the stated time. Recall of none of the three words is classified as demented (Score=0). Conversely, recalling all three words is classified as non-demented (Score =3). Intermediate word recall with 1-2 words in this screening tool is classified based on the CDT. The CDT is considered normal if all numbers are present in the correct sequence and position, and the hands readably display the requested time. For this study the cutoff score for the Mini-Cog will be ≥ 3 (total score) indicative of a negative screen for dementia (Appendix I).

Data Analysis

Statistical Package for Social Sciences (SPSS) was used to conduct statistical analyses to address the study research questions. Descriptive statistics were used to summarize the sample characteristics and responses to demographic questions and

surveys (SEE, EBB, GDS, MiniCog) (addressing RQ1). Reliability of the scales was examined for internal consistency (Cronbach's alpha coefficient) (Gliner, Morgan, & Leech, 2009). Correlations were conducted to examine associations (addressing RQ2). Pearson's correlations were conducted to analyze the associations between age, EBB and SEE. Spearman correlations were conducted to analyze the associations between age, EBB, SEE, GDS, and RAPA. To examine the associations between personal factors and outcomes, a series of ANOVAs were conducted for categorical variables, Kruskal Wallis tests were conducted for ordinal variables. The Kruskal Wallis test is a non-parametric test is used to compare scores on some continuous variables for three or more groups (Pallant, 2013). Chi square analysis was conducted to explore depression at pre and post intervention.

To evaluate the effect of the intervention for pretest and posttest design (addressing RQ3), a paired t-test was used to compare the mean scores of the SEE and EBB. A paired t-test can be used when the same group of subjects yields data on two different occasions or under two different conditions (Pallant, 2013). Wilcoxon rank signed test was used to compare pre and post scores for RAPA. To examine whether or not prior related behaviors, personal factors, perceived benefits, perceived barriers, and self- efficacy predicted physical activity at post-intervention a multiple regression analysis was conducted (addressing RQ4). Alpha level of significance was set at .05.

Summary

This chapter provides details of the methodology undertaken for this intervention study. The 6 week intervention procedure within the LTC facilities with older adults was described and measures were reviewed for evaluation of the study variables. The education provided for this intervention was guided by the NIA's (2011) *Go4Life* Exercise & Physical Activity guide. A brief synopsis of the data analysis plan was presented.

CHAPTER IV

RESULTS

A one-group pre-test post-test design was used to examine the relationships between personal factors, perceived barriers, perceived benefits, self-efficacy and physical activity. Analysis of each research question is presented in this chapter. To do this, descriptive statistics, correlation analysis, including both Pearson's and Spearman's, one-way ANOVA, Paired *t*-test, Kruskal Wallis test, Multiple Liner Regression, and Wilcoxon Signed Rank Sum test were conducted. The data were collected from participants who lived in four skilled nursing facilities located in or within a 40 mile radius of Greensboro, NC. The data will be presented in the following sequence: the first section will provide preliminary data analysis including normality testing of variables; the second section will present the facility characteristics and sample demographics; the third section will detail each research question and its specific analysis followed by the chapter summary.

Preliminary Analysis

Prior to beginning data analysis, data should be checked to determine if they are normally distributed. By doing this first, the selection of the appropriate statistical test to evaluate each research question of the study becomes apparent (Pallant, 2013). Normality testing was conducted on all continuous variables by evaluating the skewness and kurtosis of each distribution. Histograms and boxplots were examined for each

variable and outliers were assessed. Data are considered normally distributed based upon their skewness and kurtosis, with scores falling between -1 and +1. For this study, all data were reasonably normally distributed except the RAPA (see Table 3, Table 4). Shapiro-Wilk test is the more preferable recommended test for normality testing (Ghasemi & Zahediasl, 2012). For that reason, the Shapiro-Wilk was used in this investigation, with $p<.05$ indicative of normal. In addition to concerns about whether data are normally distributed, there were missing data occurred due to participant dropout. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS), Version 24 (International Business Machines Corporation, 2015) for this study.

Table 3. Normality Testing (N=24)

Variable	Mean	Standard Deviation	Skewness	Kurtosis
Age	79.33	11.09	-.66	-.57
Pre Barriers EBBS (1987)	30.58	3.41	-.70	.66
Post Barriers EBBS (1987)	29.58	4.46	-1.08	2.64
Pre Benefits EBBS (1987)	52.08	12.08	0.10	.19
Post Benefits EBBS (1987)	52.42	12.01	-.23	.24
Pre Self-Efficacy (2000)	4.81	2.18	.05	-.36
Post Self-Efficacy (2000)	5.34	1.99	-.69	1.20
Pre RAPA (2006)	3.46	.93	.04	2.88
Post RAPA (2006)	3.71	1.40	.57	-.74

Table 4. K-S & S-W Test (N=24)

Variable	Statistic	df	K-S Sig.	Statistic	df	S-W Sig.
Age	.16	24	.20	.92	24	.05
Pre Barriers EBBS (1987)	.18	24	.02	.94	24	.23
Post Barriers EBBS (1987)	.12	24	.20	.93	24	.12
Pre Benefits EBBS (1987)	.15	24	.02	.95	24	.13
Post Benefits EBBS (1987)	.17	24	.08	.95	24	.26
Pre Self-Efficacy (2000)	.12	24	.20	.97	24	.72
Post Self-Efficacy (2000)	.12	24	.20	.97	24	.58
Pre RAPA (2006)	.24	24	.00	.83	24	.00
Post RAPA (2006)	.21	24	.01	.85	24	.00

Facility Characteristics

Participants were recruited from four skilled nursing facilities in and around a 40 mile radius of Greensboro, NC. Activity directors in each facility assisted in recruitment efforts by identifying participants who met the study criteria. Table 4 provides specific

characteristics regarding the facilities. Of the four facilities, only one had a primary pay source of private insurance for its residents.

Table 5. Facility Characteristics

Facility Location	Ownership	Total Beds	Total Long-Stay Beds	Primary Payer Source	# Study Participants
Greensboro	Not-for-profit	69	69	Private Insurance	5
Greensboro	Private	135	54	Medicaid	8
McLeansville	Private	134	134	Medicaid	7
Kernersville	Corporate	92	92	Medicaid	4

Characteristics of Sample

Participants were long-stay residents of the four facilities. Twenty-nine older adults consented to participate in the intervention. One participant died before the pre interviews were started. Twenty-eight consented participants completed the pre interview process and were scheduled to begin the intervention. All twenty-eight met the cognitive criteria based on the MiniCog assessment. Total scores on the MiniCog cognitive assessment were all ≥ 3, which is indicative of a negative screen for dementia. Once the intervention sessions were set to begin, one participant decided not to participate. Another participant had an unexpected hospitalization and subsequently passed away. Two other participants dropped out at different times during the intervention. One of these two participants attended two sessions and decided not to

return. The other participant came to two sessions, contracted a contagious illness which required isolation, and did not return after her isolation period ended. Therefore the final sample size for this study was N=24 at post-intervention. Six participants attended all sessions (12) of the intervention with only one participant attending half of the sessions (6). The average number of sessions attended was 9.67. The most common reason sessions were missed was due to illness or hospitalization, or spending time with family in or out of the facility. The characteristics of the consented participants at pre intervention are presented in Table 6. Sections in which there are missing data reflect where participants failed to answer that question. The majority of the participants were female (n=16, 65.6%) and self-identified as Caucasian (n=20, 83.3%). The ages of participants ranged from 55-93, with the average age of 79.97 (*M*=79.7, *SD*=10.35). Most of the participants had lived in the LTC facility between 2-5 years (33.3%). Over half of the participants in this study had some college education. An assessment of the participants' diagnoses and medications was conducted (see Table 7). Heart Disease (41.4%), hypertension (n=10, 41.7%), fractures (n=11, 45.8%), arthritis (n=15, 62.5%), glaucoma (n=10, 41.7%), and stroke (n=11, 45.8%) were reported in over 40% of participants.

Table 6. Demographic Characteristics of Participants (N=24)

Variable	Frequency (%)
Age	
50-59	2 (8.3%)
60-69	3 (12.5%)
70-79	6 (25.0%)
80-89	9 (3.8%)
90-99	4 (16.7%)
Gender	
Male	8 (33.3%)
Female	16 (66.7%)
Education Level	
Less than high school	3 (12.5%)
Some high school	1 (4.2%)
Completed 12th grade	6 (25.0%)
Some college	7 (29.2%)
Completed Associates Degree	0
Completed Bachelor's Degree	3 (12.5%)
Completed Master's Degree	3 (12.5%)
Completed Doctorate Degree	1 (4.2%)
Race	
African American	4 (16.7%)
White	20 (83.3%)
Native American/American Indian	0
Asian/Pacific Islander	0
Hispanic/Latino	0
Other	0
Length of Time in LTC Facility	
Less than 6 months	0
6 months to one year	4 (16.7%)
1-2 years	5 (20.8%)
2-5 years	8 (33.3%)
>5 years	4 (16.7%)
Missing	3 (12.5%)

Note: Age range (55-93) years

Table 7. Diagnosis & Medications (N=24)

	Frequency (%)
Diagnosis	
Diabetes	7 (29.2%)
Hypertension	10 (41.7%)
Heart Disease	9 (37.5%)
Kidney Disease	4 (16.7%)
Stroke/CVA	11 (45.8 %)
Fractures	11 (45.8%)
COPD	4 (16.7%)
Asthma	2 (8.3%)
Cancer	5 (20.8%)
Arthritis/Osteoporosis	15 (62.5%)
Glaucoma/Visual Problems	10 (41.7%)
Other	7 (29.2%)
Medications	
Antihypertensive	12 (50%)
Antidepressants	10 (41.7%)
Seizure Meds	3 (12.5%)
Antiglycemics	7 (29.2%)
Anticholinergics	0
Antithrombotics	9 (37.5%)
Antipsychotics	5 (20.8%)
Others	5 (20.8%)

Pre-Intervention Data

Descriptive statistic for the study variables at pre and post-test were calculated. Table 8 displays these data.

Table 8. Descriptive Statistics for Outcomes at Pre and Post Intervention (N=24)

	Pre			Post		
	M	*SD*	*Min/Max*	*M*	*SD*	*Min/Max*
EBBS Barriers (1987)	30.58	3.41	22.0/37.0	29.58	4.46	16.0/37.0
EBBS Benefits (1987)	52.08	12.07	31.0/81.0	52.42	12.01	29.0/79.0
Self-Efficacy (2000)	4.81	2.08	.91/9.09	5.34	1.99	0.0/9.1
	Mdn	*IQR*		*Mdn*	*IQR*	
Depression	1	1-2		1	1-1	
RAPA (2006) (Physical Activity)	3.5	3-4		3.5	3-4	

Note: For Depression: 1=normal, score 0-5; 2=suggestive of depression, score 6-9; 3=indicative of depression, score 10-15
For Rapa: score range from 1 (never or rarely do any physical activity) to 7 (≥20mins per day vigorous physical activity, ≥3 days per week). Pre and Post scores were not significant (all ps>.05)

The EBB Barriers scale scores can range from 14-56. The higher the Barriers score, the higher (greater) the perceived barriers to exercise. The EBB Benefits scale scores can range from 29-116. The higher Benefits score, the higher the perception of benefits to exercise. (Sechrist, Walker, & Pender, 1987). The barriers scores ranged from 22-37 at pre-intervention and 16-37 at post-intervention. The benefits scores ranged from 31-81 at pretest and 29-79 at posttest. The data revealed that there was no change between pretest and posttest in perceptions of exercise benefits and barriers as a result of the intervention. The SEE scale (11 item) is scored by summing the responses of the individual 11-items and dividing by the number of responses. Scores range from 0-10. The score indicates the strength of efficacy expectations (Resnick & Jenkins, 2000;

Resnick, Luisi, Vogel, & Junaleepa, 2004). The higher the score the higher the efficacy expectations. The scores at pretest ranged from 0.91 to 9.1 and at posttest from 0.0 to 9.1. Average efficacy expectations increased from 4.81 to 5.34 from pre- to post-test, suggesting an increase in efficacy expectations at post. The GDS depression scale is scored by adding 1 point for each positive or negative response to specific questions on the 15 item scale (Yesavage et al., 1983). For this study participant response were categorized into 3 categories: 1=normal, 2=suggestive of depression, 3=indicative of depression. The data revealed that most participants did not change their report of depression from pretest to posttest. A chi square test revealed 16 participants were without depression at pretest and posttest. Three individuals who were suggestive of depression at pretest were normal at posttest; 2 individuals who were suggestive of depression at pretest were also suggestive of depression at posttest; and 2 individuals who were suggestive of depression at pretest were depressed at posttest; There were no individuals who were depressed at pretest and then normal at posttest; also, there were no individuals who were depressed at pretest and posttest. One individual who was depressed at pretest was only suggestive of depression at posttest. The RAPA scale is scored by taking the highest score with an affirmative response. Scores range from 1 (rarely or never do any physical activity) to 7 (≥20 minutes per day of vigorous physical activity ≥3 days per week) (Topolski et al, 2006). The findings suggest that there was no change in self-reported physical activity at post.

Research Question 1

What are the percentages of older adults living in LTC facilities who report being currently physical active and who have previous experience using some form of technology?

Assessment of the participants' level of physical activity and prior use of technology was calculated by responses given in the pre-intervention interview. Data were collected as part of the demographic information for the study. The findings revealed that 87.4% (n=22) of the participants reported that they were physically active in their current living situation. Specifically, 20.8% (n=5) of the participants reported engaging in physical activity between 6 and 7 days per week, with 25.0% (n=6) spending more than 30 minutes per day in activity. Further, 70.8% (n=17) of participants reported participation in physical activity less than 6 months prior to their admission to the LTC facility. The data showed that prior to admission to the facility, with 33.3% (n=8) reporting participation in that activity 3 to 5 times per week. The most commonly reported activity prior to admission was walking (n=14, 58.3%).

When questioned regarding prior experiences using technology, 83.3% of the study participants answered that they had experience, with the most commonly reported experience being with a computer (see Table 8). Seven participants (29.2%) reported they had prior experience with technology but did not report the specific type used. The assessment of prior use of a technological device was important to gather as this study is guided by the HPM that includes "prior related behavior" as a variable that can impact health promoting behavior (physical activity).

Table 9. Physical Activity & Prior Use of a Technological Device (N=24)

	Frequency
Current Physical Activity	
I am not active	2 (12.5%)
I am physically active 1-3 days per week	8 (33.3%)
I am physically active 4-5 days per week	8 (33.3%)
I am physically active 6-7 days per week	5 (20.8%)
Time Spent in Physical Activity per Day	
I am active less than 10 mins per day	5 (20.8%)
I am active 11-30 mins per day	12 (50.1%)
I am active more than 30 mins per day	6 (25.0%)
Missing	1 (4.2%)
Type of Physical Activity Participation Prior to Admission to LTC Facility	
Aerobics	1 (4.2%)
Chair Exercises	1 (4.2%)
Gardening	2 (8.3%)
Golf	1 (4.2%)
Softball	1 (4.2%)
Swimming	0
Volleyball	1 (4.2%)
Walking	14 (58.3%)
Weights	1 (4.2%)
Yardwork	2 (8.3%)
Time Spent Participating in Physical Activity Prior to Admission to LTC Facility	
Less than 6 months prior to admission	17 (70.8%)
7 months to 1 year prior to admission	4 (16.7%)
More than a year prior to admission	1 (4.2%)
Missing	2 (8.3%)
Frequency of Participation in Physical Activity Prior to Admission to the LTC Facility	
Less than 3 times per week	8 (33.3%)
3-5 times per week	8 (33.3%)
More than 5 times per week	6 (25.0%)
Missing	2 (8.3%)
Prior Experience Using A Technological Device	
Yes	20 (83.3%)
No	4 (16.7%)

Type of Prior Technological Device Reported	
Computer	6 (25.0%)
Cell Phone	1 (4.2%)
Video Game	2 (8.3%)
Remote Control	3 (12.5%)
Cordless Phone	0
Missing	7 (29.2%)

Research Question 2

What is the relationship between personal factors, perceived barriers, perceived benefits, self-efficacy and the health promoting behavior (physical activity)?

To test the concepts of the HPM used in this study, correlation analysis was used to describe the relationship among personal factors, perceived benefits, perceived barriers, and self-efficacy and physical activity. The total scores on the instruments were used for this analysis when applicable. Personal factors include, age (biological), depression (psychological), race and level of education (sociocultural). Pearson's correlation analysis was used to examine the normally distributed continuous variables in the study. The data revealed that perceived benefits at pretest were negatively associated with pretest self-efficacy (all $p > .05$, see Table 10).

Table 10. Correlation Coefficients for Relationships between Age, Perceived Benefits, Perceived Barriers, Self-Efficacy

(Pre)

Variable	1	2	3	4
Age	-	.16	.03	-.29
Pre Perceived Barriers		-	.07	.09
Pre Perceived Benefits			-	-.40*
Pre Self-Efficacy				-

**Correlation significant at 0.05 level (2-tailed)*

(Post)

Variable	1	2	3	4
Age	-	-.37	.32	-.04
Post Perceived Barriers		-	.27	-.36
Post Perceived Benefits			-	-.66
Post Self Efficacy				-

**Correlation significant at 0.05 level (2-tailed)*

A series of one-way analyses of variance (ANOVA) tests were conducted to examine associations between each of the categorical personal factors (race, and educational level) and perceived benefits, perceived barriers, and self-efficacy. The findings revealed no significant differences between racial or educational level categories. To examine the associations between personal factors (race and educational

level) and physical activity, Kruskal Wallis analysis was conducted. This statistical test was conducted because preliminary analysis of these data indicated that physical activity was not normally distributed. Therefore nonparametric testing was warranted. The results revealed no statistical significance for physical activity across racial categories or educational level.

Further nonparametric testing using Spearman Rank Order correlation analysis was used to examine relationships between benefits, barriers, self-efficacy, depression, and physical activity (Table 11). Also known as Spearman rho, this statistical test is used with ordinal or ranked data and when data do not meet the criteria for Pearson's correlation (Pallant, 2013). Pretest depression was significantly, negatively correlated with pretest self-efficacy. Posttest depression was significantly, positively correlated with posttest perceived benefits. Posttest perceived barriers was significantly, positively correlated with post self-efficacy.

Table 11. Spearman's Rho Correlations for Depression, Physical Activity, Age, Perceived Barriers, Perceived Benefits, and Self Efficacy.

(Pre)

	1	**2**	**3**	**4**	**5**	**6**
Pre Depression	1.0	.09	.06	-.01	.37	-.60*
Pre Physical Activity		1.0	-.06	-.03	-.26	.19
Age			1.0	.18	.09	-.29
Pre Perceived Barriers				1.0	-.06	.11
Pre Perceived Benefits					1.0	-.34
Pre Self Efficacy						1.0

**Correlation significant at 0.01 level (2-tailed)*

(Post)

	1	**2**	**3**	**4**	**5**	**6**
Post Depression	1.0	-.17	.01	.23	.46*	-.39
Post Physical Activity		1.0	-.22	-.04	-.02	.03
Age			1.0	-.36	.27	-.06
Post Perceived Barriers				1.0	.17	.46*
Post Perceived Benefits					1.0	-.62
Post Self Efficacy						1.0

**Correlation significant at 0.05 level (2-tailed)*

Research Question 3

Do prior related behaviors, personal factors, perceived benefits, barriers, and self-efficacy predict physical activity at baseline in nursing home residents?

Multiple regression was examined for use as the appropriate statistic to analyze this question. The assumptions for this analysis are: appropriate sample size, multicollinearity and singularity, checking for outliers, normality, linearity, homoscedasticity, and independence of residuals (Pallant, 2013). Due to the small sample size of this study (N=24) and the inclusion of some data that are not normally distributed, some of the assumptions were violated. In addition, only one of the predictor variables (time in physical activity) was significantly linearly associated with physical activity at post-intervention (Spearman rho=.45, $p<.05$). However, in efforts to examine this research question, the full model was tested using an exploratory multiple regression analysis. All variables were entered as predictors using the Enter method. The overall model was not significant, ($F(6, 22) = 2.49$, $p = .07$, $R^2 = .48$, R^2Adjusted = .29).

Research Question 4

What are the effects of a 6 week intervention using Wii video gaming on perceived benefits, perceived barriers, and self-efficacy and physical activity among nursing home residents?

Paired *t*-tests were used to explore the effects of the intervention on perceived benefits, perceived barriers, and self-efficacy and physical activity. The findings revealed no significant changes between pretest and posttest assessment of perceived barriers, perceived benefits, and self-efficacy after the 6 week intervention. (see Table 12).

Table 12. Paired t-Test of Intervention Effects on Perceived Barriers, Perceived Benefits, Self-Efficacy

	Pre		Post				
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
EBBS Barriers (1987)	30.58	3.41	29.58	4.46	1.04	23	.31
EBBS Benefits (1987)	52.08	12.08	52.42	12.01	-.13	23	.90
SEE (2000)	4.81	2.18	5.34	1.99	-1.31	23	.20

Wilcoxon Signed Rank Sum test was used to compare RAPA at pretest and posttest. This nonparametric statistical test is used when participants are measured on two different occasions (pre and post). Results revealed no significant change in physical activity at pretest and posttest, z = -.82, p = .41, with a small effect size (r=.11), the median score on the RAPA increased from pre (*Md* = 3.0) to post (*Md* = 3.5).

Summary

This chapter described the results of statistical analyses for the research questions examined for the 6 week intervention study. Twenty-four older adult participants completed the intervention. The majority of the study participants reported currently engaging in physical activity (87.4%). The majority of participants (83.3%) reported prior use of a technological device, with the computer being the most commonly reported. Pretest depression was negatively associated with pretest self-efficacy. Pretest perceived benefits was negatively associated with pre self-efficacy. Posttest depression was positively associated with posttest perceived benefits. Posttest perceived barriers

were positively associated with posttest self-efficacy. There were no significant changes at pretest and posttest of the 6 week intervention on perceived benefits, perceived barriers, self-efficacy, and physical activity ($p > .05$). There were also no significant predictors of physical activity at post-intervention.

CHAPTER V

DISCUSSION

The purpose of this intervention study was to describe the use of video game technology with older adults in nursing homes, as well as examine the effects of a 6 week intervention on perceived benefits and barriers to physical activity and self-efficacy for physical activity. An evaluation of the intervention was conducted at the end of the 6 week intervention. This chapter provides an interpretation and discussion of the findings. Implications for nursing practice, limitations, and future research recommendations are presented.

Sample

As in this study, several researchers who used the Wii (Bateni, 2012; Bainbridge et al., 2011; Wollersheim et al., 2010) report small (<30 subjects) sample sizes in their intervention programs, with some studies having as few as 7 participants (Agmon et al., 2011; Chao et al., 2013). The sample in this study consisted of a majority of white females, similar to findings reported by Kalbaugh et al (2011) in their intervention study that examined the used of Wii on the well-being of older adults. They were highly educated, with 24.1% (n=7) having completed some college level education. There was one participant who had received a doctorate degree. This is a notable difference as compared to findings reported by Ulbrecht et al. (2012), in which the majority of their participants reported high school level education. The sample in the present study was

similar to the nursing home residents described by Keogh et al. (2012), with sufficient dexterity to manipulate the video game controller, based on observation, and cognitive ability to understand directions based on pre intervention MiniCog screening. Arthritis (osteoporosis) (65.5%) and fractures (48.3%) were the highest reported diagnoses among this sample which is similar to the findings of Kenny et al. (2009) detailing the risk of these conditions in older adults residing in facilities. The most commonly reported medication classes among study participants were antidepressants (51%) antihypertensives (34.5%) antithrombotics (34.5%), and antiglycemics (34.5%) and is similar to the literature regarding older adults living in nursing homes (Karkare, Bhattacharjee, Kamble, & Aparasu, 2011; Simonson, Han, & Davidson, 2011; Zarowitz et al., 2015)

Interpretation and Discussion of Findings

Research Question 1

What are the percentages of older adults living in a long term care facility who report being currently physically active and have previous experience using some form of technology (computer, video games, etc)?

The majority of the participants in this study prior to the intervention self-reported being currently physically active, despite their living environment. This finding is contrary to previous studies that have shown that nursing home residents are generally not active and are more sedentary than non-nursing home residing older adults (De Souto Barreto, 2015; Keogh, Senior, & Beller, 2015). Self- report measures of physical activity have to be interpreted cautiously (Steene-Johannessen et al., 2016). One of the most

common limitations of self-report measures of physical activity is the potential for overestimation of current level of activity (Tucker, Welk, & Beyler, 2011). Recall bias is another limitation of self-report. Given that these data were self-reported, participants may have overestimated their current activity levels.

The most frequently reported type of physical activity that participants engaged in was walking. This result is consistent with other literature which states that walking is the most popular type of physical activity among all adults (Bryan & Katzmarzyk, 2009). For those residing in nursing homes, walking is encouraged as a means to help prevent further functional decline, and is also associated with activities of daily living and self-reported health status (Hachiya et al., 2015). Although walking speed among nursing home residents has been reported as below-normal, walking should still be encouraged as one aspect of physical activity (Keogh, et al., 2015).

Prior use of technological devices was also reported among the study participants, with the most commonly reported type of technology use being the computer. This finding is supported by recent research from the Pew Research Center (2014) that states that 71% of elders go online daily using a computer. Some of the benefits of using the computer with older adults include a personal sense of connectedness, utility, and positive learning experiences (Gatoo & Tak, 2008). Additionally, older adults responded positively to computer use in a study that included a 20-hour basic computer course (Gonzalez, Ramirez, & Viadel, 2015). Older adults are not reluctant to learn about computers. In this study, few participants had previous experience with video games. This finding did not impact this study, as participants were willing to learn how to use the

video game and participate in game play. The use of video games with older adults is a growing field (Martson, 2013; Pearce, 2008), specifically exergames which include an exercise component and require physical movement to play (Osorio, Moffat, & Sykes, 2012). The Nintendo Wii is an example of an exergame.

Research Question 2

What are the relationships among personal factors, perceived barriers, perceived benefits, self-efficacy and the health promoting behavior (physical activity) among nursing home residents?

The relationships among personal factors were evaluated in this study and their relation to the health promoting outcome (physical activity). Age was one of the personal factors evaluated in this study. The participants' ages ranged from 55-93 years old, averaging 79.97 years. There was no statistically significant association between age and the variables of perceived benefits and barriers, self-efficacy, and physical activity. Race and educational level were also examined in this study. The sample consisted predominantly of Caucasian females. The findings revealed no correlations between race and educational level and perceived benefits, perceived barriers, self-efficacy, and physical activity. Over half of the participants in this study reported having some college education, including one participant with a terminal degree. Given the advanced education of the study participants, it is possible that no significant change was noted from pre- to post intervention because they were already aware of the benefits and barriers to physical activity based upon their educational background.

Depression was evaluated due to its known impact on physical activity (Ku, Fox, Chen, & Chou, 2010). The majority of the study participants were not depressed prior to the intervention or at post-test. The data revealed a positive association between the depression score and perceived benefits of physical activity following the intervention. When perceptions of perceived benefits of physical activity were increased, depression scores in this study sample were elevated. Although some participants were depressed, alteration of their perceptions of the benefits of physical activity did not occur. This finding is similar to what is reported by Lee et al. (2014). They reported that physical activity is a protective factor for depression in older adults and it should be encouraged. Perhaps the participants that were not depressed in this study sample had a history of physical activity that protected them from the development of the condition.

Benefits and barriers to physical activity are important factors to assess when working with older adults. In the current study, the participants' perception of physical activity benefits and barriers remained essentially unchanged from to pretest to post intervention. One explanation for this is likely in the sample characteristics. First, over half of the study participants were college educated, suggesting they might have prior knowledge about physical activity and its benefits. This is important because those with knowledge of the benefits of physical activity might help encourage others for physical activity participation. Further, the study participants reported current levels of physical activity that are greater than the current recommendation of twice per week (de Souto Barreto et al., 2016). This finding suggests that study participants were a more active

sample who likely already had an awareness of the benefits, despite also having an awareness of the barriers to physical activity within the nursing home setting.

Self-efficacy was a variable considered in this research. From pretest to post intervention the participant's self-efficacy for physical activity remained essentially the same. Although their report of self-efficacy for physical activity remained steady, self-efficacy did show some statistically significant associations with perceived benefits. Perceived benefits at pre-intervention was negatively associated with the self-efficacy score. The explanation of these results are that prior to the intervention the older adults in this study had high perceived benefits of physical activity, however indicated low self-efficacy for physical activity. This finding is applicable for this population as they are cognizant of the benefit of being physically active, but do not necessarily believe that they can personally carry out the activity. McAuley (2011a) and colleagues examined self-efficacy beliefs in a randomized controlled trial of community dwelling older adults. Their findings revealed that self-efficacy strategies included in interventions should be assessed frequently, especially in the early parts of the intervention, and then continued throughout until the end of the program. Additionally, these researchers noted that declines in self-efficacy will occur with this population towards the end of the intervention unless self-efficacy strategies are built throughout the intervention period to help participants maintain their self-efficacy, which was not the case in this intervention. The decline in self-efficacy occurs because of a recalibration of their actual self-efficacy upon being exposed to the actual exercise experience. This may logically explain the

negative association in self-efficacy scores with perceived benefits in this study among participants.

Further, the data from this study revealed that at post-intervention, perceived barriers were positively associated with post self-efficacy. For this study population, these findings can be interpreted as the higher their perceived barriers to physical activity, the higher their self-efficacy for physical activity was and vice versa. The potential for competing scheduling conflicts, such as medical treatments and facilities activities, could be viewed as perceived barriers. Additionally, the ending of the intervention period and lack of knowledge concerning continuation of physical activity could also present as a perceived barrier. Although the perception of barriers to physical activity may be present, one may still have the belief that they can carry out the activity despite the awareness of the barriers. This scenario is possible with nursing home residents because the environment they reside in may be a perceived barrier to physical activity, however it may not affect their personal belief about their capacity to perform physical activity. The participants in this study participated in the intervention despite any personal perceptions of perceived barriers to physical activity.

McAuley (2011b) and colleagues reviewed self-efficacy and its relationship to physical activity and physical function and presented some recommendations for the development of physical activity programs that enhance self-efficacy. Two of the recommendations were goal setting, with challenging yet reachable goals, and social modeling, which includes watching others successfully complete a task. These two recommendations were part of the present intervention, with goals setting being discussed

at the beginning of the intervention during one of the educational session. The PI discussed goal setting based upon the NIA's Go*4*Life educational booklet and had dialogue with participants regarding short term and long term goals. Social modeling was observed among the intervention participants as each group watched the other players successfully bowl the ball down the lane.

Research Question 3

Do prior related behaviors, personal factors, perceived benefits, barriers, and self-efficacy predict physical activity at baseline in nursing home residents?

There were no significant predictors of physical activity found in the data analyses model. Because of the small sample size and data that were not normally distributed, analysis of this question was limited. Although no predictors of physical activity were statistically revealed in this study sample, perhaps including a larger sample size in a future study would provide a clearer answer to this research question.

Research Question 4

What are the effects of a 6-week intervention using Wii-Video gaming on perceived benefits, barriers of exercise, self-efficacy and physical activity among nursing home residents?

The data for this study revealed that the intervention did not have any statistically significant effect on participant's perceived benefits, barriers, self-efficacy, or physical activity from pre to posttest. One explanation for this could be that the intervention period was not long enough. For this study the intervention ran for twice per week for six weeks, with a 9.67 average of sessions attended. Perhaps conducting the intervention

over a longer time frame would allow time for a change to occur. Intervention dose remains unclear as to what is most effective with older adults (Chase, 2013).

Interventions in LTC facilities focused on physical activity have been shown to be beneficial to residents (Jansen, et al., 2014). These programs can not only assist with overall physical activity, but can also aid in unwanted outcomes such as fall (Shakeel, Newhouse, Malik, & Heckman, 2015). Interventions need to be tailored to older adults, considering their preferences, to provide a long-term benefit. This intervention was designed to support the older adults' participation. It was provided in the facility so that access to the sessions would be less of a barrier. The time the intervention sessions were conducted was arranged around the times participants would not have other major scheduling conflicts, like meals. The use of the video game for physical activity provided an alternative opportunity for physical activity engagement outside of traditional therapy which required staff oversight. Considerations for a repeat intervention using the Wii would include the addition of another game choice for variability, a longer intervention period to allow time for significant change to occur, and the addition of an objective measure of physical activity beyond self-report. Offering different types of physical activities from which residents could choose from, such as activities that involve walking, could also be beneficial to the patient population considering walking is one type of physical activity that older adults regularly engage in.

Program Acceptability and Feasibility

Although most of the findings from this study were not statistically significant, there could be some clinical significance to some of the results. Based upon direct

observation by the PI, participants generally enjoyed the intervention. Using video game technology with institutionalized older adults proved to be feasible. Time was provided for participants to learn how to use the controller and an explanation of the game system was given. Bowling was the game of choice selected by participants to play at each of the four facilities. This specific Wii Sports game has been shown to be the easiest to learn for participants and seemingly most enjoyable, as supported by Brandt and Panigua (2011).

Involvement of the nursing facility staff was important to successful completion of the study. The facility liaison at each facility was the activity director. The facility liaison at each facility assisted with reminding participants about the intervention sessions and transporting participants to the intervention session space if warranted. Additional duties of the facility liaison included recruitment of potential participants for the study. The facilities staff were supportive and helpful. Adequate space was available and participants were encouraged to be consistent in their attendance, as if it was part of their "prescribed" regimen for the day.

Educating older adults about physical activity is important, regardless of their place of residence. Utilizing the NIA *Go4Life* booklet on exercise and physical activity provided an educational basis for the intervention. Although engaging in the video game did not physically exert participants much, reviewing the different types of physical activity, and benefits and barriers with them allowed for discussion of what activity looks like for them. Discussions were had regarding the ways to begin a more consistent or maintain their current level of physical activity. This discussion covered physical activity

with and without using the Wii. These preliminary findings support the implementation of these type of programs with LTC facilities.

Health Promotion Model

The Health Promotion Model (HPM) was the guiding framework for this study. The focus of the intervention was on engaging participants in physical activity using a video game. The intervention involved active sessions using the Nintendo Wii video game. The use of this model was also selected to add to the evidence regarding health promotion activities within LTC facilities. Although findings in this study were not statistically significant, the feasibility of the model for use with older adults in LTC was apparent by the ability of its concepts to be applied to the study population.

The model contains three main sections that contain the variables: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome. Within this study the physical activity intervention was intended to impact the participant's physical activity participation. The pretest and posttest measures used were linked directly to variables in this model. These were prior related behavior, personal factors, perceived benefits, perceived barriers, self-efficacy, and the health promoting outcome. Benefits to exercise are well known (Katz & Pate, 2016). The challenge for older adults is the maintenance of physical activity over time. Assessment of an older adult's perceived barriers and benefits to exercise along with self-efficacy to perform it, will better assist health care providers in the development of programs that focus on health promoting behaviors.

While the model has been used in various patient population groups, including rural hypertensive patients (Kamran, et al., 2015) and factory workers (Shahroodi, Amin-Shokravi, Haidarnia, Nooghabi, 2013), little has been done using the model in long-term care with older adults. Nursing homes continue to be places where health promotion activities are limited, mostly focused on vaccination (Pu, Dolar, & Gucwa, 2016). The utilization of the model in this study provides some evidence that it can be used with this patient population. This evidence includes the assessment of the specific variables in this study (perceived barriers, perceived benefits, perceived self-efficacy). Although perceived benefits and barriers did not show a statistically change between pre and posttest, perceived self-efficacy had a slight overall increase. This is similar to findings from Dattilo (2014) and colleagues which reported an increase in self-efficacy from pre to posttest among ambulatory older adults in a retirement village. Since the older adult population is expected to continue to rise, the needs for LTC services will likely increase. In preparation, facilities should broaden their view of health promotion and work towards developing feasible cost efficient ways to engage their residents in those behaviors.

In this study, the participants self-reported their perceived barriers and benefits to exercise and self-efficacy for exercise. Additionally participants self-reported their physical activity level. These self-report measures were appropriate for their ease of use with this study population. Each week prior to engaging in game play, participants received education regarding physical activity for older adults based upon the NIA's program *Go4Life*. The discussions that ensued provided participants with a chance to discuss what some of their concerns were regarding barriers to exercise and how they felt

about their abilities (self-efficacy) to engage in such activities. Benefits and barriers of physical activity were also discussed and space was given to allow for any other questions or concerns to be answered. These brief education sessions provided the basis for continued discussion throughout the entire intervention period regarding physical activity.

Health promotion is lacking in LTC (Krajic, Cichocki, & Quehenberger, 2014). Physical activity has been identified as an example of a health promoting behavior (Pender et al, 2011). The constructs of perceived benefits, perceived barriers, and self-efficacy were analyzed in this study. The HPM has been used successfully with older adults (Haber, 2010) and provided a feasible framework for guiding this intervention study. Although the findings of this study were not significant, the HPM is supported for use with this population based on the applicability of its constructs to the older adult population.

There were several concepts of the model that were not addressed in this study. Personal factors such as motivation, which could have provided insight into what are the things that encourage physical activity participation. Interpersonal influences involves all of the additional persons in one's life that influence the behavior of others. Immediate competing demands involve outside influences and commitments that would make engaging in the health promoting behavior (physical activity) challenging. These are opportunities for future research with older adults in LTC to further investigate the model's feasibility.

Limitations of the Study

There were several limitations noted in this study. First, because of the small sample, this was not a representation of the population and therefore limits the generalizability of the results. Second, there was a lack of a control group which prevents comparison of the intervention effects. Additionally, data were collected via self-report measures which can limit their accuracy due to potentially poor recall or the participant's desire to give socially acceptable answers. One of the most common limitations of self-report measures of physical activity is the potential for overestimation of the current level of activity (Tucker, Welk, & Beyler, 2011). Study participants should be encouraged to provide answers that truly reflect their reality and encouraged to know that in doing so, they will not be subject to any punitive consequences of that reporting. Another limitation of the study was that the study PI worked independently, collecting data at pre and post intervention.

Further limitations include that the intervention was conducted in four nursing homes in and around Greensboro, NC, which may not be representative of nursing homes in this portion of the United States. Two facilities were privately owned, one was not-for-profit, and one was corporately owned. The comparison of these facilities to national data is not known in this study. The intervention period was 6 weeks, which may not have been long enough to see change. Also, the participants in this study self- reported being very physically active, which may have been why no change was seen from pre to post intervention. Research has shown that physical activity declines with age and perhaps the study participants were reporting levels of habitual activity (non-exercise)

(Niklas et al., 2016) versus actual physical activity. Further, the self-report of physical activity is subjective to the participant. An objective measure of physical activity would provide better insight into their activity, such as pedometers or actigraphs (Martien, Delecluse, Seghers, & Boen, 2015). Lastly, there was no measure included in the present study of the effect of the education provided during the intervention.

Implications for Nursing

In LTC, physical activity has been shown to improve quality of life, and increase independence (Stathi & Simey, 2007). However, for those residing in LTC facilities opportunities for physical activity have been few and far between. Therefore one implication to consider for this population is that the LTC facility environment must be open to providing physical activity opportunities for their residents. Administrators have to be aware of the benefits of physical activity for the residents and work towards facilitating these programs (Baert, Gorus, Calleeuw, De Backer, & Bautmans, 2016). Although several barriers have been documented and may present themselves, facilities cannot let them halt the initiation of physical activity programs that can provide benefit to the residents.

Prescribing "exercise" as if it were a medication has become a novel idea to help facilitate compliance with physical activity. One of the recently developed recommendations for physical activity in LTC is for older adults to participate in exercise training for at minimum twice per week, for at least 30-45 minutes (de Souto Barreto et al., 2016). To help facilitate the implementation of this recommendation, health care providers such as nurse practitioners can write a prescription for the physical activity

regimen. Although self-report measures have to be interpreted cautiously, the use of short tools like the RAPA assessment for physical activity have been recommended for use in clinical practice (Tolposki et al., 2006) for its ease of use with busy practitioner. As used in this study, this tool can provide some baseline data regarding current levels of physical activity and has been used in LTC with older adults (Keogh, et al., 2014).

Motivating older adults to participate in physical activity is the second implication to consider from this study. While this was not tested in the present study, it is part of the HPM included under personal factors. This is important to consider because if there is no individual motivation for physical activity, it will likely not occur. Increasing the awareness of the importance of replacing sedentary time with physical activity may help increase motivation. Chen and Li (2014) reported that eagerness for returning home, fear of becoming totally dependent, improving mood state, filling time, and previously cultivated habits were motivators for physical activity among 18 nursing home residents in Taiwan. Assessing this information from the resident and staff perspective (Baert et al., 2015) is important in planning for physical activity programs in LTC, with the goal of increasing active engagement in physical activity. Looking at physical activity over time, it may be helpful to evaluate older adults' intrinsic and extrinsic motivation to exercise. According to Dacey, Baltzell, & Zaichkowsky (2008), motivation is what differentiates activity levels in older adults. Further investigation would be beneficial as health care providers working with older adults work to plan effective physical activity programs.

Recommendations for Future Research

The need for research with residents of LTC facilities is apparent. This study focused on physical activity as the outcome. Developing appropriate physical activity programs for these health care environments will take skill and partnership with other health care team members. Because recent research revealed that many nursing home residents received exercise at the frequency of one time per week or less (de Souto Barreto et al., 2016), the impetus for engaging these residents in physical activity is great. Therefore the first recommendation for future research from this study is the need for designing and implementing randomized controlled experimental studies using control groups and comparison groups to further evaluate physical activity in LTC residents.

Additionally, conducting research using an objective measure of physical activity would provide more benefit for this patient population. Research has been done using pedometers and actigraphs with older adults (Martien, Delecluse, Seghers, & Boen, 2015; Sardinha, Santos, Silva, Batista, & Owen, 2015), which can provide more detailed numerical data. The use of self-report measures have some limitations such as missing data and responses that are socially desirable for the investigator and not a true picture of what is actually the respondent's reality. Therefore using an objective measure will provide more accurate data for analysis regarding actual physical activity levels than self-report measures alone.

Examining health promotion within LTC facilities has a lot of promise for future research. Looking beyond immunizations and physical activity, there is room for investigation of other health promoting behaviors such as nutrition, rest or sleep, and

smoking cessation. This idea is supported by a recommendation from The Global Agenda for Clinical Research and Quality Care in Nursing Homes developed by the Task Force on Nursing Homes (Tolson et al., 2011) that stated that one of the research priorities for LTC should be a function-focused approach of the prevalence of geriatric syndromes, their impact on function, and the development of strategies to improve care for them.

Lastly, perhaps the use of a different video game technology should be explored with this population. This study utilized games from the Nintendo Wii Sports package, primarily using bowling for the intervention. However, research could explore the use of another game within the Wii gaming system versus a trial of a new gaming systems such as the Xbox Kinect or Sony PlayStation to test the feasibility of their use. It is already known that the integration of videogame technology with traditional rehabilitation has positive effects on lower and upper extremities and using this technology can assist the older adult with maintenance of personal independence (Martson & Smith, 2012)

Summary

Regular physical activity for nursing home residents is an important overall health concern. Because of the overall challenges within the environment, opportunities for physical activity may be limited. The high levels of physical activity reported among the study participants likely influenced their participation and continuance in the study. Prior use of a technological device was beneficial to the learning the functions of the video game. During the educational sessions prior to game play, discussions included evidenced-based information based upon national guidelines for physical activity in older

adults. This educational dialogue before game play allowed participants the opportunity to discuss their beliefs about physical activity and learn from others in their respective group.

The use of video games with older adults provided an engaging alternative way for physical activity maintenance. Based on session observations, participants enjoyed the intervention sessions and playing together, which are important factors that influence adherence among older adults (Crocker, et al., 2013). The video game was useful in facilitating this physical activity intervention.

The awareness of perceived barriers to physical activity did not prohibit participation in physical activity. Although barriers such as competing schedules and medical treatments are not controllable for nursing home residents, physical activity options should remain available. The use of volunteers could assist in making these opportunities available.

Self-efficacy for physical activity does impact the performance of physical activity. Older adults often report self-efficacy for physical activity, however they need encouragement to actually complete the activity. Health care providers can assist with this by prescribing physical activity plans (Katz & Pate, 2016), similar to medication orders, to help facilitate compliance and maintenance of physical activity.

The presence of a depression diagnosis is common for older adults in LTC. However, having a depression diagnosis did not prohibit participation in the present physical activity intervention. This is important to note because many nursing home residents could be overlooked for physical activity opportunities based upon certain

diagnoses regardless of their capability. Reduction in depressive symptoms has been noted with physical activity (Ku, Fox, Chen, & Chou, 2010).

Although the findings of this study were not statistically significant, the intervention did allow for the participants to be exposed to video game technology and its potential health related benefits of use. Creating appropriate interventions for older adults in LTC is one way to maintain health promoting behavior among this population. Health promoting activities remain necessary for older adults, even those residing in LTC facilities, for optimal health

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APPENDIX A

DEMOGRAPHIC INFORMATION

Demographic Information

All questions should be answered honestly and completely.

1. Date of Birth: _____

2. Age: _____

3. Gender: Male _____
   Female _____

4. Race/Ethnicity: (Mark all that apply)

   African American/Black: _____

   White: _____

   Native American/American Indian: _____

   Asian/Pacific Islander: _____

   Hispanic/Latino: _____

   Other: _____

5. Length of time in the long term care facility:

   Less than six months: _____

   6 months to one year: _____

   1-2 years: _____

   2-5 years: _____

   >5 years: _____

5. Educational level:

Less than high school: _____

Some high school: _____

Completed 12th grade: _____

Some college: _____

Completed Associates Degree: _____

Completed Bachelor's Degree: _____

Completed Master's Degree: _____

Completed PhD Degree: _____

6. How would you describe your **current** physical activity level?

I am not physically active. _____

I am physically active 1- 3 days per week. _____

I am physically active 4-5 days per week. _____

I am physically active 6-7 days per week. _____

7. How much time do you spend in physical activity per day?

I am active less than 10 minutes per day. _____

I am active 11-30 minutes per day. _____

I am active more than 30 minutes per day. _____

8. Have you had any prior experience using any pieces of technology (computer, video games, etc)?

Yes: _____ No: _____

9. **Prior to** being admitted to the long-term care facility, what types of physical activity did you participate in?

_____

_____

_____

_____

a. when did you participate in this physical activity:

less than 6 months prior to admission: _____

7 months to 1 year prior to admission: _____

more than a year prior to admission: _____

b. at what frequency did you participate in this physical activity:

less than 3 times per week:_____

3-5 times per week: _____

more than 5 times per week: _____

10. Have you been diagnosed with or have a history of any of the following conditions?

Diabetes: ____

Hypertension: ____

Heart Disease: ____

Kidney Disease: ____

Stroke/CVA: _____

Fractures (any kind): ____

COPD: ____

Asthma: ____

Cancer (any kind): ____

Arthritis/ Osteoporosis: ____

Glaucoma/Visual Problems: ____

Other:_____

11. Medications:

Antihypertensives (Blood Pressure): _____

Antidepressants (Depression Meds): _____

Seizure Meds: _____

Antiglyecemic Agents (Diabetes Meds): _____

Anticholinergics: _____

Antithrombotics (Blood Thinners): _____

Antipychotics (Mood Meds): _____

Others: _____

APPENDIX B

GERIATRIC DEPRESSION SCALE: SHORT FORM

Geriatric Depression Scale: Short Form

Choose the best answer for how you have felt over the past week:

1. Are you basically satisfied with your life? YES / **NO**

2. Have you dropped many of your activities and interests? **YES** / NO

3. Do you feel that your life is empty? **YES** / NO

4. Do you often get bored? **YES** / NO

5. Are you in good spirits most of the time? YES / **NO**

6. Are you afraid that something bad is going to happen to you? **YES** / NO

7. Do you feel happy most of the time? YES / **NO**

8. Do you often feel helpless? **YES** / NO

9. Do you prefer to stay at home, rather than going out and doing new things? **YES** / NO

10. Do you feel you have more problems with memory than most? **YES** / NO

11. Do you think it is wonderful to be alive now? YES / **NO**

12. Do you feel pretty worthless the way you are now? **YES** / NO

13. Do you feel full of energy? YES / **NO**

14. Do you feel that your situation is hopeless? **YES** / NO

15. Do you think that most people are better off than you are? **YES** / NO

APPENDIX C

SELF-EFFICACY BARRIERS TO EXERCISE

Self-efficacy Barriers to Exercise

How confident are you right now that you could exercise 3 times per week for 20 minutes if:

	Not Confident										Very Confident
1. you worried the exercise would cause further pain	0	1	2	3	4	5	6	7	8	9	10
2. you were bored by the program or activity	0	1	2	3	4	5	6	7	8	9	10
3. you were not sure exactly what exercises to do	0	1	2	3	4	5	6	7	8	9	10
4. you had to exercise alone	0	1	2	3	4	5	6	7	8	9	10
5. you did not enjoy it	0	1	2	3	4	5	6	7	8	9	10
6. you were too busy with other activities	0	1	2	3	4	5	6	7	8	9	10
7. you felt tired during or after exercise	0	1	2	3	4	5	6	7	8	9	10
8. you felt stressed	0	1	2	3	4	5	6	7	8	9	1
9. you felt depressed	0	1	2	3	4	5	6	7	8	9	10
10. you were afraid the exercise would make you fall	0	1	2	3	4	5	6	7	8	9	10
11. you felt pain when exercising	0	1	2	3	4	5	6	7	8	9	10

APPENDIX D

RAPID ASSESSMENT OF PHYSICAL ACTIVITY

How Physically Active Are You?

An assessment of level and intensity of physical activity

Rapid Assessment of Physical Activity

Physical Activities are activities where you move and increase your heart rate above its resting rate, whether you do them for pleasure, work, or transportation.

The following questions ask about the amount and intensity of physical activity you usually do. The intensity of the activity is related to the amount of energy you use to do these activities.

Examples of physical activity intensity levels:

Light activities • your heart beats slightly faster than normal • you can talk and sing	 Walking Leisurely  Stretching  Vacuuming or Light Yard Work
Moderate activities • your heart beats faster than normal • you can talk but not sing	 Fast Walking  Aerobics Class  Strength Training  Swimming Gently
Vigorous activities • your heart rate increases a lot • you can't talk or your talking is broken up by large breaths	 Stair Machine  Jogging or Running  Tennis, Racquetball, Pickleball or Badminton

How physically active are you? *(Check one answer on each line)*

			Does this accurately describe you?	
RAPA 1	1	I rarely or never do any physical activities.	Yes ☐	No ☐
	2	I do some **light** or **moderate** physical activities, but not every week.	Yes ☐	No ☐
	3	I do some **light** physical activity every week.	Yes ☐	No ☐
	4	I do **moderate** physical activities every week, but less than 30 minutes a day or 5 days a week.	Yes ☐	No ☐
	5	I do **vigorous** physical activities every week, but less than 20 minutes a day or 3 days a week.	Yes ☐	No ☐
	6	I do 30 minutes or more a day of **moderate** physical activities, 5 or more days a week.	Yes ☐	No ☐
	7	I do 20 minutes or more a day of **vigorous** physical activities, 3 or more days a week.	Yes ☐	No ☐
RAPA 2 3 = Both 1 & 2	1	I do activities to increase muscle **strength**, such as lifting weights or calisthenics, once a week or more.	Yes ☐	No ☐
	2	I do activities to improve **flexibility**, such as stretching or yoga, once a week or more.	Yes ☐	No ☐

ID # _____

Today's Date _____

Scoring Instructions

RAPA 1: Aerobic

To score, choose the question with the highest score with an affirmative response. Any number less than 6 is suboptimal.

For scoring or summarizing categorically:

Score as sedentary:

1. I rarely or never do any physical activities.

Score as under-active:

2. I do some light or moderate physical activities, but not every week.

Score as under-active regular – light activities:

3. I do some light physical activity every week.

Score as under-active regular:

4. I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week.
5. I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.

Score as active:

6. I do 30 minutes or more a day of moderate physical activities, 5 or more days a week.
7. I do 20 minutes or more a day of vigorous physical activities, 3 or more days a week.

RAPA 2: Strength & Flexibility

I do activities to increase muscle strength, such as lifting weights or calisthenics, once a week or more. (1)

I do activities to improve flexibility, such as stretching or yoga, once a week or more. (2)

Both. (3)

None (0)

APPENDIX E

EXERCISE BENEFITS/BARRIERS SCALE

EXERCISE BENEFITS/BARRIERS SCALE

DIRECTIONS: Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by circling SA for strongly agree, A for agree, D for disagree, or SD for strongly disagree.

		Strongly Agree	Agree	Disagree	Strongly Disagree
1.	I enjoy exercise.	SA	A	D	SD
2.	Exercise decreases feelings of stress and tension for me.	SA	A	D	SD
3.	Exercise improves my mental health.	SA	A	D	SD
4.	Exercising takes too much of my time.	SA	A	D	SD
5.	I will prevent heart attacks by exercising.	SA	A	D	SD
6.	Exercise tires me.	SA	A	D	SD
7.	Exercise increases my muscle strength.	SA	A	D	SD
8.	Exercise gives me a sense of personal accomplishment.	SA	A	D	SD
9.	Places for me to exercise are too far away.	SA	A	D	SD
10.	Exercising makes me feel relaxed.	SA	A	D	SD
11.	Exercising lets me have contact with friends and persons I enjoy.	SA	A	D	SD
12.	I am too embarrassed to exercise.	SA	A	D	SD
13.	Exercising will keep me from having high blood pressure.	SA	A	D	SD
14.	It costs too much to exercise.	SA	A	D	SD
15.	Exercising increases my level of physical fitness.	SA	A	D	SD
16.	Exercise facilities do not have convenient schedules for me.	SA	A	D	SD
17.	My muscle tone is improved with exercise.	SA	A	D	SD
18.	Exercising improves functioning of my cardiovascular system.	SA	A	D	SD
19.	I am fatigued by exercise.	SA	A	D	SD
20.	I have improved feelings of well being from exercise.	SA	A	D	SD
21.	My spouse (or significant other) does not encourage exercising.	SA	A	D	SD

(Continued on reverse side)

		Strongly Agree	Agree	Disagree	Strongly Disagree
22.	Exercise increases my stamina.	SA	A	D	SD
23.	Exercise improves my flexibility.	SA	A	D	SD
24.	Exercise takes too much time from family relationships.	SA	A	D	SD
25.	My disposition is improved with exercise.	SA	A	D	SD
26.	Exercising helps me sleep better at night.	SA	A	D	SD
27.	I will live longer if I exercise.	SA	A	D	SD
28.	I think people in exercise clothes look funny.	SA	A	D	SD
29.	Exercise helps me decrease fatigue.	SA	A	D	SD
30.	Exercising is a good way for me to meet new people.	SA	A	D	SD
31.	My physical endurance is improved by exercising.	SA	A	D	SD
32.	Exercising improves my self-concept.	SA	A	D	SD
33.	My family members do not encourage me to exercise.	SA	A	D	SD
34.	Exercising increases my mental alertness.	SA	A	D	SD
35.	Exercise allows me to carry out normal activities without becoming tired.	SA	A	D	SD
36.	Exercise improves the quality of my work.	SA	A	D	SD
37.	Exercise takes too much time from my family responsibilities.	SA	A	D	SD
38.	Exercise is good entertainment for me.	SA	A	D	SD
39.	Exercising increases my acceptance by others.	SA	A	D	SD
40.	Exercise is hard work for me.	SA	A	D	SD
41.	Exercise improves overall body functioning for me.	SA	A	D	SD
42.	There are too few places for me to exercise.	SA	A	D	SD
43.	Exercise improves the way my body looks.	SA	A	D	SD

EXERCISE BENEFITS/BARRIERS SCALE

Scoring Information

The instrument may be scored and used in its entirety or as two separate scales. The instrument has a four-response, forced-choice Likert-type format with responses ranging from 4 (strongly agree) to 1 (strongly disagree). Barrier Scale items are reverse-scored. Items on the Barrier Scale are numbers 4, 6, 9, 12, 14, 16, 19, 21, 24, 28, 33, 37, 40 and 42.

Missing data may be handled in one of two ways. If more than five percent of the items are unanswered, it is recommended that the response be discarded. If the missing item response rate is less than five percent, median substitution prevents falsely low scores.

Scores on the total instrument can range from 43 to 172. The higher the score, the more positively the individual perceives exercise. When the Benefits Scale is used alone, the score range is between 29 and 116. When the Barriers Scale is used alone, scores range between 14 and 56. If used alone, the Barriers Scale does not need to be reverse-scored. In this instance, the higher the score on the Barriers Scale, the greater the perception of barriers to exercise.

APPENDIX F

GERIATRIC DEPRESSION SCALE PERMISSION LETTER

December 23, 2014

To Whom It May Concern:

This notification will serve as my permission for use to use the screening tool entitled the "Geriatric Depression Scale-Short Form." This form is found in public domain due to it being partly the result of Federal support.

Information on the tool and authors can be found at
http://web.stanford.edu/~yesavage/GDS.html

Sincerely,

Tomika M. Williams

APPENDIX G

EBBS PERMISSION LETTER

1987

Health Promotion Model - Instruments to Measure HPM Behavioral Determinants : Exercise Benefits/Barriers Scale [EBBS] (Adult Version)

Sechrist, Karen R.; Walker, Susan N.; Pender, Nola J.

http://hdl.handle.net/2027.42/85354

Health Promotion Model Instrumentation Group

Nola J. Pender, PhD, RN, FAAN • Susan Noble Walker, EdD, RN, FAAN • Karen R. Sechrist, PhD, RN, FAAN

Dear Colleague:

Thank you for your interest in the Exercise Benefits/Barriers Scale (EBBS). The EBBS was developed in response to a need for an instrument designed to determine perceptions of individuals concerning the benefits of and barriers to participating in exercise. Items for the scale were obtained inductively from interviews and from the literature.

The EBBS is a 43-item summated rating scale consisting of two subscales, Benefits and Barriers. Ratings are obtained using a four-point response system. The EBBS has been tested for internal consistency, validity of its constructs, and test-retest reliability. A sample of 650 individuals over 18 years of age, primarily from northern Illinois, participated in the initial testing of the EBBS. Calculation of Cronbach's alpha for the 43-item instrument yielded a standardized alpha of .954. The 29-item Benefits Scale has a standardized alpha of .954 and the 14-item Barriers Scale has a standardized alpha of .866. Factor analysis yielded a nine-factor solution initially with an explained variance of 65.2%. Second order factor analysis yielded a two-factor solution, one a benefits factor and the other a barriers factor. Test-retest reliability was accomplished with a sample of 66 healthy adults at a two-week interval. Test-retest reliability was found to be .89 on the total instrument, .89 on the Benefits Scale and .77 on the Barriers Scale. Additional information on the development and initial testing of the EBBS can be found at in the following article:

> Sechrist, KR, Walker, SN, and Pender, NJ. (1987). Development and psychometric evaluation of the Exercise Benefits/Barriers Scale. *Research in Nursing & Health, 10,* 357-365.

You have our permission to download and use the EBBS for non-commercial data collection purposes such as research or evaluation projects as long as the following conditions are met:

- The EBBS will be used without any modifications other than translation into a language other than English (see information on translation, if required);
- The copyright statement will appear on the bottom of all copies of the EBBS; and
- All study participants will be over 18 years of age since the EBBS was not validated in younger populations.

A copy of the EBBS with scoring information is available for download. A Spanish translation of the EBBS is also available. If you need additional information, you may contact Dr. Karen Sechrist by e-mail (krsech@pacbell.net).

Best wishes with your research,

Karen R. Sechrist, PhD, RN, FAAN
for Pender/Walker/Sechrist

APPENDIX H

SEE PERMISSION LETTER

Permission for use

Inbox x

Tomika Williams **<tmwilli5@uncg.edu>** 11/20/14

to Barbara

Good Morning Dr. Resnick:

My name is Tomika Williams and I am a doctoral candidate at UNC-Greensboro. I am writing to you to ask for information on the process required to obtain permission for use of two measurement tools for my dissertation. I would like to use the Self-Efficacy for Exercise Scale and the Physical Activity Survey for Long-Term Care.

I appreciate your work in the area of older adults and it has helped me with my dissertation work thus far. Please let me know the steps I need to take for working with these measures.

Thank you in advance,
Tomika Williams

Resnick, Barbara M. **<Resnick@son.umaryland.edu>** 11/20/14

to me

you should feel free to use them as you see fit. I would encourage you to use the outcome expectation measure as well. Not sure what population you are working with though. Barb
Barbara Resnick, PHd, CRNP, FAAN, FAANP
Professor
Sonya Ziporkin Gershowitz Chair in Gerontology
University of Maryland, School of Nursing
655 West Lombard Street Room 390
Baltimore, MD 21201
Tel: 410 706 5178
email: resnick@son.umaryland.edu

From: Tomika Williams [tmwilli5@uncg.edu]
Sent: Thursday, November 20, 2014 8:41 AM
To: Resnick, Barbara M.
Subject: Permission for use

2 Attachments

APPENDIX I

THE MINI COG

general assessment series

try this:

Best Practices in Nursing Care to Older Adults

From The Hartford Institute for Geriatric Nursing, New York University, College of Nursing

Issue Number 3, Revised 2013

Editor-in-Chief: Sherry A. Greenberg, PhD(c) MSN, GNP-BC
New York University College of Nursing

Mental Status Assessment of Older Adults: The Mini-Cog™

By: Deirdre M. Carolan Doerflinger, CRNP, PhD, Inova Fairfax Hospital, Falls Church, Virginia

WHY: Five and a third (5.3) million Americans of all ages have Alzheimer's disease or other dementias. Age is by far the greatest risk factor. One in ten individuals over 65 and nearly half of those over 85 are affected. A new case of dementia in some form is diagnosed every 70 seconds according to the *2010 Alzheimer's Disease Facts and Figures; Older Americans 2010 Key Indicators of Well-Being*. The increased availability of successful treatments for dementia and dementia-related illnesses means there is a substantial need for increased early identification of cognitive impairment, particularly in the geriatric population. Using a reliable and valid tool that clinicians can quickly implement facilitates early identification and allows the person to receive prompt treatment. Early identification and intervention in the form of medication and behavioral therapy may slow disease progression, delay functional decline, allow for pre-planning, and postpone nursing home placement.

BEST TOOL: The Mini-Cog™ is a simple screening tool that is well accepted and takes up to only 3 minutes to administer. This tool can be used to detect cognitive impairment quickly during both routine visits and hospitalizations. The Mini-Cog™ serves as an effective triage tool to identify patients in need of more thorough evaluation. The Clock Drawing Test (CDT) component of the Mini-Cog™ allows clinicians to quickly assess numerous cognitive domains including cognitive function, memory, language comprehension, visual-motor skills, and executive function and provides a visible record of both normal and impaired performance that can be tracked over time.

TARGET POPULATION: The Mini-Cog™ is appropriate for use in all health care settings. It is appropriate to be used with older adults at various heterogeneous language, culture, and literacy levels.

VALIDITY AND RELIABILITY: The Mini-Cog™ was developed as a brief screening tool to differentiate patients with dementia from those without dementia. Depending on the prevalence of dementia in the target population, the Mini-Cog™ has sensitivity ranging from 76-99%, and specificity ranging from 89-93% with 95% confidence interval. A chi square test reported 234.4 for Alzheimer's dementia and 118.3 for other dementias ($p<0.001$). This tool has strong predictive value in multiple clinical settings (Borson et al., 2003). Newer research suggests that a 5-point numerical scoring system based on the original algorithm may be easier to apply: repeating three items (0 points), a clock drawing distractor (CDT) (0-2 points), and recall of the earlier three items after the CDT (0-3 points). A score of 3-5 out of 5 is a negative screen for dementia (Borson et al., 2006), but a cut score of 4-5 out of 5 may increase detection of mild cognitive impairment (McCarten et al., 2012). The Mini-Cog™ by itself is not considered a valid tool for this use. For further assessment of mild cognitive impairment, consider administering the Montreal Cognitive Assessment (MoCA) (See *Try This:* MoCA).

STRENGTHS AND LIMITATIONS:
The Mini-Cog™ takes up to 3 minutes to administer. The clock drawing component of the test is scored simply as normal or abnormal for the purpose of the Mini-Cog™ and specific scoring rules are included with the tool. More comprehensive analysis of the CDT does not improve detection of dementia and would increase complexity of the currently simple training requirements for clinicians and perhaps decrease its attractiveness as a simple screening tool. The Mini-Cog™ is not strongly influenced by education, culture, or language and it was perceived as less stressful to the patient than other longer mental status tests. The accuracy of the Mini-Cog™ in heterogeneous groups may increase the identification of dementia in populations less diagnosed thereby increasing minority participation in research and improving parity of early treatment.

MORE ON THE TOPIC:

Best practice information on care of older adults: www.ConsultGeriRN.org.

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The Mini Cog™

Administration:

1. Instruct the patient to listen carefully to and remember 3 unrelated words and then to repeat the words. The same 3 words may be repeated to the patient up to 3 tries to register all 3 words.

2. Instruct the patient to draw the face of a clock, either on a blank sheet of paper or on a sheet with the clock circle already drawn on the page. After the patient puts the numbers on the clock face, ask him or her to draw the hands of the clock to read a specific time. The time 11:10 has demonstrated increased sensitivity.

3. Ask the patient to repeat the 3 previously stated words.

Scoring: (Out of total of 5 points)
Give 1 point for each recalled word after the CDT distractor. Recall is scored 0-3.
The CDT distractor is scored 2 if normal and 0 if abnormal.
(Note: The CDT is considered normal if all numbers are present in the correct sequence and position, and the hands readably display the requested time. Length of hands is not considered in the score.)

Interpretation of Results:
0-2: Positive screen for dementia
3-5: Negative screen for dementia

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