Physical Activity in Assisted Living Facility Residents

by

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DEDICATION

To my family, my husband David, my daughters Maria and Sara,

Thank you for being my inspiration for living life to the fullest every day.

Thank you for your unending support through this journey.

Everything I have, I share with you!

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ABSTRACT

PURPOSE: The purpose of this dissertation was to (1) synthesize relevant scientific literature on factors influencing PA in this population (2) explore the experience and meaning of PA in ALF residents and (3) assess the feasibility and acceptability of the activPAL accelerometer and a set of questionnaires for measuring PA behaviors as part of a preliminary step in the development of future research. **METHODS:** Studies were analyzed using Whittemore and Knafl's (2005) methodology. deBruin et al. (2008) criteria were used to determine methodological quality. A qualitative design was used to explore the experience and meaning of PA. A semi-structured interview was conducted. Raw data were reduced and analyzed guided by Moustakas' and Colaizzi's methodology. The activPAL was taped to the subjects' thigh for seven consecutive days of 24-hour monitoring of PA. A set of five questionnaires were completed. A structured interview assessed the likability and comfort of the activPAL and questionnaires using Likert scales. **RESULTS:** The integrative review consisted of 12 articles and nine were found to be cross-sectional, descriptive studies with a mean quality score of 9.58 (range 5.0-19.0, SD=3.70) indicating the strength of evidence for determining factors that influence PA in ALF residents is low to medium. The study sample consisted of 20 older adults in assisted living aged 57-96 years (M=77.4, SD=10.6) and included 16 (80%) females. Twenty-seven meaning units were derived and clustered into five themes. Residents were sedentary but saw themselves as active, in part because they compared themselves to others perceived as less active. PA meant disability could be prevented. Approximately 20 hours per day were spent sitting or lying (M=20.2, SD=2.3) and one hour per day was spent stepping. Significant correlations were detected between steps taken and age (r = -.659), MMSE (r = .466) and CCMI (r = .648). **CONCLUSIONS:** Quality evidence is lacking regarding factors influencing PA in ALF residents. PA is limited by expectations and understanding of PA. The activPAL and questionnaires are feasible to use for measuring PA in ALF residents. Further research is needed to clarify the importance of PA for healthy living in this population.

CHAPTER 1

Introduction

According to the National Center for Assisted Living (2013), in 2010 there were 31,100 assisted living facilities (ALF's) in the United States (U.S.) with a capacity for approximately 972,000 individuals. The demand for ALF's is expected to double by the year 2050 in the U.S. as the population continues to age (Harris-Kojetin, Sengupta, Park-Lee, & Valverde, 2013; Niles-Yokum & Wagner, 2015). Each year thousands of older adults relocate to ALF's and a majority of these individuals move from their homes (Carpenter, Sheridan, Haenlein & Dean, 2006). Those relocating to an ALF are typically non-Hispanic white (91%), female (70%), and 75 years of age or older (81%). Sixty-two percent are in need of assistance with two activities of daily living (ADL's) (Caffrey et al., 2010). Reasons for transferring from independent living to an ALF include decreased physical function, deteriorating cognitive status and frailty at a level requiring regular assistance with ADL's (Avery, Kleppinger, Feinn, & Kenny, 2010; Carpenter et al., 2006; Rosenberg et al., 2006).

From a historical perspective, ALF's evolved organically in the late 1970's. They offered an option for aging in place for older adults with disabilities who were not eligible for nursing homes but desired an autonomous living environment (Kane, Kane & Ladd, 1998). The first ALF's included neighborhood residential housing modified to meet the needs of individuals unable to perform various activities such as bathing,

housekeeping and shopping. They then developed further in the 1980's and 1990's into a variety of settings including free-standing facilities with private bedrooms and baths and shared eating and communal spaces, offering variable health and personal care services (Brown-Wilson, 2007). State licensing and regulations followed well after the establishment of many ALF's and today more than 30,000 such designated facilities exist across the U.S. with a range of policies and practices impacting the living environment, the delivery of health care, socialization and quality of life for residents (Gregory, Gesell & Widmer, 2007).

Currently, there is no national standardized definition or operational criteria for ALF's. The constructs related to philosophy, setting and service still vary from state to state (Resnick, Galik, Gruber-Baldini & Zimmerman, 2009). For purposes of this dissertation an *assisted living facility* (ALF) refers to any residential care facility for individuals who are unable to live independently but do not require the level of skilled healthcare provided by a nursing home (Caffrey et al., 2012). Most ALF's in the U.S. share the philosophy that assisted living is intended to maximize residents' autonomy, dignity, privacy, independence, choice and safety in the least restrictive setting possible (Assisted Living Federation of America, 2013; Mollica & Houser, 2010). An array of amenities offered by ALF's such as housekeeping, meal preparation and laundry service make them marketable and attractive to potential residents and families seeking safe and supportive housing options.

Physical activity (PA) in ALF residents can provide many benefits. PA can delay the onset of frailty (Venturelli, Lanza, Muti, & Schena, 2010) and minimize the risks of cardiovascular disease, diabetes, osteoporosis and some cancers (Kenny et al., 2009;

Taraldsen, Chastin, Riphagen, & Vereijken, 2012). Regular PA can also help to manage depression and promote feelings of well-being. It can help relieve arthritic symptoms, help with glucose control and sleep hygiene. PA can maintain or improve functional status and improve gait and flexibility resulting in fewer falls (McPhee, Johnson & Dietrich, 2004). The amenities offered by ALF's, however, may have unintended consequences and may rob residents of the opportunity to engage in PA that is beneficial to their health and well-being (Resnick, Galik, Gruber-Baldini & Zimmerman, 2011).

Studies have examined the impact of various factors influencing PA in older adults. Resnick & D'Adamo (2011) tested a model of factors thought to influence exercise activity in older adults residing in continuing care retirement communities. The study found that those with higher self-efficacy expectations and weaker negative outcome expectations for exercise spent more time exercising. Resilience, self-rated health, perceived pain, and fear of falling were found to indirectly influence exercise through negative outcome expectations. Rossen (2010) examined PA in a group of older women moving to independent living communities. Subjects reported that accessible walking routes made it possible to maintain pre-relocation levels of PA. These subjects also reported experiencing high levels of self-esteem and low levels of depression. There is little research addressing factors that influence PA in ALF residents. Studies are needed to explore the impact of factors on PA in the ALF residents in the U.S. and understand the type and amount of PA ALF residents engage in.

Statement of the Problem

Despite the known benefits of PA, adults over the age of 65 years have been found to be the least physically active individuals in the United States with only 2.5

percent meeting the recommendations for PA (Bergman, Bassett, & Klein, 2008; Troiano et al., 2008; U.S. Department of Health and Human Services, 2008). Assisted living facility residents are even less likely to engage in levels of PA that might delay or prevent functional and physiological deterioration and are estimated to spend up to 65 to 70 percent of their days in sedentary behavior (Koltyn, 2001; Krol-Zielinska, Kusy, Zielinski, & Osinski, 2010; Phillips & Flesner, 2013; Resnick et al., 2009). Few studies have examined PA in ALF residents in the U.S. A full examination of personal, social and environmental factors and their influence on PA in ALF residents is needed. There is also a lack of research on PA in ALF residents using objective measures of PA (Resnick, Galik, Gruber-Baldini & Zimmerman, 2010; Resnick et al., 2011, Rosenberg et al 2012). Accelerometry, for example, has rarely been used to measure PA and self-report instruments are commonly employed to collect PA data in this population. Tucker, Welk and Beyler (2011) compared self-report to accelerometry in older adults and found that participants over reported participation in PA by approximately 50 percent in questionnaires. This emphasizes the need to incorporate more objective measures in studies conducted in this population. More research would lead to the development of interventions that reduce sedentary behavior and support PA engagement in ALF residents.

Structure of Dissertation Proposal

A manuscript-style dissertation was proposed and three manuscript-style papers were completed for this study. The first manuscript is an integrative review of the literature on factors and interventions that influence time spent in PA in ALF residents. The second manuscript is a presentation of the results of a qualitative study to better

understand the experience and meaning of PA for ALF residents. The third manuscript is a feasibility and acceptability study. It examines the feasibility and acceptability of using of a continuous wearable accelerometry device to measure PA in ALF residents. Demographic variables, self-reported PA, self-rated health, co-morbidities and self-efficacy for PA were examined as part of a preliminary step to designing future intervention studies. Specific aims were:

1. Review the factors and interventions that influence PA in ALF residents. This aim will be accomplished by conducting an integrative review and synthesis of the relevant scientific literature.
2. Describe the experience and meaning of PA and develop an understanding of how this relates to PA in ALF residents. Qualitative methods via a phenomenological approach will be used to accomplish this aim.
3. Investigate the feasibility and acceptability of using an accelerometer to collect data on PA in ALF residents and evaluate (a) adherence to protocol (b) barriers to wearability (c) physical activity data.
4. Investigate the feasibility and acceptability of completing a set of questionnaires on demographic data, PA, self-rated health, co-morbidities and self-efficacy for PA as part of a preliminary step in the development of future research.

Theoretical Guide

Social Cognitive Theory (SCT) focuses on psychological determinants of behavior and posits that *self-efficacy*, the key concept for which SCT is widely known, correlates with various health behaviors such as engaging in PA (Bandura, 1997). Self-

efficacy (Bandura, 1997) is an individual's belief about their ability to influence events in one's life and achieve goals. Within the context of SCT, human behavior is thought to be purposive and regulated by cognized goals which serve as motivators that prompt individual efforts (Bandura, 1993). The stronger the perceived appraisal of abilities, the greater the likelihood one will be committed to goals and achieve them.

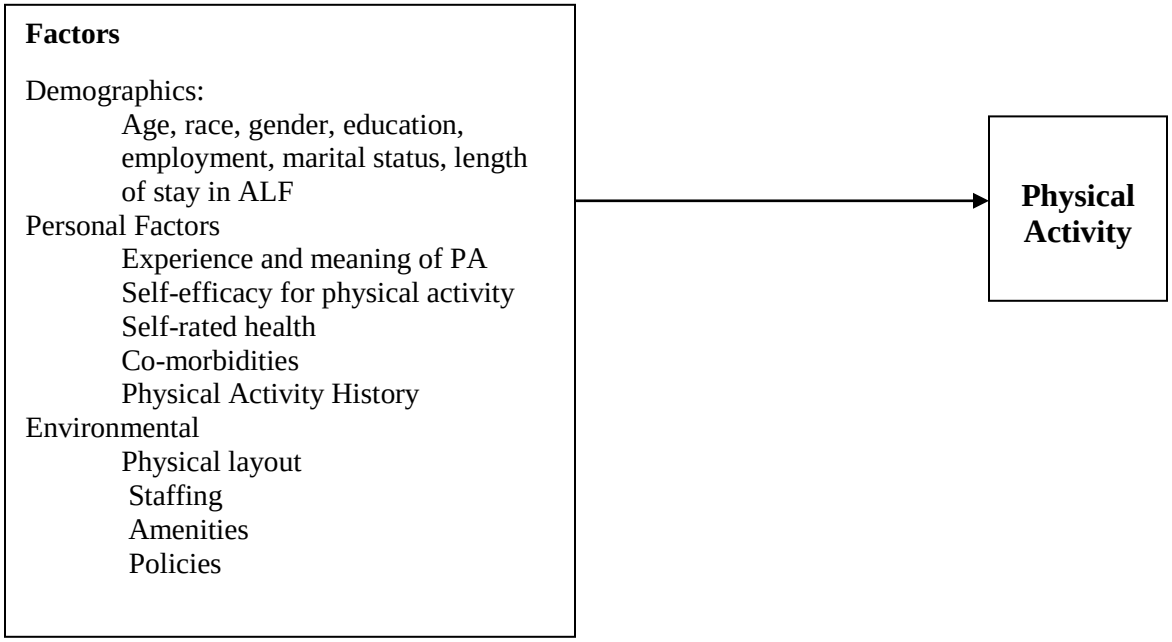
SCT has been referenced in several studies researching PA in older adults. For example, self-efficacy has been associated with adopting and maintaining PA in community-dwelling older adults (McAuley et al., 2009; McAuley et al., 2007; Resnick & Spellbring, 2000). McAuley, et al. (2011) found that higher levels of executive function and the use of self-regulatory strategies, such as enlisting social support and managing time, enhanced self-efficacy for exercise in a group of community-dwelling older adults. Self-regulation is another key concept of SCT. Self-efficacy has also been identified as a mediator of the effects of PA on functional limitations in older women (McAuley et al., 2007). This supports Bandura's proposed pathway from self-efficacy to behavior through potential *facilitators* and *barriers* and suggests other factors related to the aging process may have implications for health behaviors like PA behavior (Bandura 2004). Facilitators and barriers are environmental determinants of behavior and together constitute another key concept in SCT.

Facilitators may be personal, social or environmental factors that can make engaging in PA easier for ALF residents. These may include health status, social support from family or staff and safe walkways. *Barriers* to engaging in PA may also be personal, such as poor physical function or the belief that one has little control over their level of PA. Barriers may be social or environmental such as lack of adequate staffing or

system-related policies, procedures and regulations that prohibit engagement in PA. Resnick (2004) found in a longitudinal study of community-dwelling older adults that a decrease in self-efficacy expectations significantly related to a decrease in exercise behavior over the course of four years and that self-efficacy was influenced by personal perceptions of poor physical health. In this preliminary study, the experience and meaning of PA in addition to self- efficacy for PA and various factors, such as self-rated health and co-morbidities, were examined for their influence as facilitators of or barriers to PA in ALF residents within the SCT framework.

The qualitative portion of this study was the primary source of information to describe the experience of PA and identify potential factors that may be amenable to interventions designed to increase PA in ALF residents. The feasibility and acceptability study provides needed information on the activPAL accelerometer which can be used to objectively measure PA in ALF residents in future studies. Demographic variables, PA history and environmental factors were examined as possible additional factors influencing PA in ALF residents in this study and are included in Figure 1.1.

Figure 1.1 Factors Influencing Physical Activity.



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CHAPTER 2

Factors and Interventions Influencing Physical Activity in Assisted Living Facility Residents: An Integrative Review of the Literature

Introduction

The American College of Sports Medicine (ACSM) in conjunction with the American Heart Association (AHA) has issued joint guidelines for physical activity (PA) in older adults (Chodzko-Zajko et al., 2009). These guidelines suggest that adults 65 years of age and older should engage in a minimum of 30 minutes of moderate-intensity aerobic PA five days a week. This is in addition to muscle strengthening activities a minimum of two days a week (CDC, 2014). Bouts of light PA performed as tolerated are also recommended and are considered beneficial for older adults (Nelson et al., 2007; Safdar et al., 2010). Despite these recommendations, evidence demonstrates that a majority of older adults are physically inactive and that inactivity tends to increase with age (Conn, Minor, Burks, Rantz, & Pomeroy, 2003). Older adults residing in assisted-living facilities (ALF's) in the United States (U. S.) may be at risk for high levels of physical inactivity yet little is known about PA levels and factors that influence PA in these individuals (Phillips & Flesner, 2013). Advancing age, cognitive impairment, physical disability and other factors influence PA in older adults (Resnick & D'Adamo, 2011), but such evidence is scarce in ALF residents. Understanding what factors

influence PA in ALF residents would be beneficial for designing intervention research aimed at increasing or maintaining PA levels.

Assisted living facilities (ALF's) in the U.S. have evolved over the last 30 years (Brown-Wilson, 2007). They currently operate within a range of policies and practices that impact the living environment, the delivery of health care, socialization, quality of life and PA engagement for residents (Gregory, Gesell & Widmer, 2007). Most ALF's in the U.S. offer unique combinations of housing, 24-hour assistance with medication administration and personal care such as bathing and toileting (U.S. Department of Health and Human Services, 2008). They also help with instrumental activities of daily living (IADL's) such as housekeeping and transportation services and provide social and recreational activities (Resnick & Galik, 2013). The variety of helpful services, however, may prevent residents from engaging in levels of PA that could be beneficial (Mihalko & Wickley, 2003). In addition, family and client expectations regarding the assurance of safety in the ALF environment can dictate the level of resident participation in PA. These expectations are often met by management and staff eager to provide services and satisfy consumers. This may further limit opportunities to engage in PA and contribute to functional decline, frailty and disability in ALF residents (Giuliani et al., 2008).

Residents in ALF's tend to exhibit functional decline similar to those found in nursing home residents (Fonda, Clipp & Maddox, 2002). Approximately 74 percent of ALF residents receive assistance with ADL's, with bathing and dressing being the most common (Caffrey et al., 2012; Mollica & Houser, 2010; Niles-Yokum & Wagner, 2011). The average length of stay in an ALF is two years with declining physical function accounting for half of all transfers to skilled nursing facilities (Avery, Kleppinger, Feinn

& Kenny, 2010; Phillips et al., 2003). It is important to understand how to increase PA and reduce sendentary behavior in ALF residents in order to benefit overall health, delay functional decline, and contribute to improved utilization of health care services.

Barriers and Facilitators of PA

Research has examined barriers and facilitators of PA in the older adult population. Barriers known to limit participation in PA in older adults include painful conditions such as joint degeneration and peripheral neuropathies (Lihavainen et al., 2011; Macniven et al., 2013). Other barriers include unstable gait and muscular weakness (de Bruin, Vanhet Reve & Murer, 2012), impaired cognition, depression, lack of motivation, and lack of social support (Burdick et al., 2005; Peri et al., 2007). Side effects of medications and increased weight can also be barriers to PA in older adults (Yamakawa, Tsai, Haig, Miner & Harris, 2004). Hall and McAuley (2010) report that functional decline and the absence of safe walking paths present barriers to PA in community-dwelling older adults. Lack of knowledge about the benefits of PA and ageism can also prevent older adults from engaging in beneficial levels of PA (Nelson et al., 2007).

Little is known about the barriers to participating in PA in ALF residents. Lu (2010), in a mixed-method study of 34 ALF administrators, identified that resident walking behavior was related to the design of the interior ALF environment. Narrow corridors without seating, a lack of continuous handrails, poor lighting and poor window views were reported as a hindrance to walking. Phillips & Flesner (2013) did focus group interviews with a mixed group of 47 ALF and independent living community residents. Fear of falling, laziness, and boredom were identified as barriers to participation in

structured exercise programs. More research is needed to understand the impact of personal, social and environmental factors that may be barriers to engaging in PA in ALF residents.

Strong self-efficacy for PA has been identified as one facilitator of exercise adherence in community-dwelling older adults (McAuley et al., 2007) and in continuing care retirement community residents (Hall & McAuley, 2011; Resnick & D'Adamo, 2011; Resnick, 2004). Chen, Li and Yen (2015) found that higher self-efficacy for exercise predicted total PA in residents in long-term care institutions in Taiwan. There is currently limited understanding, however, of how self-efficacy or other personal, social or environmental factors may facilitate PA in ALF residents in the U.S. This presents a gap in research.

Statement of the Problem

Older adults have been found to be the least physically active group of individuals in the U.S. (U.S. Department of Health and Human Services, 2008). It is suggested that ALF residents are even less active and spend significant amounts of time in sedentary behavior (Resnick, Galik, Gruber-Baldini & Zimmerman, 2009). Too much sedentary behavior is an area of concern with ALF residents because it can put them at higher risk for metabolic and musculoskeletal problems and increased frailty (Krol-Zielinska, Kusy, Zielinski, & Osinski, 2010; Matthews et al., 2008; Song et al., 2015). The **purpose** of this study is to conduct an integrative review to synthesize the relevant scientific literature and better understand the factors and interventions influencing PA in ALF residents in the U.S.

Methods

Review Process

Whittemore and Knafl's (2005) methodology was used to guide the integrative review. The steps included (1) problem identification and the purpose (2) the literature search using a minimum of two strategies for identifying relevant studies, (3) evaluation of methodological quality for each study (4) data extraction and analysis and (5) data synthesis (Appendix A). Data are displayed in table format to enhance the visualization of findings across sources and aide in interpretation and synthesis. A novel approach integrating two methods was used to assess methodological study quality. In the first method, Brink and Wood's (1998) classification system was used to categorize and evaluate both experimental and non-experimental research studies. Brink and Wood (1998) identify three levels of research design. Design Level I indicates the study is qualitative or descriptive. Design Level II indicates the study is comparative or correlational. Design Level III indicates the study is quasi-experimental or experimental.

Downs and Black (1998) created a checklist widely used to assess the methodological quality of randomized and non-randomized studies. deBruin et al. (2008) designed and used a purpose-adjusted list of the Downs and Black checklist to complete a literature review that assessed descriptive, mixed-method, correlational and experimental research designs. Downs and Black (1998) is comprised of 5 domains and 27 items with a total possible quality score of 32. The deBruin et al. (2008) list is comprised of 18 items representing the same 5 domains (1) quality of reporting with 8 points possible (2) external validity with 1 point possible (3) internal validity-bias with 5 points possible (4) internal validity-confounding (selection bias) with 3 points possible and (5) power with 5

points possible. The total possible quality score is 22 points (Appendix B). The main difference between the two checklists is in the internal validity domain which addresses confounding selection bias. The deBruin et al. (2008) 18-item checklist was the second method used to evaluate the methodological quality of identified studies. The methodological quality scores using deBruin et al. (2008) were calculated on two occasions by the same reviewer with a 3-month washout period between reviews. Utilizing Brink and Wood (1998) and deBruin et al. (2008) for evaluating quality will enhance rigor and result in more meaningful evaluation of sources (Whittemore & Knafl, 2005).

Literature Search

A systematic literature search of five computerized databases, PubMed, MEDLINE, CINAHL, Web of Science and Cochrane Systematic Reviews, was completed in January, 2015. Key search terms included: “assisted living”, “assisted living facilities”, “assisted care facilities“, ”exercise”, “therapeutic exercise”, “exercise therapy”, “motor activity”, “physical activity”, “walking” and “movement ” (Appendix C). No time limits were placed on the searches. All retrieved articles were migrated into an online reference manager where all database searches were merged and duplicates of the searches were identified and removed. A hand search of the reference section of all final accepted articles was the second search strategy.

Data Evaluation

Inclusion criteria (Appendix D) were (a) any type of research design except case study, (b) subjects had to be cognitively intact, meaning no diagnosis of dementia or Alzheimer’s disease, (c) ALF residents living in the U.S. must comprise all or part of the

study sample and be readily identifiable in the analysis portion of the study, (d) personal, social or environmental factors and interventions thought to influence PA are identifiable, (e) physical activity must be a study variable measured. Exclusion criteria were (a) studies conducted outside of the U.S. because of international differences in health and facility policies that might influence PA, (b) abstracts, conference presentation summaries and poster presentations, (c) case studies since methodological quality evaluation criteria is not applicable to these aforementioned designs.

The following process (Appendix E) was used to identify eligible studies for full review: (a) title and abstract were screened by a primary investigator and secondary reviewer using the inclusion and exclusion criteria (b) identified full text articles were reviewed by the primary investigator and secondary reviewer (c) reference lists of the full text reviewed articles were hand searched for additional possible articles (d) unanimous agreement between both reviewers was achieved for the final selection of studies for analysis. Thirty articles were identified as meeting criteria for full-text review from 368 retrieved articles. The hand search among the reference sections of these 30 articles identified one more citation for review. Of these 31 articles, 19 were excluded and 12 articles remained for the integrative review (Figure 2.1). Data were analyzed using IBM SPSS Statistical Package 23©. The following information was extracted from each publication (a) author, year (b)sample characteristics(c) study design (d) purpose (e) measures used to assess PA (f) amount and type of PA measured (g) findings related to the factors or interventions influencing PA (h) methodological quality and (i) strengths and limitations.

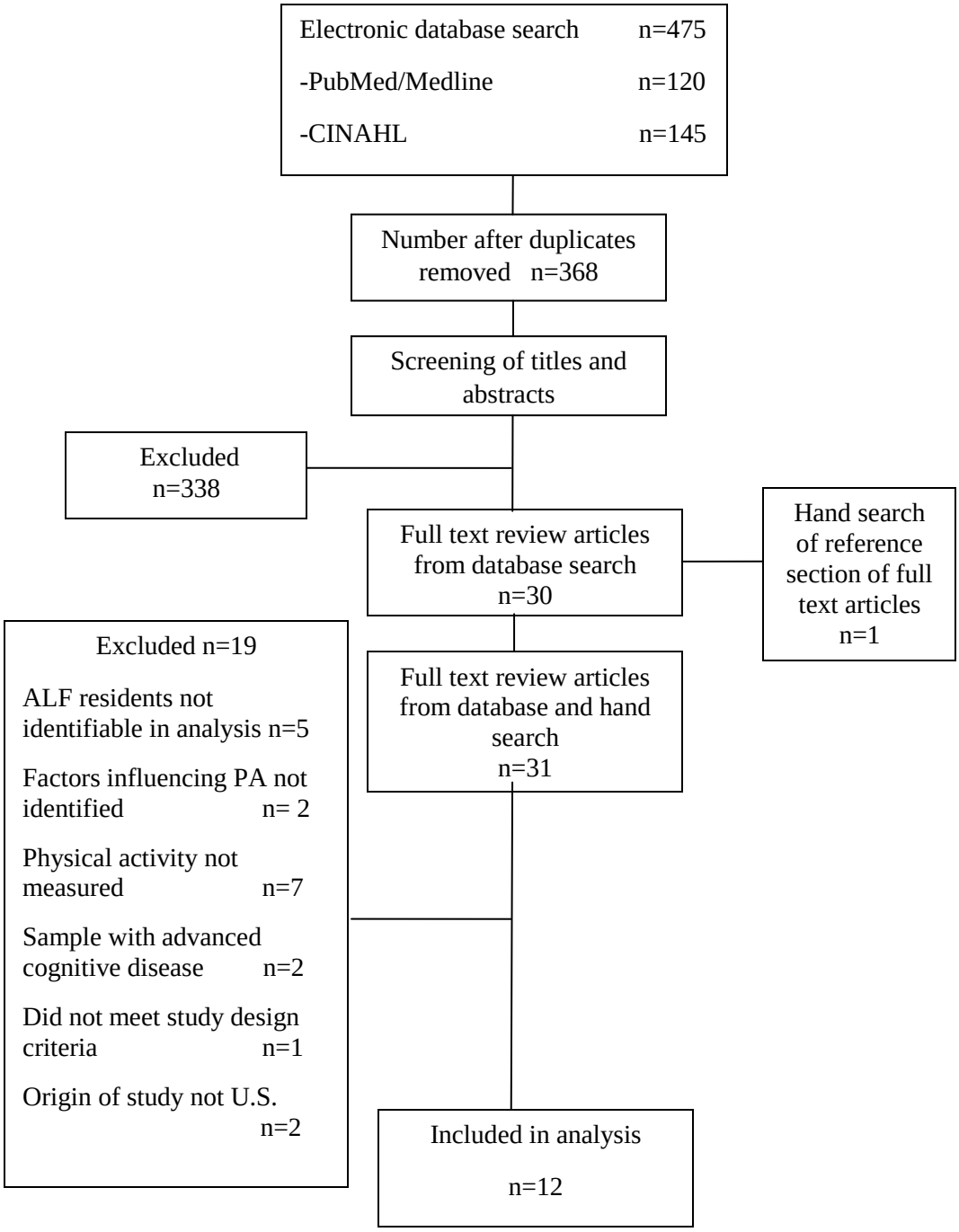
Results

Study Characteristics

The date range for the analyzed articles was 1998 through 2014. Sample sizes in the studies ranged from 10 to 1,079 (M=233.0, median=64). Fifty-eight percent of the studies had sample sizes less than 70. A majority of studies were cross-sectional (n=9, 75%). One study was qualitative (Lu, Rodiek, Shepley & Duffy, 2011). One study was a secondary analysis of data collected from a cross-sectional study (McPhee, Johnson & Dietrich, 2004). Five studies used a comparative design to examine differences in PA between ALF residents and either independent living (IL) older adults or nursing home (NH) residents or between multiple ALF sites (Bergman, 2005; Koltyn, 2001; Resnick, Galik, Gruber-Baldini & Zimmerman, 2010a; Schroeder, Nau, Osness & Potteiger, 1998; Wyrick, Parker, Grabowski, Feuling & Ng, 2008). Two studies used a quasi-experimental design to test different environmental conditions and the impact on PA (Herbert & Greene, 2001; Resnick et al., 2009). One study was a randomized controlled trial (Resnick, Galik, Gruber-Baldini & Zimmerman, 2011).

The purpose of the studies fell into three major categories. The first category was to examine the influence of environmental factors on PA (Bergman, 2005; Lu et al., 2011; Rodiek, Lee & Nejati, 2014; Schroeder et al., 1998). The second category examined how personal factors such as using a walker, engaging in healthy habits, self-efficacy for PA and the value of PA impact PA (Horowitz & Vanner, 2010; Koltyn, 2001; McPhee et al., 2004; Resnick et al., 2010; Wyrick et al., 2008). The third category tested an intervention to examine the impact of personal or environmental factors on PA (Herbert & Greene, 2001; Resnick et al., 2009; Resnick et al., 2011).

Figure 2.1 Flow Diagram of Systematic Search



Sample Characteristics

The total number of ALF residents in the studies was 2,428. The majority of subjects were female (M/F=692/1905, F=73%). The age range was 74.0 to 87.7 years of age. Other demographic information such as race, marital status, education level and health problems was inconsistently reported. Two studies (Resnick et al., 2010; Resnick et al., 2011) were based on the same sample of ALF residents. A summary of study and sample characteristics including the methods and purpose can be found in Table 2.1.

Table 2.1 Integrative Review Study and Sample Characteristics

Author/Year/Region	Sample Characteristics	Design/Methods	Purpose
Bergman (2005)[27]	N=37 RH=17 M/F=5/12 AL=8 M/F=3/5 NH=12 M/F=3/9 Mean Age All=85.8 ±4.2 RH=85.4±5.5 AL=87.0±4.0 NH=85.5±3.2	Cross-sectional Comparative	Compare physical activity levels (steps per day) in retirement home (RH) older adults with physical activity levels in older adults residing in assisted living (AL) facilities and nursing homes (NH).
Herbert & Greene (2001)[109]	N=10 M/F=0/10 Mean Age=79.6 Age range 70-89	Quasi-experimental Within-Subject	Investigate the effect of the preferred condition (either walking with or without a dog and walking with a dog indoors or outdoors) on walking distance in ALF residents.
Horowitz & Vanner (2010)[118]	N=131 M/F=52/77 Mean Age=83.1±7.24 Age range=65-99	Cross-sectional Correlational	Examine the relationship between physical activity, physical and mental quality of life, and life satisfaction in ALF residents. Learn whether assisted living residents' engagement in diverse physical activities was influenced by the values these activities held for them, specifically those of greatest importance.
Koltyn (2001)[368]	N All=60 AL=15 M/F=0/15 IL=45 M/F=0/45 Mean age=74±10	Cross-sectional Comparative	Examine the association between physical activity and quality of life in older women in independent living arrangements and in assisted living. Examine preferences and barriers to physical activity in older women living independently (IL) and in assisted living (AL) facilities.
Lu et al. (2011)[184]	N=50 M/F=7/43 Mean age=84.0 Age range= 60.0-99.0	Cross-sectional Qualitative Focus Groups	Identify (a) ALF residents' reasons to choose walking indoors (b) walking types/patterns, and (c) the influence of the physical environment on PA.

McPhee et al. (2004)[203]	N=1,079 M/F= 249/830 Mean Age=83.3±6.7	Cross-sectional Descriptive Secondary Analysis	Define the relationship between participation in 7 healthy habits as identified by The Healthy Generation Survey including engaging in regular physical activity, and the health status of older adults living in assisted living facilities.
Resnick et al. (2009)[261]	N=14 M/F=4/10 Mean age=86.2±6.0	Quasi-experimental Pre-test Post-test	Pilot study to test the feasibility of the Restorative Care for Assisted Living (Res-Care-Al) intervention. Intervention: An RN trained in Res-Care-AL worked 15-hours/week to develop short term goals for residents regarding bathing, dressing, or exercise. Goal attainment scale was completed by resident articulating long-term goals regarding activities. The trained RN worked with an RN at the facility and taught the aspects of the intervention. The nursing assistants were taught how to promote activity in residents using enactive mastery, verbal persuasion, vicarious experience and by decreasing unpleasant symptoms such as pain to increase self-care and physical activities such as walking.
*Resnick et al. (2010)[262]	*N=171 M/F= 35/136 Mean Age= 87.7 ± 5.7	Cross-sectional Descriptive Comparative	Describe ALF residents' self-efficacy for physical activity, outcome expectations regarding physical activity, physical activity levels, physical environment fit and functional performance. Compare findings across three assisted living facilities.
*Resnick et al. (2011)[260]	Assisted Living Residents *N=171 M/F=35/136 Mean Age=87.7±5.7	Experimental RCT	To develop and test the Function Focused Care in Assisted Living (FFC-AL) intervention so as to alter the decline that older adults in assisted living experience and to improve time spent in PA. Intervention: A FFC nurse coordinated and implemented FFC-AL with support from an RN and direct care workers at randomized sites by working 15 hours/week for 6 months, then 8 hours/week for 3 months, then 4 hours/week for 3 months. Four Components of the FFC-AL intervention included (1) environment and policy assessments by the facility RN (2) education of staff and residents on FFC (3) establishing goals for each resident regarding participation in self-care and other activities (4) mentoring and motivating done by direct care workers

			one-on-one with each resident. Control sites received FFC education component only.
Rodiek et al. (2014)[273]	N=906 M/F=200/706 Mean Age=84.0±8.4	Cross-sectional Mixed-Method	Evaluate how exterior doorways affect outdoor usage and walking for PA.
Schroeder et al. (1998)[286]	N=69 IL=23 M/F/=4/19 AL=23 M/F=2/21 NH=23 M/F=3/20 Mean Age IL=79.9±3.3 AL=81.0±2.7 NH=80.4±2.7	Cross-sectional Comparative	Quantify functional ability, balance, muscular strength, flexibility, life satisfaction and physical activity in older adults 75-85 years of age living in one of 3 residential settings: nursing home (NH), assisted living (AL) facility, independent community living (IL) and examine differences between living settings.
Wyrick et al. (2008)[357]	N=21 M/F= 5/16 Mean Age: 85.5±4.5	Cross-sectional Comparative	Test the hypothesis that habitual physical activity, depression, fatigue, and perceived health status are negatively affected by walker or cane use in an assisted living facility.

AL=Assisted Living; IL=Independent Living; NH=Nursing Home; *Studies based on same sample.

Measurement of Physical Activity

Both objective and subjective measures were used in the studies to assess PA. Three studies used objective measures exclusively (Bergman, 2005; Resnick et al., 2011; Wyrick et al., 2008). Seven studies used subjective measures exclusively (Horowitz & Vanner, 2010; Koltyn 2001; Lu et al., 2011; McPhee et al., 2004; Resnick et al., 2009; Rodiek et al., 2014; Schroeder et al., 1998). Two studies utilized both objective and subjective methods (Herbert & Greene, 2001; Resnick et al., 2010). Objective measures included the Actigraph accelerometer which was used in three studies (Resnick et al., 2010; Resnick et al., 2011; Wyrick et al., 2008). Resnick et al. (2010) and Resnick et al. (2011) collected Actigraph data for 24 hours. Wyrick et al. (2008) collected Actigraph data for seven days. Bergman (2005) employed the StepWatch pedometer worn on the ankle to measure number of steps taken for one 24-hour period.

Studies employing objective measures of PA reported results in a variety of ways. Distance walked, steps per day, time spent in light and moderate PA, and energy expenditure were reported. Walking distance was measured through direct observation and ranged from 4.5 laps or 2,250 feet per day to 6.25 laps or 3,125 feet per day which equates to approximately a half mile (Herbert & Greene, 2001). Mean steps per day (2,592 ±1,961.69) were reported in one study (Bergman, 2005). Time spent in light PA was reported as 143.4 ±147.1 minutes per day post-intervention (Resnick, 2010) and as 499.0 ± 275.0 raw accelerations per day at light intensity (Wyrick et al., 2008). Time spent in moderate PA was reported as 0.70 ± 2.40 minutes per day post-intervention (Resnick et al., 2010), as 0.72 ± .33 minutes per day post-intervention (Resnick et al., 2011) and as 50.0 ± 40.0 raw accelerations per day at moderate intensity (Wyrick et al., 2008). Energy expenditure was reported as 58.04 ± 9.93 kcals per day post-intervention (Resnick et al., 2011). A summary of findings in studies using objective measures can be found in Table 2.2.

Subjective measures included single item questions asking participants if they exercised regularly (Lu et al., 2011; McPhee et al., 2004). The 55-Item Activity Checklist (Everard, Lach, Fisher & Baum, 2000) was also used to identify social and leisure activity participation (Horowitz & Vanner, 2010). The Physical Activity Survey in Long-Term Care (PAS-LTC) (Resnick & Galik, 2007), the Physical Activity Questionnaire for the Elderly (Voorrips, Ravelli, Dongelmans, Deurenberg & Van Staveren, 2000) and the Yale Physical Activity Survey (YPAS) (Diepietro, Casperson, Ostfeld & Nadel, 1993) were also used.

Studies employing subjective measures of PA reported results in a variety of ways. This included energy expenditure, frequency of total PA engagement, time spent in total PA, minutes walked, and as a weighted score used to compare PA engagement across groups. Energy expenditure was estimated to be 1,387 ±1,658 kcals per week (Koltyn, 2001). Frequency of engagement in PA was reported as 27.5% ± 5.0% of total sample engaging in PA four or more times per week (McPhee et al., 2004). Time spent in total PA was expressed as 303.3 ± 133.5 minutes per week post-intervention (Resnick et al., 2009). Time spent in walking was reported as 111.0 ± 122.7 minutes per week (Rodiek at al., 2014). Schroeder at al. (1998) reported a weighted PA score of 6.8 ± 1.3 and compared it to PA scores in nursing home patients (1.2 ± 0.3) and independent living subjects (7.6 ± 1.1). Two studies measured PA but did not report amounts of PA (Horowitz & Vanner, 2010; Lu et al, 2011). A summary of findings in studies using subjective measures can be found in Table 2.3.

Factors: Barriers to PA

Barriers to PA were identified in five of the studies (Bergman, 2005; Koltyn 2001; Lu et al, 2011; Rodiek et al., 2014; Schroeder et al., 1998). The most frequently mentioned barriers addressed indoor or outdoor environmental features. Having a limited area to walk indoors, small width of interior corridors, lack of access to natural landscape features and sounds such as birds chirping, high door opening force, high thresholds in doorways leading outdoors, self-locking doors and an L-shaped versus rectangular layout to the facility were all identified as barriers to walking, steps taken and total PA. Personal factors identified as barriers to PA (Bergman, 2005; Lu et al., 2011; Schroeder et al.,

1998) included a perceived level of frailty, poor personal health. There were no social barriers identified in the studies.

Factors: Facilitators of PA

Personal, social and environmental facilitators of PA were identified in seven studies (Herbert & Greene, 2001; Horowitz & Vanner, 2010; Lu et al., 2011; Koltyn, 2001; Resnick et al., 2010; Rodiek at al., 2014; Schroeder et al., 1998). Personal factors that facilitated PA included: better physical function, better emotional well-being, better mental health, the availability of preferred activities, and perceiving the health benefits of engaging in PA. Social factors that facilitated PA included the desire to interact with other people (Koltyn, 2001; Lu et al., 2011; Resnick et al., 2010), support from family, friends and experts (Resnick et al., 2010) and having supervision during physical activities (Koltyn, 2001).

Environmental factors identified that facilitate walking activity included feeling safe from crime indoors, no adverse weather conditions indoors, the presence of handrails, periodic seating for rest periods, having access to large windows to see outdoor features, adequate width of corridors and carpeted floors. The distance to mailboxes and meal dining rooms were also identified as facilitating walking in ALF residents (Lu et al., 2011, Resnick et al., 2010). Rodiek et al. (2014) identified that lower door opening force and slowly closing doors facilitated more outdoor walking activity.

Factors: Interventions

Three studies employed interventions to increase PA in ALF residents. Two of the studies yielded significant findings that suggest the interventions facilitated an increase in PA (Herbert & Greene, 2001; Resnick et al., 2009). In the first study, Herbert and Greene

(2001) found that mean distance walked (6.25±2.32 laps/500 feet per lap) was significantly greater for individuals who engaged in the most preferred activity versus the least preferred activity [(4.5±3.25 laps/500 feet per lap) $t(7)=2.7$, $p= .06$]. The most preferred activity was walking a dog outside. The least preferred activity was walking alone inside. Direct observation of the walking distance took place which supports validity of the findings. However, the sensitivity of the questionnaire used to determine most preferred and least preferred activities may not have been sufficient to detect variations in preference.

In the second study, the feasibility of the Restorative Care for Assisted Living (Res-Care-Al) intervention was tested (Resnick et al., 2009). The intervention involved the training of ALF staff to promote activity in residents supported by the concepts of self-efficacy, enactive mastery, verbal persuasion, vicarious experience and decrease of unpleasant symptoms from Social Cognitive Theory (Bandura, 2004). Residents exposed to the intervention significantly increased time spent in PA (Table 2.3). However, a small homogeneous sample and the use of a subjective measure of PA may have biased results.

The third intervention study tested the Res-Care-AL intervention (Resnick et al., 2011) and did not produce significant increases in time spent in PA. It did, however, demonstrate a small increase in activity from baseline to 12 months (.43 minutes/day to 1.00 minutes/day moderate PA). This study was the major study that emerged from the aforementioned pilot study (Resnick et al., 2009). A summary of factors influencing PA can be found in Tables 2.2 and 2.3.

Table 2.2 Objective Measures of PA and Factors Influencing PA

Author/Year	Measure of Physical Activity	Amount and Type of PA	Findings on Factors Influencing PA: Barriers and Facilitators
Bergman (2005)[27]	Objective Measure: StepWatch Step Activity Monitor[3] worn on right ankle during waking hours for one day excluding water-based activities to collect data on walking activity.	Steps per day: RH=8,518.47±4,707.78 AL=2,592.75±1,961.69 NH=5,117.17±5,913.01 Significant difference in steps taken per day between assisted living (AL) and retirement home (RH) residents ($p \leq .05$).	**Barriers:** The number of steps taken had a significant negative relationship with ADL problems (rho= -.587, *p*=.000) ADL impairment (rho= -.621, *p*= .000) and perceived health status (rho -.346, *p*=.036) for all groups combined. The assisted living facility was observed to have L-shaped layout which was thought to be less conducive to walking than a rectangular layout. No Facilitators identified.
Herbert & Greene (2001)[109]	Objective and Subjective Measures: Direct observation of walking distance. Semi-structured interview to determine how strongly participants felt about their preferences	Most preferred activity of walking with a dog outside: N=8; mean laps =*6.25±2.32 Compared to least preferred activity walking alone inside: N=8; mean laps=*4.5±3.25 P value= .016 Walking with dog: N=10; mean laps *6.15±2.74 Compared to walking alone: N=10; mean laps *5.15±2.96 P value= .050 *1 lap=500 feet	**Barriers:** Less preferred activity. **Facilitators**: Mean distance walked (number of laps) was significantly greater for most-preferred activity (dog/outside) t(7)=2.70, *p*=.016 when compared to least preferred activity of walking alone inside. Significantly more laps were completed when walking with a dog versus walking alone [F(1,9)=5.15, *p*=.050]. Interview results identified that preference statements were strong enough to indicate that preference for an activity seems likely to influence performance.

*Resnick et al. (2010)[262]	Objective and Subjective Measures Actigraph accelerometer worn for one 24-hour period. Self-report Physical Activity Survey for Long-Term Care (PAS-LTC) completed.	According to Actigraph: Residents engaged in 143.4 minutes ±147.1 of light PA per day Residents engaged in 0.70minutes ±2.4 of moderate PA per day Residents expended 54.4 kcals ±47.9 in a 24-hour period. According to PAS-LTC questionnaire participants engaged in: 162.9 minutes ±81.4 of total PA over a 24-hour period. 101.5 minutes ±51.9 were spent in personal care activities 8.5 minutes ±17.6 were spent in moderate PA 16.5 minutes ±38.9 were spent in recreational activity	No Barriers identified. **Facilitators:** Social support from family, friends and experts appear to be associated with higher levels of PA. Better physical function is associated with more moderate physical activity. Distance to dining room, mailbox and front door of facility from residents' rooms may increase PA.
*Resnick et al. (2011)[260]	Objective Measure Actigraph accelerometer worn for one 24-hour period.	Kcals/day At baseline: 50.79±5.32 At 4-months post intervention: 54.48±7.85 At 12-months post intervention: 58.04±9.93 Minutes in Moderate PA/day At baseline: .43 ±.14 minutes/day At 4-months post intervention: 1.00 ±.36 minutes/day	No barriers identified. **Facilitators**: There were no significant differences between treatment groups with regard to Actigraph data although the intervention group did increase activity from baseline to 4-months post intervention (.43 minutes/day moderate physical activity to 1.00 minutes/day).

		At 12-months post intervention: .72 ± .33minutes/day	
Wyrick et al. (2008)[357]	Objective Measure Actigraph accelerometer worn 7 days around the waist during waking hours with the exception of bathing. VM=raw accelerations measured as daily activity units divided by 100.	Total PA: 549 VM ± 270/day Light PA: 499VM ± 275/day Medium PA: 50 VM ± 40/day	No barriers or facilitators identified. No significant difference in PA between subjects using an assistive device and those not.

*Same sample used.

Table 2.3 Subjective Measures of PA and Factors Influencing PA

Horowitz & Vanner (2010)[118]	Subjective Measure 55-Item Activity Checklist self-report instrument to measure participation in instrumental, social and leisure activities. For each activity a score of 0.0 is given if the activity is not being done, 0.5 if the activity is being done less than before and 1.0 if the activity is being done now. Scores are summed then divided by the	Total productive activity scores not reported.	No Barriers identified. **Facilitators:** Low-moderate yet statistically significant relationship between life satisfaction and the percentage of productive activities (r=0.355, p< 0.01) suggesting a positive association between emotional well-being and continued participation in activities Significant positive correlations were found between the percentage of productive activities and physical health (r=.324, p< .01), physical function (r=.354, p<.001) and mental health scores (r=.250, p<.01) suggesting physical and mental health and physical function reflect the ability necessary to retain engagement in productive activities.

	number of items and scores range from 0.0 – 1.0.		Significantly more subjects continued participating in activities they identified as most important when compared to less important activities (*T*=48, Z= -3.315, *p*=0.001) indicating valued or preferred activities may provide motivation for continued participation in productive activities.
Koltyn (2001)[368]	Subjective Measure Yale Physical Activity Questionnaire (YPAS) Interview questions addressed preferences of physical activities, what physical activities were avoided because of their current physical condition, what factors would make it easier to begin regular physical activity.	Energy expenditure: AL=1,387±1,658 kcal/week IL=7,327±3,395kcal/week Total hours per week in PA: AL=6.0±7 range 0-23 IL=32±16 range 4-82 Number of walks per month: AL=6±9 range 0-32 IL=15.5±12 range 0-48 Number of hours moving/day: AL=5±3 range 0-9 IL=8±2 range 2-10 Flights of stairs per day: AL=1±2 range 0-6 IL=9±7 range 2-35 All variables demonstrated significant difference between the groups p=.05.	No Barriers identified. **Facilitators:** Factors identified that would make it easier for AL women to engage in physical activity included: (1) being able to exercise without being uncomfortable (2) being convinced of its impact on improving concentration and well-being (3) exercising with supervision (4) having others to interact with (5) higher self-rated quality of life
Lu et al. (2011)[184]	Subjective Measure Focus Group Interviews to answer the following questions: 1. Tell us about your walking experience.	Themes identified in response to questions included: a. Safe place to walk b. Comfortable and convenient c. Weather conditions d. Limited area to walk e. Walking for exercise f. Walking to destination g. Walking for interaction	**Barriers:** Having limited area to walk indoors due to short corridors and few spaces. Lack of beautiful landscape, no sounds of birds chirping, no plants or gardens discouraged indoor walking. Width of corridors that don't accommodate 2 people

	2. Is there any place in the facility that you like to go to as a daily routine? 3. When you are walking in the corridor what do you like or dislike?	h. Safety i. Comfort and convenience j. Aesthetics Synthesis: physical environmental features influence ALF residents' judgments about corridor walkability.	walking together side by side. Additional factors: Having to get to meals, mailbox and other activities offered encouraged walking. Desire to meet and interact with other people **Facilitators:** High level of safety from crime reason for walking indoors versus outdoors. Carpeted corridors make it comfortable for walking indoors. Indoor corridors are free from adverse weather conditions. The presence of handrails, periodic seating, adequate length and width of corridors for walking distances, windows for viewing outdoors and the presence of plants encouraged walking indoors. Residents' perceived level of frailty.
McPhee et al. (2004)[203]	Subjective Measure Physical activity measured in response to question: 'do you exercise regularly?' meaning 2 or more times per week.	%± 95% confidence interval: 27.2% ±5.1 engaged in no activity 7.9% ±5.8 engaged in activity 2-3 times per month 9.5% ±5.7 engaged in activity once per week 27.8% ±5.1 engaged in activity 2-3 times per week	No Facilitators or Barriers identified. No significant associations between age, gender, health conditions of arthritis, stroke, heart problems, cancer or diabetes and exercise frequency were found.

		27.5% ±5.0 engaged in activity 4 or more times per week	
Resnick et al. (2009)[261]	Subjective Measure Physical Activity Survey for Long Term Care (PAS-LTC). Higher scores indicate more PA.	Residents significantly increased time spent in PA as reported by the resident and the nursing assistant: Resident reported baseline185.2min/week±111, 4-month post-intervention 303.3min/week±133.5, *F*(16.3, *p*=.01) Nursing assistant reported baseline 262.8min/week±127.9, 4-month post-intervention 321.33±123.2, *F*(5.1, *p*=.04].	No Barriers identified. **Facilitators:** Res-Care-AL intervention appears to increase PA in ALF residents.
Rodiek et al. (2014)[273]	Subjective Measure Self-report Survey 5 multiple choice questions addressing amount of time spent walking and ease of accessing outdoor areas of the ALF based on door openings, thresholds and landings and self-locking doors. Walking PA assessed: 1. Do you ever take walks indoors or outdoors just to get	Minutes per week walking: 111.0±122.7	**Barriers:** 57.5 % of respondents mentioned doorways made it difficult to access outdoors using a walker, wheelchair or scooter limiting time spent walking. 80% of respondents cited door opening force presented difficulty accessing outdoors. Researcher estimated the range of door opening force to be up to 13.4 pounds in the facilities which exceeds federal standards of 5.0 pounds. 15% of respondents' mention threshold heights make accessing outdoors difficult. Self-locking doors significantly associated with fewer walking minutes per week (τ=0.033, *p*= 0.017).

	exercise? 2. If you walk for exercise, about how long do you walk each time?		**Facilitators:** Door closing slowly enough significantly associated with increased walking minutes per week (τ=0.049, p=0.027).
Schroeder et al. (1998)[286]	Subjective Measure Physical Activity Questionnaire for the Elderly completed during one-on-one interview. Possible range of weighted scores 0-22.	PA score AL 6.8±1.3 PA score NH 1.2±0.3 PA score IL 7.6±1.1 Significant difference detected among the three groups for self-reported physical activity [F (2,26)=27.17, p=0.00].	**Barriers:** Significant difference in functional ability based on Physical Performance Test (PPT) detected among the three groups [F (2, 66) = 45.94, p=.00] suggesting poor physical function interferes with being active. Learned helplessness from being in a facility where staff performs certain tasks may decrease activity levels. **Facilitators:** Flexibility may increase activity.

Methodological Quality

Applying Brink and Wood's (1998) classification system for categorizing studies, four studies (33.3%) were a Design Level I (Lu et al., 2011; McPhee et al., 2004; Resnick et al, 2010; Rodiek et al., 2014). Five (41.7%) studies were a Design Level II (Bergman, 2005; Horowitz & Vanner, 2010; Koltyn, 2001; Schroeder et al., 1998; Wyrick et al., 2008). Three studies (25.0%) were a Design Level III (Herbert & Greene, 2001; Resnick et al., 2009; Resnick et al., 2011). The range of methodological quality scores using deBruin et al. (2008) was five to nineteen with a mean score of 9.58 (SD=3.70). This would indicate that the overall methodological quality of the articles was medium based on a score of 1 to 7 being low quality, a score of 8 to14 being low to medium quality and a score of 15 to 22 being medium to high quality. The Kappa measure of agreement value for two reviews on quality was .442 (p = .016) which represents moderate agreement (Landis & Koch, 1977).

The overall quality of evidence in this review is considered to be low based on the high number of Level I and Level II cross-sectional designs with small samples, and on calculated methodological quality scores. Calculated quality scores by Design Levels I, II and III can be found in Appendix F and demonstrate that lower Design Level studies had the lowest methodological quality scores.

Strengths and Limitations of Studies

A strength of the studies was the reported reliability and validity of self-report questionnaires used to measure PA. Researcher experience with studying the ALF population was another strength (Lu et al., 2011; Resnick et al., 2009; Resnick et al., 2011). One limitation is that only four studies used objective measures of PA (Bergman,

2005; Herbert & Greene, 2001; Resnick et al., 2011; Wyrick et al., 2008). In addition, where the Actigraph was used, it generally collected data for only 24 hours which is contrary to recommendations for valid wear time of four to 10 days (Hart, Swartz & Cashin, 2011). Another limitation is a majority of studies were cross-sectional, non-experimental in design and had small, self-selected samples (n=9, 75%). Only one study had a medium to high methodological quality score (Resnick et al., 2011) and no significant changes in PA were reported post-intervention in that study. Loss of data in studies using objective measures also limited strength of findings (Resnick et al., 2010a; Resnick et al., 2011). A summary of the quality evaluation and strengths and limitations of the studies can be found in Table 2.4.

Table 2.4 Quality Evaluation of Studies

Author/Year	Design Level I, II or III	Calculated Methodological Score (0-22)	Study Strengths	Study Limitations
Bergman (2005)[27]	II	8 low-medium	Objective measure of PA employed with Step Watch pedometer.	PA data collected for only 24 hours. Self-selected, small sample. Cross-sectional design.
Herbert & Greene (2001)[109]	III	6 low	Direct observation of PA enhances validity of findings. Reliability of preference measure used to determine strength of preference was found to be acceptable (α= .81).	Self-selected, small sample of all females. 2 subjects were excluded from analysis for having no preference or inconsistent preference thereby reducing sample size and undermining validity of findings.
Horowitz & Vanner (2010)[118]	II	9 low-medium	Large sample from 12 assisted living facilities. Valid and reliable scales used to measure self-reported PA. One-on-one interviews were completed to collect data on all instruments decreasing the incidence of missing data.	Convenience sample. Cross-sectional design. Self-reported activity required one-year recall thereby possibly introducing reporting bias.

Koltyn (2001)[368]	II	8 low-medium	YPAS Physical Activity Questionnaire is reliable and valid in the population being studied. No reported missing data from instruments measuring physical activity.	Small, convenience sample. Cross-sectional design. Self-report of current PA may have been biased.
Lu et al. (2011)[184]	I	5 low	Size and number of focus groups adequate for analysis. Researchers have previously studied ALF walking environments.	Self-selected sample. Cross-sectional, qualitative study.
McPhee et al. (2004)[203]	I	9 low-medium	Large diverse sample.	Cross-sectional design. Self-report of physical activity frequency may have been biased.
Resnick et al. (2009)[261]	III	14 low-medium	Subjective measure for collecting data on PA reliable and valid. Quasi-experimental design. Researchers have previously studied physical activity in older adults.	Small, homogeneous sample. Self-report of PA may have been biased.
*Resnick et al. (2010)[262]	I	10 low-medium	Large, diverse sample representative of 4 different ALF's. PA objectively measured using Actigraph. Subjective measures of PA reliable and valid in older adults. Researcher experienced in assessing PA in older adults.	Sample self-selected. Actigraph collected data for only 24 hours. 25% of Actigraph data lost due to residents' inability or unwillingness to wear the device. Self-report of PA may have been biased.
*Resnick et al. (2011)[260]	III	19 med-high	Objective measure of PA using Actigraph. RCT design. Research team experienced in assessing PA in older adults living in assisted living.	Actigraph collected data for only 24 hours. Actigraph data loss estimated to be 35% due to significant loss of participants at 12-months post-intervention.
Rodiek et al. (2014)[273]	I	9 low-medium	Large diverse sample surveyed.	Self-selected sample. Cross-sectional design. Self-reported PA may have been biased.

Schroeder et al. (1998)[286]	II	8 low-medium	Two independent living communities, three assisted living facilities and four nursing home facilities were used to recruit volunteers representing a large sampling frame. One-on one interview to collect physical activity data decreased the likelihood of missing data.	Cross-sectional design. Self-reported physical activity tool may lack sensitivity for detecting differences between groups. One-year recall of PA may have introduced bias.
Wyrick et al. (2008)[357]	II	10 low-medium	Physical activity measured objectively with Actigraph for 7 days. .	Small, convenience sample from one assisted-living facility in Wisconsin limits variability and generalizability. Cross-sectional design.

*Same sample used.

Discussion: Data Synthesis

Summary of Studies

The number of studies meeting criteria for evaluation was small (n=12). In addition, a majority of studies were cross sectional and descriptive or exploratory in design (n=9) indicating the level of evidence for determining factors that influence PA in ALF residents is weak. This small number of studies constrains analysis and indicates the scarcity of research on this topic. This is not surprising considering the studies' short range of publication years (1998 to 2014) which reflect the brief period of ALF growth and development in the U.S. in the last 15 years. The outcome measure of PA lacked reliability and validity in most studies because subjective measures were commonly used which introduced recall bias. Objective measures were used in three studies but only one study used an accelerometer worn for seven days of valid wear time. This further substantiates that evidence for determining factors that influence PA in ALF residents is weak.

Measures of PA

There were several ways of measuring PA in the studies. Objective measures of PA included the use of accelerometer, pedometry and direct observation. Objective measures of PA are considered to be more accurate in assessing time spent in various types of PA in older adults since they are not subject to recall bias (Prince et al., 2008). The Actigraph, the common accelerometer used in the reviewed studies, is capable of detecting step counts, steps per minute, and total activity counts which can be converted into energy expenditure (Colbert, Matthews, Havighurst, Kim & Schoeller, 2011; Hall et al., 2013). It is reliable and valid when worn for the prescribed amount time. Loss of data, however, from subjects forgetting to put the monitor back on after removing it, can be considerable. This was demonstrated in two of the studies (Resnick et al., 2010; Resnick et al., 2011). Based on study results using the Actigraph, ALF participants engaged in very little PA which highlights the pressing need for more research in this population.

Barriers to PA

Barriers to PA in ALF residents were identified as being personal or environmental. No social barriers were identified in the review of the literature. Personal barriers included a perceived level of frailty, perceived poor health status, problems with ADL's and poor physical function. Benjamin, Edwards, Ploeg and Legault (2014) have reported that poor health is frequently cited by both staff and residents in long-term care as a barrier to regular PA. Unfortunately, promotion of PA by support staff has not been found to be a focus in this setting as staff deem 'getting their work done' as their primary focus (Benjamin, Edwards & Caswell, 2009). Environmental barriers to PA identified in this review included having a limited area to walk outdoors, a lack of aesthetically

pleasing features to look at, narrow corridors limiting space to one person, doors difficult to open, high thresholds to step over in the doorways, self-locking doors that prevent re-entry into the building from the outside and an L-shaped layout to the facility limiting continuous walking. These findings are consistent with literature (Lu, 2010; Hall & McAuley, 2010).

Facilitators of PA

Facilitators of PA in ALF residents were categorized as personal, social or environmental in nature. Personal facilitators identified in the examined studies included better physical function, better emotional well-being and mental health, understanding the perceived benefits of PA and being able to engage in activities that are preferred over those less preferred. Resnick et al. (2010) found that where residents had better physical function they engaged in more moderate PA. These findings are comparable to research in independent living older adults where fewer health problems and better physical function were correlated with being more active (McAuley, et al., 2007). Horowitz and Vanner (2010) found statistically significant relationships between life satisfaction, emotional well-being, better mental health and the ability to engage in preferred or personally important activities with higher participation in leisure-time PA and walking. This is also supported in research with community living older adults (Hall & McAuley, 2010).

Social support has been found to play a role in PA levels in independent-living older adults. Social support was found to have an indirect effect on PA by producing a more positive effect during activity leading to higher overall levels of PA (McAuley, Jerome, Elavsky, Marquez & Ramsey, 2003). In the analyzed studies, social facilitators

that may influence PA in the subjects were identified as a desire to interact with other people, having support from family, friends and experts and having someone supervise activities in the ALF setting.

Environmental facilitators of PA identified in the studies included: perceived level of safety indoors, no adverse weather conditions to worry about while indoors, the presence of hand rails and periodic seating as a place to sit and rest while walking, adequate width of corridors to accommodate two people walking side by side, access via views to outdoor features such as trees, flowers and other landscape items, a carpeted surface to walk on and ease of access through doorways that open easily and close slowly. Gallagher et al. (2010) demonstrated support for these findings where weather conditions, safety from crime, sidewalk and traffic conditions, and peaceful, attractive surroundings were identified as factors that encouraged walking behavior in urban-dwelling older adults. Over 65% of the studies cited environmental factors that facilitate PA in ALF residents. This factor was dominant throughout this literature review and attention to the access, appearance, safety and attractiveness of places used for walking and other activities by ALF residents are important to address.

Interventions

There were three studies introducing an intervention to maintain or increase time in PA in ALF residents (Herbert & Greene, 2001; Resnick et al., 2009; Resnick et al., 2011). The intervention of Res-Care-AL in Resnick et al. (2009) yielded a significant increase in PA 4-months post-intervention. The findings were clinically significant and demonstrated an increase of two hours participation in personal care and recreational activities which may ameliorate the effects of too much sedentary behavior (Safdar et al.,

2010; Wellburn et el., 2016). This study sample, however, was very small (n=14) which may have been insufficiently powered to detect a significant change in PA. The study was successful, however, in testing the feasibility of the intervention and suggests the use of facility staff to encourage more activity may reduce sedentary behavior and increase light PA.

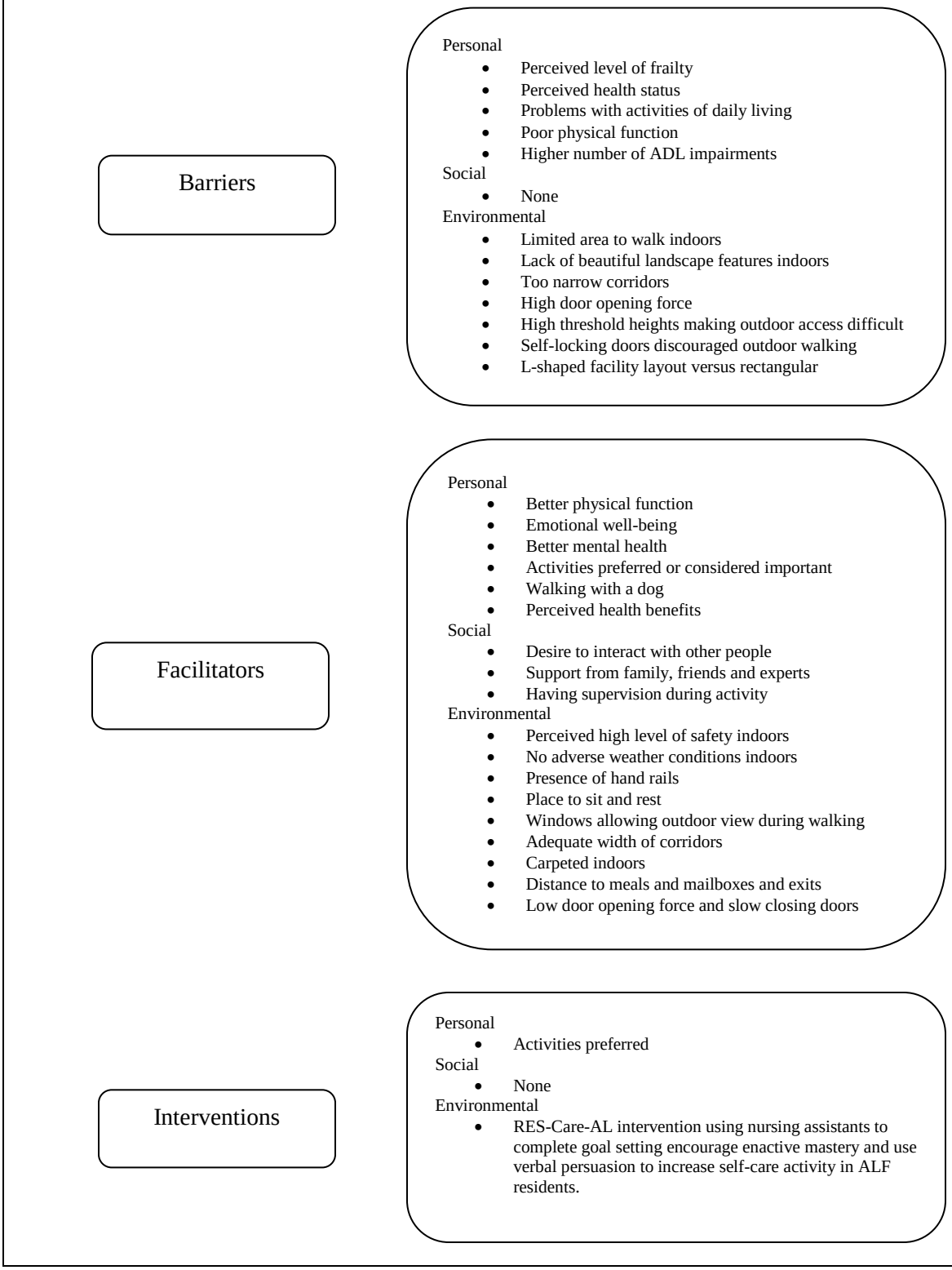
The intervention by Herbert and Greene (2001) demonstrated a significant increase is distance walked when the resident participated in the most preferred activity versus the least preferred activity. The findings are clinically significant since walking distance increased by 800 feet per day. This is the equivalent of 267 yards or nearly two and a half lengths of a football field. This lends support for the idea of assessing individual interests and preferences when residents are admitted to an ALF and at regular to intervals to maximize participation in PA. One weakness of this particular study was the small sample (N=10) which may have demonstrated a large effect size but increased the likelihood of a Type I error. In addition, there is no evidence that other variables were controlled for that may have influenced the outcome.

In summary, several barriers, facilitators and two interventions were identified as potentially influencing PA in ALF residents. The findings are supported in literature addressing PA in community living older adults. However, the low number of intervention studies to increase PA in ALF residents highlights the need for additional research that incorporates personal, social as well as environmental variables that may exert a positive influence on PA levels.

Conceptual Model

A model depicting the factors influencing PA in ALF residents (Figure 2.2) can serve as a guide for the design of future studies to address gaps in knowledge. Future studies could explore or test the known factors or explore or test unstudied or understudied factors that may influence time spent in PA. Historical levels of PA, perceptions of PA and what it means to residents within the context the ALF are unstudied factors that could be explored. Further testing of the Res-Care-AL intervention over a longer period of time might also prove beneficial. Further exploration of the variety of preferred conditions for engagement in PA, such as those identified Herbert and Greene (2001), could also offer a foundation for intervention studies. Additional research on the impact of social support and social interaction is needed. Resnick et al. (2010) suggested that social support from friends, family and experts may have some influence time spent in PA. Koltyn (2001) found that women in ALF's were more likely to engage in PA if they were able to be around others and also if it was done under supervision. This latter finding suggests that an intervention testing the effect of an activity director's actions to encourage or discourage participation in PA might be beneficial.

Figure 2.2 Summary of factors and interventions influencing physical activity in ALF residents.



Conclusion

This integrative review examined the state of research on factors influencing PA in ALF residents. The small number of studies and lack of sufficiently powered experimental designs suggests continued research is required. In addition, the cross-sectional nature of a majority of the studies and their small samples implies more prospective and longitudinal studies are needed with larger samples to understand the influence of multiple factors on PA in ALF residents. Personal factors need further exploration and examining the relationship between specific health conditions and personal preferences and time spent in PA may prove beneficial. Qualitative studies examining the experience of PA, both current and historical, and the meaning of PA may also offer important insights as a foundation for experimental study design. Social factors also require additional attention. Future studies also need to incorporate objective measures such as continuous wear accelerometers so that PA is measured accurately and measurement error is minimized.

One limitation of this review is the small number of retrieved articles meeting inclusion criteria. Also, the articles were mainly non-experimental and were therefore not suited for a quantitative meta-analysis. This required the application of a systematic but subjective analysis procedure which may have produced incomplete and biased results. In addition, the use of the purpose-adjusted Downs and Black criteria (de Bruin et al., 2008) to determine methodological quality of the articles resulted in inconsistent scoring, signaling that this instrument may need additional reliability and validity testing.

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CHAPTER 3

The Experience and Meaning of Physical Activity in Assisted Living Facility Residents

Introduction

Assisted living facility (ALF) residents engage in very lower levels of physical activity (PA) (Koltyn, 2001; Krol-Zielinska, Kusy, Zielinski, & Osinski, 2010; Resnick, Galik, Gruber-Baldini & Zimmerman, 2009). Resnick, Galik, Gruber-Baldini and Zimmerman (2011) found that ALF residents spent approximately 162.9 minutes per day engaged in PA and that most activity was spent in bathing and dressing. In addition, the study found that residents spent less than one minute per day in moderate intensity PA and expended an estimated 54.4 kilocalories over a 24-hour period. This contrasts significantly with current national guidelines for PA in older adults which recommend 150 accumulated minutes of moderate PA per week (Chodzko-Zajko et al., 2009).

Reducing sedentary behavior and engaging in more light PA could provide many health benefits for ALF residents. These include reduced arterial stiffness, pain, and frailty and better physical function (Buman et al., 2010; CDC, 2014, Gando et al., 2010; Peterson et al., 2009). Improved cognitive function is an additional benefit (Zhu et al., 2016). Evidence is scarce however, addressing PA in ALF residents in the United States (U.S.). Further research and knowledge development are needed. Understanding the

experience of PA and what PA means to ALF residents can enhance the understanding of PA behaviors and help identify factors amenable to intervention. An exploratory study would provide an opportunity for uncovering important insights on this topic.

Background

Optimizing health and well-being through regular PA is essential for older adults in ALF's (Niles-Yokum & Wagner, 2011). Most functional limitations are seen in individuals over the age of 80 years, yet a majority says they have no plan to increase daily PA levels (Schutzer & Graves, 2004). In addition, sedentary behavior may be unintentionally encouraged in ALF residents due to the nature and number of supportive services offered to individuals in the setting. Shopping, meal preparation and housekeeping services provided by most ALF's may work to diminish autonomy and independence and contribute to increased disability and frailty (Mihalko & Wickley, 2003; Stefanacci, 2010). Reducing sedentary behavior and replacing it with light PA could contribute to reduced mortality (Martinez-Gomez, Guallar-Castillon & Rodriguez-Artalejo, 2016) and improve cognitive performance (Johnson et al., 2016).

Research has shed some light on PA in ALF residents. One study examined the experience and value of PA in a mixed group of 47 independent-living and ALF residents in the U.S. Phillips & Flesner (2013) found that PA was valued for the ability to maximize physical function and provide a sense of well-being. Other factors identified as impacting participation in PA included having a motivated leader and adequate space and time for activity. Additional factors may also impact PA in the ALF setting. Kruger, Thompson, McKenzie and Naccarella (2007) found that family, staff and resident assumptions about the inability of older adults to engage in PA limited PA in residents of

a residential care facility in Australia. In the same study it was found that modeling of various physical activities such as tai chi and swimming by older adults lead to greater participation in such activities.

Physical activity in Taiwanese ALF residents has also been researched. Chen, Li and Yen (2015) found that past exercise participation predicted an increase in current PA. Additionally, they found self-efficacy for exercise independently and positively predicted current exercise participation. In another study, Koltyn (2001) reported that females in ALF's in the U.S self-reported six hours of work, recreational and walking activity per week. Subjects in the study also identified that being convinced of the health benefits of PA influenced participation in PA. Other studies conducted in the U.S identified that the walkability of paths inside and outside the ALF influence time spent in walking activity (Lu, Rodiek, Shepley & Duffy, 2011; Rodiek, Lee & Nejati, 2014). However, the overall quality and strength of evidence describing PA in ALF residents in the U.S. is weak and more research is needed to understand this phenomenon in this population.

Statement of the Problem

The benefits of PA in older adults are well established (Conn, Minor, Burks, Rantz & Pomeroy, 2003; Healthy People 2020, 2011). Yet older adults, especially ALF residents, tend to lead a very sedentary lifestyle (Resnick et al., 2011; U.S. Department of Health and Human Services, 2008). There are no known studies that explore the experience and meaning of PA in ALF residents in the U.S. The **purpose** of this study is to explore the past and current experience of PA and the meaning of PA in ALF residents to develop an understanding of what factors may influence PA and to answer the following research questions:

1. What is the experience and meaning of PA in ALF residents?
2. What are the factors, situations or circumstances associated with the experience of PA in ALF residents?

The knowledge gained from this research will be used to develop interventions to promote PA in ALF residents.

Theoretical Guide

Social Cognitive Theory (Bandura, 2004) posits that there are specific determinants of health behaviors. These determinants, which constitute one of the five major concepts of SCT, are called f*acilitators* and *barriers*. Physical activity in ALF residents is influenced by facilitators that may include positive perceptions of PA, good physical function, and environmental factors such as adequate staffing and a facility layout that can make engaging in PA easier for ALF residents. Barriers to engaging in PA by ALF residents may include poor physical function, negative perceptions about PA and low self-efficacy for PA (Resnick, 2004). Barriers may also be social or structural such as lack of adequate staffing in a given environment or system-related policies, procedures and regulations that prohibit or limit engagement in PA. *Self-efficacy* is another major concept in SCT and addresses beliefs about the ability to perform behaviors to achieve desired outcomes. These major concepts from SCT were used to guide the development of interview questions in this study addressing the past and current experience of PA.

Methods

Design, Sample and Setting

A qualitative, exploratory study design was employed guided by an adaptation of Moustakas' (1994) transcendental phenomenological methodology. This approach aims

to fully identify and richly describe the experience of PA and what it means to ALF residents. The methodology allows for the phenomenon of interest to emerge naturally from individual reflection so that meaning is more fully understood. The focus is less on interpretation and more on description of the phenomenon (Creswell, 2007). The initial setting aside of preconceived ideas or biases about the phenomenon by the primary investigator (PI) allows the researcher to uncover a fresh description of the experience of the phenomenon from the participants' point of view. Colaizzi's (1978) methodology was employed to code, reduce and analyze data into themes.

One-on-one interviews were conducted with a convenience sample of 20 ALF residents (Safman & Sobal, 2004) recruited from four state-licensed ALF facilities in mid-Michigan following approval by the Institutional Review Board (IRB) at the University of Michigan. Data collection took place during the months of May through September, 2015. Eligibility criteria included (a) 55 years of age or older residing full-time in an assisted-living facility for a minimum of three consecutive months (b) able to read, write and/or speak the English language (c) able to engage freely in PA throughout the day without the aid of a wheel chair or motorized cart (d) complete cognitive screening using the Mini-Mental State Exam (MMSE) and achieve a score of 24 or greater.

Participating facilities had a combined capacity of 176 residents: site one had 66, site two had 46, site three had 34 and site four had 30. The facilities were all one-story buildings with a central dining room that residents walked to for three daily meals. All facilities had an activities director on duty during daytime hours five days a week. All facilities offered in-house activities such as seated exercises, craft classes such as sewing

and painting, and social events five days a week such as piano recitals and sing-a-longs. Outside trips to restaurants, shopping centers and other destinations were offered weekly or monthly depending on resident interest. All facilities provided medication administration and assistance with ADL's as needed in addition to housekeeping and laundry services.

Data Collection Instruments

A demographic data form was completed including information on age, gender, race, marital status, employment status, level of education, length of stay in the ALF and use of assistive walking devices (Appendix G). A semi-structured interview (Appendix H) consisting of open-ended questions with additional probes was conducted (Moustakas, 1994; Ulin, Robinson & Tolley, 2005). Another instrument used to complete the interview included a weekly activity form for listing typical activities engaged in during a weeks' time. This was used to engage participants in thinking about PA (Appendix I). In addition, subjects were asked to complete a lifeline (Appendix J). Life histories are a qualitative approach to revealing how experiences and events link to action and behaviors (Gramling & Carr, 2004). This approach has been used to study adaptation to disability and life changes in select populations. It has also been used by developmental theorists to examine how important events impact physical and mental health outcomes. For purposes of this research, life history was described using a lifeline whereby subjects were asked to draw a line that represents the high and lows for specific aspects of their life. The lifeline helped subjects reflect on and describe PA over the course of their lifetime (Gramling & Carr, 2004). The interview was audio-taped and transcribed verbatim.

Procedure

Facility contact information was accessed through the Michigan Department of Human Services online list-serve. Permission to recruit subjects at the facilities was authorized by representatives at each facility. Once IRB approval was received, the PI met individually with potential subjects identified by the authorized representatives and shared an overview of the study including (1) the purpose of the study (2) eligibility criteria including completing cognitive screening and (3) what the time commitment was for all activities. This process took approximately 15 minutes to complete.

The PI administered the MMSE cognitive screening form and provided directions for the participant to complete the activities (Appendices K and L). The MMSE instrument has 30 items comprised of questions and paper and pencil activities that take approximately 5 to 10 minutes to complete. The current version of the MMSE was designed to screen for cognitive impairment in adults aged 18 to 100 years. Test re-test reliability has been established with Cronbach's alpha coefficient 0.79 to 0.98 and inter-rater reliability 0.83 to 0.95. A minimum score of 24 on a scale of 0 to 30 was required to continue on with the study. This cut point has been established since cognitive ability is considered to be impaired below 24 and adequate cognitive function is required to carry out the activities of this study (Folstein, Folstein, McHugh & Fanjiang, 2001). All participants achieving a score of 24 or greater on the MMSE and meeting all other inclusion criteria proceeded with the consent process which took an additional 30 to 45 minutes. The demographic data form was then completed by the subject. The one-on-one interview then commenced.

Referencing the weekly activity form, subjects were asked to respond to the first primary inquiry: Tell me about your weekly activity form; describe the things you do during a typical week, the physical activities you engage in. This was to explore what they experienced with PA. They were then asked to respond to additional probes to explore the meaning of weekly PA. The questions allowed for the full disclosure of the experience and meaning of current PA and possible factors, situations or circumstances that might influence PA. At the end of this portion of the interview, participants were offered a break.

Next, subjects completed a lifeline, a second piece of paper with a straight, horizontal line representing the span of their life. Subjects were asked to place an "X" on the line where the move to the ALF took place and to write down the year. They were then asked to draw a continuous line representing the ups and downs of PA throughout life. The straight line represented a neutral point of reference for PA. Subjects were given 5 minutes to complete this. Individuals with visual or fine motor difficulties verbally stated their lifetime PA levels as the PI recorded this on the lifeline. Subjects were then asked to explore the experience of PA in their lifetime responding to the following: Tell me about your drawing and about PA in general in your lifetime. Additional probes were used to promote full disclosure of the experience of past PA and possible factors, situations or circumstances that may have influenced higher or lower levels of PA during their lifetime. Final questions addressed whether the subject felt they had shared everything significant about PA to them. The interviews lasted from 40 minutes to one and a half hours.

Data Analysis

Descriptive statistics were reported with regards to the sample. Colaizzi's (1978) phenomenological approach was used to reduce and analyze the qualitative data. *Epoche*, the review of the personal understanding and experiences of PA by the PI, first took place prior to data collection. This process assisted in setting aside any pre-judgments about the phenomenon allowing for a fresh and unbiased focus on the subjects' experiences. The epoche process was also completed prior to each individual interview in order to recognize attitudes and knowledge about PA that developed in the course of data collection (Moustakas, 1994).

Raw data were then reviewed. Individually recorded interviews were listened to several times to get an overall feeling for the quality of the content and to see if questions were asked in a way that elicited valuable responses. Field notes transcribed during and immediately following the interview were reviewed to help provide a better understanding of the context and quality of the responses and whether or not the questions were open-ended yet specific enough to stimulate adequate responses (Hycner,1985). Transcribed verbatim interviews were read several times, compared to the audio interview to check for accuracy, and data were reduced. The PI scrutinized the data and identified all relevant and non-overlapping statements pertaining to the experience of PA. Next, meaning units were identified by reviewing the statements. The meaning units were then examined and clustered into themes common to all participants. The themes were used to go back through the transcripts to check if they matched the content. The themes were used to describe the experience and meaning of PA reflecting on feelings,

beliefs and perceptions associated with the experience. Factors, situations or circumstances associated with the experience of PA were identified.

Several validation strategies were used to enhance methodological rigor. The epoche process clarified researcher biases that might influence data collection, coding and analysis. Methodology was rigorously adhered to as each part of the process was completed before moving on to the next step. This was to avoid premature closure of analysis and yield more trustworthy results (Waltz, Strickland & Lenz, 2010). Verification of data analysis was supported by a literature review, keeping field notes, using an adequate sample size, employing a second reviewer, and by reviewing contrary or negative cases (Creswell, 2007; Stathill, McKenna & Fox, 2003). Data management and analysis was supported by NVivo 11© software.

Results

Demographic Characteristics

The sample consisted of 20 adults from four ALF's in mid-Michigan. The age range was 57-96 years (M=77.4, SD=10.6) and included 16 (80%) females and 4 (20%) males. Fifty percent (N=10) had some college education or a college degree. Two (10%) reported being employed. Thirteen (65%) reported using a walker occasionally and seven (35%) reported never using a walker as an assistive device. The range for length of stay in the ALF facility was 3-89 months (M=27.6, SD=26.0). MMSE scores ranged from 24-30 (M=27.65, SD=2.03). Table 3.1 includes sample characteristics.

Table 3.1 Sample Characteristics (N=20).

Variable	**N=20**	**%**
Gender		
Female	16	80
Male	4	20
Ethnicity		
White	19	95
African American	1	5
Marital Status		
Widowed	11	55
Single	5	25
Divorced	4	20
Education		
Less than high school degree	2	10
High School degree	8	40
Some college	3	15
College degree	7	35
Employment Status		
Part Time ≤ 20 hrs per week	1	5
Full Time ≥ 40 hrs per week	1	5
Walker Use		
Yes	13	65
Never	7	35
	Range	M±SD
Age	57-96	77.4±10.6
Length of stay (months)	3-89	27.6±26
*MMSE Score (0-30)	24-30	27.6±2.0

*MMSE=Mini Mental State Exam (Folstein et al. (2001) Psychological Assessment Resources, Inc., 2010).

Meaning Units and Themes

From 20 verbatim transcripts significant statements were extracted, 27 meaning units were derived and clustered into five themes common to all participants (Appendix M). The first theme was that residents saw themselves as being active. The second theme was that PA is dependent on a schedule or routine. The third theme was that beliefs and perceptions influenced PA. The fourth theme was that motivations and preferences influenced PA. The fifth theme was that PA has multifaceted meanings. Two cases were not consistent with general findings. One contrary case demonstrated a higher level of PA currently compared to past PA. A second contrary case identified that the ALF is no place for PA engagement and this participant did not consider themselves to be active.

Theme 1: Residents Saw Themselves as Being Active

Subjects saw themselves as being active in a variety of physical activities across the lifespan. Physical activity ranged from vigorous intensity in childhood to light intensity and sedentary in older age (Ainsworth et al., 2011). Past PA activity included organized and spontaneous sports, exercise classes, work and occupational activities ranging from heavy labor to secretarial work and household activities. Current PA included social activities such as attending concerts and plays, and spiritual activities that included church services. Leisure activities such as walking and attending craft classes, activities of daily living (ADL's), instrumental activities of daily living (IADL's), and therapeutic activity such as physical therapy were identified as PA. Lifeline tracings of PA demonstrated a consistent pattern with higher levels shown in childhood and young adulthood compared to later life. Most subjects' tracings remained above the lifeline throughout life with dips in PA related to specific events or illnesses such as car accidents for two subjects, strokes, falls, hospitalizations, pulmonary infection and surgery for the remaining subjects. All subject's tracings currently remain above the lifeline, however, most current tracings are lower than at any point in their life with the exception of one contrary case.

Past PA experiences included sports activities in youth and were described by all subjects. Most were spontaneous and usually involved other children whether participating or observing. Some subjects engaged in riding bicycles, walking long distances, roller skating, sledding, swimming, riding horses, dancing, and playing hide and go seek. A majority of PA in childhood was moderate to vigorous intensity and occurred on a regular basis (Ainsworth et al., 2011). Some subjects engaged in sport and

exercise activities during middle to late adult years; however, the frequency of engagement was less than as children. In addition, a majority of the activities were light to moderate intensity and included bicycling, walking and golfing. (Ainsworth et al., 2011). Subjects discussed PA across the lifespan. Past PA included the following examples:

> As a kid I used to run, I used to do all kinds of stuff, played on the street with other kids, I've always been active. I was out every day of the week; that was fun. Like when I was younger, I would probably ride a bike.
>
> I was always really active as a little kid. My goodness, we kept going all the time. We played softball in the street and walked to the library and back. We walk, walk, walked! We never had a ride anywhere.
>
> When I was in high school I started golfing. I was in two leagues for the summer. I just lived for the summer to get here.

Past work and occupational activities were a part of most subjects PA experiences. Activities included work in industrial trades putting up siding and installing electrical wiring for two subjects. It also included farming activities such as plowing fields, milking cows, baling hay, and tending to animals for two subjects. Food preparation and catering were occupational activities engaged in for other subjects. Secretarial work, working as a door-to-door salesperson, working for the railroad, cooking for restaurants and doing janitorial work were also mentioned. Household activities were also part of the subject's past PA experiences and included cooking and canning, vacuuming, laundry, housekeeping and shopping. The range of PA associated with occupational activity was vigorous to light intensity (Ainsworth et al., 2011). Some subjects discussed past occupational activity:

> I went to school and then I came home and then I got into the milking of cows. I done a lot of lifting. I think that's what's wrong with my back. We had milkers and those got pretty heavy. We had a brick building that had two big things for

> milk and that and I lifted the cans into the cooler with my knee. I lifted a lot wheat bags.
>
> I was a tinsmith; sheet metal work. Put siding up, put partitions in, made all the duct work for fresh air exhaust. I spent a lot of time on a ladder. Six days a week.
>
> I did a lot of secretarial work. Worked for a lot of principals and important people. Once they were looking for someone to run a billing machine so they called me up and hired me.
>
> I've been busy my whole life; I mean up and down stairs washing diapers, doing laundry. I raised my family, did all the canning and cooking, I loved that. It never ended.

Current PA for most subjects involved daily sessions, usually five days a week, where stretching and range of motion activities, games that involved throwing, reaching or catching and craft activities such as sewing and painting took place. These were mainly seated leisure activities meeting criteria for sedentary behavior (Ainsworth et al, 2011). Walking activity occurred occasionally and took place inside the facility or on an outside walking path. Current household experiences of PA included bed making and putting away laundry. Social and spiritual activities were also mentioned as part of current PA including chapel or church services at the ALF or outside the facility. Also, going on excursions to restaurants, baseball games, plays, to see a movie or concert with other residents or family was shared. Leisure activities such as making jewelry and painting, playing games, reading, watching television, sending emails, gardening and sewing were identified as current PA by most subjects. They also shared that engagement in ADL's, IADL's and physical therapy comprised part of current PA experiences. The residents shared some examples of current PA:

> Well, they have bean bag toss where you toss the bean bag on a thing and try to get points. They have a wooden thing that's set up and we bowl and try to do good. Then they have—oh, they have different things; the kickball where they have a great big ball and you kick it back and forth.

> In the afternoon I go to craft or we play jeopardy or trivia which I love. At seven we play bingo and then I go back to my room and watch TV until about eleven and then I go to bed. That's my day. On the weekend, I'll go to the movie because we don't have craft or jeopardy or anything.
>
> They usually come in and wake me up with pills or medication as soon as I get out of bed. And I get up and I get myself washed good. And put on my robe, and I go down for breakfast. And so then I go back to my room after breakfast and a little bit of chatting with people at the table. I start getting dressed for my exercise class. Last week I had a doctor's appointment and a dentist, eye appointment. My daughter picked me up.
>
> Two or three times a week I go to the doctor's. I have physical therapy. We just upped it to three days. My back, I can't walk very far. I was hoping it'd just heal itself, and it never did. And now it's gotten to the point where it's really bad, so I have physical therapy before they can do anything else to it.

One contrary subject demonstrated an increase in PA in old age compared to youth. Sedentary behavior was prominent during most of childhood and into young adulthood due to functional disability. PA increased in frequency and intensity in older age because opportunities became available and functional ability had improved since childhood. Current PA for this subject, however, included similar types of activities engaged in by all the residents and involved mainly seated leisure and social activities. This resident stated:

> Well, since I've been here, it's the most activity I've ever had. And it feels good.

The second contrary case demonstrated that not all residents viewed themselves as active. This subject said the ALF was not a place where one engaged in PA but rather rested from life's labors. The resident indicated:

> I don't do those activities. I don't care for it. Like, they're out there bowling today. I'm just not interested in that kind of stuff. I'm as physically active as I'm going to be. I love the quiet. The minute I get into my robe I love that. I didn't come here to do activities, I came here to rest.

Theme Two: Physical Activity is Dependent on a Schedule or Routine

Physical activity occurs within a set schedule, including all leisure, social, personal care activities, meal times and program activities sponsored by the ALF. Sponsored activities are communicated through printed calendars and overhead announcements and by room to room visits reminding residents to attend. Family members often arrive on a scheduled day and time to take residents to outside activities. There is little time for residents to engage in spontaneous PA. There were no responses identified, however, where residents were dissatisfied with established scheduling of activities. Most had the calendar of events readily available or had memorized what activities and events were scheduled each day and time. Regarding the scheduling of activity residents remarked:

> They have a lot of activities here. Just about every day. They give us a paper of every day events; they tell you what time and whose doing it.
>
> There are activities in the afternoon and sometimes the evening. Monday through Friday they offer those activities. And they let you know, they announce it, come to this or come to that. Monday through Friday they offer activities. Devotions at 9:00, sewing every Tuesday at 3:00, girl comes with her guitar every Wednesday. We take a trip every month.
>
> I rise early, about 5:00am or so. Cause they bring medicine in. That's my breakfast. Then I take a nap or work on my computer, usually check email. Go to the little exercise class in the morning, 10:00 or 10:30. Lunch between 11:00 and 12:00 usually. I read a lot. Go outside and walk, walk around the building. Dinner is probably 4:30, 5:00. It's early, that's not really evening. Then I come back and read until I go to be. I usually go to sleep by 8:00.

Theme Three: Beliefs and Perceptions Influence PA

All participants expressed some belief that their current physical condition in some way influenced daily activities. Health conditions were clearly articulated as well as the potential for the conditions to limit PA. A certain level of resilience in the face of

health problems to continue on with PA was consistently communicated. Participants responded:

> I cough a lot and that worries me, my whole body shakes cause I cough so hard. And that affects your ability to do stuff. But I want to do as much as I can. It means a lot. Because then I'm not just sitting there with my face down.

> I always go to exercise class. I didn't go for the first time today I think in months and months because the first thing this morning I had a spell of numbness in my leg. But, I do whatever I want to. I take laps every day. If you look at my calendar here, these are the recordings of—I went four times around [the inside of the facility] then I went one, then I went three. So, I try to do as many as I can, yes. I used to do seven when I first got here. I can't do that anymore, my legs don't hold up.

Residents compared the frequency and intensity of their current PA to other residents. All residents, except for one contrary subject, perceived that they engaged in more PA and more vigorous PA compared to other residents viewed as sedentary. In addition, subjects expressed pride in their current level of PA when compared to others. These constant comparisons provided motivation to sustain engagement in as many activities as possible. Staff and family perceptions about the physical ability of residents were also shared and this influenced PA engagement. Some of the responses included:

> I keep busy here; I'm not just sitting here twiddling my thumbs. It worries me that I'm sitting more than I ever did in my life. I'm well aware I've got to keep moving in some way. But I think I do more than most around here.

> I suppose they could have more activities, but there's so many people that don't take advantage of any of that stuff. You'd be surprised the few people that go to that. And it's hardly worth getting somebody and all the equipment that you need to work with. And there so many people, they come late, and they start making whatever you're making. So then the person giving instructions, they have to stop and start all over again. Old people are funny.

> And a lot of these people have given up 'cause they just don't do'. That's why she has to go three times to tell people to come. I feel all the energy she [activities director] puts into having it, we should at least show her the courtesy of going, of attending.

> They [facility staff] require me to use a walker all the time. With the group I use it. They'll say "where's your walker" and they'll go get it for you, you know. "Just stay right here, I'll go get your walker". They don't want me to fall.
>
> My daughter says, what are you doing out there pulling weeds? You shouldn't be doing that. But I like it!

Theme Four: Motivations and Preferences for PA

Maintaining mental health and physical health, particularly physical function, were the most frequently mentioned motivating factors. The monetary benefits of engaging in occupational work activities at the facility in addition to the social benefits of engaging in PA were also referenced as motivating current PA. Additional statements offered wisdom and advice about PA. Residents stated:

> Oh, that's the only thing that keeps me sane [activity] and halfway out of depression, because I tend to have a little depression. I would get bored. I would just get bored, and I would get disgusted with my limited lifestyle, just plain disgusted. The more activity, the better my depression was. It was better to keep active. I feel like, you have to do something with your body. If you don't use it, you lose it.
>
> If I didn't move, then everything would freeze up and I would end up in a wheelchair. I do it because I want to keep at least somewhat fit. It makes me feel good. It helps me keep my strength. That's why I keep on people, that you can do it; you shouldn't say you can't do it because you can. I would tell them, keep moving, don't just sit in a chair. Just get up. I would always try, I know I would always try. I wouldn't say I can't do it.
>
> Well, it's [delivering mail] extra money. It pays for the extras you know, like my vitamins.
>
> If there wasn't anybody there [at exercise class] then it wouldn't be any fun. Because, you got to have enough people. I just like people, I like to talk and we get to know each other. I like the companionship, I enjoy chatting with people. That's why I go [to activities].

Participants expressed clear preferences for certain types of PA. Seated, leisure activities such as craft classes, and seated exercise classes that were organized by facility staff were mentioned most often. Spontaneous walking in and around the facility was also

mentioned as preferred PA for several participants. In some instances, strong preferences for not engaging certain activities were expressed. Residents knew their likes and dislikes and acted on them. Some residents stated:

> I go to that little exercise class every morning and I just love that. It's just a half hour. And it's great, I love it. I try to keep as busy as I can physically. And then of course I sit and I read a lot too. But, I'm always busy. I want to continue to keep walking, and reading and working on my computer. Those are the most important things to me.
>
> What I like to do is the crafts. I like crafts, it's my favorite. I made this necklace. But, if someone would come and say "would you like to go shopping?" Well, this would take a back seat. On the weekend in the afternoon I'll go to the movie because we don't have any craft or jeopardy or anything, so I'll go to the movie. That's a nice time.
>
> As I say, my day is a little quieter because I tend not to participate in everything. I tried everything just to see what it was. But I love to read, but I don't go to the book club because I want to enjoy reading for myself, and to sit and pick it apart has never appealed to me. So I don't do that. It makes it sound like "well, aren't you a snob?" but it just doesn't appeal to me.

Theme Five: PA has Multifaceted Meaning.

Current PA means having a purpose in life and in living. It means they are preventing or delaying physical disability. Engaging in PA means that residents can improve self-sufficiency and avoid dependence on others. PA means they can experience overall health and well-being. PA means they can plan and hope for the future. Residents stated:

> If I couldn't do those things, well, I'd just pray to die I guess. If I couldn't walk it would be terrible. I think it would be horrible to be in a wheelchair.
>
> I like what I do and it means I'm not relying on somebody else to do stuff for me. I'd feel like an invalid; it would make me feel like a cripple if I couldn't walk by myself.
>
> I'd feel bad about it [not doing PA] cause I like to keep busy. If I couldn't walk, I wouldn't like that at all. I would miss that, yeah. I'd hate to end up in a

wheelchair, that would be really hard, difficult. It's [PA] a benefit, cause it makes you feel better.
If I couldn't do it I would probably be sad. I think I'd go crazy.

If I couldn't do it, I'd be in a bed across the street where you can't do nothing for yourself. I got a future, I want to get there. But being here and being able to do what I'm doing, it keeps you alive and it makes you worthwhile. And when you do for others and they appreciate it, that makes you feel alive, makes you feel better inside, as a person. If there ain't no future, then why not give up? I still need another piece of paper, for my life, so you can add more. I have a plan, just ask me what I'm doing tomorrow.

Discussion

PA was defined in broad terms that included all bodily movement and social engagement. Current PA was primarily comprised of self-care and seated social and leisure activities. Subjects viewed themselves as being physically active even though a majority of their current activities qualify as sedentary behavior including craft activities, watching television and reading. Findings in this study suggest that residents' understanding of PA is different from established definitions of PA and guidelines for engagement (CDC, 2014). These findings are supported by previous research with community-dwelling older adults who identified quilting, travel, card games and sewing as being part of an active life when describing PA (Aronson & Omon, 2004).

A new finding is that residents in an ALF are dependent on schedules created by others for PA engagement. All participants discussed a schedule or routine established by staff or family around which most physical activities were performed. The interview guide used in this study, which included the weekly activity form, may have contributed to describing PA as being tightly scheduled. However, none of the participants deviated from discussing PA as being scheduled and none voiced dissatisfaction with the schedules or routines. It may be that schedules contribute to a sense of consistency and

comfort for residents, but this would need to be further examined. It could also be that limited autonomy due to set schedules in this setting may be restricting participation in more light to moderate PA. More information is needed to better understand the impact of schedules on PA in this setting and how they might be used to increase the amount of time spent in PA.

Residents believed that overall health was a factor in PA engagement. This finding is supported by prior research that states better physical health contributes to participation in more PA in older adults (Conn, 1998; McPhee, Johnson & Dietrich, 2004; Schroeder, Nau, Osness & Potteiger, 1998). Another finding was that, despite health challenges, participants worked through those challenges to achieve a level of PA they found to be acceptable and desirable. They understood their limitations due to health and functional ability but made a choice to overcome those limitations and engage in PA because they believed they could. One could say that participants had high self-efficacy for PA (Bandura, 1994). Several studies support this finding, that higher self-efficacy for PA in older adults positively influences PA engagement (Chao, Scherer, Wu, Lucke & Montgomery, 2013; Chen et al., 2015; Sperber et al., 2014; Resnick, 2004). This would be an important variable to include in future studies of PA in ALF residents.

All participants perceived they were engaged in more frequent and vigorous PA compared to other residents. This is an interesting new finding. The comparisons may serve to demonstrate to others, family, staff or other residents, how much healthier and vital they are for their level of PA engagement. Or, it may be that the comparisons are a way to improve self-confidence or measure personal ability and health. The comparisons may also stimulate self-awareness of PA and increase personal resolve to engage in PA

whenever possible. Social comparisons have been studied for their impact on eating behaviors in adolescents (Polivy & Pliner, 2015) and on health seeking behaviors in individuals with mental illness (Pederson & Paves, 2014). A literature search of social comparisons in older adults regarding engagement in PA resulted in no studies addressing this phenomenon. One important aspect is that the continual comparisons are providing false assurance that PA levels are adequate when a majority of activities are sedentary. This perception could be a barrier to adding or substituting more beneficial light PA for these individuals. Further work is needed to better understand how these comparisons with other residents impact PA.

The motivations identified by the participants to engage in PA are supported in literature. Phillips and Flesner (2013) found that older adults were motivated to engage in PA by the prospect of delayed disability, improved health, better stamina, enhanced self-sufficiency and improved mental health. Understanding these motivating factors may assist staff in counseling residents regarding PA. In addition, the impact of PA preferences on PA behaviors is also found in literature. Herbert and Greene (2001) identified that subjects engaged in PA for longer periods of time when allowed to participate in a preferred activity. Offering preferred activities might yield engagement in more light PA, such as walking, and provide the health benefits residents are seeking, such as improved physical function and better mental health (Bell, Von Allmen, Devries & Phillips, 2016; Hatch & Lusardi, 2010; Hummer, Silva, Yap, Toles & Anderson, 2015; Lihavainen et al., 2011; Peri et al., 2007).

Engagement in daily PA held meaning for all subjects. PA meant disability could be kept at bay. The thought of having to use a wheelchair, not being able to walk

independently, and not being able to participate in every- day activities was an alarming proposition to many. Being bed-ridden or viewed as needing help was a repulsive idea and staying engaged in daily activities meant they could retain their physical function and abilities and appear vital to others. In addition, daily PA also meant boredom and depression could be prevented. Daily engagement in PA ensured health of body and mind, provided residents with a sense of purpose in life and meant they could hope and plan for the future. This lends support to the idea that self-transcendence may be achieved and result in improved health and well-being by way of PA behaviors. In addition, research on the meaning of walking in Parkinson's patients lends support to this study's findings. Hammarlund, Andersson, Andersson, Nilsson & Hagell (2014) studied seven men with Parkinson's and found that being able to walk meant one could remain independent and continue to participate in society. Welmer, Morck & Dahlin-Ivanoff (2012), in a qualitative study of older adults, found that PA meant counteracting disability and frailty. This implies that integrating PA in daily life is important for ALF residents. This information can be useful for ALF staff as they plan activities to engage residents on a regular basis.

Conclusion

The experience of PA was found to be a blended composite of all activity that involves bodily movement and social engagement with others. However, not all activities identified as PA meet the standard definition for PA (Ainsworth et al., 2011). One new factor found to influence PA was scheduling and routines set by facility staff. Another new finding was that residents saw themselves as active, in part because they compare themselves to each other. They see PA as important for healthy living but do not engage

in the types of PA that would impart health benefits such as improved physical function. Comparisons to others reinforce an attitude that present levels of PA are satisfactory when in fact most of the PA described involves seated, leisure activities and not PA. One limitation of the study is that the self-selected sample may have limited the discovery of experience and meaning of PA among other, less active residents.

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CHAPTER 4

The Acceptability and Feasibility of a Continuous Wear Accelerometer Device and Completing Questionnaires in Assisted Living Facility Residents: A Preliminary Study

Introduction

Older adults living in assisted living facilities (ALF's) can spend significant amounts of time in sedentary behavior (Resnick, Galik, Gruber-Baldini & Zimmerman, 2009). This puts them at risk for higher metabolic, cardiovascular and musculoskeletal problems and frailty (Avery, Kleppinger, Feinn & Kenny, 2010; Krol-Zielinska, Kusy, Zielinski & Osinksi, 2010). ALF residents who engage in regular physical activity (PA), particularly light PA, can experience many benefits. Light PA such as walking, gardening and some household activities may contribute to better cognitive function and preserve skeletal muscle integrity (Johnson et al., 2016; Safdar et al., 2010). Little is known, however, about factors that influence PA in ALF residents. Demographic variables, co-morbid conditions, self-rated health and self-efficacy for PA and the influence on PA in ALF residents has not been widely studied. Exploring these variables would provide the groundwork for studies aimed at increasing PA in this population.

Background and Significance

Measurements of physical activity (PA) in older adults can be complex, sporadic and vary significantly within and between subjects (Baranowski, Masse, Ragan, & Welk, 2008; Kowalski, Rhodes, Naylor, Tuokko & McDonald, 2013). Methods may be

objective or subjective. Objective measurement methods, such as pedometers and accelerometers, provide data which is considered to be more accurate than the subjective data produced by questionnaires and activity logs (Arnardottir et al., 2012; Yang & Hsu, 2010). Accelerometry and pedometry are the most frequently used objective measures of PA in the older adult population (Kowalski et al., 2012). A few studies have employed the use of accelerometry in ALF residents to measure PA (Resnick, Galik, Gruber-Baldini & Zimmerman, 2011; Wyrick , Parker, Grabowski, Feuling & Ng, 2008). However, the waist-mounted accelerometer devices used in these studies were removed for sleep and bathing. This resulted in significant loss of data from subjects forgetting or refusing to reapply the device (Resnick et al., 2011; Resnick, Galik, Gruber-Baldini & Zimmerman, 2010a). No known studies have used continuous wear accelerometry attached directly to the body to collect PA data in ALF residents in the United States (U.S.).

Few studies have examined factors that influence PA in ALF residents in the U.S. Environmental factors such as limited area to walk indoors, narrow corridors and a non-continuous layout of the facility have been found to limit walking activity in ALF residents (Lu, Rodiek, Shepley & Duffy, 2011; Rodiek, Lee & Nejati, 2014). In addition, perceived level of frailty, numbers of ADL impairments and poor physical function have been reported to interfere with engagement in PA in ALF residents (Bergman, 2005; Lu et al., 2011). Phillips and Flesner (2013) examined the past experience of PA, the value of PA, and characteristics of the environment that promote or hinder PA in a mixed sample of ALF and community-dwelling older adults. It was found that PA was valued for its ability to maximize physical function and provide a sense of well-being.

Additional factors identified as possibly impacting participation in PA included having a motivated leader and adequate space and time for activity. More research is needed to understand the impact that multiple variables may have on PA specifically in ALF residents.

Theory-Guided Research

Theory-guided research can test and explain relationships between concepts and variables. However, theories have rarely been utilized to guide studies examining PA in ALF residents. Health related behaviors such as PA can be influenced by interrelated determinants such as personal and environmental factors. Social Cognitive Theory (Bandura, 2004) has successfully been implemented as a theoretical guide in several studies examining PA in older adults (Hall & MCAuley, 2011; McAuley et al., 2007; Resnick & D'Adamo, 2011; Resnick, 2004) and in two studies of ALF residents in the U.S. (Resnick et al., 2009; Resnick et al., 2011). SCT is well-suited for studies examining the influence of demographic, personal and environmental variables on PA in ALF residents and was used to guide this research. It was hypothesized that demographic and personal factors influence PA and this relationship was explored.

Statement of the Problem

Assisted living facility residents are thought to engage in very little PA with a majority spending one minute or less in moderate PA in 24 hours (Resnick et al., 2010a; Resnick, Galik, Gruber-Baldini & Zimmerman, 2010b) but the evidence is limited. Understanding factors that influence PA and obtaining accurate measurement of PA and sedentary behavior is needed for the development of research aimed at maintaining and promoting PA in the ALF resident. (Sarkisian, Prohaska, Davis & Seiner, 2007).

The **specific aims** were:

1. Investigate the acceptability and feasibility of using an activPAL^3 accelerometer to measure physical activity in ALF residents and evaluate (a) accelerometer likability, comfort and barriers to wear (b) compliance with wear time (c) compliance with daily skin check protocol (d) skin assessment results and (e) physical activity data.
2. Investigate the acceptability and feasibility of completing a packet of questionnaires on demographic variables, present and historical physical activity, self-rated health, co-morbidities and self-efficacy for physical activity and evaluate (a) questionnaire likability and barriers to completing the questionnaires (b) compliance with completing the questionnaires and (c) questionnaire data.
3. Establish a preliminary estimate of PA in ALF residents and explore the potential relationship between variables and PA.

Methods

Design, Sample and Setting

A cross-sectional descriptive research design was used. Data were collected during the months of May through September, 2015. A convenience sample of 20 ALF residents was recruited from four state-licensed ALF facilities in mid-Michigan following approval by the Institutional Review Board (IRB) at the University of Michigan. The participating facilities had a combined capacity of 176 residents. Eligibility criteria included (a) be an adult 55 years of age or older residing full-time in an assisted-living facility for a minimum of three consecutive months (b) able to read, write and/or speak

the English language (c) no history of reaction to an adhesive film dressing that caused blisters, skin welts, rash, bleeding, skin breakdown, or infection (d) no current evidence of skin blisters, skin welts, rash, bleeding, skin breakdown, or infection on the right, anterior thigh region (e) able to engage in physical activity independently any time during the day without the aid of a wheel chair or motorized cart (f) willing to participate in the full preliminary study (g) complete cognitive screening using the Mini-Mental State Exam (MMSE) and achieve a score of 24 or greater. Exclusion criteria included (a) currently receiving chemotherapy, radiation or steroid treatment (b) history of chemotherapy in the last 12 months (c) history of radiation treatment to either of the lower extremities (d) subject verbally expresses concern about wearing the adhesive film and accelerometer device for 7 days and what it may do to their skin (e) any observation of skin blisters, skin welts, rash, bleeding, skin breakdown, or infection on the right, anterior thigh region (f) receiving current medical treatment for an active skin infection.

The facilities were all one-story buildings with a central dining room that residents walked to for all meals. All facilities had an activities director on duty during daytime hours five days a week. All facilities offered in-house activities such as seated exercises, craft classes and social events five days a week. Outside trips to restaurants, shopping centers and other destinations of interest to the residents were offered weekly or monthly depending on resident interest. The facilities provided medication administration and assistance with ADL's in addition to housekeeping and laundry services.

Measures

The activPAL^3 was used to measure PA. It is a small triaxial accelerometer that weighs approximately 15 grams and measures approximately 53 by 73 millimeters and is

seven millimeters thick. It is attached to the body on the mid, anterior position of the thigh using an adhesive film dressing. It can be worn continuously and unobtrusively under clothing and does not require manipulation by the subject. It can be waterproofed, attached directly to the skin, and does not impede movement. It records acceleration signals related to walking in addition to postural changes such as sitting or lying down to standing and can provide data on both PA and sedentary behavior. Step counts are also recorded (PAL Technologies Ltd., 2006). The battery life makes it possible to record and store up to 7-plus days of activity data.

The activPAL is reliable and valid. It was used as the criterion measure for validating the Actigraph-GT3X accelerometer in two studies because of its ability to detect postural changes and more accurately classifying standing (Aguilar-Farias et al., 2013; Grant, Granat, Thow & Maclaren, 2010). In addition, Taraldsen, Chastin, Riphagen & Vereijken (2012) found that the activPAL showed no misclassification of activities and accurately detected transitions from sitting or lying down to standing. Grant et al. (2010) found it to have less than one percent error for all walking speeds in older adults using video recording as the criterion measure and greater than 99 percent accuracy for step counts. The activPAL^3 is pre-programmed by the manufacturer to record the number of steps taken, time spent standing, stepping, sitting or lying and the number of transitions from sitting or lying to standing. Software creates summary reports on all measures for each 24-hour period and for the total number of days recorded. Attached directly to the body, it results in little if any loss of data thereby decreasing measurement error. It is considered the gold standard for measuring sedentary behavior (PAL Technologies, 2006).

The packet of questionnaires contained six separate measures. The Physical Activity Scale for the Elderly (PASE) (Washburn, Smith, Jette & Janney, 1993), the Historical Self-Administered Physical Activity Questionnaire (H-PAQ) (Orsini, Bellaco, Bottai, Pagano & Wolk, 2007), the SF-12v2 self-rating health survey (Ware, Kosinski & Keller,1996), the Charlson Comorbidity Index (CCMI) (Charlson, Pompei, Ales & MacKenzie, 1987), the Self-Efficacy for Exercise Scale (SEE) (Resnick & Jenkins, 2000) and the Mini-Mental State Exam (MMSE) (Folstein, Folstein, McHugh & Fanjiang, 2001).

The PASE was used to measure total PA levels. It is comprised of 12 items designed to assess leisure, household and work-related PA over the past seven days. It takes approximately five to 15 minutes to complete the questions. Muscle strengthening and endurance activities, strenuous, moderate and light sports activities, jobs involving standing or walking and walking activities are scored based on how many hours per day an individual participates in them over seven days. Lawn or yard work, caring for another person, home repairs, heavy housework, light housework and outdoor gardening are scored based on whether they did or did not engage in that activity in the last seven days. Each item's frequency score is multiplied by an empirically derived activity weight based on intensity and the item scores are then summed. Summed scores can range from zero to 400 and higher scores indicate higher levels of PA.

The PASE is designed to specifically capture the types of low-intensity activities common in older adults. It is a subjective measure used to assess time spent in light, moderate and vigorous physical activities in older adults (Kowalski, et al., 2012). The PASE has demonstrated satisfactory test-retest reliability (r = 0.75 by interview, r = 0.84

by mail, r = 0.68 by telephone) and construct validity in older adults where the validation measures of peak oxygen uptake, systolic blood pressure and balance scores significantly correlated with the PASE (Washburn, McAuley, Katula, Mihalko & Boileau, 1999; Washburn et al., 1993). This questionnaire has also been validated using accelerometry (Liu et al., 2011). The PASE was used in this study to describe PA for the group of subjects, compare results to normative PASE data and establish acceptability and feasibility for use in future studies (Appendix N).

The H-PAQ was used to estimate historical levels of PA (Orsini et al., 2007). Work and occupational activities, walking and bicycling, household work, leisure time activities such as reading and watching television, exercise and time spent sleeping in a 24-hour day are assessed at ages 15, 30, 50 years and the last year. Scores are calculated by multiplying hours per day spent in various activities by the MET'S assigned to each activity based on the Compendium of Physical Activities Guidelines (Ainsworth et al., 2000). Results are then summed for each age category and reported as MET-hours per day. Normative scores are based on reliability testing in a group of older women in the Swedish Mammography Cohort (Larsson, Bergkvist & Wolk, 2005) and range from 30.9 MET-hours per day to 44.1 MET hours per day for all age categories. Test-retest reliability (r= 0.66 at 50 years, r= 0.71 at 30 years, r=0.78 at 15 years) has been established for in women over the age of 65 years (Orsini et al., 2007). Concordance correlations (r= 0.36 *to* r= 0.47*)* provide evidence of validity for the H-PAQ in the older adult population (Orsini et al., 2008). The H-PAQ can be completed in 15 minutes. The H-PAQ was selected for this study to examine historical levels of PA in the subjects and establish acceptability and feasibility for use in future studies (Appendix O).

The SF-12v2 instrument was used to measure self-rated health. It was designed to capture self-rated health across multiple health dimensions, including subscales for physical (PHS) and mental health (MHS), while limiting subject burden (Ware et al., 1996). The questionnaire consists of 12 items addressing general health, problems with daily activities, emotional problems, pain, and ability to engage in social activities. It takes approximately five to 10 minutes to complete. Scoring is accomplished using proprietary software and higher scores on each subscale indicate better overall self-rated health. Standardized scores range from 30 to 70 for each subscale. The software is capable of producing individual reports comparing the subject's scores to the general population. Reliability has been established (α =0.76-.0.89) and construct validation has been supported relative to the original questionnaire the SF-36 (Ware et al., 1996). Cronbach's alpha coefficient for this study was α=.82. This questionnaire was selected to establish acceptability and feasibility for use in future studies and to describe overall health as rated by the subjects (Appendix P).

The CCMI (Charlson et al., 1987) was used to measure mortality risk. It has been used to examine the association between mortality risk and activity levels in older adults (Ball, Joy, Gren, Cunningham & Shaw, 2016). There are 21 items requiring a 'yes' or 'no' response based on whether the subject has any of the listed co-morbid diseases. Items are weighted based on co-morbid condition. Age is also included as an item. Each decade of age over 40 years adds one point to the risk index score. Scores can range from zero to seven with each risk score associated with a predicted 10-year survival probability calculation. Higher index scores are indicative of greater mortality risk. Evidence of criterion-related and construct validity was supported in a cohort of breast cancer patients

(N=604) when compared to the Kaplan Feinstein method for classifying co-morbidities (Kaplan & Feinstein, 1974). This instrument was included in this study to assess mortality risk in the subjects and establish its acceptability and feasibility for use in future studies. The instrument takes approximately five minutes to complete (Appendix Q).

The SEE (Resnick & Jenkins, 2000) was used to measure self-efficacy for PA. It is a 9-item questionnaire that asks the participant how confident they are they can participate in 20 minutes of PA or exercise three times per week given various conditions such as feeling tired, experiencing pain or being busy with other activities. The scale for each item ranges from zero to 10 (zero=not confident, 10=very confident). Total scores are summed then divided by the number of questions. Final scores range from 0-10 with higher scores indicating higher self-efficacy for PA. Reliability has been established (α= 0.93) and validity was supported based on hypothesis testing in a group of 187 older adults, where mental health and physical activity scores on the SF-12v2 predicted self-efficacy expectations and self-efficacy expectations predicted exercise activity. (Resnick & Jenkins, 2000). Cronbach's alpha coefficient for this study was α=.89. This instrument was included to examine its acceptability and feasibility for use in future studies (Appendix R).

The MMSE (Folstein et al., 2001) was used to screen for cognitive ability. The MMSE has 22 items comprised of questions and paper and pencil activities that take approximately 10 minutes to complete. The current version of the MMSE was designed to screen for cognitive impairment in adults aged 18 to 100 years. Test re-test reliability has been established with Cronbach's alpha coefficient 0.79 to 0.98 and inter-rater reliability 0.83 to 0.95 (Appendix L).

Procedure

Facility contact information was accessed through the Michigan Department of Human Services online list-serve. Permission to recruit subjects at the facilities was authorized by representatives at each facility. Once IRB approval was received from the University of Michigan, the PI met individually with potential subjects identified by the authorized representatives and shared an overview of the study including (1) the purpose of the study (2) eligibility criteria including completing cognitive screening and (3) what the time commitment was for all activities. This process took approximately 15 minutes to complete.

The PI administered the MMSE cognitive screening form and provided directions for the participant to complete the activities (Appendices K and L). A minimum score of 24 on a scale of 0 to 30 was required to continue on with the study. This cut point has been established since cognitive ability is considered to be impaired below 24 and adequate cognitive function is required to carry out the activities of this study. All participants achieving a score of 24 or greater on the MMSE and meeting all other inclusion criteria proceeded with the consent process which took an additional 30 to 45 minutes. The demographic data form was then completed by the subject and included information on age, gender, ethnicity, marital status, highest level of education completed, employment status, the use of assistive devices for walking, and length of stay (LOS) at the ALF (Appendix G). An appointment was then scheduled to place the activity monitor on the participant or it was done immediately following consent based on subject preference.

The activPAL^3 accelerometer device was charged and programmed using the PAL

Technologies docking station and proprietary software. It was programmed to begin measuring PA at 5:00 A.M. the day after application and continue recording for seven consecutive days ending at 5:00 A.M on day eight (PAL Technologies Ltd., 2006). This was to ensure the recommended five to seven days of monitoring in order to collect valid and reliable data (Reid et al., 2013). The activPAL^3 was waterproofed using a latex-free nitrile sleeve wrapped by 3M Tegaderm.

Subjects were asked again if they have ever had any reaction to the 3M Tegaderm product. Care was taken to apply the device only on skin that was without skin breakdown, redness, blisters, rash, bleeding or drainage. If lotion was detected on the leg, the skin was cleansed with water and allowed to dry thoroughly before applying the film to prevent skin irritation and to ensure good adhesion. The activPAL^3 was applied to either the right or left anterior thigh midway between the knee and hip per product specifications (Figure 4.1). PAL Technologies recommends placement on the dominant thigh that corresponds with right or left-handedness. Care was taken to apply adequate pressure to secure the device. Stretching of the tape was avoided during application to reduce the risk of skin trauma. PAL Technologies Ltd. (2006), the maker of the activPAL^3, recommended 3M Tegaderm film adhesive for prolonged wear of the device in older adults. It is latex-free and bacteria, moisture and outside contaminates are impermeable to the covered area. 3M Tegaderm is a conformable film that flexes with movement. The adhesive is gentle to the skin, yet has good adherence for extended wear (3M Healthcare Academy, 2016).

Figure 4.1 Placement of activPAL^3 device.

Directions on how the device works to record information, how to manage it through daily activities, when to contact the PI and when and how to remove it were provided and left with the subject. Directions for removal followed 3M Tegaderm specifications for rolling back one edge of the film then slowly peeling it back (3M, 2016). The removal procedure was demonstrated to the participant using a sample piece of the 3MTegaderm film on the PI's hand.

The packet of questionnaires was then presented to the subject and each questionnaire was reviewed. The subject decided to keep the packet of questionnaires and complete them on their own within one week or complete those by having the PI read each question on each questionnaire. If the subject elected to keep the questionnaires, a follow-up visit was scheduled to retrieve the packet, review each questionnaire for completion, and answer any questions the participant had about the questionnaires. The questionnaires could be completed in any order and completed in short segments of time or all at one sitting.

A follow-up examination of the device and assessment of the skin each day for two consecutive days followed application. The skin was checked for signs of breakdown, redness, blisters, rash, bleeding drainage or complaints of itching. If any of these were evident, the device was removed by the PI and the subject's health care provider was called for additional assessment and treatment the same day the skin

problem was identified. A daily phone call, email or visit was then done for the next five days to assess the skin and device. The detailed daily skin assessment record can be found in Appendix S. When the seven days of wear time were completed, the activPAL^3 was removed by the subject or the PI. A structured interview then took place to assess the acceptability and feasibility of the activPAL^3 (Appendix T).

To assess acceptability subjects were asked to rate how much they liked or disliked wearing the monitor using a 5-point Likert scale (1=*disliked it very much, 2=disliked it somewhat, 3=didn't like it or dislike it, 4= liked it somewhat,* 5=*liked it very much*). To further assess acceptability subjects were asked to rate how comfortable or uncomfortable it was to wear the monitor using a 5-point Likert scale (1=*very uncomfortable, 2=somewhat uncomfortable, 3=neither comfortable nor uncomfortable, 4=somewhat comfortable*, 5=*very comfortable*). Acceptability was further assessed by assessing barriers to wearing the monitor by asking the subjects if was there anything hard about wearing the monitor and what would have made wearing the monitor better.

Feasibility was assessed by asking the subjects if they wore the monitor for seven days and seven nights and whether they removed the device at any time. If they acknowledged that they removed the device, they were asked what the reasons were for taking it off. Feasibility was further assessed by reviewing the daily skin assessment log for any unusual findings related to wearing the activPAL^3. Adherence to protocol checks in-person and by phone or email to check on skin condition was also assessed.

A review of the completed questionnaires took place next. If subjects requested assistance completing the questionnaires this was done at this time. Sixteen subjects requested assistance. Next, the acceptability and feasibility of completing the

questionnaires was assessed. To assess acceptability subjects were asked, using a 5-point Likert scale, to rate how much they liked or disliked completing the packet of questionnaires (1=*disliked it very much, 2=disliked it somewhat, 3=didn't like it or dislike it, 4= liked it somewhat*, 5=*liked it very much*). Acceptability was further assessed by asking the subjects what, if anything was hard about completing the questionnaires. Feasibility of completing the questionnaires was assessed by asking the subjects if they completed all of the questionnaires and if not, why they did not complete the questionnaires. This ended the data collection procedure. Compensation for participation in this study included a $25.00 gift card.

Data Analysis

Data were entered into SPSS for Windows version 23.0 and initially screened to check for missing data and entry errors. Distribution of scores for normality included examination of outliers and extreme cases using histograms, boxplots and normal probability plots and by assessing their impact on the mean by examining the five percent trimmed mean. The Kolmogorov-Smirnov (KS) statistic for normality was also computed (Pallant, 2010; Tabachnick & Fidell, 2007). Descriptive statistics were completed for all variables. Bivariate correlations between age, length of stay (LOS), MMSE, SF-12v2, CCMI, SEE, PASE and H-PAQ and PA variables were completed to examine for statistically significant relationships. The critical value for correlation with $df = 18$and level of significance for a two-tailed test $p < .05$ is .444 to reject the null (Gravetter & Wallnau, 2008). Non-parametric statistics were conducted to test for differences in PA variables between walker users and non- users with the Mann-Whitney U test.

Results

Sample Characteristics

The sample consisted of 20 adults from four ALF's in mid-Michigan. The age range was 57-96 years (M=77.4, SD=10.6) and included 16 (80%) females and 4 (20%) males. Nineteen were White by race (95%) and one was African American (5%). Eleven were widowed (55%) five were single (25%) and four were divorced (20%). Two had less than a high school degree (10%) and eight completed high school (40%). Fifty percent (N=10) had some college education or a college degree. Thirteen (65%) reported using a walker occasionally. The range for length of stay in the ALF facility was 3-89 months (M=27.6, SD=26.0). Two reported being employed (10%). MMSE scores ranged from 24-30 (M=27.65, SD=2.03). Table 4.1 includes sample characteristics.

Activpal Data

The mean number of steps per day was 4,381 (± 2,817, median=3,567). Time spent sitting or lying per day ranged from 13.44-23.03 hours (M=20.10 ±2.29, median=20.70) or an average of 86% of the day. Hours spent in stepping activity per day ranged from .23-2.42 hours (M=.99 ± .58, median=.87). Hours spent in standing activity separate from stepping activity ranged from .55-10.01 hours per day (M=2.88 ± 2.15, median=2.57).

Table 4.1 Sample Characteristics (N=20).

Variable	**N=20**	**%**
Gender		
Female	16	80
Male	4	20
Ethnicity		
White	19	95
African American	1	5
Marital Status		
Widowed	11	55
Single	5	25
Divorced	4	20
Education		
Less than high school degree	2	10
High School degree	8	40
Some college	3	15
College degree	7	35
Employment Status		
Part Time ≤ 20 hrs per week	1	5
Full Time ≥ 40 hrs per week	1	5
Walker Use		
Yes	13	65
Never	7	35
	Range	M±SD
Age	57-96	77.4±10.6
Length of stay	3-89	27.6±26
*MMSE Score (0-30)	24-30	27.6±2.0

*MMSE=Mini Mental State Exam (Folstein et al. (2001) Psychological Assessment Resources, Inc., 2010).

Total hours spent standing and stepping per day was computed. The range of hours spent standing and stepping together was .97-10.56 hours per day (M=3.86 ±2.29, median=3.30). Transitions per day ranged from 12-106 (M=56 ±18, median=56).

Three subjects accounted for all outliers and extreme cases. One subject spent an excessive amount of time stepping and standing. Closer examination of this subject revealed that excessive amounts of time were spent in the upright position due to a medical condition prohibiting long periods of sitting. Another subject generated an excessive number of transitions. This was caused by a medical condition that produced extreme agitation. The third subject spent an excessive amount of time sitting and lying.

This was due to the subject having a recent fall and being cautious about getting up. See Table 4.2 for activPAL^3 physical activity data.

Table 4.2 activPAL^3 Physical Activity Data

Variable	Range	M	SD	Median	KS	df	*P value
Steps per day	891-10,619	4,381	2,817	3,567	.149	20	.200
Sitting and lying hours/ day	13.44-23.03	20.10	2.29	20.70	.161	20	.188
Stepping hours/ day	.23-2.42	.99	.58	.87	.142	20	.200
Standing hours/ day	.55-10.01	2.88	2.15	2.57	.197	20	+.041
Excluding extreme case	.55-5.24	2.50	1.38	2.48	.103	19	.200
Stepping and standing hours/ day	.97-10.56	3.86	2.29	3.30	.183	20	.050
Transitions/day	12-106	56	18	56	.211	20	+.020
Excluding extreme case	12-72	53	14	53	.169	19	.154

*p-value of ≥ .05 indicates normal distribution of scores (Pallant, 2010). +violates assumption of normal distribution, KS=Kolmogorov-Smirnov Statistic.

Activpal Acceptability

Likability scores for wearing the activPAL^3 ranged from 3.00-5.00 (M=4.35 ± .87). No one reported disliking it and 12 subjects (60%) reported liking it very much. Comfort scores for wearing the activPAL^3 ranged from 3.00-5.00 (M=4.70 ±.57). No one said it was uncomfortable and 15 subjects (75%) reported it was very comfortable. A majority of subjects reported no barriers (N=16, 80%). Barriers were reported by four subjects (20%) and included the responses that they knew it was attached or that it felt unusual or unnatural. Those reporting barriers said it was not enough to make them want to remove the device. None of the subjects suggested anything that would have made wearing the monitor better and 95% reported that they forgot they had it on unless they could see it.

Activpal Feasibility

Nineteen (95%) subjects had 100 percent compliance with wearing the activPAL^3 for seven days, 24-hours a day. One (5%) subject asked to have the device removed on day six to attend a family function resulting in the loss of two full days of data or 1.4% of

total data. The individual mean was substituted for the missing data. No subjects removed the activPAL^3 and no devices were lost or damaged. The protocol for carrying out the required in-person skin assessments the first two days of wear time was completed for 17 subjects (85%). The reason for deviation from this protocol in the three remaining cases was that the subjects were not available. The total number of in-person checks for the entire protocol was 92 which exceeded protocol requirements for a total of 40 in-person checks. This was due to subjects requesting an extra visit which the PI did not refuse.

One subject (5%) reported itching immediately following application which subsided after a few hours. No subjects reported or showed evidence of skin breakdown, redness, blisters, rash, bleeding or drainage. A slight indentation was left on the skin of 10 subjects (50%) following removal with no residual skin problems observed or reported. Two (10%) subjects had evidence of poor adhesion with the Tegaderm dressing which was replaced by the PI. No other problems with adhesion were observed or reported. See Tables 4.3 for activPAL^3 acceptability and feasibility findings.

Questionnaire Acceptability and Feasibility

Likability scores for completing the packet of questionnaires ranged from 2.00-4.00 (M=3.20 ± .52). A majority (N=14, 70%) said they didn't like or dislike completing the questionnaires. Four (20%) completed all the questionnaires on their own. Two subjects (10%) attempted to complete the questionnaires and requested assistance to finish them. Fourteen subjects (70%) did not complete any of the questionnaires for various reasons and requested that the PI read them aloud to them in order to complete them. Barriers were reported by several subjects. Two (10%) said they could not hold a pen or pencil well enough, two (10%) said they had poor vision, seven (35%) said the

questionnaires were too confusing and the remaining three subjects (15%) said they were too long.

Table 4.3 activPAL^3 Acceptability and Feasibility Findings

Variable	Range	M	SD	Median	Mode
Activpal Acceptability					
Likability (1-5)	3.00-5.00	4.35	.87	5.00	5.00
Comfort (1-5)	3.00-5.00	4.70	.57	5.00	5.00
	N=20	**%**			
Activpal Feasibility					
Barriers					
none	16	80			
knew it was attached	2	10			
felt unusual/unnatural	2	10			
Completed wear time protocol	19	95			
Skin Assessment					
in-person checks first 2 days	17	8			
itching reported	1	5			
indentation observed	10	50			
poor adhesion	2	10			
	Actual/possible	**%**			
Total days monitored/total possible days monitored	138/140	98.6			
Total actual in-person checks/total possible in-person checks	92/40	*130			

*exceeded requirements

PASE scores ranged from 9.64 to 213.48 (M=63.84±45.71, median=55.53). Total H-PAQ scores ranged from 28.04-53.67 MET-hours per day (M=35.65 ±6.97, median=34.73). H-PAQ scores at 15 years of age ranged from 20.69-64.32 MET-hours per day (M=36.18 ±11.50, median=32.79). There were two outliers detected with high values. H-PAQ scores at 30 years of age ranged from 26.26-60.72 (M=41.34 ±9.99, median=38.35). H-PAQ scores at age 50 years ranged 23.24-60.03 (M=38.67 ±10.01, median=39.55). H-PAQ scores in the last year ranged from 18.79-34.31 (M=26.39 ±4.21, median=27.19).

The total SF-12 v-2 scores ranged from 71.77-117.09 (M=98.93 ±12.93, median=100.25). The SF-12v2 PHS scores ranged from 20.79-58.83 (M=46.16 ±11.07,

median=48.50). The SF-12v2 MHS scores ranged from 30.83-67.21 (M=52.77 ± 10.22, median=57.09). The number of Charlson co-morbid conditions ranged from 2.00-7.00 (M=4.60 ±1.50, median=5.00). Scores for the CCMI ranged from .00-.90 (M=.34 ± .33, median=.21). The SEE scores ranged from 2.44-10.00 (M=6.74 ±2.48, median=7.11).

Table 4.4 Feasibility Data from Questionnaires

Variable	Range	M	SD	Median	Mode		
Questionnaire Acceptability							
Likability	2.00-4.00	3.20	.52	3.00	3.00		
	N=20	**%**					
Questionnaire Feasibility							
Completed all on own	4	20					
Completed partial on own	2	10					
Required help completing all	14	70					
Barriers to completion							
could not hold pen/pencil	2	10					
poor vision	2	10					
too confusing	7	35					
too long	3	15					
	Range	**M**	**SD**	**Median**	**KS**	**df**	***P value**
PASE	9.64213.48	63.84	45.71	55.53	.146	20	.200
H-PAQ⸗	28.04-53.67	35.65	6.97	34.73	.178	20	.097
H-PAQ at 15 years⸗	20.69-64.32	36.18	11.5	32.79	.242	20	+.003
H-PAQ at 30 years⸗	26.26-60.72	41.34	9.99	38.35	.246	20	+.002
H-PAQ at 50 years⸗	23.24-60.03	38.67	10.01	39.55	.145	20	.200
H-PAQ in last year⸗	18.79-34.31	26.39	4.21	27.19	.153	20	.200
SF-12v2 Total (60-140)	71.7-117.09	98.93	12.93	100.25	.149	20	.200
SF-12v2 PHS (30-70)	20.79-58.83	46.16	11.07	48.50	.192	20	.052
SF-12v2 MHS (30-70)	30.83-67.21	52.77	10.22	57.09	.201	20	.200
SEE	2.44-10.00	6.74	2.48	7.11	.106	20	.200
	Range	**M**	**SD**	**Median**	**Mode**		
Charlson co-morbid conditions (0-7)	2.00-7.00	4.60	1.50	5.00	5.00		
Charlson co-morbidity probability index (0-100%)	.00-.90	.34	.33	.21	.21		

*p-value of > .05 indicates normal distribution of scores (Pallant, 2010). +violates assumption of normal distribution, KS=Kolmogorov-Smirnov Statistic.PASE=Physical Activity Scale for the Elderly; H-PAQ=Self-Administered Physical Activity Questionnaire; SF-12v2=Self-Rating Health Survey; PHS=Physical Health Score; MHS=Mental Health Score; SEE=Self-Efficacy for Exercise Scale; ⸗ = (MET hours/day).

Relationship Between Variables

Pearson correlations demonstrated statistically significant negative relationship between total steps taken and age (r =-.659) and total time spent standing and age (r=-.595); a significant positive relationship between total steps taken and MMSE scores (r=.466,) and between total time spent in stepping activity and MMSE (r=.486); between total steps taken and CCMI (r=.648), between time spent in stepping activity and CCMI (r=.610) and between number of transitions from sitting to standing and CCMI (r=.552); between total number of steps taken and PASE (r=.756) and between time spent in stepping activity and PASE (r=.782). Correlations indicate medium to large strength in relationships (Cohen, 1992). See Table 4.5.

The Mann-Whitney U test revealed a significant difference in total steps taken (U=2.00, z=-3.447, p=.001), total time spent stepping (U=4.00, z=-3.289, p=.001) and total number of transitions (U=17.00, z=-2.258, p=.024) between those using a walker occasionally and those not using a walker. Those not using a walker took significantly more steps, spent more time stepping and completed more sit to stand transitions. Effect sizes were large (total steps taken, r=.77; time spent in stepping activity, r=.74; number of transitions, r=.51). See Table 4.6.

Table 4.5 Bivariate Pearson Correlations Between Personal, Environmental and Physical Activity Variables

	LOS	MMSE	SF-12v2	CCMI	SEE	PASE	H-PAQ	Steps	Sit/Lie	Stepping	Standing	Transitions
AGE	-.198	-.105	.345	-.746**	.518*	-.496*	.093	-.659**	-.030	-.595**	.194	-.441
LOS	-	.291	-.103	.357	-.314	.161	-.306	.307	.018	.268	-.089	.393
MMSE	-	-	-.167	.138	.032	.168	-.267	.466*	-.362	.486*	.269	.261
SF-12v2	-	-	-	-.188	.343	-.009	.377	-.177	-.061	-.096	.115	-.105
CCMI	-	-	-	-	-.456*	.346	-.117	.648*	-.098	.610*	-.053	.552* + .495*
SEE	-	-	-	-	-	.001	.392	-.128	-.312	-.053	.331	-.269
PASE	-	-	-	-	-	-	.243	.756*	-.372	.782**	.172	.153
H-PAQ	-	-	-	-	-	-	-	.074	-.134	.061	.082	.115
Steps	-	-	-	-	-	-	-	-	-.293	.989**	.054	.424
Sit/Lie	-	-	-	-	-	-	-	-	-	-.353	-.968** +-.952**	.380
Stepping	-	-	-	-	-	-	-	-	-	-	.117	.379
Standing	-	-	-	-	-	-	-	-	-	-	-	-.512* + -.475*
Transitions	-	-	-	-	-	-	-	-	-	-	-	-

*Correlation is significant at the 0.05 level (two-tailed). ** Correlation is significant at the 0.01 level (two-tailed). LOS=Length of stay in months. MMSE=Mini-Mental State Exam. SF-12v2= total self-rated health. CCMI=Charlson Co-Morbidity Index. SEE=Self-Efficacy for Exercise. PASE=Physical Activity Scale for the Elderly. H-PAQ=lifetime physical activity. Steps=total steps taken. Sit/Lie=total hours spent sitting and lying. Stepping=total hours spent stepping. Standing=total hours spent standing. Transitions=total number of transitions; + correlation with extreme case removed.

Table 4.6 Difference in Physical Activity Variables Between Walker Users and Non-Users

	Steps	Sit/Lie	Stepping	Standing	Transitions
Mann-Whitney U	2.00	40.00	4.00	41.00	17.00
Z	-3.447	-.436	-3.289	-.357	-2.258
Asymp. Sig (2-tailed)	.001*	.663	.001*	.721	.024*

*Statistically significant difference in PA variable and walker use. Steps=total steps taken. Sit/Lie=total hours spent sitting and lying.Stepping=total hours spent stepping. Standing=total hours spent standing. Transitions=total number of transitions.

Discussion

PA Data

The number of steps taken per day is consistent with results reported in other studies. Tudor-Locke (2011) has estimated 1,200-8,000 steps per day to be normative for older adults with disabilities and chronic conditions. Bergman, Bassett and Klein (2008) estimated steps per day in ALF residents using a pedometer for seven days to be 6,420 ± 3,180 (N=13). Reid et al. (2013) used activPAL^3 and found the mean number of steps per day to be 1,055 in ALF residents (N=31) in Australia. Sedentary behavior was also found to be consistent with results reported previously. Resnick et al. (2010a) estimated that ALF residents spend 88.7% of the day in sedentary behavior. This was based on a subjective measure of PA and where participants were required to score a minimum 11 on the MMSE cognitive screening tool for the study. Poor cognitive function may have contributed to the amount of time spent being sedentary. Reid et al. (2013) estimated that ALF residents spend most of their time sitting or sleeping (20.2 hours, 84%) which closely parallels the findings of this study. There is no evidence available on objective measures of sedentary behavior in ALF residents in the U.S. using the activPAL^3.

Time spent standing was somewhat comparable to findings in other research. Reid et al. (2013) estimated that ALF residents spent an average of 1.9 hours of standing per day compared to 55 minutes in this study. There are no known studies examining transitions in ALF residents in the U.S. In summary, the activPAL^3 data establishes preliminary estimates of PA and sedentary behavior in ALF residents in the U.S. Few hours are spent in PA with a majority of time (86%) spent in sedentary behavior. An

average of 56 transitions per day from the sitting to standing position take place and less than one hour per day on average is spent in stepping activity.

Acceptability and Feasibility of activPAL^3

The likability and comfort of the activPAL^3 was rated very favorably by the sample. In addition, no barriers that would interfere with wearing the device were identified and no suggestions were made regarding anything that would have made wearing the monitor better. This is consistent with results reported by deBruin, Hartmann, Uebelhart, Murer and Zijlstra (2008) that older adults' acceptability of removable devices for measuring PA attached to the hip or ankle is low. The activPAL^3 is light-weight, unobtrusive, does not impede movement, can be worn during water-based activities and requires no manipulation or removal by the subject. These features overcome the barriers identified by older adults regarding removable and uncomfortable accelerometers. Additionally, activPAL^3 does not emit any signals that provide real-time visual feedback which has been previously found to change PA behavior in study subjects (Ardic & Gocer, 2016; Harris et al., 2015).

There were no adverse skin reactions observed or reported by the subjects. This supports feasibility of the activPAL^3 when the recommended protocol for placement and adhesion is followed. In-person visits to assess for skin problems and device adhesion exceeded the established protocol. The additional in-person assessments provided assurance for the subjects that the device was working properly. The additional visits also engaged the subjects in social interaction which they enjoyed and appreciated. These extra visits increased the time required for data collection. Future studies may require modification of this protocol in order to meet the mutual needs of subjects and research

team members. In-person visits the first two days of wear time are critical to the study since any adverse skin reactions to the adhesive would be detected in the first 24 to 48 hours (3M, 2016). Follow-up checks for skin problems or adhesion issues could be done by phone or electronically by computer.

Demographic Data

Sample characteristics reflect national trends in ALF residents with the exception of age where 55% of the sample was 75 years of age and older, compared to 81% nation-wide. This age variance may be a regional finding or reflect changing national trends in ALF residents. Age is an important consideration for future studies because an increase in age has been shown to negatively correlate with PA levels (Matthews et al., 2008; Schutzer & Graves, 2004). Gender representation in the sample (80% female) reflects national statistics (77% female). Chen, Li & Yen (2015a) has found that differences exist between men and women regarding predictors of PA in ALF residents in Taiwan. Past exercise participation, better physical function and higher education predicted more PA for men. For women, lower depression was found to predict more PA. Therefore, consideration for age, gender in addition to other demographic variables such as education level is important for designing future studies examining PA levels in ALF residents.

Acceptability and Feasibility of Questionnaires

The acceptability and feasibility of completing the questionnaires was very low. Care was taken to select questionnaires that identified important variables potentially influencing PA and that were easy to read and understand. However, presenting the questionnaires following a lengthy screening and consenting process that took over one

hour for most subjects may have posed an added burden for participants resulting in reluctance to complete the questionnaires on their own. Also, a desire to answer the questionnaires completely and correctly in order to please the PI may have been motivation for the subjects to complete them with PI's assistance. Completing the questionnaires with the PI also offered residents another opportunity for social interaction. The information from this study identifies that a modification in how selected questionnaires are completed is needed. A majority of questionnaires, however, would be retained for future studies for their ability to reliably and validly measure self-reported historical and current physical activity, self-rated health, co-morbidities and self-efficacy for physical activity. The preliminary analysis of distribution of scores on all questionnaires suggests they would be amenable to robust statistical analysis in future studies.

PASE scores were considerably lower than scores reported in previous research. Preliminary norms have been established and range from 0-361(M=102.9 ±64.1, median=90). This is based on a random sample of community living older adults (N=222, age range 65-100 year) (Washburn et al., 1993). Zalewski, Smith, Malzahn, VanHart & O'Connell (2009) examined PA levels in a group of continuing care retirement community members residing in independent apartments and found the mean PASE score to be 136.56 ±105.00. There are no known studies examining PASE scores in ALF residents in the U.S.

The H-PAQ questionnaire (Orsini et al., 2007) was reported to be the most difficult to respond to and all subjects stated that is was not easy to recall PA levels particularly as a teen and young adult. In addition, the H-PAQ does not address PA level

for decades between 50 years of age and 60, 70, 80 or 90 years of age. This is important because 14 or 70% of participants were over the age of 70 years. One subject accounted for outliers at each decade of life and engaged in heavy manual labor for a majority of his lifetime.

Group mean PHS scores were lower than the U.S. average (M=50 ± 10) and group mean MHS scores were higher than the U.S. average (M=50 ± 10). The sample as a whole rated overall well-being as unimpaired. In this sample, N=5 subjects exhibited impaired function according the PHS scores and 2 exhibited impaired function on the MHS scores (Ware et al., 2010). Results for the CCMI demonstrate that the overall mortality risk for the sample was high with a 10-year survival rate estimated to be 34%. Age contributed significantly to the overall index due to the advanced age of a majority of residents.

Relationship Between Variables

Significant correlations between age, mortality risk (CCMI), cognitive function, self-efficacy for PA and PA provide preliminary insight into potential relationships between these factors. Cohen (1992) cautions, however, that it is best to have a sample of 85 cases to detect a medium effect for a significance level of p=.05 in correlational studies. Based on the sample size, this study did not engage the minimum number of subjects to detect significant differences between variables and may have incurred a Type II error. In addition, the non-parametirc Mann-Whitney U test results indicated large effect sizes when comparing PA between walker users and non-users. These findings should be interpreted cautiously as well since Cohen (1992) recommends a sample of 177 to detect a medium effect between two populations.

Theoretical Evaluation

Self-efficacy is one personal determinant that can exert control over one's health habits such as engaging in beneficial levels of PA. SCT has been successfully applied in studies examining the influence of self-efficacy as a determinant on PA in older adults, yet few studies have applied the theoretical concept of self-efficacy in ALF residents. Self-efficacy has been demonstrated to positively impact exercise behavior in ALF residents (Chao, Scherer, Wu, Lucke & Montgomery, 2013). Chen, Li and Yen (2015b) found the mean SEE score to be 5.62 ± 2.67 (N=304) in a sample of Taiwanese ALF residents which predicted higher levels of PA. Self-efficacy was rated high in this study (6.74 ± 2.48) . This indicates that the self-selected individuals view their overall ability to engage in PA positively. However, no significant relationship was detected between SEE and the PA variables in this study. This could be due to the small sample. Self-efficacy beliefs may play a central role in PA in ALF residents and further research is needed to examine the effect. Other factors including mortality risk and cognitive function could be additional determinants that may directly impact PA outcomes or enhance self-efficacy beliefs (Bandura, 2004).

Strengths and Limitations

The major strength of this study is the use of an objective measure of PA, one that is associated with minimal loss of data. One limitation is the cross sectional design which provides information about variables at one point in time making it difficult to determine any causal relationships. The small sample also limited statistical analysis beyond descriptive and correlational. In addition, selection bias from self-identified, non-random sampling limits generalizability of findings. Another limitation is the activPAL[3]

is not capable of distinguishing between sitting and lying behavior, nor is it capable of detecting upper body movement. Another limitation is the subjects may have responded to the protocol and questionnaires in a socially desirable manner. Two subjects had medical conditions that resulted in extreme scores that skewed activPAL^3 data.

Conclusion

The results of this study demonstrate the low levels of PA that ALF residents engage in and the significant amount of time spent in sedentary behavior. Potential positive relationships were demonstrated between PA and cognitive function, survival probability, and self-efficacy for PA. Potential negative relationships were demonstrated between PA and age. The results of this study also demonstrate that: the activPAL^3 continuous wear accelerometer is acceptable and feasible for measuring PA in ALF residents; that the protocol for including a battery of questionnaires addressing certain variables that may influence PA and procedure for screening future subjects requires some modification and; the integration of SCT may be useful to guide future research on PA in ALF residents.

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CHAPTER 5

Conclusion

The purpose of this multi-method preliminary study was to better understand PA in ALF residents. This was accomplished by completing three manuscripts. The first, was an integrative review of relevant scientific literature to assess the quality and strength of evidence related to factors influencing PA in the ALF population in the U.S. The second manuscript was a qualitative inquiry exploring the experience and meaning of PA in ALF residents. The third manuscript was a feasibility and acceptability study of a continuous wear accelerometry device to objectively measure PA, and a set of questionnaires.

Findings from the integrative review, which included twelve studies, indicated a lack of research on factors and interventions that influence PA in ALF residents in the U.S. In addition, the quality and strength of evidence was weak with a majority of identified studies being cross-sectional, exploratory and descriptive. This limits inference regarding factors influencing PA.A conceptual framework was created to identify gaps in knowledge and to guide future studies. Factors found to possibly pose a barrier to PA included perceived level of frailty, poor physical function and limited areas to walk that are also narrow or difficult to get to. Factors found to possibly facilitate PA included better overall health, perceived benefits of PA, being able to engage in preferred activities over less preferred activities, a desire to be with other people, and an indoor environment with high perceived level of safety. Interventions identified as possibly influencing PA

included being able to engage in preferred activities and using trained ALF staff to encourage participation in activities of daily living. Personal, social and environmental factors and their influence on PA all necessitate further research.

Key findings from the qualitative inquiry indicated that ALF residents consider themselves to be physically active even though a majority of the PA they describe would qualify as sedentary behavior. This belief is reinforced through social comparisons with other residents considered to be less active. These comparisons provide a false sense of accomplishment because the overall understanding of PA does not match published guidelines for PA in older adults. This suggests work needs to be done to elucidate the understanding of PA and its importance for healthy living in this population. An additional key finding was the influence of scheduling and routines set by facility staff on PA. Schedules were viewed positively by residents suggesting walking and other light intensity activities could be introduced within daily routines.

Findings from the feasibility and acceptability study demonstrated that the activPAL^{3}continuous-wear accelerometry device is both feasible and acceptable for measuring PA in ALF residents. The device accurately detected steps taken, time spent in standing and stepping activity, and time spent in sedentary behavior. Loss of data was negligible because the device was not removed for the duration of the study. This minimized measurement error. The use of this device for objectively measuring PA in ALF residents is recommended for future studies.

The set of questionnaires were found to be feasible and acceptable. A majority of participants requested assistance with completing the questionnaires which increased the amount of time spent in data collection. This would be a consideration when planning for

future studies. The H-PAQ questionnaire was deemed the most confusing questionnaire to complete by participants. It did not correlate significantly with any other items; therefore, it may not be suitable in future studies examining PA in ALF residents. All other questionnaires would be useful in future studies.

Social Cognitive Theory (Bandura, 1997) focuses on psychological determinants of behavior. Self-efficacy has been found to correlate with various health behaviors such as PA. Self-efficacy was found to be high in this sample. Further research would be beneficial to examine the pathways between identified factors such as perceived health and perceived level of PA and the impact on PA levels through self-efficacy.

Implications

The benefits of PA in older adults are well established (CDC, 2014). As more individuals enter ALF's, the need to understand how to augment PA behavior becomes evident. Assisted living facility residents who engage in the recommended amount and type of PA may not only experience better health and physical function, they may also delay transfer to nursing homes and hospitals and spend fewer dollars on health care (Hall & McAuley, 2011). Evidence from this preliminary study provides an understanding of the state of research on this topic and will be instrumental in designing future studies.

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APPENDICES

Appendix A

Methodology for Integrative Review

Step	Description
1. Problem identification and purpose of review	Includes statement of the health care problem, identification of the target population, and a clear purpose statement that provides focus and boundaries.
2. Methods: Literature search	Includes a comprehensive literature search to identify the maximum number of eligible articles utilizing a minimum of two of the following strategies: computerized database search, journal hand searching, networking, research registry searching and ancestry searching.
3. Methods: Data evaluation for methodological quality of each study	Includes the application of inclusion and exclusion criteria by two independent investigators to identify the sample of articles for data extraction and analysis. Data quality assessed for experimental and non-experimental designs using Brink & Wood (1998) and the purpose-adjusted 18-item checklist adapted from deBruin et al. (2008) and Downs and Black (1998). Studies are organized into one of three levels based on study design then a quality score is calculated.
4. Results: Data extraction and analysis	Data extraction for each study includes author, year, study purpose, sample characteristics, measures to assess PA, reported amount and type of PA, factors or interventions associated with or influencing PA, level of study design, calculated methodological quality score, study strengths and study limitations.
5. Discussion: Data synthesis	Summary discussion of findings including identification of factors or interventions that may be personal, social or environmental and influence PA.

Adapted from Whittemore & Knafl, 2005.

Appendix B

Methodological Quality Checklist

Criteria	Score
Domain 1:Quality of Reporting	
Is hypothesis/aim/objective clearly described?	yes/no
Are outcomes clearly described in the methods section?	yes/no
Are subject characteristics described?	yes/no
Are interventions clearly described?	yes/no
Are main findings clearly described?	yes/no
Are estimates of random variability for main outcomes provided?	yes/no
Have adverse events related to the intervention reported?	yes/no
Have characteristics of subjects lost to follow-up been described?	yes/no
Domain 2: External Validity	
Were subjects representative of the entire population from which they were recruited?	yes/no/unable to determine
Domain 3: Internal Validity-Bias	
Were subjects blinded to the study intervention?	yes/no/unable to determine
In trials and cohort studies, do the analyses adjust for different lengths of follow-up? Or, in case control studies, is the time period between intervention and outcome the same for cases and controls?	yes/no/unable to determine
Were statistical tests used to assess the main outcomes appropriate?	yes/no/unable to determine
Was compliance with the intervention(s) reliable?	yes/no/unable to determine
Were the main outcome measures used accurate (valid and reliable)?	yes/no/unable to determine
Domain 4: Internal Validity-Confounding (selection bias)	
Were the subjects in trials and cohort studies in different intervention groups; or if in case-control studies, were subjects recruited from the same population?	yes/no/unable to determine
Were study subjects in trials, cohort studies or case-control studies recruited over the same period of time?	yes/no/unable to determine
Were subjects lost to follow-up taken into account?	yes/no/unable to determine
Domain 5: Power	
Did the study have sufficient power to detect a clinically important effect where the probability for a difference being due to chance is less than 5%	Dependent on sample size Score or 1,2,3,4 or 5
Total Score	/22

*yes=1, no=0, unable to determine=0

Adapted from deBruin et al. (2008) and Downs & Black (1998).

Appendix C

Database Search Strategies and Terms

	Web of Science Search	Results
#1	TS=(motor activity) OR TS=(physical activity) OR TS=(physical activities) OR TS=(therapeutic exercise) OR TS=(exercise therapy) OR TS=(exercise) OR TS=(walking) OR TS=(walk) OR TS=(movement) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH Timespan=All years	935,853
#2	TI=(assisted living facility) OR TI=(assisted living facilities) OR TI=(assisted living) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH Timespan=All years	1,558
#3	#1 and #2 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH Timespan=All years	**95**
	CINAHL Search	Results
S1	assisted living facility OR assisted living OR assisted living facilities	2,659
S2	MH physical activity	20,026
S3	MH "motor activity+"	7,401
S4	"physical activity" OR "physical activities" OR "motor activity" OR "motor activities"	38,364
S5	exercise OR exercise therapy OR MH "therapeutic exercise" OR walking OR walk OR movement	137,305
S6	(S2 OR S3 OR S4 OR S5)	162,113
S7	S1 AND S6 Search modes – Boolean/Phrase	**145**
	PUbMed/MEDLINE Search	Results
#1	Search (assisted living facilities[MeSH Terms]) OR assisted living[Title/Abstract]	1,676
#2	Search (((((((exercise[MeSH Terms]) OR therapeutic exercise[MeSH Terms]) OR exercise therapy[MeSH Terms]) OR motor activity[MeSH Terms]) OR exercise[Title/Abstract]) OR therapeutic exercise[Title/Abstract]) OR exercise therapy[Title/Abstract]) OR motor activity[Title/Abstract]) OR physical activity[Title/Abstract]	350,373
#3	Search ((walking[Title/Abstract]) OR walk[Title/Abstract]) OR movement[Title/Abstract]	213,351
#4	Search ((((((((((exercise[MeSH Terms]) OR therapeutic exercise[MeSH Terms]) OR exercise therapy[MeSH Terms]) OR motor activity[MeSH Terms]) OR exercise[Title/Abstract]) OR therapeutic exercise[Title/Abstract]) OR exercise therapy[Title/Abstract]) OR motor activity[Title/Abstract]) OR physical	529,432

	activity[Title/Abstract])) OR (((walking[Title/Abstract]) OR walk[Title/Abstract]) OR movement[Title/Abstract])	
#5	Search ((((((((((exercise[MeSH Terms]) OR therapeutic exercise[MeSH Terms]) OR exercise therapy[MeSH Terms]) OR motor activity[MeSH Terms]) OR exercise[Title/Abstract]) OR therapeutic exercise[Title/Abstract]) OR exercise therapy[Title/Abstract]) OR motor activity[Title/Abstract]) OR physical activity[Title/Abstract])) OR (((walking[Title/Abstract]) OR walk[Title/Abstract]) OR movement[Title/Abstract]))) AND ((assisted living facilities[MeSH Terms]) OR assisted living[Title/Abstract])	**120**
	Cochrane Search	Results
#1	MeSH descriptor: [Exercise Therapy] explode all trees	7,045
#2	MeSH descriptor: [Exercise] explode all trees	13,827
#3	"therapeutic exercise":ti,ab,kw (Word variations have been searched)	202
#4	MeSH descriptor: [Motor Activity] explode all trees	16,004
#4	"physical activity":ti,ab,kw (Word variations have been searched)	6,464
#6	exercise therapy (Word variations have been searched)	22,821
#7	MeSH descriptor: [Walking] explode all trees	2,564
#8	MeSH descriptor: [Movement] explode all trees	19,266
#9	"walk":ti,ab,kw (Word variations have been searched	8,591
#10	"movement":ti,ab,kw (Word variations have been searched)	12,558
#11	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10	51,060
#12	assisted living:ti,ab,kw (Word variations have been searched)	561
#13	MeSH descriptor: [Assisted Living Facilities] explode all trees	34
#14	#12 or #13	561
#15	#11 and #14	**115**
	Total Articles Retrieved All Searches	**475**

Appendix D

Inclusion Criteria for Studies

***All asterisk (*) boxes must be checked to circle YES**	Abstract Reference Number_____	Reviewer_____ Accept (circle) YES NO
CRITERIA	**YES**	**COMMENTS**
***Research Design**: Any but case study.* Dissertations accepted.	*_____	
Participants/Patient Population/Sample of Interest Cognitively intact Assisted Living Residents in the United States **not all participants of interest need to be assisted living residents-any % of total sample acceptable but must be separately identifiable in analysis*	*_____	
Factors/Interventions Influencing or correlating with Time Spent in Physical Activity may include any or all of the following: *<u>Personal factors</u> such as: age, gender, education, overall health, disability, balance, obesity, fatigue, polypharmacy, pain, vision, fear of injury, cognition, nutritional status, self-efficacy, outcome expectations, attitudes, beliefs or perceptions about PA, quality of life, life satisfaction.* *<u>Social Factors</u> such as: social support from family, friends or staff, programs or activities available.* *<u>Environmental Factors</u> such as: building type, size and appearance, wayfinding, walkability features; safety features including obstacle free areas and policies including fall prevention; amenities including housekeeping, meal preparation, exercise or fitness classes, telephone availability and health care services.*	*_____	
Physical Activity Measured *Interview _____* *Self-Report _____* *Objective measure (accelerometry, pedometer, direct observations) _____*	*_____	
Comments:		

Appendix E

Process for Study Selection

Process Steps	Primary Investigator	Second Reviewer
Computerized database search	X	
Title and abstract of all retrieved studies reviewed using inclusion and exclusion criteria	X	X
Full text of articles meeting all criteria reviewed	X	X
Reference lists of full text studies meeting all criteria hand-searched for additional articles	X	
Unanimous agreement reached on final selection of studies to be included in data extraction and analysis.	X	X

Appendix F

Methodological Quality Review Scores

	Review #1*	Review #2*	Level I‡ n=4	Level II‡ n=5	Level III‡ n=3
Range	4.00-18.00	5.00-19.00	5.00-10.00	6.00-10.00	9.00-19.00
Mean Score	8.17	9.58	8.25	8.00	14.0
Mode	4.00	8.00 and 9.00	9.00	8.00	-
SD	4.15	3.70	2.22	1.41	5.00

*deBruin et al. (2008); ǂ Brink and Wood, 1998.

Appendix G

Demographic Data Form

Date of Birth: _____/_____/_____ **Age in Years**:_____

Male_____ **Female**_____

Race or Ethnicity:
☐ White
☐Hispanic
☐African American
☐Asian Pacific Islander
☐Native American
☐Other

Marital Status:
☐Married
☐Single
☐Divorced/Separated
☐Widowed

Highest Level of Education Completed:
☐Less than High School Degree
☐High School
☐Some College
☐Technical or Training/Degree
☐College Degree
☐More than one college degree

Employment Status
☐ Retired/Not working
☐ Occasional (1-2 times per week) Describe: _____
☐ Part Time (20-39 hours/week) Describe:_____
☐Full Time (40 hours or more per week) Describe:_____

Assistive Devices for Walking
☐None
☐Cane Hours per day use_____
☐Walker Hours per day use_____

Length of Stay at Assisted Living _____ months

Admission Date: _____/_____/_____

Appendix H

Semi-Structured Interview Oral Script

Key Issue/Concept	Instructions/Main Questions	Response Notes	Additional Probes	Response Notes	Memo
Introduction of PI/Interviewer to participant.	I am a research student at the University of Michigan. I want to thank you for meeting with me today and for your time.				Interview #1 of 2. Audio-recording set-up for maximal quality. Explain that this is a process to ensure accuracy of information gathering. It may be necessary to interrupt the interview if the recording stops or the recorder requires re-setting. Offer water to the participant.
Purpose of Research	The purpose of this interview is to learn more about your experience of physical activity. Your experiences of physical activity and what it means to you is very important to this study.				
Timeframe for Interview	There are a few activities we will do that will aide in collecting information for the study. The entire process will take approximately 1.5 hours. A second interview that will take approximately 30 minutes will take				

	place when I return in about a week or two.				
Continue to develop trust and rapport. Orient the participant to an activity that begins to engage the participant mentally on the topic	Most people have a weekly routine. Take a moment and think about your typical week; what types of things you do the places you go and the people you see.				Begin audio recording at this point. The first activity and interview questions should take 30-45 minutes to complete.
Begin to explore the present experience and meaning of physical activity. These questions are designed to answer what the *experience* of	I have a chart here that represents the most recent week on it. The days are divided into morning, afternoon, evening and night time. I would like you to use words, symbols and/or pictures to fill in the chart with the types of things you do, where you go, your physical activities, who you see and anything else. **Q. Tell me about your chart; describe the things you do during a typical**		**Q. Describe how your physical activities change during the week.**		Provide pencil and paper with days of the week on it. Allow 5 minutes to complete. Encourage any questions for clarification of the process. Facilitate obtaining rich descriptions of the subjects' experience of physical activity.

physical activity is, how it is experienced and in what context the experience takes place. The responses will provide information that will help form the *textural and structural* descriptions of the phenomenon which help to arrive at the meaning and experience of PA. The questions are also designed to discover *facilitators* and *barriers* to engagement in physical activity.	**week, the physical activities you engage in.**		**Q. Tell me about where your weekly physical activities take place.** **Q. Is there anything about the week's physical activities that stand out for you?** **Q. Is there anything that influences your physical activities during the week?** **Q. Are there any physical activities that involve other people that stand out for you?** **Q. How do you feel about your weekly physical activities?** **And/Or**		This includes the dimensions, the context and the people associated with the experience of physical activity. This probe will help explore how physical activity may affect others in the subject's life or how others may affect the subject's physical activity. Seek full disclosure of feelings associated with the experience of physical activity.

These questions are designed to further examine the present *meaning* of the phenomenon to the participant.	**Q. What does physical activity mean to you?**		**Q. How do your physical activities make you feel?** **Q. What does it mean to you when you are unable to be as active as you would like?** **Q. What physical activities are the most important to you that you would like to continue to do in the future?** **Q. Is there anything else you would like to say about your weekly physical activities?**		At the end of this activity and interview portion ask the participant how they are feeling. Ask them if they need a break for any reason. This is to check on fatigue level.

These questions are designed to answer what the lifetime *experience* of physical activity is, how it was experienced and	You've talked about physical activities during a typical week. Now I would like to talk about physical activity over your lifetime. Here is a piece of paper with a line on it representing your life from birth to the present time. I would first like you to place an "X" on the line where you moved to the assisted living facility. Now, with the pencil I would like you to trace over the line with a pencil mark representing physical activity throughout your lifetime. The straight line represents a neutral point of reference for physical activity levels for you.		**Q. Is there anything about physical activity in your lifetime that stands out for you?**		The following activity and interview questions should take 30-45 minutes to complete. Provide the piece of paper with the line on it. Show a sample of a tracing over the line representing physical activity over a lifetime. Allow 5 minutes to complete the activity. Ask the participant if they have completed the activity to their satisfaction.

in what context the experience took place. The responses will provide information that will help form the historical textural and structural descriptions of the phenomenon. The questions are also designed to identify facilitators and barriers to physical activity throughout the lifetime. Responses will provide an opportunity to compare and contrast past and present experiences of physical activity.	**Q. Tell me about your drawing and about physical activity in general in our lifetime.**		**Q. Tell me what was happening, where you were, who you were with that influenced physical activity.** **Q. Tell me what caused physical activity to change over your lifetime.** **Q. How did your physical activity affect others in your lifetime?** **Q. How do you feel about physical activity in your lifetime?**		Again, facilitate obtaining rich descriptions of the subjects' experience of physical activity. This includes the dimensions, the context and the people associated with the experience of physical activity. Again, seek full disclosure of feelings associated with the experience of physical activity during the participant's lifetime.

These questions are designed to examine the *meaning* of the phenomenon to the participant during their lifetime. These questions are to ensure that the participant is able to reflect on responses and provide additional information that would enrich the descriptions of the experience and meaning of physical activity.	**Q. What has physical activity meant to you during your lifetime?**		**Q. What do the changes in physical activity in your lifetime mean to you?** **Q. Have you shared everything that is significant about physical activity to you?** **Q. Is there anything else you would like to say about physical activity?**		the participant know this is the end of the first interview. Thank them for their time and participation. Remind them of the second interview to take place in one to two weeks. Offer the gift card incentive at the end of the interview. Make sure the participant has contact information for any questions or concerns related to the study.

Appendix I

Weekly Activity Form

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning							
Afternoon							
Evening							
Sleep							

Appendix J

Lifeline of Physical Activity

Appendix K

MMSE Screening Oral Script

Script	Activity
We have already reviewed some important topics to help me know whether or not you would be able to participate in the research study. There is one more activity I would like to complete that will help me decide whether or not you would be able complete all that is being asked of you for this study. I would like to have you answer a set of questions and do some activities. This is to complete what is called the Mini-Mental State Exam. Answering these questions and doing the activities will help me understand if you might be able to continue with the rest of the study. For some people it can be burdensome to do everything they are being asked for a research study and I don't want to burden you. That's why I am using this tool. These questions and activities will help me understand if the research study might be a burden for you. Are you willing to complete these activities?	Have the MMSE instrument ready. Have pencil and piece of paper with words to read and for the folding exercise.
	Using the MMSE tool as a guide, administer the exam. Total the score for the exam. Do not show the score to the participant.
I have reviewed the results of all of the questions and activities. The results indicate that it may be difficult for you to complete all portions of the study and may therefore be burdensome for you. I do not want to cause you any burden. I do want to thank you for your time today, however, and for your willingness to meet with me. Do you have any questions for me?	If MMSE score <24
I have reviewed the results of all of the question and activities. The results indicate that you would likely be able to complete all that is being asked of you in this study without it being overly burdensome. Would you like to hear more about the study?	If MMSE score ≥ 24

Appendix L

MMSE Sample Questions

Orientation to Time:

"What day is today?"

Naming:

"What is this?" [point to eye].

Repetition:

"Now I am going to ask you to repeat what I say. Ready? It is a lovely, sunny day but too warm. Now you say that." [Wait for examinee response and record response verbatim. Repeat up to one time].

Appendix M

Meaning Units and Themes

	Theme (5)	Meaning Units (27)
1.	Residents see themselves as active (experience)	• Sports activities in childhood and adulthood • Exercise classes • Work and occupational activities • Household activities • Social and spiritual activities • Leisure activities • Engaging in ADL's and IADL's. • Therapeutic PA such as physical therapy
2.	PA is dependent on a schedule or routine. (experience)	• Personal care • Meals • ALF Sponsored activities • Family and friend availability
3.	Beliefs and perceptions influence PA. (experience)	• Perceived health and health problems • Perceptions associated with age, gender and disability • Critical comparisons • Positive and negative feelings, opinions and emotions about PA • Shared wisdom about PA
4.	Motivations and preferences for PA (experience)	• Physical, mental, social, personal and monetary benefits • Physical environment • Preferences for PA
5.	PA has multi-faceted meaning. (meaning)	• Purpose in life • Physical function • Self-reliance • Self-satisfaction • Disability delayed or avoided • Mental health maintained • Expectations, goals and hopes for the future

Appendix N

PASE Questionnaire

INSTRUCTIONS:
Please complete this questionnaire by either circling the correct response or filling in the blank. Here is an example:

During the past 7 days how often have you seen the sun?

[0] never [1] seldom (1-2days) [2] sometimes (3-4 days) [3] often (5-7 days)

Answer all items as accurately as possible. All information is strictly confidential.

LEISURE TIME ACTIVITY

1. Over the past 7 days, how often did you participate in sitting activities such as reading, watching TV or doing handcrafts?

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

Go to Q #2

1a. What were these activities?
_____

1b. On average, how many hours per day did you engage in these sitting activities?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

2. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog, etc.

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

⇩

Go to Q #3

2a. On average, how many hours per day did you spend walking?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

3. Over the past 7 days, how often did you engage in light sport or recreational activities such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

⇩

Go to Q #4

3a. What were these activities?

_____

On average, how many hours per day did you engage in these light sport or recreational activities?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

4. Over the past 7 days, how often did you engage in moderate sport and recreational activities such as doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

⇩

Go to Q # 5

4a. What were these activities?

_____

4b. On average, how many hours per day did you engage in these moderate sport and recreational activities?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

5. Over the past 7 days, how often did you engage in strenuous sport and recreational activities such as jogging, swimming, cycling, singles tennis, aerobic dance, skiing (downhill or cross country) or other similar activities?

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

⇩

Go to Q #6

5a. What were these activities?

_____

5b. On average, how many hours per day did you engage in these moderate sport and recreational activities?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

6. Over the past 7 days, how often did you do any exercises specifically to increase muscle strength and endurance, such as lifting weights or pushups, etc.?

[0] NEVER [1]SELDOM (1-2days) [2]SOMETIMES (3-4days) [3]OFTEN (5-7days)

⇩

Go to Q#7

6a. What were these activities?

_____

6b. On average, how many hours per day did you engage in exercises to increase muscle strength and endurance?

[1] less than 1 hour [2] 1 but less than 2 hours

[3] 2-4 hours [4] more than 4 hours

HOUSEHOLD ACTIVITY

7. During the past 7 days, have you done any light housework, such as dusting or washing dishes?

   [1] NO [2] YES

8. During the past 7 days, have you done any heavy housework or chores, such as vacuuming, scrubbing floors, washing windows, or carrying wood?

   [1] NO [2] YES

9. During the past 7 days, did you engage in any of the following activities?

   Please answer: YES or NO for each item.

	NO	YES
a. Home repairs like painting, wallpapering electrical work, etc.	1	2
b. Lawn work or yard care, including snow or leaf removal, wood chopping, etc.	1	2
c. Outdoor gardening	1	2
d. Caring for another person, such as children, dependent spouse, or another adult.	1	2

10. During the past 7 days, did you work for pay or as a volunteer?

[1] NO [2] YES

10a. How many hours per week did you work for pay and/or as a volunteer?

_____ HOURS

10b. Which of the following categories best describes the amount of physical activity required on your job and/or volunteer work?

[1] Mainly sitting with slight arm movements. [**Examples**: office worker, watchmaker, seated assembly line worker, bus driver, etc.]

[2] Sitting or standing with some walking. [**Examples**: cashier, general office worker, light tool and machinery worker.]

[3] Walking, with some handling of materials generally weighing less than 50 pounds. [**Examples**: mailman, waiter/waitress, construction worker, heavy tool and machinery worker.]

[4] Walking and heavy manual work often requiring handling of materials weighing over 50 pounds. [Examples: lumberjack, stone mason, farm or general laborer.]

Appendix O

H-PAQ Historical Self-Administered Physical Activity Questionnaire

SELF-ADMINISTERED PHYSICAL ACTIVITY QUESTIONNAIRE

Think about your physical activity at ages 15, 30, 50 and over the past year. Place an '**X**' on the line that best describes your level of activity for each of the 5 activities at ages 15, 30, 50 and over the past year.

SAMPLE

	At Age 15	At Age 30	At Age 50	Over the past year
1.Work/Occupation				
Mostly sitting down	x			x
Sitting down half the time		x	x	
Mostly standing up				
Mostly walking, lifts, carry *little*				
Mostly walking, lifts, carry *much*				
Heavy manual labor				

MARK ONE ANSWER FOR EACH ACTIVITY AT AGE 15, 30, 50 AND OVER THE PAST YEAR

	At Age 15	At Age 30	At Age 50	Over the past year
1.Work/occupation				
Mostly sitting down				
Sitting down half the time				
Mostly standing up				
Mostly walking, lifts, carry *little*				
Mostly walking, lifts, carry *much*				
Heavy manual labor				

	At Age 15	At Age 30	At Age 50	Over the past year
2.Walking/bicycling				
Hardly ever				
Less than 20 minutes per day				
20 - 40 minutes per day				
40 – 60 minutes per day				
1 – 1.5 hours per day				
More than 1.5 hours per day				
3.Home/household work				
Less than 1 hour per day				
1-2 hours per day				
3-4 hours per day				
5-6 hours per day				
7-8 hours per day				
more than 8 hours per day				
4. Leisure time: watching TV/reading				
Less than 1 hour per day				
1-2 hours per day				
3-4 hours per day				
5-6 hours per day				
More than 6 hours per day				
5.Exercise				
Less than 1 hour per week				
1 hour per week				
2-3 hours per week				
4-5 hours per week				
More than 5 hours per week				
How many hours of each 24 hour day do you usually sleep?				

Appendix P

SF-12v2 Self-Rated Health Questionnaire

YOUR HEALTH AND WELL-BEING

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. *Thank you for completing this survey!*

For each of the following questions, please mark an X in the one box that best describes your answer.

1. In general. Would you say your health is:

Excellent	Very Good	Good	Fair	Poor
☐	☐	☐	☐	☐

2. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	☐	☐	☐
b. Climbing several flights of stairs	☐	☐	☐

(SF-12v2® Health Survey Standard, United States (English

3. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Accomplished less than would like	☐	☐	☐	☐	☐
b. Were limited in the In the kind of work or other activities	☐	☐	☐	☐	☐

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Accomplished less than would like	☐	☐	☐	☐	☐
b. Did work or other activities less carefully than usual	☐	☐	☐	☐	☐

5.During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐	☐	☐	☐	☐

6. **These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…..**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Have you felt calm and peaceful?	☐	☐	☐	☐	☐
b. Did you have a lot of energy?	☐	☐	☐	☐	☐
c. Have you felt downhearted and depressed?	☐	☐	☐	☐	☐

7. **During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relative, etc.)?**

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐	☐	☐	☐	☐

Appendix Q

CCMI- Charlson Comorbidity Index Questionnaire

CHARLSON COMORBIDITY INDEX

1. Have you ever had to be hospitalized for a heart attack?
___ No
___ Yes

2. Have you ever been hospitalized or treated for heart failure? You may have felt more short of breath, and the doctor may have told you that you have fluid in your lungs, or that your heart was not working efficiently.
___ No
___ Yes

3. Have you ever had pain or cramping in your calf while walking that causes you to stop or slow down?
___ No
___ Yes

3a. If yes, have you had a peripheral bypass operation on the arteries in one of your legs to fix the problem?
___ No
___ Yes

4. Have you ever had a stroke?
___ No
___ Yes

5. Do you have difficulty moving an arm or leg, or difficulty talking?
___ No
___ Yes

6. Do you have chronic lung disease, such as asthma, bronchitis, or emphysema, that makes you short of breath or requires ongoing treatment?
___ No
___ Yes

7. Do you have diabetes or high blood sugar?
___ No
___ Yes

7a. If yes:

Has your diabetes caused damage to your kidneys?
___ No
___ Yes

Has your diabetes caused problems with your eyes that required treatment by an eye doctor?
___ No
___ Yes

Has your diabetes caused problems with your feet, such as numbness or tingling?
___ No
___ Yes

8. Do you have decreased kidney function?
___ No
___ Yes

8a. If yes, are you on dialysis, or have you had a transplant?
___ No
___ Yes

9. Do you have liver disease, such as hepatitis B or C or cirrhosis?
___ No
___ Yes

9a. If yes, does the liver disease cause abdominal swelling, vomiting blood or other severe problems or have you had a liver transplant?
___ No
___ Yes

10. Do you have any trouble with ulcers in your stomach or small intestine?
___ No
___ Yes

11. Have you had cancer (other than basal cell skin cancer)?
___ No
___ Yes

If yes, which:
___ Lymphoma
___ Leukemia
___ Breast
___ Colon
___ Prostate
___ Lung
___ Melanoma
___ Other _____

11a. If yes, has the cancer spread to other locations from its original location?
___ No
___ Yes

12. Do you have Alzheimer's or any other condition that seriously impairs your memory and thinking?
___ No
___ Yes

13. Do you have any rheumatic or connective tissue disease? Such as rheumatoid arthritis, polymyositis, systemic lupus erythematosus, polymyalgia rheumatica, vasculitis, sarcoidosis, Sjogren's syndrome, mixed connective tissue disease or other systemic rheumatic disease?
___ No
___ Yes

14. Do you have HIV or AIDS?
___ No
___ Yes

Appendix R

SEE- Self-Efficacy for Physical Activity Questionnaire

Self-efficacy Barriers to Exercise

Here are 9 situations that might affect your participation in exercise. For each one use this scale, where 0 is Not Confident and 10 is Very Confident, to tell me how confident you are right now that you could exercise 3 times per week for 20 minutes in each of these situations:

	Not Confident										Very Confident
1. The weather was bothering you	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 felt pain when exercising	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 were too tired	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	10
9. You felt depressed	0	1	2	3	4	5	6	7	8	9	10

Appendix S

Daily Skin Assessment Record

DATE/TIME	ASSESSMENT NOTES	ACTION TAKEN
In Person ☐	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**
In Person ☐	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**
In Person ☐ **By Phone ☐**	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**
	Skin intact ☐ Redness ☐ Blisters ☐ **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**

In Person ☐ **By Phone ☐**		
In Person ☐ **By Phone ☐**	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**
In Person ☐ **By Phone ☐**	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**
In Person ☐ **By Phone ☐**	**Skin intact ☐ Redness ☐ Blisters ☐** **Rash ☐ Bleeding ☐ Drainage ☐** **Itching reported ☐ Other describe ☐:** **Memo:**	**Monitor maintained ☐** **Monitor removed ☐** **Monitor re-applied ☐** **HCP contacted ☐** **Other describe:**

Appendix T

Interview to Assess activPAL^3 and Questionnaire Acceptability and Feasibility

Q.#	Question
1.	**a. Monitor Acceptability**: On a scale of 1 to 5, rate how much you liked or disliked wearing the monitor. (5=liked it very much, 4=liked it somewhat, 3=didn't like it or dislike it, 2=disliked it somewhat, 1=disliked it very much) Why did you give this answer? What did you like most about wearing the monitor? What did you dislike the most about wearing the monitor? **b. Questionnaire Acceptability:** On a scale of 1 to 5, rate how much you liked or disliked completing the questionnaires(5=liked it very much, 4=liked it somewhat, 3=didn't like it or dislike it, 2=disliked it somewhat, 1=disliked it very much)
2.	**Monitor Acceptability:** On a scale of 1 to 5, rate how comfortable or uncomfortable wearing the monitor was. (5=very comfortable, 4=somewhat comfortable, 3=neither comfortable nor uncomfortable, 2=somewhat uncomfortable, 1=very uncomfortable). Is there anything that would have made wearing the monitor more comfortable?
3.	**a. Monitor Protocol**: Did you wear the monitor for 7 days and 7 nights? If not, how many days and how many nights did you wear it? **b. Questionnaire Protocol:** Did you complete all of the questionnaires? If not, how much would you estimate you completed? If not, why did you not complete the questionnaires?
4.	**Monitor Protocol:** Did you take off the device at any time while you were wearing it? If so, what are the reasons you took it off?
5.	**a. Monitor Barriers:** What, if anything, was hard about wearing the monitor? Is there anything that would have made wearing the monitor better? **b. Questionnaire Barriers:** What, if anything, was hard about completing the questionnaires?