Treadmill Walking Capacity among Older Adults in Assisted Living Settings: A pilot, feasibility study

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Jenna Ann Johnson

Abstract

Background: Decreased physical activity levels are an increasing concern, specifically for the aging population. Older adults (>65 years) are able to achieve health benefits from participating in a regular exercise program based on studies done in younger community-dwelling older adults. However, there is less research investigating the efficacy of exercise for improving physical function among the older adult population in assisted living settings. Barriers among the research that has been done so far include generalizability, specificity and varying exercise prescription details. The present study investigated the novel idea of using a treadmill with a harness system, to engage older adults in aerobic exercise. It is unknown if it is feasible to recruit and retain older adults in assisted living settings for such a treadmill study and if older adults would be able to achieve intensities associated with health benefits.

Objectives: To determine the feasibility of recruitment and retention of older adults in an assisted living facility for a pilot treadmill walking study. Secondary objectives include: to identify determinants of participation and compliance with the treadmill study and to determine if the older adult population in assisted living settings are able to achieve exercise intensities aligned with established guidelines that are associated with health benefits.

Design and Setting: Pilot, multi-visit feasibility study in an Assisted Living Facility in the Kitchener-Waterloo Region with care needs ranging from Retirement Home to Palliative Care

Population: Older adults (>65y) living in an assistive living facility who could follow two-step commands and were able to walk two metres independently (with or without the use of an aid).

Methods: The feasibility of recruitment and retention was determined by recording: the number of older adults who consented to participate in treadmill walking for three weeks; the number of older adults (and/or their legal representatives) who declined treadmill participation and reasons

as to why; and the number of participants who completed the six treadmill sessions. Health-related and demographic characteristics were collected to characterize the population while age, number of co-morbidities, number of medications, cognition, fear of falling and walking ability were evaluated as potential determinants of participation. A detailed attendance log was used to assess compliance with the study. To determine if participants could achieve the recommended exercise intensity associated with health benefits, exercise intensity (40 %HRR) and duration (twenty minutes) achieved after the final treadmill session were reported.

Results: Thirty percent of the residents on the eligibility list were recruited and consented to participate in the treadmill study. Average compliance was 94.4%±10.8%; one treadmill participant dropped out due to declining health. There are no significant differences between treadmill participants and those who chose not to walk on the treadmill. Treadmill participants were able to achieve the recommended intensity (40%HRR) and achieved an average intensity of 50.3% ± 30.2% and a frequency of three sessions in one week. Average total duration was approximately five minutes shy (14:53min ± 6:43min) of the recommendation of twenty minutes.

Conclusion: The current study provides preliminary evidence that it is feasible to recruit and retain older adults in assisted living facilities to participate in a three week treadmill walking study, however it may be difficult to recruit a large number of individuals for a larger study. Treadmill participants were able to achieve ACSM's recommended intensity and frequency for aerobic or endurance exercise. Secondly, the older adult population living in assisted settings may be able to achieve the recommended exercise prescription targets for cardiovascular training, specifically intensity and frequency; however they may need more than three weeks of progression or multiple sessions per day to obtain the recommended duration.

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List of Abbreviations

LTC	**Long-Term Care**
HR	**Heart Rate**
HRR	**Heart Rate Reserve**
BP	**Blood Pressure**
ACSM	**American College of Sports Medicine**
AFC	**Activities-Specific Fall Concern Scale**
RPE	**Rate of Perceived Exertion**
3MS	**Modified Mini Mental State Examination**
MMSE	**Mini Mental State Examination**
CV	**Cardiovascular**
ADL	**Activities of Daily Living**
ROM	**Range of Motion**
PT	**Physical Therapy**
6MWT	**6 Minute Walk Test**
TM	**Treadmill**

Overview of Thesis Literature Review and Objectives

The age of the population is beginning to increase and approximately twelve percent of the population is over the age of 65 and are considered to be older adults (1). Approximately 30 to 60% of older adults become inactive as they age, which can lead to functional decline (2-4). Functional decline can result in a loss of independence, causing an increased dependence on formal and informal care-givers, and some older adults end up moving into an assisted living facility, thus increasing the economic burden through elevated health care costs (5).

Exercise programs are often promoted by health care professionals and National Guidelines as a means to improve or even maintain physical function and independence in older adults, specifically those residents that reside in assisted living facilities (10, 11, 72). The majority of exercise research studying older adults has been conducted in relatively healthy community-dwelling older adults; however the potential for exercise to improve health outcomes among older adults in assistive living settings is less clear. Many exercise interventions have been conducted in long-term care (LTC) facilities including a wide range of seated strengthening programs, modified Tai Chi sessions, functional Physical Therapy and aerobic training. The research done thus far has shown that resistance training can improve overall function, muscle strength and gait velocity, Tai Chi programs are able to decrease the fall rate, increase the sense of well being and flexibility, while Physical Therapy programs are able to increase functional performance and the ability to complete Activities of Daily Living among older adults in assisted living settings. Although some research on exercise for older adults in assisted living exists, there are a number of limitations including decreased generalizability, specificity of observed outcomes and the lack of details regarding the exercise intervention. For example, there are often

strict inclusion and exclusion criteria, such as excluding residents with mild to severe cognitive impairments (7-9). Furthermore, there seems to be a lack of motivation and commitment from both the residents and health care professionals when it comes to participating and administering the exercise program (6-8). Finally, exercise prescription guidelines have been outlined by the American College of Sports Medicine (ACSM) specifically for older adults and recommend that each older adult should be exercising at least three to five times a week, reaching at least 40% HRR for at least twenty minutes a day, aerobically (10, 11). However, it is uncertain if the recommendations made by the ACSM are appropriate and accurate for the assisted living population as residents are more likely to be frail compared to community-dwelling older adults.

General exercise, such as walking, can improve strength, endurance, quality of life, and independence among older adults and may be ideal for older populations (10, 12-15). Walking is a functional skill that is used in everyday life that may increase strength of large muscle groups particularly in the lower limbs; improve balance by challenging the central nervous system and increases independence. Since walking over-ground for residents may be risky and is often avoided due to the fear of falling, the present study used a harness system for safety purposes. However, the harness could also be used to provide body-weight support if needed while participants walk on the treadmill. For example, body-weight can be supported to relieve pain and rapid fatigue associated with weight bearing. Although walking on a treadmill with a harness may be an ideal mode of exercise for older adults in assisted living, it is unknown if they would be willing to perform this type of exercise, or whether they can achieve the recommended frequency, intensity, or duration associated with health benefits. Thus, the objectives for the current investigation include:

- To assess the feasibility of recruiting and retaining older adults in assisted living to participate in a study of treadmill walking. The a priori criteria for success are: a) 30% of the eligible individuals will consent to participate in the study; b) participants will comply with at least 70% of the required sessions on the treadmill.
- To determine factors associated with compliance to the treadmill walking sessions. Hypothesis: Compared to participants who comply with 70% or more sessions of treadmill walking, those who do not comply will be less mobile (use of an aid and less distance covered in 6-minute walk test), a greater cognitive impairment (lower 3MS score), be more fearful/anxious (higher AFC score), have increased pain and present more co-morbidities.
- To determine the characteristics and determinants of participation among assisted living in the treadmill walking study. Hypothesis: Compared to those that decline participation in treadmill walking, treadmill participants that complete the study will be younger (65 to 75 yrs compared to 75yrs+), more active/mobile (greater distance covered during 6 minute walk test), lesser fear of falling (pre-AFC score) and have higher 3MS scores.
- To determine if older adults in assisted living can achieve an intensity, frequency and duration of exercise consistent with the ACSM guidelines for older adults (3-5 times a week, 40% HRR, 20-60 minutes) after a familiarization session and progressive protocol over 3-weeks (10, 11). Hypothesis: Treadmill participants will be able to achieve three sessions of greater or equal to 20 minute duration and a peak intensity of 40% HRR or greater in one week.

Introduction

Aging and Physical Activity

The age of North America's population is increasing and approximately twelve percent are over the age of 65 (1). Roughly 30 to 60% of older adults are considered to be inactive which, in many cases, can eventually lead to functional decline and adverse events (2-4). Ten percent of the older adult population each year lose their ability to complete activities of daily living (ADL) and become more dependent on home care and or informal care givers (5, 16). The loss in ability for older adults to live independently in their community may result in a shift of residency to an assisted living facility, where they can receive the necessary care required (5, 16). Functional decline can also increase the number of falls, fractures and co-morbidities among the older adult population within assisted living settings. Residents of long-term care facilities are at an increased risk of falls compared to their counterparts within the independent living community and, with an increased risk of falls, there is an increase in the number of hip fractures and higher mortality rates (86-89). Residents in assisted living settings are more likely to have a number of co-morbidities; this along with the number of chronic diseases seen constitutes a major public health concern (24). From the period of 1997 to 2000 Canada has seen an increase of eight percent in health care costs associated with adults over the age of 65 years, some of which are attributable to costs associated with living in assisted settings, as well as injuries and chronic disease (5, 17).

The increase in human and economic costs associated with aging may be attenuated through increasing physical activity levels among older adults in assistive living settings. Health benefits of a regular exercise program include prevention of chronic disease, and improving

muscle strength, endurance, reaction time, quality of life, life expectancy and independence (2, 12, 19-21). For example, resistance training can increase muscle mass, thus avoiding sarcopenia (3, 5, 25, 73), weight bearing exercise can help attenuate bone loss in osteoporosis (26, 74-76), aerobic exercise can decrease visceral fat to help improve type two diabetes (77-80) and increase blood flow, strengthening exercises can help improve symptoms of arthritis (81-82) and general exercise has been shown to decrease the risk of cardiovascular (CV) disease by up to 50% (83-85). Exercise can play an important role in delaying or slowing the disease process or onset while possibly reversing some age related changes (4, 13). Because of the potential of exercise to reduce burden associated with chronic disease, health status and increased care demands, more focus is needed on enhancing physical activity levels among older adults in assisted living settings.

Now the question is what type of exercise should researchers and health care providers intervene with for the older adult population in assisted living settings? It is important, particularly among older adult populations in assisted living, that exercises are not too complicated nor require learning a skill; the exercise should be simple and inexpensive, for example, walking around the neighborhood or along the hallways of a residential facility (19). When looking for specific improvements it is important to identify goals and design the individual exercise intervention with the focus of attaining the goals set. For instance, decreasing the risk of falls can be done through exercises that involve balance ability through proprioception and Tai Chi (2, 19, 20). Flexibility training has been shown to improve other age-related changes, such as decreased range of motion (23). For older adults, walking has important functional benefits as it can increase independence and mobility (20, 22). Walking is also a weight bearing exercise, providing an opportunity to attenuate bone loss, increase muscle

strength, decrease body fat composition and improve cardiovascular health (20, 22). A more detailed exploration of current research and guidelines may provide insight into the ideal exercise prescription for older adults in assisted living settings.

Health Benefits among Community-Dwelling Older Adults

Studies that have been done in community-dwelling older adult populations demonstrate that older adults are able to achieve health benefits from participating in a regular exercise program (10, 11, 27-31, 36-38, 72). Recommendations have been made for older adults with regards to specific exercise prescription. The American College of Sports Medicine (ACSM) guidelines state that older adults should be aerobically exercising three to five days a week, for a minimum of 20 to 30 minutes and at 50-70% heart rate reserve (HRR) (10, 11). The ACSM guidelines are directed towards healthy older adults living in the community and may not necessarily be appropriate or achievable for older adults in assistive living settings. Health Canada has recommendations, which are similar to ACSM, that have been provided in an easy access 'Guide to Physical Activity' (72). Health benefits found from community-dwelling older adults increasing physical activity levels include continued independent living, better physical and mental health, increased energy, fewer aches and pains, improved self esteem and weight maintenance, stronger muscles and bones as well as an increased ability to relax and reduced stress (72). Research has shown that resistance and strength training interventions have been successful in improving outcomes such as overall function, muscle strength and gait velocity among community-dwelling older adults (27-31). A new and popular form of exercise to help in improving balance and flexibility among older adults is Tai Chi and is considered to be an "unconventional" treatment in Western society despite the extensive research that has been done in North America (36). Studies exploring the efficiency of Tai Chi for improving health related

outcomes in community-dwelling adults have demonstrated decreased blood pressure and rate of falls, reduced fear of falling (37, 38), improved depression symptoms and increased sense of well-being (38). It can be concluded here that research among older adults living in the community has shown extensive health benefits to participating in exercise, whether it be, aerobic, resistance or balance training.

Exercise in Assisted Living Settings

The health benefits of exercising are clearly demonstrated within the community-dwelling older adult population, however, there is limited research that has been done showing the health benefits among older adults within the assistive living setting. A number of interventions have been studied to determine if they can increase strength, balance, flexibility, physical function and aerobic capacity in residents over the age of 65 years. The research that has been done demonstrates that frail older adults in assisted living are able to improve walking ability, balance, flexibility, knee and hip strength, as well as overall function through resistance training (27-43). The effective strength training interventions, in both the community and assisted living, utilized weight machines, sand-bag weights, therabands and task specific exercises to achieve improvements (32-34). One study conducted used placemats with pictures of seated exercises on it and found that within eight weeks physical parameters including the six minute walk test (6MWT) distance and the ability to rise from a chair improved significantly among older participants in an exercise class and receiving home care (27). A study, part of the 'Frailty and Injuries: Cooperative Studies of Intervention Techniques' (FICSIT), demonstrated that practicing Tai Chi can improve balance, mobility and fear reduction among older women living in a retirement community (39). In addition to the FICSIT study, a group overseas developed a 'Simplified Tai Chi Exercise Program' (STEP) to decrease the cognitive demand

associated with Tai Chi (40). The STEP was shown to be effective in increasing lower body flexibility and hand grip strength while maintaining health status, balance and reducing blood pressure in older adults in assisted living (41). Physical therapy (PT) is another means to engage older adults in physical activity; however the results associated with the use of PT are somewhat contradictory. It is here where the observed improvements are specific to the exercise program characteristics, particularly in mobility, stability, reaction time and coordination (44-50). For instance when a one-on-one PT intervention among older adults in assistive living settings where the focus was to work on the clients' specific deficits using range-of-motion, strength, balance, transfer, and mobility exercises (44). Despite working towards the specific deficits and non-mobility goals of the clients', only significant improvements were seen in the mobility subscale of the Physical Disability Index (44). Recently, a functional training and resistance training program was effective in improving reaction time and flexibility in those older adults who attended at least 75% of the classes (47).

Another type of exercise that has shown health benefits among the older adult assistive living residents is walking; however observed improvements were specific to mobility outcomes. Benefits found include improved ambulatory status, walking time and endurance (51-58, 66-68). For example, a study assessing the benefits of over-ground walking in twenty participating residents found a significant improvement in ambulatory status ($p<0.01$) (51) and another study one year later in nineteen nursing home residents found an increase in maximum walk time ($p=0.002$) and distance ($p=0.005$) (52). Studies that assessed walking on a treadmill found similar results including decreased heart rate (68), amount of time to walk a quarter mile ($p<0.05$) and 6MWT ($p<0.01$) (56, 57). Table 1 summarizes the walking exercise interventions among older adults in assisted living settings that have been done thus far. The evidence

provided shows that older adults in assisted living settings may be capable of achieving health benefits from exercise interventions; however the observed benefits are often specific to the intervention characteristics.

Barriers in Research among Older Adults in Assisted Living

Research studies done to date have shown that exercise can improve health related outcomes among older adults in assisted living; however, there are three common barriers seen; lack of generalizability of findings, limited available details regarding exercise prescription application of the specificity of program characteristics. Results of exercise interventions done thus far were not very generalizable for a variety of reasons including strict inclusion/exclusion criteria, small sample sizes and limited reports of compliance to the program. These factors can affect who participates and complies with exercise intervention studies, as well as the feasibility, recruitment and the implementation of an exercise program. There is also a lack of guidelines in exercise prescription for older adults in assisted living settings, and inconsistent reporting of intensity, mode, frequency and duration among studies of exercise interventions (Table 1). A review of exercise interventions studies to date has also revealed that specificity of exercise program characteristics plays a role in terms of which outcomes will be improved and which ones will not (27-34). It is not often reported why certain tasks, protocols and outcomes were chosen and may influence the application of such detail. What seems to be missing as well is a standard exercise protocol as a means to determine and increase intensity, which can be replicated. Therefore, there is a strong need to address the specific barriers in future research exploring the utility of exercise among older adults in assisted living settings.

Table 1: Summary of Exercise Studies focusing on Walking Interventions

Author	Population	Mode	Frequency	Intensity	Duration	Main Finding
Sauvage et al (1992)	Male Nursing Home Residents	Strength + Cycling	3d/w	Moderate to High	45-75 min	Improved mobility, strength, endurance and gait
Gillies et al (1999)	Residential Homes	Walk+Chair and Stair Rise and Decent	2d/w	Not Reported	30 min max	Improved walking performance
Williams et al (2008)	Nursing Home Residents	Strength+Flexibility+ Over-Ground walking	5d/w	Number of Minutes of treatment	30 min max	Individual exercise recommended for Alzheimers to benefit
Nowalk et al (2001)	Long-Term Care Residents	Resistance+Flexibility+ Treadmill Walking	3d/w	Not Reported	Not Reported	No differences in number of falls
Schoenfelder (2000)	Long-Term Care Residents	Over-Ground + Ankle Strength	3d/w	Not Reported	20 min	Maintain or improved balance, walking speed and ankle strength
Bo et al (2006)	Long-Term Care Residents	Treadmill and/or Bike	5d/w	75% HR max	30 min max	Improved ability to walk
Stamford (1972)	Institutionalized Geriatric Men	Treadmill	5d/w	70% HR max	6-20 min	Training effect seen in HR and BP
Pilon et al (2006)	Retirement Community	Treadmill/Bike/NuStep/ Over-ground	3-5d/w	4-6 METS (light-moderate)	20-30 min	Improved walking speed
Tappen et al (2000)	Nursing Home Residents	Over-Ground Walking	3d/w	Not Reported	30 min	Maintain functional mobility
MacRae et al (1996)	Nursing Home Residents	Over-Ground Walking	5d/w	Not Reported	30 min max	Improved walking endurance capacity
Koroknay et al (1995)	Nursing Home Residents	Over-Ground Walking	Not Reported	Not Reported	Not Reported	Improved ambulatory status

Generalizability

The current ability to generalize the exercise research that has been done to date among older adults residing in assisted living settings is limited. There are a number of barriers related to the implementation of clinical and research programs in assisted living settings, including the residents' unwillingness to participate, staff time, cost and equipment required, all of which can lead to the difficulty of conducting a successful and effective exercise intervention study (6, 8). Part of the residents' unwillingness to participate in such programs could be a result of frailty, previous lifestyle, lack of motivation, access to exercise programs, lack of knowledge as to why exercise is beneficial and inconsistent and poorly described guidelines (6, 8).

Strict eligibility criteria, small sample sizes and unknown compliance to exercise interventions can affect the generalizability of research findings. Most studies exclude individuals for reasons such as safety and health concerns. In the older adult population, cognition is often a reason for excluding people as their own safety may be compromised if the individual is unable to follow instructions. Having certain co-morbidities, such as severe or late stage dementia, unstable or chronic illnesses, and history of stroke and or cardiovascular disease is another reason why older adults are often excluded in research studies (27, 28, 30, 31). Tai Chi interventions are also likely to have fewer older residents with cognitive impairment participate, due to the increased cognitive demand of Tai Chi (37-42). However, due to the personalization of PT interventions, such a program can be applied to older adults regardless of cognitive ability, as long as the proper supervision is available and residents are reminded to attend PT sessions (48). Only allowing people to participate if they meet a certain cognition level limits the generalizability of study findings to all older adults that live in assisted living settings by not having a representative sample.

Another aspect that may affect the generalizability of research findings is when exercise intervention studies have a small sample size. Small sample size indirectly affects generalizability; since there are less people participating, there is likely to be less variability among characteristics and studies may be less confident in the accuracy and representativeness of the results. For example, by only having nine participants in PT interventions, the sample groups are not likely to represent the entire assisted living population and when outcomes such as 6MWT, fear of falling and ankle strength do not significantly change, it is uncertain if the intervention was not successful or if the study was not powered to detect a difference (53). Other circumstances that may decrease sample size include only studying one gender. Although treadmill walking has been shown to improve heart rate and blood pressure among older men, the findings cannot be generalized to women and are limited to men who passed very strict inclusion/exclusion criteria (68). Another instance where only one gender was studied was when improvements in balance and functional mobility were seen in older women that practiced Tai Chi for three months, thus the results can only be applied to older women and the effectiveness of men practicing Tai Chi are not demonstrated here (39). Small sample sizes, as observed in many of the PT studies done to date, also contribute to decreased generalizability (44, 46-48).

Finally, when conducting research in the older adult population in assisted living settings, difficulties affecting the generalizability of the exercise program can arise. One such difficulty would be compliance. Reasons for residents not to comply with a research exercise program can include frailty (decreased mobility and cognitive function, increase co-morbidities) and lack of motivation to exercise, despite being the people who could benefit most from participating in exercise programs (12, 58). With regards to reporting compliance, only six of the eleven studies presented in Table 1, did not report compliance at all (51, 53, 55-57, 68). Of the five studies that

did report compliance, it ranged from 57% in a 16-week program (55) to 95% in a 12 week program (66) with the longest study lasting 24 months reporting that participants either complied with the exercise program greater than 66% or less than 33% (57). An example demonstrating that compliance can influence findings and the generalizability of results can be seen when a study using a PT intervention only showed improvements in those participants who complied with the program at least 75% of the time (47). Therefore research should focus on increasing sample size, having a more representative study population and aim for increasing compliance without jeopardizing participant safety. The feasibility and compliance of conducting an exercise study among a representative sample of individuals in assisted settings should be determined.

Exercise Prescription Details

When prescribing exercise frequency, intensity, time and type (FITT) all must be taken into consideration and research studies should report each of these components consistently regarding what was targeted and achieved among older adults in assisted living settings. National and international guidelines are available but all have discrepancies in terms of what is the recommended 'dose' of exercise, specifically for older adults within assisted living settings (Table 2). The ACSM guidelines for exercise prescription in older adults are mainly geared towards older adults still living in the community and it is undetermined if these guidelines are appropriate for those older adults in assisted living facilities. The variation in published recommendations may create confusion among lay people and among clinicians looking for a specific direction in the frequency, intensity and duration required to achieve health benefits (Table 2). In addition, although a number of studies have investigated the effectiveness of exercise for improving health related outcomes in individuals in assisted living settings, it is not

clear what the ideal frequency, intensity and duration are and it is unknown if the older residents are capable of achieving such exercise prescription.

Table 2: Guidelines and Recommendations in Endurance Exercise for Older Adults

	Frequency	Intensity	Time (Duration)	Type (Mode)	Other
Canada's Health Guidelines	4 to 7 days/week	moderate	30 to 60min (gradual increase)	Endurance	Walk, Swim, Dance, Skate, Cycle
Singh, 2002	3 to 7 days/week	40-60% HRR (12-13 RPE)	20 to 60min	Cardiovascular Endurance	Low-impact, weight bearing
ACSM	At least 3 days/week	40-60% HRR (11-13 RPE)	At least 20min	Aerobic	Weight bearing

With regards to the other exercise types including strength, flexibility and PT interventions, there are also inconsistencies in the reported exercise intervention. Strength training interventions conducted in assisted living settings have been reported to last anywhere from ten weeks to at least a year, with residents attending three one hour sessions a week (28, 30, 31). What seems to be missing here is the specific intensity in either what was achieved or what was targeted. It is also difficult to reproduce the exercise programs because the details and descriptions of exercises are not often reported. Tai Chi studies have similar limitations regarding poorly reported intervention details and inconsistent intensity parameters. It has been reported that the Tai Chi programs may not have been vigorous enough (38-41) and this could possibly be due to such reasons as the participants always being in the seated position or, simply, the exercise being too simple for them. Briefly, as seen in Table 1, there are not only discrepancies in providing detail on the FITT components of exercise, but also how participants

are progressed to a specific intensity. Within the few walking trials that have been done to date, progression of intensity is rarely reported; one case being the exception, where increasing intensity was done by increasing the grade on the treadmill and the duration of each sessions (68). Also, if more than one mode of exercise was used, for instance cycling and walking on a treadmill, it is important to report how often each mode was used by each participant, but it should be acknowledged that using multiple modes of exercise may influence the magnitude, direction and generalizability of the findings (56, 57). Having recommendations that are based on evidence specific to older adults in assisted living settings would better help to assist health care providers and lay people design exercise associated with health benefits that are specific to the goals and population of interest.

Specificity

Some of the most important decisions to make when designing an exercise intervention study is what outcomes are going to be used, what exercise is going to be conducted and how. Reasons why a specific task, exercise and outcome were chosen and how it was implemented is rarely described in detail within the studies done to date among older adults in assisted living. Because outcome measures are often specific to the intervention characteristics, a clear rationale for the chosen intervention is needed.

The rationale and specificity of exercise intervention characteristics used in the research that has been done to date is insufficient with regards to detail, resulting in not having enough information to determine and accurately apply established specific exercise prescription and progression towards specific goals. Most strength, Tai Chi and PT interventions have been done in the seated position a table (27), or in a group setting (32-34). The rationale that is often

provided for having participants sit focuses mainly on the safety for residents, so there is a decreased risk of falling while minimal number of staff lead and observe to ensure the participants are performing the exercises correctly so they can receive the most benefits (32-34). What is even more important is reporting the details of how residents were progressed, specifically and individually within the research protocol. Research articles do not often include the exact exercises in full description and how each residential participant was progressed to increase intensity, thus decreasing the reproducibility (27-34). Outcome measures often have similar characteristics to the tasks that were incorporated into the exercise intervention class, which is to be expected; residents being able to improve their ability to rise from a chair probably came from the exercise protocol incorporating an exercise where the participants ascended and descended into a chair (35). It is critical to ensure that measured outcomes are representative of the outcomes of importance. Outlined here is the need for exercise interventions to be more like PT programs, where it is designed specifically to meet certain goals that are most often set by the participant. For example, a study done, based on the Sullivan model of PT, encompassed four areas: mobility, stability, controlled mobility and skill (for more details see Harada et al 1995 (45)), which showed significant improvement in balance and functional ability (45). Due to the specificity of the programs geared to each individual's needs and goals, desired outcomes were only seen in the areas of interest; for example improving gait speed was not a priority, therefore when the gait velocity outcome measure was assessed no improvements were seen (45). Therefore, targeted individualization therapy may be needed to address client-specific goals and should describe exactly how participants were progressed throughout the intervention; otherwise it is difficult to apply the results.

Specificity is not only present in strength training, Tai Chi and PT programs, but also in walking or aerobic studies as well. It is often seen in studies, which only involved walking as an intervention, show improvements in walking time and endurance (52). For example, an on-unit walking intervention found significant improvement in ambulatory status in twenty participating residents ($p<0.01$) (51). When other types of exercise such as strength training are introduced into the walking program it is still found that walking distance improved significantly ($p=0.0009$) where no differences were found in the ability to get in and out of a chair and walking up and down stairs (67). Another intervention looked specifically at reducing the number of falls which occur and consisted of several intervention groups, including a control group, treadmill walking group and a tai chi group (54). With 67 fallers and 43 non-fallers included in the two year follow up analysis, the study showed that fallers health deteriorated faster than non-fallers regardless of intervention group and no significant differences were seen in the number of falls in any group, suggesting that exercise interventions need to be tailored to achieve the outcome of interest (54). Therefore, there is a need to identify and use outcomes that are of importance to the objectives, to design exercise prescription specifically to the targeted goals and to provide rationale for the chosen exercise, frequency, intensity, duration and type based on personal goals and study objectives.

Since outcomes are linked specifically to intervention characteristics, it is important to choose the most appropriate mode of exercise for the desired outcomes. An example of this can be demonstrated with walking; walking exercise is proposed as a means to improve mobility, endurance and reduce fall risk among older adults in assisted living settings. Walking is a functional activity that many, but not all individuals in assisted living perform as part of their ADL's. There are many benefits of walking as a form of exercise as it uses large muscles groups,

particularly of the lower limb, is a weight bearing activity, and provides a balance challenge to the individual. It is important to involve large muscle groups to increase functional mobility, strength and blood flow to the specific regions (14). Weight bearing is additionally important as it can help attenuate bone loss and prevent falls through challenging the balance system (14). Specifically, treadmill walking may have additional advantages including, but not limited to, minimizing obstacles and distractions from the surrounding environment, using a constant speed can be used to regulate intensity more accurately, the potential to use a body-weight support harness to provide unloading of body weight, if needed. Several studies to date have demonstrated that walking can improve cognition, walking endurance, functional mobility and the improved ability to walk in individuals residing in assisted living settings, suggesting that walking is potentially effective and accepted form of exercise (51, 51, 56, 66-68, 92). Also, the treadmill can be used not only to improve health status but to improve quality of gait through gait re-training. Despite all the potential advantages, there is one disadvantage of utilizing a treadmill for exercising older adults in assisted living and that is because it is unknown whether or not they will actually be willing to get on the treadmill itself. Due to the advancements in technology older adults may not have had experience with walking on a treadmill or may be fearful of falling; therefore utilizing the harness may assist with getting older adults within in assisted living setting to commence aerobic exercise.

Summary of Research and Barriers

There is limited research assessing exercise interventions among older adults in assisted living settings to date. Studies so far have only tested the effectiveness of different modes of exercise including, strength and resistance training, Tai Chi, Physical Therapy and aerobic training. Many benefits that have been found include increase in lower limb muscle strength,

improved flexibility, overall function, and increased walking capacity. However, the findings of the studies are limited as they are not very generalizable, they are extremely specific to the exercise program characteristics, and details are not often provided to allow reproducibility of exercise programs. Limited generalizability affects our ability to apply the findings to a wider variety of people and does not help us understand whether exercise would be feasible in individuals with characteristics that are dissimilar to those studied. Among current research the lack of rationale for using specific exercise interventions and not providing sufficient details such as how the participants were progressed in terms of increasing exercise intensity limits the interpretation of research results and the ability to duplicate exercise interventions. Finally, there is a definite lack of consistent reporting in terms of frequency, intensity, time and type of exercise being conducted and many guidelines from numerous sources are being used which can cause confusion. It is necessary to conduct well designed studies with clear rationale to investigate the efficacy of exercise for improving health related outcomes. Although it is thought that walking on a treadmill with a harness may be an ideal mode of exercise for older adults in assisted living, it is unknown if they would be willing to perform this type of exercise, or whether they can achieve the recommended frequency, intensity, or duration associated with health benefits. Thus, the objectives of the present study include determining the feasibility of recruitment and retention for older adults to participate in a treadmill walking study and to assess if treadmill participants are able to achieve an exercise capacity associated with health benefits.

Objectives

Research questions, along with the primary outcome and the method of analysis for each can be seen in Table 3.

Primary Objectives and Hypothesis

The primary objective of the present study was to assess the feasibility of recruiting and retaining older adults in assisted living to participate in a treadmill walking exercise program. The a priori criteria for success were: a) recruiting 30% of the eligible individuals to participate in treadmill walking b) the treadmill participants would comply on average with 4 out of 6 (70%) treadmill sessions.

It was hypothesized that it would be feasible to recruit 30% of the eligibility list and the treadmill participants would achieve 70% compliance to the present study of treadmill walking with a safety harness.

Secondary Objectives and Hypothesis

The second objective of the current study was to determine the characteristics and determinants of participation and factors associated with compliance to the treadmill walking sessions.

It was hypothesized that treadmill participants would be younger (<75y), healthier (< 4 co-morbities), more cognitively alert (> 3MS score), with an increased walking ability (>250m in 6MWT). Of those treadmill participants it was further hypothesized that those participants who were not retained in the 3-week period would have increased fear of falling (>AFC), complaints of pain (>5/10 on pain scale), decreased mobility (<velocity and distance in 6MWT).

The next objective was to determine if older adults in assisted living settings can achieve an intensity (40% HRR), frequency (three times for one week) and duration (minimum of 20 minutes) consistent with the ACSM guidelines for older adults after a familiarization treadmill session and progressive protocol over a 3-week period (10, 11).

It was predicted that treadmill participants would be able to walk for twenty minutes at their individually determined fastest most comfortable, achieve at least 40% HRR intensity by the last treadmill session, and will attend all 3 sessions in the last week.

Table 3: Statistical Methodology for outcome measures

Primary Research Question	Primary Outcome	Method of Analysis
Is it feasible to recruit older adults to participate in treadmill walking and have them comply?	Number of treadmill participants / Total number of eligible residents Number of sessions completed / 6 possible treadmill session	A priori 30% recruitment with 70% compliance. A flow chart tracked people through the study.
Secondary Research Questions	**Outcome**	**Method of Analysis**
What are the determinants of participation and compliance?	Characteristics from Medical Chart eg) age, co-morbidities, medications 6-minute walk test distance AFC 3MS Gait characteristics eg) gait velocity, cadence, step/stride length	Student t-test ($\alpha = 0.05$) Descriptive Mean ± SD, # (%) Student t-test ($\alpha = 0.05$) Descriptive Mean ± SD, # (%)
Can participants achieve intensity (40%), frequency (3x/wk), and duration (20 min) ACSM recommendations?	HRR Intensity (peak HR) RPE (10-point scale) Frequency (3 sessions in 1 week) Speed, Duration, Distance (treadmill)	Descriptive Mean ± SD, # (%)

Methods

Setting and Study Population

Participants were recruited from Winston Park Long-Term Care and Retirement Home facility in Kitchener, Ontario. All participants were screened by the Kinesiologist at Winston Park and the Research Associate from the Research Institute for Aging (RIA) for eligibility. Residents were considered eligible for the study if they met the following inclusion criteria: able to safely walk two meters independently (with or without assistive aids i.e. walker, cane), greater than 65 years of age, able to follow two-step commands and receive their physician's approval to participate in aerobic exercise – walking on the treadmill. The ability to follow two-step commands was estimated by the research associate using their own judgment when creating the eligibility list and was confirmed by determining if the participant's score on "Three-Stage Command" was greater than 2 out of three on the Modified Mini Mental State Examination (3MS). Residents were excluded from participating if: they were under palliative care, have Parkinson's disease, history of Stroke affecting gait, Multiple Sclerosis, Peripheral Neuropathy or other neurological condition severely affecting physical function. The reasons for not including individuals that have a history of neurological diseases are for safety concerns and that it may not be appropriate to assume that they can achieve ACSM guidelines for aerobic exercise. Finally informed consent must have been obtained before or at the walking assessment by the resident, or if applicable, their legal representative. Residents who were their own legal representative provided their own written consent. For those residents who had a designated legal representative; consent was first obtained from the legal representative before the resident was approached for consent. The legal representative or Power of Attorney contact information was provided by the facility.

Recruitment

The following procedures were used to increase awareness about the study within the facility and assisted with recruitment of participants (See Figure 1 for flow chart):

1) Eligible residents and legal representatives were provided with a checklist, information letter, consent form and an invitation to attend an information session hosted at Winston Park.

2) The information session was held to provide attendees with more details about the study and to show some of the equipment being used, for example, polar heart rate monitor. The presentation covered all of the information presented in the information letter and consent form, including a previously recorded video of a consenting resident walking on a treadmill while using the safety harness and included a demonstration and/or explanation of the GAITRite protocol and 6MWT. Interested residents were asked to fill out the checklist or consent form and return it to the research coordinator associated with the facility (The RIA Research Associate or to the main office at Winston Park).

3) For residents who did not attend the information session, the RIA Research Associate contacted each resident individually and provided them with a checklist and consent form. For cases where residents are unable to consent on their own, the family member or legal representative was contacted.

4) The Information Letter was sent to all the eligible residents' families. The purpose of sending the advertisement to the families was to inform them of the study and to get consent by proxy for individuals who were not considered able to provide informed consent, to avoid ascertainment bias.

5) Each family member or legal representative was contacted via a follow up phone call approximately two to four weeks after the packages were mailed out to: a) inform the families that the resident consented to participate in the study or b) obtain consent from the legal representative to have the resident participate in the study.

6) Once residents and their family member or legal representative provided informed consent, the initial walking assessment was scheduled.

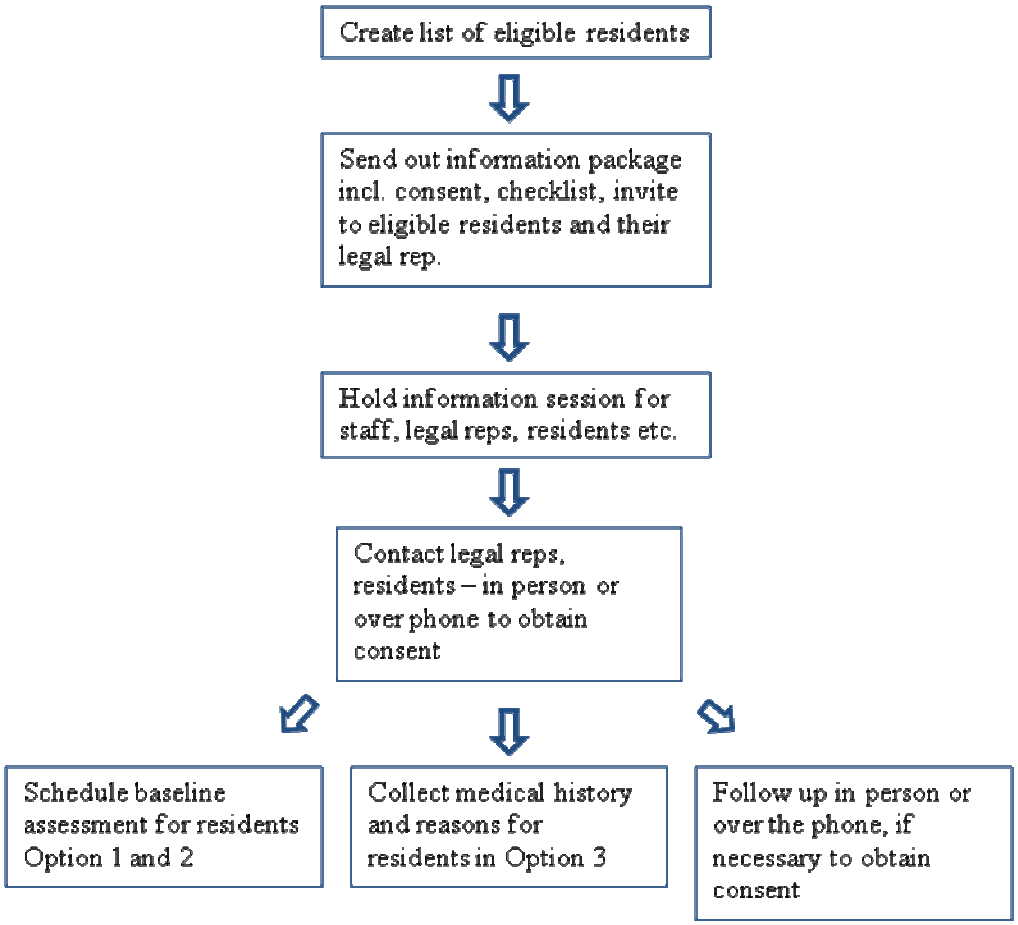

Figure 1: Participant Recruitment Methodology

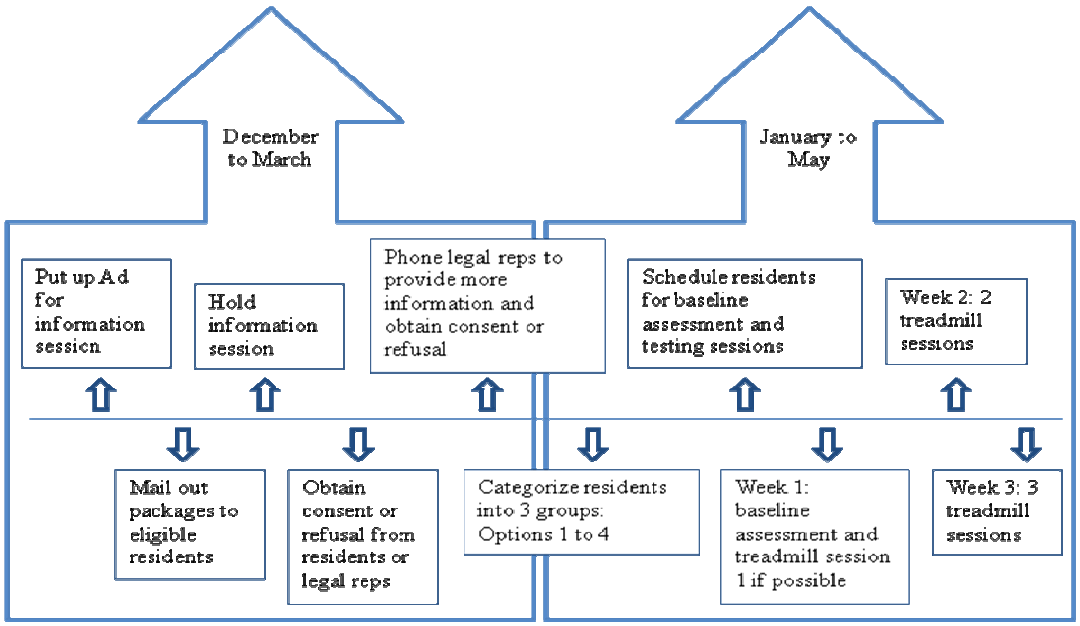

Figure 2: Timeline for participant recruitment and data collection

Treadmill Protocol

Participants were asked to attend one walking assessment and to walk on the treadmill for a total of six times; one session in week one, two sessions in week two, three sessions in week three, so as to provide an opportunity to evaluate tolerance of and compliance with multiple (two to three) sessions during one week. The treadmill and harness used in the present study was the RTM 600 treadmill with handrails and the Unweighing System from Biodex (London, ON, Canada). Treadmill walking speed and duration for each session were recorded every one to two minutes (Table 8). Specific instructions on how speed and duration were increased (according to participant tolerance) can be seen in Table 4. The main goal for session's three to six was to maintain the fastest most comfortable walking speed obtained in session two while increasing duration. The heart rates associated with 40 and 60% HRR were documented and were referred to each treadmill session. If a treadmill participant's working heart rate was below the heart rate associated with 40% HRR and the participant was able and willing to increase walking speed,

speed was increased according to tolerance in an attempt to obtain the 40% HRR intensity. If a treadmill participant was above the heart rate associated with the 60% HRR intensity, speed was decreased in order for the work load to be within the upper target zone of 60% HRR. Heart Rate and Rate of Perceived Exertion were measured throughout every treadmill session (Table 8). Rate of progression with regards to speed, duration, intensity depended on the participants' tolerance and requests. Participants were reminded to tell the primary researcher if they want to walk faster, slower, or if they want to stop and or take a break. Upon completion of each treadmill session, pain was recorded based on a ten point scale (see appendix 2). Any adverse events were to be reported and to be reviewed by a panel at the University Of Waterloo Office Of Research Ethics.

Individuals who chose not to participate in treadmill walking were asked to complete the walking assessment and a chart abstraction so that differences between those that chose to participate and those that declined participation could be evaluated. Those that declined participation in the walking assessment were asked to allow the team to perform only a chart abstraction. These data were collected to provide insight as to whether certain participant characteristics were more common among those that chose not to participate in treadmill walking. The reason provided for not participating in treadmill walking was also recorded.

Table 4: Instructions for each Treadmill Session

Session	Instructions/Goal
1	Used as a familiarization session. Participants were to walk at a self-selected speed beginning at 0.2 km/hr.
2	First session used for comparison purposes. Participants began walking at 0.2km/hr and were to reach the speed obtained in session 1 within the first 2 minutes. The goal was for the participants to increase speed to determine their fastest most comfortable walking speed.
3 - 6	Participants were to begin walking at 0.2 km/hr and reach their fastest most comfortable walking speed achieved in session 2 within the first 2 – 3 minutes. The goal was then to maintain constant speed while increasing duration each session. Speed was adjusted as requested by the participant.

Figure 3: Resident walking on treadmill using the body-weight support system as a safety harness

Outcome Assessments

Feasibility Outcomes

A recruitment spreadsheet was kept with all details regarding eligible residents. The spreadsheet was only passed between the primary researcher and the research associate at the Research Institute of Aging and was password protected. This spreadsheet included residents names, whether they chose to participate, and any additional information required including reasons for not participating, room number required for scheduling purposes, the status of legal representative contact and consent. Additionally, a weekly calendar was printed off with an hourly schedule of when treadmill participants were scheduled and for what session they were attending. The calendar assisted in the determination of compliance for each participant.

Health-Related and Demographics Outcomes

Health-related and demographic characteristics were used to characterize the population and used as potential determinants of participation and compliance, and included age, length of stay, co-morbidities. Medical history was obtained from medical charts at the facility. Cognition was measured using the Modified Mini Mental State Examination (3MS) and was scored by the same primary researcher to ensure consistency in scoring (62). A person was deemed able to follow two-step commands if they could score greater or equal to two out of three in the 'Three-Stage Command' subsection. Other subsections scores that were considered when determining if a resident could participate in the study safely, were scoring six or greater out of nine on each of the 'Recall' and four or greater out of five on the 'Repetition subsection even if their total score was less than 80/100.

Walking Competency and Fear of Falling

Walking competency and fear of falling were determined as potential determinants of participation and compliance. The 6MWT distance was used to assess muscular endurance and average HR was noted, as a means to determine what was to be expected on the treadmill in terms of intensity (60). Through each 36 metre loop of the 6MWT, participants walked over a GAITRite mat (version 3.8) to determine walking speed, cadence, step/stride length, temporal asymmetry (Table 4) (61, 63-64). The GAIT Rite mat is fourteen feet long and the minimum number of steps required to properly estimate step-to-step stability is twenty. As a result the number of passes over the mat is dependent on the distance covered in the 6MWT. On average individuals were required to walk over the mat twice for the twenty footfalls to be obtained. Residents were allowed to walk with their usual walking aid (if applicable). Fall concerns were determined using the 'Activities-specific Fall Caution' scale (AFC) (90). The AFC was scored by the primary researcher to ensure consistency.

Treadmill Walking Capacity: frequency, intensity and duration

Parameters related to exercise capacity were determined throughout every treadmill session to quantify exercise intensity and duration. Older adults may not be able to become familiar with treadmill walking within 1 session; therefore, the current study used the data from the second treadmill session as a comparison to relate to progress (71). Speed, distance, duration and RPE (see appendix 2) were measured every one to two minutes, depending on participants' tolerance. Heart rate was constantly monitored using a Polar Heart Rate monitor. To determine the intensity reached in each treadmill session, peak HR was used in the Karvonen formula to determine HRR% intensity achieved (See appendices page 77). Target heart rate range (40% to

60%) was based on the guidelines from ACSM (10). For participants on beta blockers, the age-predicted maximum heart rate was adjusted by 85% [.85(220-age)] (91).

Statistical Analysis

The primary objective included assessing the feasibility of recruitment and compliance. Recruitment was assessed by determining the number of people who participated in treadmill walking over the number of potentially eligible residents. The a priori criterion was to recruit 30% of the eligibility list. Compliance was determined by the number of sessions completed divided by six treadmill sessions. The a priori criterion was to have participants complete 70% (four of six) of the treadmill sessions. A flow chart was used to track the flow of people through the study.

To identify determinants of participation and compliance variables noted in the hypothesis were used including age, co-morbidities, pain, walking competency, fear of falling. Data were reported as mean (standard deviation) for continuous data and frequency (percentage) for categorical data. To determine if the hypothesized characteristics were significantly different between the two participation groups, t-tests were conducted and the mean difference and 95% confidence intervals were determined using the statistical software program, SPSS.

To determine if participants were able to reach the ACSM intensity recommendations (40 to 60%) peak percent of HRR intensity reached during the last session was reported and compared to the target %HRR. Average duration in the last session was determined and compared to the ACSM guidelines (at least 20 minutes). Participants were considered to have achieved the recommended frequency of exercise if they attended 3 sessions in 1 week. A post hoc, qualitative comparison was made between groups who increased total duration less than five

minutes to those who increased total duration by more than ten minutes relative to the first treadmill session to determine if there were any differences in age, number of co-morbidities, walking competency.

Results

Feasibility of Recruitment and Compliance

The a priori criterion for success was to recruit 30% of the eligibility list to participate and to have the participants comply with 70% (4/6) of the treadmill sessions. A total of 263 residents at Winston Park Retirement Home and Long-Term Care Facility were screened for eligibility; 43 were identified as eligible for the study. Thirteen (30%) individuals agreed to participate in treadmill walking, and thirteen (30%) declined participation but agreed to either the assessment and chart abstraction, or the chart abstraction only (Figure 4). Reasons given for declining participation in treadmill walking included: health concerns (n=6), perceived inability to walk (n=4), not within physical ability range (n=1), unable to get better by walking on a treadmill (n=1), unable to make a decision (n=1) and no reason provided (n=9). The average compliance was 94.4%±10.8% of the thirteen participants participating in treadmill walking, twelve (92%) met the feasibility requirement of attending four of the six sessions scheduled. One participant did not meet the expected compliance because of declining health that resulted in moving out of the facility. A total of four scheduled treadmill sessions were missed with the main reason being scheduling conflicts (n=3), and one session was missed due to a fall in the morning.

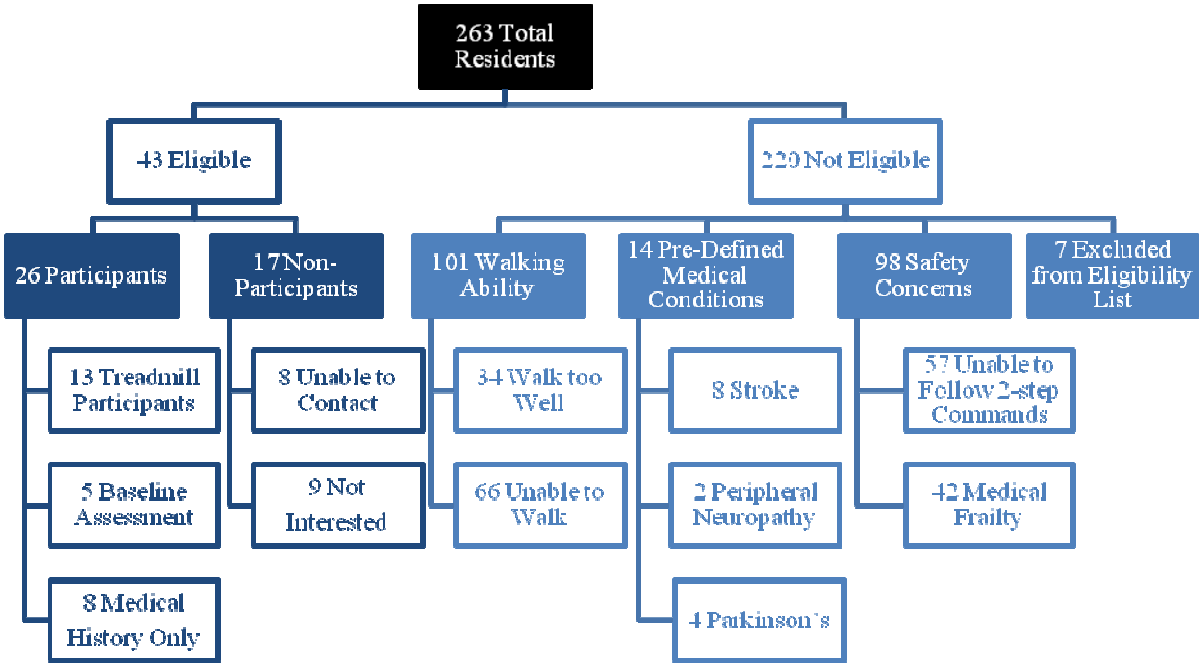

Figure 4: Flow diagram of participant recruitment and resident exclusion.

Characteristics of Participants

Some of the demographic and health-related characteristics of the individuals who chose to participate in treadmill walking were compared to those that chose not to participate, but agreed to the assessment plus chart abstraction, or the chart abstraction only (Table 5). There were no significant differences between treadmill participants and non-treadmill participants in health-related and demographic characteristics (Table 7). However, the mean difference and confidence intervals for age and cognition suggest that a true difference between groups cannot be discounted, and that having a larger sample size in the future may be necessary to confirm whether a difference exists (Table 7). Only one of the five non-treadmill participants who walked the 6MWT reported pain (five out of ten) while none of the treadmill participants reported pain while walking over ground.

Table 5: Participant Characteristics

Characteristic	Treadmill Participants (n=13*)	Non-Treadmill Participants (n=13)
Age in years: mean (SD)	84.9 (7.3)	88.6 (4.3)
Number of Females: n	8	5
Mean Length of Stay (years): mean (SD)	3 (2.7)	3.42 (1.91)
Cognitive Function (3MS score /100): mean (SD) (n=5)	81.8 (15.0)	74.2 (15.3)
Fall Concern (AFC Score /40): mean (SD) (n=5)	19.2 (8.3)	17.3 (8.6)
# Co-morbid conditions		
0-2: n	0	1
3-5: n	6	5
6+: n	7	7
Average number of medications: mean (SD)	7.8 (3.8)	9.15 (3.21)
On 10 or more medications: n	3	5
Number on Beta Blockers: n	5	5

*Characteristics include the one resident who dropped out after three treadmill sessions.

Table 6: Over-Ground Gait Parameters

6-Minute Walk Test Parameters	Treadmill Participants (n=13)	Non-Treadmill Participants (n=5)
Distance in m: mean (SD)	237.6 (82.9)	243.6 (26.0)
Velocity in cm/s: mean (SD)	80.9 (24.7)	81.2 (11.4)
Average Step Length in cm: mean (SD)	48.1 (10.4)	50.2 (4.3)
Overall Temporal Asymmetry: mean (SD)	1.21 (0.5)	1.10 (0.07)
Use of Assistive Devices (n=13): n (%)	9 (69%)	11(85%)

Table 7: Hypothesized determinants of participation and or compliance

Characteristic	Mean Difference (95% Confidence Interval)	p-value (t-test)
Age (years)	3.7 (-8.5, 1.2)	0.13
Cognitive Function (3MS Score)	7.6 (-9.2, 24.5)	0.35
Fall Concern (AFC Score)	1.6 (-7.4, 10.7)	0.71
# Co-morbidities	0.5 (-1.7, 2.6)	0.66
6MWT Distance	6.0 (-87.5, 75.5)	0.88

Treadmill Walking Capacity

Ten of the twelve participants in treadmill walking were able to achieve the target intensity (40%) and frequency (three days/week). Although treadmill participants were able to progressively increase duration, eight of the twelve participants did not achieve the recommended minimum duration of twenty minutes by session six. On average treadmill speed and distance within session two were 2.16 ± 1.3 km/hr and 0.13 ± 0.08 km respectively. Participants progressively increased speed and distance through the six sessions in three weeks to an average of 2.48±1.36 km/hr and 0.67±0.57 km respectively (Table 8).

The body-weight support system was used for only one resident with severe osteoarthritis (OA). The treadmill participant did not use the body-weight support within the first session, but had complaints of knee pain due to her OA, so the body-weight support option was presented to the participant. The body-weight support was then used for the remaining treadmill sessions as the participating resident continuously reported decreased pain when walking and afterwards compared to the first session.

Exercise Intensity

Ten participants were able to achieve the recommended 40% HRR intensity by session six. Treadmill participants were able to progressively increase exercise intensity from 39.6% ± 23.9% HRR to 50.3% ± 30.2% (Table 8). The target HR range was 91 to 119 bpm at 40% to 103 – 120 bpm at 60% for the twelve participants. In Figure 5, individual HR's are presented and participants on beta blockers are identified. Table 9 depicts the adjusted or modified exercise intensity for those participants on beta blockers. The 85% adjustment on age predicted maximum heart rate [.85(220-age)] increases the observed HRR intensity, as beta blockers are known to decrease resting and maximal heart rates. When adjustments in target HRR were made for those on beta blockers, ten treadmill participants achieved the 40% target. The remaining two participants who did not reach the target of 40% HRR were also on beta blockers, and achieved intensities of 25% and 26% after adjustments were made (Table 9).

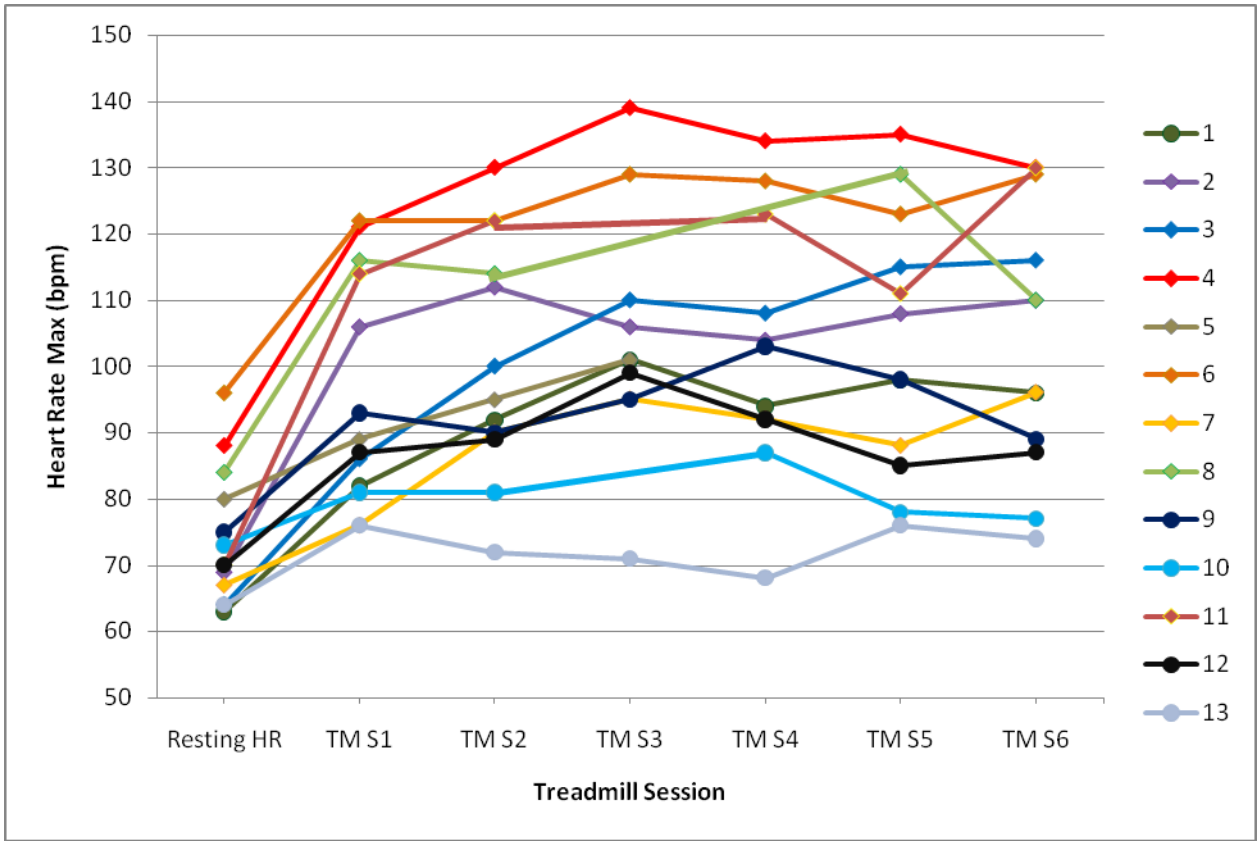

Figure 5: Treadmill Participant Heart Rates: Participants heart rate at rest and peak heart rate during each treadmill session. Figure includes the participant who dropped out after TM Session three (#5). Residents on beta blockers are labeled with a circle.

Table 8: Walking Capacity During Treadmill Sessions

Parameter	TM Session 1	TM Session 2	TM Session 3	TM Session 4	TM Session 5	TM Session 6
Speed (km/hr)	1.55 (1.0)	**2.16 (1.33)**	2.58 (1.4)	2.59 (1.27)	2.43 (1.37)	**2.48 (1.36)**
Distance (km)	0.13 (.08)	**0.30 (0.22)**	0.52 (0.37)	0.50 (0.39)	0.60 (0.49)	**0.67 (0.57)**
Peak HR (bpm)	96.6 (17.9)	**101.2 (18.4)**	105.0 (19.9)	103.0 (19.5)	103.6 (19.7)	**103.6 (20.1)**
Intensity (% HRR)	44.5 (19.9)	**53.1 (21.6)**	59.6 (25.3)	57.9 (27.2)	58.4 (25.2)	**57.6 (23.4)**
RPE (1-10)	4.1 (1.6)	**4.6 (1.2)**	5 (1.3)	4.8 (1.3)	4.8 (1.3)	**4.58 (1.16)**
Duration (min:sec)*	5:48 (2:00)	**9:13 (3:44)**	10:30 (4:40)	12:30 (5:30)	13:40 (5:38)	**14:53 (6:43)**

* Session 1: duration was limited to 6 minutes to match the 6MWT assessment.

Table 9: Exercise Intensity of Treadmill Participants

Condition	Peak HR (bpm)		Intensity (HRR%)	
	Session 2	Session 6	Session 2	Session 6
Met 40%HRR Intensity (n=10)	106.1 (20.0)	109.3 (16.8)	58.1 (19.8)	63.9 (20.0)
Did not meet 40% HRR Intensity (n=2)	76.5 (6.4)	75.5 (2.12)	28.5 (12.0)	25.5 (0.7)

Exercise Duration

The recommended total duration per session of twenty minutes was not achieved by eight of the treadmill participants. Participants increased total walking time on average by five minutes twenty seconds from session two (9:33 ± 3:40 min) to session six (14:53 ± 6:43 min) (Figure 6). Some participants stopped due to fatigue; qualitative comments included 'that's enough for today', or they reached their personal goal 'once I make one lap, I'm going to stop', or the participants had another event to attend 'I only have 30 minutes because I have to go to play bridge at two o'clock'. If individuals were characterized by the extent to which they could increase the duration walked on the treadmill between session one and session six, it appears that individuals who were able to increase their treadmill walking duration by ten minutes or greater were younger, could walk further during the 6MWT, and had higher 3MS scores compared to those who could not increase total walking duration by more than five minutes (Table 10). However, no statistical comparison was made between those that could and could not achieve the duration of 20 minutes because of the small number of participants.

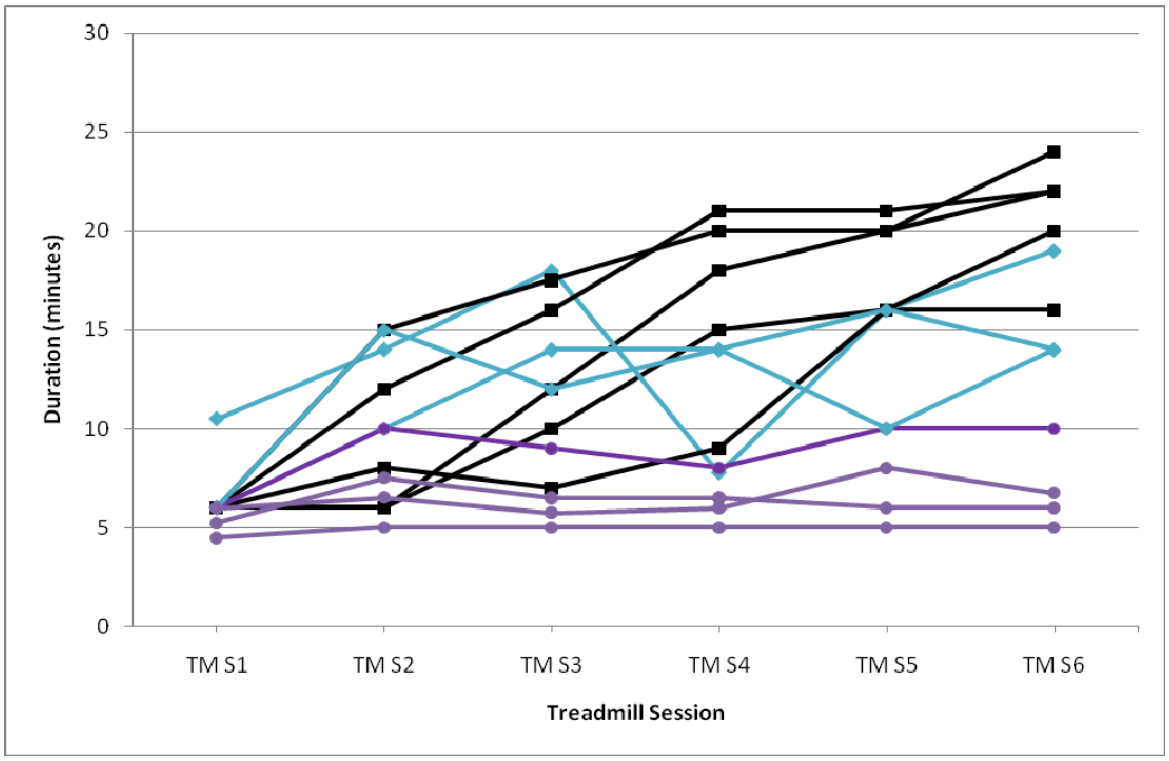

Figure 6: Treadmill walking durations. Purple circles are participants whose duration changed < five minutes; Blue diamonds are those who increased total duration between five and ten minutes; Black squares are participants who increased duration by > ten minutes.

Table 10: Clinical Characteristics of Participants based on treadmill walking duration

Characteristic	Group A (0<5min)	Group B (5<10min)	Group C (>10min)
Mean Age (y)	88.5	87.3	80
Location of residence:			
LTC	1	0	1
Retirement home	3	3	4
Mean Length of Stay (y)	2	4.25	3.15
Mean 6MWT Distance (m)	198.5	251.6	272
3MS (/100)	72.75	86.3	92.4
AFC (/40)	18	21.3	19.6
Number on beta blockers	2	1	2
Number of Osteoarthritis	2	1	3
Number of gait aid users	2	3	3

Discussion

Summary of the Main Findings

The current study demonstrates that it is feasible to recruit 30% of eligible older adults in assisted living settings to participate in treadmill walking and that a goal of 70% compliance to prescribed sessions is reasonable. It was hypothesized that treadmill participants would have been younger, healthier and less cognitively impaired; there were no statistical difference in demographic and health related variables such as age, cognition, fall concern and the number of co-morbidities. However, the mean difference between groups and 95% confidence intervals suggest that a potential difference should not be discounted in age and cognition between treadmill participants and non-treadmill participants. ACSM guidelines state that older adults should be exercising three to five days per week, for up to 20 to 30 minutes a day reaching a minimum of 40% heart rate reserve (HRR) intensity (10, 11). Ten of the twelve participants were able to meet the recommended intensity and frequency levels by the last treadmill session, but may need multiple sessions a day for the first three weeks or more than three weeks time to get accustomed to aerobic exercise in order to reach the recommended daily duration of twenty minutes.

Feasibility of Recruitment

The current investigation determined that it is feasible to recruit older adults that live in assisted settings to participate in treadmill walking and most residents achieved the target compliance goal, however there were a few barriers encountered. Thirty percent of the eligibility list consented to participation and twelve of the thirteen participants complied with the treadmill study. Only a few other studies that involved walking as part of an intervention reported the

proportion of people that were screened, included and consented. For example, of the 88 eligible subjects for one study fifteen (17%) consented (66), another study reported 22 (25%) of the 86 eligible residents participated (57), while 37 (28.5%) participants consented of the 130 eligible residents (52). Even though the a priori criteria were met for recruitment feasibility, there were a lot of difficulties encountered which may have affected recruitment. There are two sets of barriers that could be addressed, the first being methodological issues and the second being resident-related issues. Methodological recruitment barriers encountered in the present study include having:

- One to two staff members who are not completely familiar with all the residents within the facility review the eligibility list and determine who meets the inclusion criteria.

- Certain exclusion criteria, such as having a neurological disorder/disease, residents were removed from the eligibility list despite the participation possibility.

- The local ethics board requirement that staff, rather than researchers, make contact with the residents' families.

Recruiting participants required staff to make judgments about eligibility and assist with the recruitment process, which resulted in a slow process and potentially missed participants due to the extra time required and the need to coordinate between multiple people. Because of the slow recruitment process and the high new admissions per month in the facility, new residents may not have been considered for participation because they came to the facility after the eligibility list was created. In the future, possibly weekly or months updates to the eligibility could overcome this barrier. Resident-related recruitment barriers included the unwillingness of

the resident to participate or the refusal of the legal representative to allow their family member to be approached. Below are a few methods that could be used in the future to help improve recruitment feasibility:

1) A frequent review of new residents for inclusion on a weekly basis should be considered for the development of the most accurate eligibility list;

2) Upon completion of creating the eligibility list, it could be feasible to separate the list into respective floors/phases/areas to have the charge nurse review the eligibility criteria and confirm that the list is accurate. The involvement of the charge nurse should be limited to determining resident's eligibility only;

3) Supply the residents with education materials well in advance of the recruitment/information session so they could have more time to discuss participation with family members or legal representatives or Power of Attorney;

4) Invite legal representatives to the information session well in advance (held in the evening) through communication techniques such as handouts, posters, newsletter ads, phone calls.

Ory et al in 2002 summarized effective recruitment methodologies used in the FICSIT trials to increase participation (70). The present study was successful in achieving the required feasibility participation (30%) due to a few recruitment factors adopted from the FICSIT trials outlined in Ory et al. Factors include:

- Minimize the use of facility staff (physicians, kinesiologists, support aids) not directly involved with recruitment, treadmill sessions, and transporting residents.

- Increase face-to-face interaction - residents who attended the information sessions were more likely to consent to participate in treadmill sessions versus relatively quick individual visits from the research associate only.
- Give sufficient time to provide informed consent - residents who participated in any option of the current study took their time to think the decision over, whereas those residents who did not consent to participate refused instantly.
- Provide direct and indirect benefits - participants who attended the information sessions were more likely to understand the benefits of exercise to them and research to society, and could possibly mean that residents who valued exercise were more likely to participate (70).

Even though the present study did in fact reach the a priori criteria for success, it was just barely met. Only thirteen of 264 total residents walked on the treadmill, suggesting that it may not be realistic to conduct a similar study with a greater sample size, especially when only one exercise modality is provided which may not be applicable or appealing to everyone. It is recommended that any future clinical trials screen four times the number of required participants and possibly have more than one mode of exercise available in order to ensure the a priori criterion was sufficiently met. When it comes to recruiting, the legal representative plays an important role in the residents' participation in any research study, suggesting that further recruitment methodologies need to be put into place such as: more information about the study protocol (step-by-step), providing figures or diagrams of equipment to be used throughout the study and sufficient notice for invitation to information sessions/presentations located at the facility. Improving such screening and recruitment methods would enhance the feasibility of conducting a randomized controlled trial of treadmill walking.

Compliance with Treadmill Walking

Another objective was to assess the determinants of compliance to the treadmill study and it was predicted that participants who did not comply with four of six treadmill sessions would be less mobile, have increased fear or concerns about walking on a treadmill, complain of pain or have cardiovascular disease. The present study found that the treadmill participants complied with the required treadmill sessions throughout the duration of the study. The one exception was when one treadmill participant dropped out of the study after three treadmill sessions due to declining health and had to move out of the facility. The compliance associated with the present study was 94.4% where other studies have reported compliance varying from 57% to 95% (52, 54, 55, 57, 66, 67). No sessions were missed due to fatigue or pain, while there was one session missed due to a fall experienced in the morning in a frequent faller. Arm pain was reported in two cases during walking on the treadmill due to the participants leaning on their arms and using the handrails for additional support. Relying on one's arms too much while walking on the treadmill may affect the ability to progressively increase intensity and in the future treadmill walkers should be asked to rely less and less on their hands, possibly leading to no handrail use at all. It may be difficult for older adults to completely let go of the handrails on the treadmill due to probable fear and uncertainty issues of walking on a treadmill. Fear did not seem to affect compliance to the study as there were no statistical differences seen in the fall concern (AFC) scores between participation groups. No adverse events were reported throughout the study.

There was high compliance with treadmill walking observed in the current study. Missed sessions were mainly due to scheduling conflicts (n=4), which may be inevitable when working with older adults in assisted living settings, as there are many activities that take place

throughout the day. Possible reasons for obtaining such a high compliance may be due to the short duration of the study (3 weeks), the use of the harness as a safety device (no body-weight supported) while walking on the treadmill, having highly motivated residents, or providing multiple options and flexibility while scheduling every resident. Previous studies have reported compliance ranging from 57% (sixteen weeks long) to 95% (twelve weeks long), where the compliance in the present was 94.4% (three weeks long). Studies with low compliance were also likely to be the longer studies, providing evidence that the length of the study may affect the compliance with the exercise study. Therefore, was to enhance compliance to a longitudinal study would be to schedule sessions on a consistent time of day and day of the week and utilize motivational strategies.

Motivational strategies were used to help increase compliance in the present feasibility study of treadmill walking. A group of researchers outline many effective methods that may be used in any exercise study, especially when it involves the older adult population (69).

- The residents were educated as to why exercise is important, specifically through the use of presentations at the facility.
- A video where a recognizable resident was walking on the treadmill using the harness and a detailed consent form were used for informing residents about the study.
- Each treadmill session was goal orientated (see Table 4) where the participant provided feedback to guide immediate changes in speed and duration was implemented to allow for gradual progression.
- Safety was addressed by utilizing a harness and stop buttons were shown and their use explained to each participant at the beginning of every treadmill session.

- The protocol and equipment was adaptable via the use of adjustable velcro straps on the harness, the use of small increments in speed on the treadmill and the availability of handrails while walking.
- Participants were empowered by being able to control the walking speed and duration, as well as when they were scheduled to attend treadmill sessions.
- The equipment was accessible (within the facility) with no associated costs and socialization was welcome; friends and family were invited to attend to observe sessions but were instructed not to interfere with the integrity of the study and remained out of sight while the participant was on the treadmill.

Above and beyond implementing the above suggestions to increase compliance it could be that those who chose to participate are those residents who were really motivated, whereas if a more representative group participated, the compliance could have been worse. The results should be interpreted with caution as the treadmill participants were only asked to complete 6 sessions and to maintain good compliance with a longitudinal study may be more difficult. It would be expected that the compliance would decrease with an increase in the duration of the study. Therefore, it is realistic to expect that participants will comply with a short term study for instance, four out of six (70%) treadmill sessions, but there is a need for a better estimate of compliance with long term studies. With the possibility of having lower compliance, negative implications should be considered when determining the effectiveness of the interventions. For instance, such an exercise program may be effective for those who comply with it; however, if compliance is too low, the study may determine that the exercise program was not effective, possibly resulting in a 'true negative' conclusion. To avoiding low compliance, more rigorous

recruitment and motivational strategies could be implemented, as mentioned here, an example being more careful and flexible with scheduling.

Participation Determinants

Demographic information including medical history in addition to walking competency of participating residents were presented and assessed to identify participation determinants. Although there were no significant differences between treadmill and non-treadmill participants, the mean differences and 95% confidence intervals for age and cognition suggest that a true difference cannot be discounted. The two groups may have been similar because the participants live within the same facility and were also from the same residential floor within that facility, meaning all the participants have similar abilities, needs and health status. True differences between treadmill and non-treadmill participants may be underestimated because seventeen people declined any assessment. Cognition information was not available for the participants who only provided medical history information. Individuals with cognitive impairment may have been less willing to participate in treadmill walking due to memory, safety concerns, or misunderstanding. In comparison to other walking exercise studies, the treadmill participants in the current study were approximately the same age and more cognitively intact according to 3MS and or MMSE scores, thus suggesting that the people who agree to participate in such a study may not be representative of the LTC residential population as a whole (52, 55, 65).

It is possible that self-perception of over-ground walking ability may affect residents' willingness to attempt walking on a treadmill. Although 6MWT performance was not different between treadmill participants and those residents who chose not to walk on the treadmill, this finding should be interpreted with caution given the small number of participants in the study. A common reason provided by residents who participated in the study but chose not to walk on the

treadmill was the perceived inability to walk well (n=4) or that it was not within one's capabilities (n=1). Additionally, because there were thirteen of the 43 eligible residents that did not wish to walk on a treadmill in the present study, the chosen mode of exercise of walking on a treadmill may be a potential barrier to participation. By only having one mode of exercise, this could have affected the feasibility of recruitment. Study participation may have been better if the residents had other options, such as using a recumbent stepper, cycling or even over ground walking depending on the individuals needs. If a resident declines treadmill walking due to the perceived inability to walk, the specific goal of the resident should therefore be to improve the quality of gait during over ground walking first. Upon improving the residents' gait and confidence of their walking ability, they may be more likely to try to walk on the treadmill or use a recumbent stepper first. A solution to this recruitment and exercise modality situation would be to try to identify ways to communicate with residents such that their perceptions of walking ability do not cause them to decline participation in a walking study. Evidence has shown that older adults in assisted living with decreased mobility can increase ambulation with a walking intervention (65). Recruitment materials should be clearer about the potential benefits associated with treadmill walking while containing examples and references to previous research studies that have demonstrated improved mobility in similar populations as the target group of residents.

LTC residents who agree to participate in exercise trials may not always be representative of the LTC population as a while, therefore the generalizability of the results may be compromised. For instance, the participants in the current study are quite comparable to those who participated in the Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT) trials (70). Cognition and gait speed were similar, but the age of residents in the current study population was seven to ten years older compared to the participants in the FICSIT trial

(70). This was expected as eligibility criteria were similar: no terminal illness, MMSE >fifteen, ambulatory and able to follow directions. Although it would be ideal to consider including residents of all cognition levels, it may not be safe to include residents who cannot understand the commands used within the treadmill protocol. To include residents of all mobility levels it may be appropriate to utilize the body-weight support harness and unloading system. Advantages to using a harness during treadmill walking include reducing the risk of injury due to a fall and providing body weight support to those who have difficulty supporting their own body weight due to pain or muscle weakness; however using a harness may not be appropriate for everyone. The ability to support body weight may expand the potential pool of individuals who can access this type of exercise. For example, the one treadmill participant who utilized body-weight support was able to achieve increased duration and speed, thus raising %HRR intensity as a possible result of using body weight support. To ensure the safety of residents who have cognitive impairment or difficulty with mobility many stop mechanisms should be put into place including stop buttons, words, signals, RPE and HR levels.

Treadmill Walking Capacity

Ten of the twelve participants in the current study were able to achieve the intensity and frequencies of exercise recommended by ACSM for older adults but eight of the twelve participants were unable to reach the recommended duration. The participants in the current study were able to achieve the goal of walking on the treadmill for three sessions for one week, at an intensity of 52.8% HRR, up to an average speed of 2.48 km/hr (Table 8) within three weeks, with a cumulative duration of fifteen minutes on average, only five minutes shy of the minimum ACSM recommended guidelines. Two participants, who were on beta blockers, were only able to reach 25% and 26% of HRR respectively after the maximum age-predicted heart

rate adjustment. Reasons why these two participants were unable to reach the recommended intensity could be due to other co-morbidities, not walking long enough to allow for the increase or the fact that the adjusted HRR may not have been accurate as it was based on an age-predicted maximum heart rate. The recommended duration of exercise (minimum twenty minutes) was not achieved for eight (75%) participants even after six sessions. Those who were able to increase their total duration by more than ten minutes appeared to be younger (by eight years), with better performance on the 6MWT (by 73.5m) and had a higher 3MS score (by twenty points) (Table 5 and 6). Some participants had to walk a great distance just to get to the treadmill and were sometimes tired upon arrival thus possibly affecting their performance, particularly duration on the treadmill itself. It may be possible to achieve the goal of twenty minutes per day by using multiple sessions per day or placing more focus on increasing duration.

When prescribing an exercise program for older adults to participate in, it is essential to consider the frequency, intensity and duration that are suitable for each individual and to make the program specific depending on the persons needs. For older adults it is recommended to increase duration first and the adjust speed (work load) as necessary (10, 11). In the present study the treadmill participants were instructed to walk at their fastest most comfortable speed in one treadmill session as a way increase their HR enough for them to obtain a higher, possibly beneficial, work load (intensity). Upon determining the working intensity considering the target %HRR zone while walking at their fastest most comfortable walking speed, the goal was to increase duration regardless of what the %HRR was. Since it is recommended that older adults increase duration first, if treadmill participants were unable to achieve the recommended duration and or intensity, speed was adjusted (in most cases lowered) so that they could work at a lower intensity for a longer amount of time. If the 40% HRR target intensity could not be

reached by increasing speed, the limiting walking speed factor could have been due motor control challenges. In this specific case, the obtainable walking speed should be maintained while focusing on improving the quality of walking first. Upon achieving the ability to improve walking quality, the aim should then be to increase duration. If the goal for the individual is to achieve a cardiovascular challenge and the %HRR target zone is unattainable at the fastest most comfortable walking speed of the individual, introducing the use of an incline may be helpful. Using an incline would further increase the HR, thus increasing the working intensity of the person on the treadmill without having to increase speed. Whenever introducing an incline while an older adult is walking on the treadmill, they should be aware and understand the change that is going to occur and for safety purposes, conservative judgment should be used depending on the residents' capabilities. In the older adult population living in assisted living settings may not be able to achieve both working at a high intensity for a long duration, therefore having individuality is important while setting goals for each resident should be weighed and the progression protocol should be designed to address the needs of the individual or the desired outcomes of the study.

Specificity of exercise prescription to the desired outcome is important when designing an exercise protocol. The importance of having specificity in research studies can be seen in a few studies that have been done to date. For instance the goal of the twelve week walking program was to walk up to a maximum of 30 minutes a day as the objective of the study was to identify the effects of daily walking on walking endurance capacity (52). To adapt the walking program to each resident, a personal goal was determined each week based on what was achieved by the resident in the previous week; which is a prime example of how important it is to set specific goals for each individual participant and adapt the program each week based on what

the resident is capable of doing (52). Therefore, there is a need to ensure that the exercise program and prescription are consistent with the goal for that individual.

A number of studies have investigated the effectiveness of exercise for improving health related outcomes among older individuals in assisted living settings, however it is not clear what the ideal frequency, intensity and duration are (Table 1 and 2). The inconsistent design and reporting of exercise parameters limits future replication of and comparison with these studies. It is recommended that future studies should consider the importance of goal setting to set achievable goals that are aligned with the participant's abilities to achieve the recommended exercise prescription. Also, researchers should consider using the CONSORT criteria during the design, conduct and reporting of clinical trials. The lack of progression and prescription details were addressed here by developing a protocol a priori for setting a training intensity (See appendix 3) for each treadmill participant based on established methods. The present study also set out to see if the residents could actually achieve a pre-specified frequency, intensity and duration that were based on established guidelines from the ACSM. All studies should provide a description of how exercise parameters of frequency, intensity, duration and mode were chosen and monitored. It is important that results are reported consistently to assist in the formulation of exercise guidelines and to be able to make comparisons between studies.

A limited number of studies have investigated treadmill walking as a form of exercise among institutionalized older adults and have found that treadmill walking has shown promise in improving gait outcomes in terms of velocity, ambulation status, and endurance despite varying methodologies (Table 1). However, research protocols should be more specific when trying to improve the needs of the individual whether it be to increase walking quantity or quality, more when determining methods used to determine exercise intensity and what the frequency of use

for each mode of exercise (56). For instance, it may be more practical and feasible to determine target exercise intensity range in the older adult population by using the Karvonen method, rather than a maximum oxygen consumption test or METS. Future interventions may need to last a minimum of six weeks, as one treadmill study saw no training effects until week six of twelve (68). Also, the ACSM recommends increasing duration as a means of increasing intensity rather than increasing speed or treadmill grade (10, 11, 68). Future work should therefore consider maintaining a level walking surface, while increasing duration and should last at least 6 weeks where health benefits may begin to be seen.

Overall, future research could use the findings of the present study to assess the effectiveness of aerobic exercise programs within the older adult population living in assisted settings. As part of effectiveness, compliance needs to be included as an outcome; compliance is likely to decrease as with a more representative, thus possibly less motivated population. As for the exercise recommendations, health care providers should take note of the protocol for progressing intensity and duration used in the present study as a way to increase physical activity and intensity within older adults, particularly individuals that may be considered sedentary. The protocol presented here may allow older residents to engage in physical activity at a comfortable pace when they are more likely to comply with the program. In addition, the guidelines for endurance exercise for older adults may be accurate for some, but not all residents in assisted living facilities in terms of achievability for HRR intensity and frequency; however, older residents may need more time and multiple sessions within one day to be able to achieve the total duration recommendations.

Limitations

The sample size in the current study was small and may have represented a select group of highly motivated individuals. This could mean that the results of the study are not generalizable to the long-term care population, as treadmill participants in the current study were possibly younger, healthier and more motivated to stay fit. Identifying true differences may not have been identified between treadmill participants and non-treadmill participants in the present study due to the small sample size. The feasibility of recruitment information presented here may not represent the feasibility of recruiting residents to an exercise study in general, as residents may have been willing to participate in a study of another type of exercise such as over ground walking or cycling. A number of methodological and resident-related challenges in recruitment have been identified here and suggestions have been made to overcome them to increase sample size and have a more representative sample for future studies.

The second most common limitation encountered in the literature done to date and also in the current treadmill study was decreased compliance due to scheduling conflicts. Barriers that affected scheduling include events that occur within the facility, including designated meal times. In addition, whenever conducting research in assisted living settings the possibility of medical outbreaks should be taken into consideration. The present study experienced a medical outbreak upon completion of data collection, and was put on hold for a four week period. By possibly having recruited the healthier more motivated residents, they were probably more willing to move around other items on their schedule to be able to attend treadmill sessions. Thus conclusions drawn regarding feasibility, compliance and whether people can obtain the recommended exercise prescription may be limited due to the population recruited.

Only using a treadmill could be considered another barrier to the feasibility of recruitment in the present study because older adults may not want to walk on one for many reasons including that they have never been on one, or are fearful of walking on a treadmill. Future work should consider offering other modes of exercise such as the recumbent stepper, cycling or even over ground walking to provide the participants with options and exercise modes that may be more specific to achieving their goals and meeting their needs.

Future Research

Research exploring the appropriate exercise prescription and progression, monitoring methods, effectiveness of interventions and determinants of exercise participation among older adults is needed to provide evidence-based recommendations to health care providers and residents. A larger multicenter randomized controlled trial of at least six weeks in duration is needed to assess the effectiveness of achieving health benefits of exercise with clearly defined protocols. The larger study should identify the goal and make the prescription specific to that goal. If the participant is able to reach higher intensities, it would be appropriate to identify an intensity target zone and use speed or incline as a means to achieve the intensity. Where the goal is to achieve a specific duration, intensity should be adjusted to achieve it. For those individuals who do not wish to walk on a treadmill, other modes should be considered and utilized, such as over ground walking or recumbent stepper. It would be important in this case to record and accurately report the mode(s) used and the frequency of use per mode of exercise. The current study does not provide information about whether older adults in assisted living settings will persist with a training regimen using this protocol or whether it is associated with significant health benefits. The method of determining and progressing exercise intensity and duration used in the present study may allow older adults to adjust and adapt to exercising more slowly. Having a standardized protocol for progression specific to the residents' abilities could also increase compliance as participants would feel additional control over the exercise and therefore enjoy it more.

Conclusions

The current study provides preliminary evidence that it is feasible to recruit and retain older adults in assisted living facilities to participate in a three week treadmill walking study. Because the present study just met 30% recruitment, future work should consider the needs of the individual and use other modes of exercise if necessary. Treadmill participants were able to achieve ACSM's recommended intensity and frequency for aerobic or endurance exercise. Difficulties were seen in achieving the recommended duration of twenty minutes. The current study provides information for future studies involving treadmill walking and the older adult population within assisted living in regards to more rigorous recruitment strategies, methodology for intensity progression and ways to increase total duration. Future research evaluating the effectiveness of exercise for LTC residents should consider multicentre trials to increase sample size, should aim to improve reporting and should adopt consistent protocols for determining and progressing intensity, frequency and duration.

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Appendices:

1) **Recruitment Materials (p 65)**

Checklist for Residents Participation

Information Letter to Residents and Families

Telephone Script

Physician Permission Letter

Informed Consent

Refusal Questionnaire

Eligibility Form

2) **Outcomes (p 75)**

Chart Abstraction

Protocol Checklist

6-minute Walk Test

Gait and Treadmill Information incl. Qualitative Question and Exercise Log

Modified Mini Mental State Examination (3MS)

Activity related Fall Concern Scale (AFC)

Beck Depression Inventory Scale (BDI)

Mosby Pain Rating Scale

Rate of Perceived Exertion (RPE)

3) **Standard Operating Procedure for Treadmill Intensity Progression (p 86)**

Volunteers Required for a Research Study

We are looking for individuals 65 years of age or older who can safely walk 2 meters, with or without aids, to participate in a research study. The purpose of the study is to determine the amount of exercise people 65 years or older are capable of.

All participants in the study will be asked:

- To perform a walking test
- To allow researchers to record medical history information from their charts
- To walk on a treadmill while secured by a safety harness one or more times

If you do not wish to walk on the treadmill you can still participate by answering an exit questionnaire and performing a walking test.

If you might be interested in participating in the study and would like more information, please contact:

Susan Brown, Research Associate at 519.571.1873 ext. 129

OR

Please check an item below and return this sheet to the Main Office:

□ I would like more information about the study.

□ I do not wish to walk on a treadmill, but I might be willing to complete a brief interview and walking test.

□ I do not want to participate in any aspect of this study.

Name: _____ Phone #: _____

November 2008

Dear Residents and Family Members,

The Village of Winston Park is involved in a research study regarding ambulation (walking) and treadmill exercise. In December and January, a researcher from the University of Waterloo, Lora Giangregorio, and her graduate students will be testing residents in our fitness room, measuring their walking ability on the treadmill. To participate, we require the consent of the participant or their legally authorized representative. Please read the following information about the research study. Kindly sign the consent portion if you agree to have your loved one participate in the study, and return this signed consent form to the main office at Winston Park. A member of the research team will call you shortly to discuss the details of the study further.

The purpose of the study is to determine if treadmill walking is a feasible type of exercise for the older adult population living in long-term care and retirement settings. To be included participants much be at least 65 years of age or older, be able to safely walk 2 meters with or without an assistive device, and to be able to follow two-step commands. The study is also interested in determining characteristics of the residents who refuse to walk on the treadmill but might be interested in answering a questionnaire and performing a walking assessment. Participants who consent to fully participate will perform a walking assessment, answer a few questionnaires to assess concerns with falling and cognitive function, and walk on the treadmill for 1 to 6 sessions.

The Schlegel-UW Research Institute for Aging (RIA) brings top researchers from across Canada to study the aging process with the participation of staff and residents in Oakwood homes. The overall goal of the RIA is to enhance the care that residents receive in both long-term care, retirement homes, and in the broader community through research and training. The RIA only supports research with direct application to practice and care. All studies are reviewed and receive clearance through a University Office of Research Ethics prior to beginning in any of our facilities.

If you have further questions, do not hesitate to contact Susan Brown (Research Associate with the RIA). She can be reached by phone (519.571.1873 ext. 129) or email (sgbrown@rbjschlegel.com)

Matt Drown
General Manager
The Village of Winston Park
519.576.2430 ext. 222
mdrown@winstonpark.net

CC: Susan Brown (Research Associate, Schlegel-UW Research Institute for Aging)

TELEPHONE SCRIPT – OBTAINING CONSENT TO PARTICIPATE

Participant's Name:

Date Contacted:

Hello Ms/Mr._____, my name is _____, I am a research assistant calling on behalf of Dr. Lora Giangregorio, a researcher at the University of Waterloo. Dr. Giangregorio is working with the Village of Winston Park on a research study on treadmill walking ability among residents living in long-term care and retirement settings. The results of this research will help identify if treadmill walking is a feasible type of exercise for the older adult population. Your family member is being asked to participate in this study because they live at the Village of Winston Park.

Several weeks ago, we mailed you some information about the study that we are doing. Did you receive this information letter? Have you had a chance to look at it? {If not, summarize study}

We are asking approximately 30 men and women who live in Winston Park to participate in a research study. Your family member will be asked to participate in a session where they walk across a mat to collect information about how they walk and to complete a serious of questionnaires. For the residents willing to will walk on a treadmill while secured in a safety harness for 1 to 6 sessions, where walking information and heart rate will be collected. All participants will also be asked to give the researchers permission to look at their medical charts to collect information about their medical history. The initial research session will take approximately 1 hour and will be conducted at a time that is convenient for your family member. A total of 6 treadmill sessions will be scheduled for the resident where they will walk at a comfortable speed and duration.

The reason we are calling is that in addition to obtaining your family member's consent, we would like to obtain your consent for them to participate in this research. Do you have any questions about anything I have mentioned?

Do you consent to having your family member participate in this research?
□ Yes
□ No

{If no, thank you very much for your time.}

I want to thank you for agreeing to participate and if you have any questions about this study, you are welcome to contact Susan Brown, Research Associate for Oakwood Long-term care facilities anytime at 519.571.1873 ext. 129

Dear Dr _____:

We are writing to you in regards to your patient, _____, who is interested in participating in a research study at Winston Park Retirement and Long-Term Care facility that involves participating in treadmill walking. The research study will involve a total of 6 treadmill sessions. During each treadmill session the participant will walk for short (2 to 10 minute) bouts with rest in between. The speed and duration of each bout is self selected by the resident. The goal of the study is to determine if treadmill walking is a feasible mode of exercise for the older adult population. We will be continuously recording heart rate using a polar heart rate monitor while they are on the treadmill as well as their rate of perceived exertion. We do not expect to see any significant physiological changes as a result of the treadmill walking as this exercise study only involves 6 treadmill sessions.

The purpose of this letter is to inform you that your patient is considering participation in this study, and to determine if there is any medical reason why they should not participate. We are requesting that you complete the items below and fax the completed form to us at 519 576 8990 attn: Jenna Johnson. Should you have any questions, please do not hesitate to contact us. We would be happy to provide a copy of the study protocol or speak with you about the study if you require more details prior to completing the attached form.

Sincerely,

Jenna Johnson, B.Sc Kin
Master of Science Candidate
Department of Kinesiology
University of Waterloo
Cell - (416) 845 1029

Dr. Lora Giangregorio
Assistant Professor
Department of Kinesiology
University of Waterloo
Cell - (519) 362 5672

☐ **I have reviewed the patients' medical chart and provide clearance for _____ to participate in the treadmill walking study.**

☐ **I have reviewed the patients' medical chart and have some concerns. I would like additional information, please contact me at: _____.**

☐ **I have reviewed the patients' medical chart and do not want _____ to participate in the treadmill walking study.**

Physician Signature: _____

Comments:

_____

_____

_____

Participant Information Sheet and Consent Form

Title of project:
Treadmill walking for improving musculoskeletal health and mobility in individuals living in long-term care: a pilot, feasibility study

Primary Investigator: Lora Giangregorio
University of Waterloo, Department of Kinesiology
(519) 888-4567 Ext. 36357
or by email at lmgiangr@uwaterloo.ca

Co-investigators: Dr. Bill McIlroy, Dr. Eric Roy, Dr. Alexandra Papaioannou, Dr. Lehana Thabane, Dr. Richard Cook

Student Investigators: Jenna Johnson

You are being invited to participate in a research study. To decide whether or not you want to be a part of this research study, you should understand what is involved. This form gives detailed information about the research study, which will be discussed with you. You will be asked to sign this form if you wish to participate. Please take your time to make your decision.

Why is this research being done?

Physical inactivity in older adults is a major public health concern. Inactivity is linked to functional decline and dependence on others. Using new technology, we will collect information about exercise and walking ability in individuals aged 65 years and older living at Winston Park facility.

What is the purpose of the study?

The purpose of the study is to understand the characteristics of individuals 65 years of age or older interested in exercising on a treadmill. The study will also evaluate walking patterns, exercise capabilities and if treadmill walking is an appropriate method of exercising in the older adult population.

What will my responsibilities be if I decide to take part in the study?
If you volunteer to participate in the study, you will be asked to participate in one walking assessment lasting approximately one hour. During the assessment you will be asked to do the following things:

1. You will be asked to walk 10 metres across a pressure-sensitive mat 2-3 times as well as performing a 6 minute walk test. The mat looks like a thin rubber carpet. You will be asked to walk at your most comfortable walking speed. You will be able to walk with your usual walking aid if needed and take breaks as required.
2. You will be asked to provide consent to the research team to record your medical history. The research team will record your medical history by checking your medical records at the facility where you live. The data will be collected by a researcher or student working on the project. We are collecting information such as health problems, medications,

history of falls and injuries and anything that might be related to a risk of falling. This will help us describe the group of people we are studying.

3. You will be asked to complete a series of questions about whether you have concerns of falling while completing certain daily activities. For example, we would ask you how confident you are that you could maintain your balance during activities such as walking. You will also complete a series of questions to assess your memory. For example, we might ask you to recall when you were born.

If you volunteer to participate in the study, you will be asked to participate in treadmill walking exercise session. You will do the exercise session 1 - 6 times in total; walking assessment in week one, twice in week two, and three times in week three. You will be supervised at all times. You will still receive the same level of care that you would have received if you were not in the study. You will also be asked to answer a few questions about the experience of walking on a treadmill.

What are the possible benefits of the study for me and/or society?

We cannot promise any personal benefits to you from your participation in the study. This study will benefit society by evaluating the exercise capabilities is the older adult population and help develop future exercise studies.

What are the possible risks and discomforts?

The risks associated with participation are minimal. Your Doctor's approval will be sought before you participate in the study. It is possible that you may experience muscle soreness and other exercise-related outcomes, such as changes in blood pressure and heart rate. Other potential risks include:

1) There is a risk that you might fall during the walking test. The risk is not expected to be any higher than the risk of falling during everyday walking. There will be at least two individuals present during the walking tests. They will stand nearby to help prevent a fall. You can use a walking aid if you wish to reduce the risk of a fall.

2) There is a risk that you might fall while walking on the treadmill. You will be secured into a safety harness, (seen in the picture) that can support body weight; this will minimize the risk of injury if a fall occurs. A small number of people have experienced chafing from the harness, which can be minimized with the use of foam.

How many people will be in this study?

Thirty individuals aged 65 years and older who live in at Winston Park Long-Term care or retirement home will be recruited to participate.

What information will be kept private and confidential?

Your data will not be shared with anyone except with your consent or as required by law. All personal information will be removed from the data and will be replaced with a number. A key file linking the ID with your name will be separate from the data and will be stored on a password protected computer. A hard copy of the key file and all forms and study materials will

be stored in Dr. Giangregorio's locked office in Burton Matthews Hall at the University of Waterloo. Paper and electronic records will be retained indefinitely. Only the research team will have access to the data. Some of the data will be used as part of student thesis projects and research internships, but your name or other identifying information will not appear with the data.

If I do not want to take part in the study, are there other choices?

It is important for you to know that you can choose not to participate in the study. If you choose not to participate it will in no way affect the regular therapy or health care that you receive at Winston Park Facility. You are under no obligation to participate and may withdraw from the study at any time by advising the researcher of this decision.

If you choose not to participate in the study, we will ask you to complete a questionnaire, walk across a 14 foot long mat to determine your walking ability and if you will allow the research team to access your medical charts at the facility. The reason we are collecting this information is to help us determine if there are any significant differences between people who participate in the study and those who do not. The questionnaire and walking assessment will take 10-20 minutes. You can choose not to complete the questionnaire if you wish.

Can I end my participation early?

If you volunteer to be in this study, you may withdraw at any time and this will in no way affect the quality of care you receive at this institution. You have the option of removing your data from the study. The investigators may withdraw you from this research if circumstances arise which warrant doing so.

Will I be paid to participate in this study?

There is no remuneration for participation in this study.

Are there any costs to me for my participation?

Your participation in this research project will not involve any additional costs to you or your health care insurer.

What happened if I have a research-related injury?

If you sign this consent form it does not mean that you waive any legal rights you may have under the law, nor does it mean that you are releasing the investigators, institutions and/or sponsors from their legal and professional responsibilities. Financial compensation for such things as lost wages, disability or discomfort due to injury is not routinely available.

Consent of Participant

I have read the information presented in the information letter about a study being conducted by Dr. Giangregorio and colleagues at the University of Waterloo and McMaster University. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact Dr. Susan Sykes, Director, Office of Research Ethics at 519-888-4567 ext. 36005.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study. I understand that I will receive a signed copy of this form

Consent Statement

Name of Participant

_____

Name of Legally Authorized Representative (if applicable)

_____

Signature of Participant or Legally Authorized Representative Date

_____ _____

Name of Witness

_____

Signature of Witness Date

_____ _____

REFUSAL QUESTIONNAIRE

It is important for us to know if there are significant differences between people who choose to participate in our study and people who do not. Would you mind answering a few brief questions that will be used to determine if the group of people who did not participate are different than those who did? Your name or any identifying information will not be used with this information.

1. What is your age? _____ Gender: □ Male □ Female

2. Do you use a wheelchair, walker or other aid to help you get around? (check all apply)

- ❑ Wheelchair
- ❑ Walker
- ❑ Other: _____
- ❑ None of the above

If yes, what do you use most often?

- ❑ Wheelchair
- ❑ Walker
- ❑ Other: _____

3. Would you be willing to allow the research team to access your medical chart to record health-related information so that we can look at differences between those that did and did not participate in the study?

- ❑ Yes
- ❑ No

4. Would you be willing to perform a 6 minute walk test and walk across a 14 foot long mat (GAITRite mat) 1-2 times to assess your walking ability so that we can look at differences between those that did and did not participate in the study?

- ❑ Yes
- ❑ No

5. Would you be willing to answer questions about any concerns you may have with activities of daily living so that we can look at differences between those that did and did not participate in the study?

- ❑ Yes
- ❑ No

Eligibility Form

Please check whether the resident meets the inclusion criteria below and does NOT meet the exclusion criteria.

Inclusion Criteria

Able to safely walk 2 metres independently (with or without assistive aids) (<0.8m/s) □

Greater than 65 years of age □

Able to follow two-step commands □

Exclusion Criteria

Physician declines resident for participation □

Walking ability of community ambulatory (>0.8m/s) □

One of the following: palliative care, Parkinson's, Stroke, Multiple Sclerosis, peripheral neuropathy or other neurological condition severely affecting physical function □

If the patient fulfills all of the criteria above, they are eligible for the study.

Is the patient eligible for the study? □ YES □ NO

Form completed by: _____

Date of informed consent: __ __ __ __ **year** __ __ **month** __ __ **day**

CHART ABSTRACTION

DOB: __ __ __ __ year__ __ month __ __ day Gender: □ Male □ Female

Date began living at Oakwood Facility: __ __ __ __ year __ __ month __ __ day

Height: _____ cm Weight: _____ kg Nutritional risk: _____

Medical conditions:

□ Alzheimer's □ Arthritis □ CHD□ Hypertension □ Cancer
□ Diabetes □ Respiratory □ Parkinson's □ Renal □ Osteoporosis
□ Peripheral vascular disease □ Rheumatoid Arthritis □ Osteoarthritis
□ CVA (indicate side of weakness if applicable):_____
□ History of arthroplasty (specify site and side): _____
□ Musculoskeletal disease/disorder: _____
□ Problem with vision: _____
□ Other: _____ □ Other: _____
□ Other: _____ □ Other: _____
□ Other: _____ □ Other: _____
□ Other: _____ □ Other: _____

Behaviours: _____

Medications: _____
_____
_____
_____
_____
_____
_____

Mobility:

Wheelchair: □ NO □ YES: □ manual □ electric
Walking aid: □ NO □ YES:
□ Walker: □ 4-wheeled □ 2-wheeled □ standard
□ Cane: □ quad □ straight
□ Other: _____

Falls:

Experience any falls in the past year: □ NO □ YES
If YES: How many? _____

Admission Profile:

Cognitive Losses:
□ Disoriented time □ Place □ Person □ Word searches
□ Hallucinates □ Short-term memory loss □ Parkinson's

History of any fracture? □ NO □ YES

Fracture 1:
Date of fracture: __ __ __ __ year __ __ month __ __ day
Site/Side of fracture: _____
Mechanism of injury (i.e. fall): _____

Fracture 2:
Date of fracture: __ __ __ __ year __ __ month __ __ day
Site/Side of fracture: _____
Mechanism of injury (i.e. fall): _____

Fracture 3:
Date of fracture: __ __ __ __ year __ __ month __ __ day
Site/Side of fracture: _____
Mechanism of injury (i.e. fall): _____

Fracture 4:
Date of fracture: __ __ __ __ year __ __ month __ __ day
Site/Side of fracture: _____
Mechanism of injury (i.e. fall): _____

MEMORY AND ORIENTATION

Orientation to facility environment: _____
Identification and recognition of staff and their roles: _____
Ability to remember instructions: _____

Protocol Checklist

Week 1: Session 1/7 Time of Day : _ _: _ _ (24 hours)

- □ Consent form signed and filed
- □ Put on heart rate (HR) monitor
- □ Put on accelerometers
- □ HR watch on walker / chair / wrist
- □ Conduct 3MS
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain 6 Minute Walk Task (6MWT)
- □ Complete 6MWT – record data
- □ Ask QL Q's while seated
- □ Explain walks over GAITRite Mat
- □ Walk 2 – 3 passes across the GAITRite Mat
- □ Sit down and remove HR monitor, accelerometers
- □ Thank You and Schedule next treadmill session
- □ Complete chart abstraction

Week 1: Session 2/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor
- □ Put on accelerometers
- □ HR watch on walker / chair / wrist
- □ Conduct AFC
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: determine self selected walking speed (max 6 min)
- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor and accelerometers
- □ Thank You and Schedule next treadmill session

Week 2: Session 3/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor
- □ HR watch on walker / chair / wrist
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: determine fastest most comfortable walking speed (max 6 min)

- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill (2-3 bouts)
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor
- □ Thank You and Schedule next treadmill session

Week 2: Session 4/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor
- □ HR watch on walker / chair / wrist
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: walk at fastest most comfortable walking speed aim to increase duration
- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill (3 bouts)
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor
- □ Thank You and Schedule next treadmill session

Week 3: Session 5/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor
- □ HR watch on walker / chair / wrist
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: walk at determined speed for as long as they want/can, increase speed if desired and as tolerated
- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill (3 bouts)
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor
- □ Thank You and Schedule next treadmill session

Week 3: Session 6/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor
- □ HR watch on walker / chair / wrist
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: walk at determined speed for as long as they want/can, increase speed if desired and as tolerated
- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill (3 bouts)
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor
- □ Thank You and Schedule next treadmill session

Week 3: Session 7/7 Time of Day : _ _: _ _ (24 hours)

- □ Put on heart rate (HR) monitor and accelerometers
- □ HR watch on walker / chair / wrist
- □ Conduct AFC
- □ Ask 1st half of Scale Questions
- □ Put on BP cuff
- □ Sit quietly for 1 minute
- □ Measure and record resting HR and BP
- □ Explain how harness will be attached
- □ Explain treadmill session goal: walk at determined speed for as long as they want/can, increase speed if desired and as tolerated
- □ Attach harness, adjust as needed
- □ Resident stands up and begins to walk on treadmill (3 bouts)
- □ Ask RPE and measure HR every minute
- □ Sit resident down, remove harness
- □ Ask 2nd half of Scale Questions
- □ Record HR – ensure back to resting
- □ Remove HR monitor and accelerometers
- □ Provide resident with contact information, Thank You!

6 MINUTE WALK TEST

The following elements should be present on the 6MWT worksheet and report:

ID# _____ Date: _____

Blood pressure: _____ / _____
Time ___:___ ___:___
Heart Rate _____ _____
Stopped or paused before 6 minutes? No Yes, reason:
_____
_____
Other symptoms at end of exercise: angina dizziness hip, leg, or calf pain

Number of laps: _____ *(xx meters) final partial lap: _____ meters

Total distance walked in 6 minutes: _____ meters

Average Gait Velocity (m/s): _____

Average Step Length (cm, L/R): _____

Average Cadance (steps/min): _____

Average Gait Asymmetry (calculated by software): _____

Gender: M F Age: ____ Height: ___ft ____in, ____ meters

Weight: _____ lbs, _____kg

Medications taken before the test (dose and time): _____

Supplemental oxygen during the test: No Yes, flow _____ L/min, type _____

Gait and Treadmill Information

GAITRite Trials (Baseline)

Trial (Time of day)	Velocity (m/s)	Aid (Y/N)	Notes:
1 ( )			
2 ( )			
3 ( )			
4 ( )			

Do you have any questions or concerns with walking on a treadmill? Yes/No (Explanation)

_____

_____

_____

_____

Treadmill Measures

Bout 1	Speed (km/h)	Duration (min:sec)	Distance (m)	Heart Rate (bpm)	RPE
I					
II					
III					
Total					
Avg.					

Rest Time (min:sec) : _____

Bout 2	Speed (km/h)	Duration (min:sec)	Distance (m)	Heart Rate (bpm)	RPE
I					
II					
III					
Total					
Avg.					

Rest Time (min:sec) : _____

Bout 3	Speed (km/h)	Duration (min:sec)	Distance (m)	Heart Rate (bpm)	RPE
I					
II					
III					
Total					
Avg.					

Rest Time (min:sec) : _____

Comments/Notes:_____

_____

_____

The Modified Mini-Mental State (3MS)

Examiner _____ Normal or Dx _____ Edu /yrs_____

3MS _____ /100 MMS _____/30

3MS	MMS		
		DATE AND PLACE OF BIRTH Date: year _____ month_____ day _____ Place: town _____ state_____	
__/5			
__/3	__/3	REGISTRATION (No. of presentations: _____) SHIRT, BROWN, HONESTY (or: SOCKS, BLACK, MODESTY) (or: SOCKS, BLUE, CHARITY)	
__/7	__/5	MENTAL REVERSAL *5 to 1*	
		Accurate	2
		1 or 2 errors/misses	0 1
		DLROW	0 1 2 3 4 5
__/9	__/3	FIRST RECALL	
		Spontaneous recall	3
		After "Something to wear"	2
		"SHOES, SHIRT, SOCKS"	0 1
		Spontaneous recall	3
		After "A color"	2
		"BLUE, BLACK, BROWN"	0 1
		Spontaneous recall	3
		After "A good personal quality"	2

3MS	MMS		
__/10		FOUR-LEGGED ANIMALS (30 seconds) 1 point ea.	
__/6		SIMILARITIES	
		Arm-Leg	
		Body part; limb; etc	2
		Less correct answer	0 1
		Laughing-Crying	
		Feeling; emotion	2
		Other correct answer	0 1
		Eating-Sleeping	
		Essential for life	2
		Other correct answer	0 1
__/5	__/1	REPETITION	
		"I WOULD LIKE TO GO HOME/OUT"	2
		1 or 2 missed/wrong words	0 1
		"NO IFS___ANDS___OR BUTS___"	
__/3	__/1	READ AND OBEY "CLOSE YOUR EYES"	
		Obeys without prompting	3
		Obeys after prompting	2
		Reads aloud only (spontaneously or by request)	0 1
__/5	__/1	WRITING (1 minute)	
		(I) WOULD LIKE TO GO HOME/OUT (MMS: Spontaneous sentence: 0 1)	
		COPYING TWO PENTAGONS (1 minute)	

"HONESTY, CHARITY, MODESTY" 0 1 10 1

15 5 TEMPORAL ORIENTATION

Year

Accurate	8
Missed by 1 year	4
Missed by 2-5 years	0 2

Season

Accurate or within 1 month	0 1

Month

Accurate or within 5 days	2
Missed by 1 month	0 1

Day of month

Accurate	3
Missed by 1 or 2 days	2
Missed by 3-5 days	0 1

Day of week

Accurate	0 1

5 5 SPATIAL ORIENTATION

State	0 2
County	0 1
City (town)	0 1
Hospital/office building/home?	0 1

5 2 NAMING (MMS: Pencil ___ Watch ___)
Forehead ___ Chin ____
Shoulder ____
Elbow _____ Knuckle _____

	Each Pentagon
5 approximately equal sides	4 4
5 unequal (>2:1) sides	3 3
Other enclosed figure	2 2
2 or more lines	0 1 0 1
	Intersection
4 corners	2
Not 4-corner enclosure	0 1

3 3 THREE-STAGE COMMAND

___ TAKE THIS PAPER WITH YOUR LEFT/RIGHT HAND
___ FOLD IT IN HALF, AND
___ HAND IT BACK TO ME

9 SECOND RECALL

(Something to wear)	0 1 2 3
(Color)	0 1 2 3
(Good personal quality)	0 1 2 3

(Teng EL, Chui HC. A Modified Mini-Mental State (3MS) Examination. Journal of Clinical Psychiatry 1987;48:314-318. Copyright Physicians Postgraduate Press. Reprinted with permission.)

A. Explanation: to be read to the resident while showing the response card

"We are going to ask you whether you are more careful or cautious in certain situations. First, let me show you the answer choices."

"Does this remind you of anything?" ___ says traffic light; ___says No. In any case, reinforce that **"this is like a traffic light with one more color (orange)".**

"Can you see the colors okay"? Yes____ (what are they?) No____ If person has vision problems, administer verbally (with or without the card), repeating the choices (go, a little careful, very careful, wait or stop) for each item or as needed.

Explain: **"Like traffic lights, green is for GO, yellow and orange mean proceed with CARE or CAUTION, while red means WAIT OR STOP. Point to the green circle when you just GO ahead and do something. Point to the yellow when you are "a little careful" or the orange when you are "very careful". Point to the red circle, when you would wait or stop, for example until someone came to help you or the situation changes. You can point to one of these circles or just tell me."**

"Do you have any questions?" If yes, note:_____

WHEN SURVEY IS COMPLETE:

Optional: may wish to ask: " we would like to know what kind of day you are having?" (may help explain discrepant responses on repeat administrations of the tool)

1 = good day 2 = average/regular day 3 = bad day

Record time for administration: _____

Note any problems with administration and be sure to note any uncertain or qualified responses beside the item itself on C.

Resident Name/ID #:_____ **Assessor:**_____

Date: _____ **Start Time:** _____ (am or pm)

B. Practice Questions:

"Now, let's try a few examples." Point to each response choice on the card as you read.

1. ***"Say you had a very hot cup of coffee, tea or soup. "What would you do?"*** **Green: go ahead and drink? Yellow: sip a little carefully? Orange: sip very carefully? Red: Wait or Stop: don't drink till it cools**? Resident response: _____

If person appears to understand the response options, proceed to the next example.

2. **"*Now, let's suppose you were sitting in a chair without arms. You want to get up and no one is around. Your _____(gait aid) is right next to you. What would you do?*** **Green: go ahead and get up? Yellow: get up a little carefully? Orange: get up very carefully? Red: Wait or Stop: until someone comes to help**? Response: _____

Does the resident appear to understand the task? ___ Yes (proceed)

___ No. Explain why here:_____ If clearly confused, do not proceed with scale administration. If uncertain, try a few items.

Prior to Tool Administration:

Does the person use any gait aids? ___No ___Yes

If yes, **specify all types** (walker, cane, wheelchair): _____

And **situation**s (e.g., may use their walker all the time or only outside their room; may use a wheelchair to go outside or for long distances):_____

_____

Notes when administering the AFC Scale:

a) refer to their personal gait aid (e.g., walker), as applicable, for each situation.

b) use your judgment whether to repeat the instructions and response options for all 13 items (situations). For some people, the instructions and answer choices may need to be repeated each time. Others, meanwhile, may only need occasional reminders.

C: The 13-item AFC Scale©

Instructions: *Now, we'll talk about some other activities. This time, I want you to tell me whether you are more careful or cautious because you may be worried about falling.*

No one is around to help, but your _____ (gait aid) is handy.

Suppose you are (e.g., # 1: sitting on the side of the bed and you wanted to reach for…), what would you do? Just go ahead and do it, be a little careful, be very careful or stop and wait till someone comes to help?

1. Sitting on side of the bed and reaching for something at far end of side table? _____
2. Getting in or out of bed? _____ *(suppose you wanted to get in or out of bed)*
3. Getting up during the night? _____ *(how about…)*
4. Standing at the sink and washing your hands? _____ *(when you are…)*
5. Turning around to sit down? _____ *(how about when you are…)*
6. Putting your sweater on or taking it off?_____
7. Reaching up into your closet to get your clothes off a hanger? _____
8. Bending over to pick something up from the floor? _____
9. Walking down a **busy** hallway? _____
10. When you see a spill or a wet floor sign? _____
11. The floor surface changes say from tile to carpet or the floor slopes? _____
12. Moving around a room **full** of people, furniture, or walkers? _____

We realize someone there may be someone to help you get in and out of a car. Still are you more careful or cautious because you may be worried about falling when…?

13. Getting in or out of a car? _____

Scoring: 0 = Go (green); 1 = a little careful; 2 = very careful; 3 = Wait or stop (red)

Total Score:_____ (possible total score can range from 0 to 39)

(Please refer to scoring instructions)

Beck Depression Inventory Scale

0	I am not sad at all
1	
2	I feel a little sad
3	
4	
5	I feel sad
6	
7	
8	I am sad all the time and I can’t snap out of it
9	
10	I am so sad or unhappy that I can’t stand it

Mosby Pain Rating Scale

0	No Pain at all	
1		
2	Hurts a little (mild)	
3		
4	Hurts a little more	
5	(moderate)	
6	Hurts even more	
7		
8	Hurts a whole lot (severe)	
9		
10	Worst possible pain	

Rate of Perceived Exertion

0	nothing at all
0.5	very, very light (just noticeable)
1	very light
2	light
3	moderate
4	somewhat hard
5	hard (heavy)
6	
7	very hard
8	
9	
10	very, very hard (maximal)

1) Determine resting HR: _____bpm resting BP: _____ / _____
2) Age predicted max HR: 220 - age = _____bpm
3) Target HR (40% to 60%): Karvonen Method
    a. (HR max – HR rest)*0.4 + HR rest = _____bpm
    b. (HR max – HR rest)*0.6 + HR rest = _____bpm
    Therefore **Target HR range: _____bpm to _____bpm**
4) Perform 6MWT
    a. HR at 1 min: _____bpm
    b. HR at 2 min: _____bpm
    c. HR at 3 min: _____bpm
    d. HR at 4 min: _____bpm
    e. HR at 5 min: _____bpm
    f. HR at 6 min: _____bpm Average HR: _____bpm
5) Any Medication that could affect HR?
    Y / N, if Y, which one: _____ and how: _____
6) Treadmill Session 1:
    a. Max HR achieved _____bpm Speed: _____km/h
    b. Is this within the Target HR range above? Y / N
7) Treadmill Session 2: speed_____km/h
    a. Max HR Bout #1 _____bpm
    b. Max HR Bout #2 _____bpm
    c. Max HR Bout #3 _____bpm
    Did the resident reach THR minimum? Y / N
    Is there room for progression? Y / N
    If Y, Enter moderate intensity group
    If N, Enter light intensity group ***decision point***
8) Treadmill session 3 – 6
    a. HR Bout #1 _____bpm
    b. HR Bout #2 _____bpm
    c. HR Bout #3 _____bpm
    Moderate Group: Aim to increase intensity via increasing duration first, then speed as tolerated and or requested by resident. You should not need to increase intensity above 60% to 70%.
    Light Group: Aim to improve gait qualitatively and to increase duration with constant speed with support if needed.