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Using the Concept of Environmental Press to Examine the Built Environment and Physical Activity Among Older Adults Lying in Long-Term Care Homes

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USING THE CONCEPT OF ENVIRONMENTAL PRESS TO EXAMINE THE BUILT ENVIRONMENT AND PHYSICAL ACTIVITY AMONG OLDER ADULTS LIVING IN LONG-TERM CARE HOMES

KATHERINE MORGAN

Thesis submitted to the Faculty of Graduate and Postdoctoral Studies in partial fulfilment of the requirements for the MSc degree in Epidemiology

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ABSTRACT

OBJECTIVE: To apply the concept of environmental press to study the relationship between the built environment and physical activity among older adults living in long-term care (LTC) homes.

METHODS: This cross-sectional study used a questionnaire to assess physical activity among 78 seniors living in seven LTC homes. Secondary data analysis of existing environmental scans divided the homes into two levels of environmental press. Type and duration of physical activity were compared between seniors living in homes with appropriate and inappropriately high levels of environmental press.

RESULTS: Seniors' total amount of physical activity did not differ between the two groups of homes. Seniors living in homes with appropriate environmental press were more likely to receive physiotherapy and less likely to stretch alone than those living in homes with inappropriately high environmental press.

CONCLUSIONS: Environmental press did not significantly influence seniors' total participation in physical activity. Validated environmental assessments tailored to LTC settings are needed.

CHAPTER ONE: INTRODUCTION

This chapter introduces the issue of physical inactivity among seniors residing in long-term care settings, describes the concept of environmental press, introduces the original study upon which this thesis was based, and outlines the purpose and structure of the thesis.

The Issue

Physical inactivity has become a major public health issue, with seniors aged 75 and older reporting the greatest levels of inactivity (Statistics Canada, 2001). The benefits of physical activity among the elderly are well documented and include reductions in risk for cardiovascular disease, diabetes, arthritis, obesity, Alzheimer's disease, falls, malnutrition and depression (Baker, Atlantis & Fiatrone Singh, 2007; Hussey & Wilson, 2003; Schmid, Weiss & Heseker, 2003; Taylor et al., 2004).

Compared to seniors living independently in the community, few empirical studies have examined physical activity among seniors living in long-term care (LTC) settings. LTC homes "provide care and services for people who no longer are able to live independently or who require onsite nursing care, 24-hour supervision or personal support" (Ministry of Health and Long-Term Care, Ontario, 2007, p.1). In 2004, over 70,000 seniors lived in LTC homes in Ontario (Ministry of Health and Long-Term Care, Ontario, 2004). This number is expected to grow as the Canadian population ages. The proportion of seniors is expected to double between the years 2005 and 2036, increasing from 13.2% to 24.5% of the Canadian population (Statistics Canada, 2006).

Physical activity may be broadly defined to encompass "all leisure and non-leisure body movement produced by the skeletal muscles and resulting in an increase in energy

expenditure" (Caspersen, Powell & Christenson, 1985, p.126; Public Health Agency of Canada [PHAC], 2005a). Physical activity includes informal or recreational activities, such as taking a leisure walk outdoors; formal or structured activities, such as group exercise or physiotherapy sessions; and instrumental or purposive activities, such as walking for transportation. Different types of physical activity offer different physiological benefits. Endurance or aerobic activities strengthen or maintain cardiovascular and respiratory functioning, strength training increases or maintains skeletal muscle and bone strength, balance activities improve posture and balance, and flexibility activities increase the range of motion of muscles and joints (Hui & Rubenstein, 2006).

Physical activity, even walking, can be difficult for the frail elderly who have weak muscle strength and balance (Baum, Jarjoura, Polen, Faur & Rutecki, 2003). Falls are very common in LTC homes, and a fear of falling may not only inhibit residents from participating in physical activity, but also inhibit care providers from encouraging active behaviours (Scheonfelder, 2004). Yet, several studies have demonstrated that seniors living in LTC homes can achieve significant improvements in muscle strength, functional mobility, flexibility and balance by increasing their level of physical activity (Baum et al., 2003; Evans, 1999; Lazowski et al., 1999; Taylor et al., 2004). These improvements can in turn help reduce their risk of morbidity and mortality.

Still, older adults report a number of other barriers to physical activity, including individual factors (e.g., age, gender, and health status), social and organizational factors (e.g., level of social support, policies, level of physical activity programming), and physical environmental factors (e.g., hazards in the built environment, inclement weather, hilly terrain) (Rasinaho, Hirvensalo, Leinonen, Lintunen & Rantanen, 2007; Schutzer & Graves,

2004). The present study focuses on the interaction between the built environment and physical activity among older adults living in LTC homes.

In recent years, the influence of the built environment on health has received increasing attention in a number of disciplines, including public health, epidemiology, transportation, and urban planning (Dannenberg et al., 2003). The built environment is a complex, multidimensional concept that can be examined at different levels (Handy, Boarnet, Ewing & Killingsworth, 2002). At the neighbourhood or regional level, the built environment includes transportation systems, land-use patterns, street connectivity, and aesthetic qualities of communities and cities (Cunningham & Michael, 2004). At the building or site level, it has been described as the structural and interior design features of buildings and homes (Morgan & Stewart, 1999), and the "fixed, semi-fixed, and unfixed components of the physical structure, the furnishings, fixtures, décor, and equipment used" (Cutler & Kane, 2005, p.34). For the present study, the built environment is described as the interior, exterior, and structural design features of LTC homes, including those which are fixed (e.g., floor plan, type of flooring), semi-fixed (e.g., furniture), and unfixed (e.g., clutter, ambient light).

The concept of "environmental press" helps describe the relationship between the built environment and physical activity. Environmental press is the stress or demand that environmental characteristics place on people's ability to negotiate in, or adapt to, their environment. It can be present within physical or social environments; and can be positive, negative, or neutral depending on how it affects the individual (Lawton & Nahemow, 1973). Certain features of the built environment can create environments with inappropriate levels of environmental press (i.e., either too much or too little), which impair individuals' capacity to positively interact with their environment. For example, it may be too challenging for

seniors living in LTC homes to independently navigate hallways that do not have handrails with dimensions appropriate for seniors' use. Thus, the lack of appropriate handrails creates too much environmental press in the LTC home and may increase residents' dependence on wheelchairs, increase their risk for falls, or cause them to avoid walking in these hallways altogether – all of which may reduce older adults' participation in physical activity. Environments with too little environmental press can likewise lead to negative health outcomes, such as functional declines and deconditioning (Lawton & Nahemow, 1973), since these environments may not adequately stimulate or challenge the individual (Cutler, 2000). For example, LTC homes that lack pleasant indoor places to walk may discourage residents from walking indoors. LTC homes with no stairs or ramps might not have enough environmental press to help residents condition or exercise their muscles to maintain their physical mobility. Hence, an 'appropriate' level of environmental press (rather than too much or too little) is needed to support residents' participation in physical activity and prevent functional declines. Several studies have examined how the built environment can influence physical activity among older adults living in communities or neighbourhoods, but very few have done so among seniors living in LTC homes. One such study, described below, provided the foundation upon which this thesis was developed.

Original Study

This thesis was an extension of a multi-site, qualitative study conducted in 2006, entitled *'Physical Activity of Older Adults in Long-Term Care Facilities: A Consultation with Long-Term Care Facilities in the Ottawa Region'* (hereafter referred to as the original study). The original study was co-lead by Nancy Edwards (the supervisor of this thesis), and examined organizational and environmental factors that influence physical activity among

seniors living in LTC homes (Benjamin, Edwards & Caswell, in press). Data in the original study were collected in several ways, including: walkabout interviews[1] with administrators; focus groups with care providers, family members, and residents; and environmental scans of the homes' built environments. Some of the data collected for the original study were also used for this thesis.

Purpose of the Thesis

The purpose of this thesis was to explore the relationship between the built environment and physical activity among older adults living in LTC homes, using the concept of environmental press to analyse this relationship.

Structure of the Thesis

This thesis is divided into five chapters. Chapter One introduces the topic and outlines the purpose and structure of the thesis. A review of the literature, including the theoretical foundations, is included in Chapter Two. Chapter Three describes the objectives and methods. Chapter Four presents the findings. Chapter Five includes a discussion of the study findings in relation to other work in the field, the study's strengths and limitations, areas for future research, practical considerations for LTC settings, and the main conclusions of the study.

[1] 'Walkabout interviews': are interviews whereby the interviewee (i.e., the resident) takes the interviewer on a walking tour of the LTC home to point out and describe the facilitators for, and barriers to, physical activity.

CHAPTER TWO: LITERATURE REVIEW

This chapter consists of eight main sections. The first two outline the objectives of the literature review and the search strategy used. The remaining sections summarize the theoretical approaches to environmental press, and the empirical evidence examining relationships between the built environment and physical activity.

Objectives of the Literature Review

The objectives of the literature review were to describe the theoretical foundations used to guide this thesis; to explore the interactions between the built environment and physical activity among older adults; to discuss how the built environment and physical activity have been measured in previous studies; and to explore the benefits of, and barriers to, physical activity among older adults.

Search Strategy

The literature search was conducted in 2005 and updated in December 2007. No limit on publication year or language was applied. Two electronic databases (MEDLINE, 1966 to December 2007, and Ageline, 1978 to November 2007) were searched using combinations of the following four categorical searches of terms included in the title or abstract:

i) (physical adj2 activit$) or (exercis$) or (fitness$) or (walk$) or (strength adj training) or (resist$ adj train$) or (range adj motion) or (gait adj speed);

ii) (senior$) or (older adj adult$) or (elder$);

iii) (nursing adj home$) or (long adj term adj care); and

iv) (built adj2 environment$) or (physical adj2 environment$).

The Cochrane Library of systematic reviews was also searched using the following key terms: (physical activit$ OR exercise$) in the title, abstract or keywords and (institution OR nursing home OR long term care) in the title, abstract or keywords. Reference lists of key articles were also scanned to identify additional potentially relevant literature.

A total of 1327 titles and abstracts were screened. Full text reports were obtained if they addressed one or more of the following topics: 1) the effects of physical activity among older adults (either community-dwelling or living in LTC settings); 2) theoretical or empirical interactions between the built environment and older adults' behaviour, particularly physical activity; 3) measurement of the built environment; 4) measurement of physical activity; or 5) barriers to physical activity among older adults.

To date, much of the research examining environmental press has been theoretical and descriptive; few empirical studies have been conducted to examine how levels of environmental press in the built environment can influence older adults' behaviour. There was also a greater focus in the literature on community-dwelling older adults than on seniors living in LTC homes and, similarly, a greater focus on physical activity influences of outdoor neighbourhood-level characteristics than indoor characteristics of the built environment. So in the following sections, where information about LTC homes and their residents were limited, findings related to older community-dwelling adults are presented. The theoretical foundations used to guide this thesis are discussed next.

Theoretical Foundations

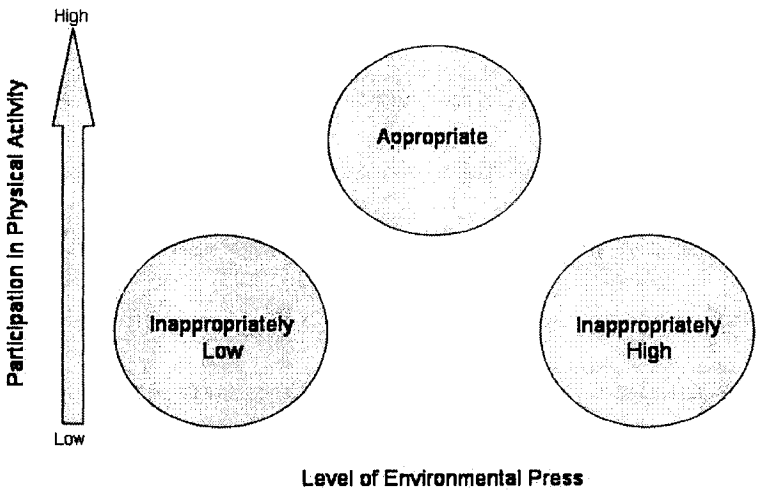
Ecological and socio-ecological models have been developed to help explain how individuals interact with their environment. Ecological models recognize that factors in the

physical environment influence individuals' behaviour. The Competence-Environment Press theory is based on an ecological model of aging and stipulates that an individual's 'competence' (i.e., functional capacity) and the level of 'press' in their environment influence their behaviour (Lawton, 1982; Lawton & Nahemow, 1973). The concept of Person-Environment fit is a key concept that emerged from this broader theory, and stipulated that a good 'fit' between a person's competence and their environment will lead to positive outcomes for the person's well-being (Lawton & Nahemow 1973). Criticisms of the Competence-Environment Press theory point out the lack of attention to other personal factors (e.g., attitudes, beliefs, perceptions) or to positive sources of press, such as social support (Iwarsson, 2005). Social factors are highlighted in socio-ecological models, which recognize that an individual's behaviour is influenced by both their physical and social environments (Cunningham & Michael, 2004). In this tradition, the Person-Environment Interaction theory was based on a socio-ecological model and suggests that an individual's behaviour is a function of personal factors, their physical environment, their social environment, and interactions among these factors (Lawton, 1982). Previous studies have examined personal and social influences of physical activity, but fewer have focussed on factors related to the physical environment (Cunningham & Michael, 2004). So, for this thesis, emphasis was placed on examining the interactions between the built environment and physical activity; the Competence-Environment Press theory was used to guide the investigation.

A conceptual framework, Figure 1, was developed to illustrate the interactions between the levels of environmental press and older adults' participation in physical activity.

Figure 1.

Conceptual framework linking environmental press to physical activity



Stemming from the Competence-Environment Press theory, the 'docility hypothesis' suggests that "as the competence of the individual decreases, the proportion of behaviour attributable to environmental, as contrasted with personal, characteristics increases" (Lawton & Nahemow, 1973, p.658). In other words, the influence of environmental press on a person's behaviour increases as the person's functional capacity decreases. This hypothesis has been tested in some recent studies. Shumway-Cook, Patla, Stewart, Ferrucci, Ciol, and Guralnik (2003) conducted a cross-sectional study examining the relationship between characteristics of the physical environment and mobility disability among 54 community-dwelling older adults from two cities in the United States and Canada. This study found that compared to nondisabled older adults, older adults using assistive walking devices (e.g., walker, cane) avoided, and therefore walked less in, areas where the following physical challenges were present: stairs ($p < .001$), distances greater than 10 blocks ($p < .001$), icy weather ($p = .003$), and curbs ($p < .001$). Although these findings refer to outdoor mobility, they may have pertinence to LTC homes, as many LTC residents also use walkers or other assistive devices, and may display these avoidance behaviours in environments where similar physical challenges are present.

Iwarsson (2005) conducted another study that lends some support to the docility hypothesis. This was a longitudinal study conducted with 72 community-dwelling seniors, which assessed problems of person-environment fit in their homes. The presence or absence of 188 potential environmental barriers was assessed and a person-environment fit score was correlated with the seniors' level of functional ability, measured by their Activity of Daily Living (ADL) and Instrumental Activity of Daily Living (IADL) dependence. Over the six-year follow-up period, increases in seniors' person-environment fit problems were more often due to declines in their functional capacity than to changes in their environment (i.e.,

seniors' ADL-IADL dependence increased significantly, while their environments did not change). A moderate positive correlation ($r_s = 0.45$, $p = .0059$) between person-environment fit scores and ADL-IADL dependence was found among those with more person-environment fit problems, but not among those with fewer person-environment fit problems. This finding supported the docility hypothesis by suggesting that older adults with greater ADL-IADL dependence were less capable of adapting to environmental barriers (i.e., inappropriately high environmental press).

The Built Environment

Most studies examining the relationship between physical activity and the environment have focused on community or neighbourhood level influences rather than influences at the level of an institution or building, and on community-dwelling older adults rather than those living in LTC homes (King et al., 2003; Li, Fisher, Brownson & Bosworth, 2005; Pikora, Giles-Corti, Bull, Jamrozik & Donovan, 2003;). The following section describes results from the literature review that examined the relationship between the built environment and physical activity among older adults (both living in the community as well as LTC homes).

Several neighbourhood-level factors, including the safety, accessibility, convenience of facilities, community design, street connectivity and aesthetics have been found to play an important role in influencing physical activity for older adults (Cunningham & Michael, 2004). Studies have shown an increase in walking among community-dwelling older adults in neighbourhoods that have enjoyable scenery (Ball, Bauman, Leslie & Owen, 2001), attractive destinations (Gilles-Cortis & Donovan, 2003; King et al., 2003; Van Lenthe, Brug & Mackenbach, 2005); and safe walking paths (Booth, Bauman, Owen & Gore, 1997; Li et

al., 2005; Owen, Humpel, Leslie, Bauman & Sallis, 2004). In a cross-sectional quantitative study, Saelens, Sallis, Black & Chen (2003) found that older adults living in neighbourhoods with 'high walkability' (characterized by the presence of low crime rates, adequate street lighting, high street connectivity, and pedestrian and traffic safety) were more likely to walk outdoors for exercise than those living in neighbourhoods with 'low walkability'. These findings reinforce commonly reported environmental barriers to neighbourhood walking that include: poor or unsafe sidewalks, heavy traffic, inadequate lighting, bad weather, inaccessible exercise facilities, and lack of spaces to sit or rest (Balfour & Kaplan, 2002; Clark, 1999; Henderson 2000). The findings from a cross-sectional study (Lee & Moudon, 2006) conducted with community-dwelling older adults also supported these associations between increased recreational walking patterns and longer path lengths and paths with hills or slopes. Insights from these studies regarding which environmental factors influence physical activity among community-dwelling adults may be useful when exploring similar interactions among residents' participation in physical activity and characteristics in the outdoor environments surrounding LTC homes.

A few studies examining the built environment and physical activity among residents in LTC homes have recently been conducted. Joseph & Zimring (2007) identified the built environmental factors that influenced the indoor and outdoor walking patterns of 114 seniors living in three American 'continuing care retirement communities' (which included three types of care: independent living, assisted living, and skilled nursing care). This study found that outdoor paths with fewer hills were used more for instrumental walking. For both indoor and outdoor paths, longer path segments, increased path connectedness and centrality (an indication of how integrated the path segment is within the whole network of paths), and the absence of steps were associated with a statistically significant increase in recreational

walking among older adults. This suggests that this population prefers uninterrupted pathways that are free of steps or stairs for recreational walking. Interestingly, this study also found that, in two of the three sites, a moderate or steep slope was associated with increased recreational walking behaviour among older adults, suggesting that older adults may prefer including this challenge in their recreational walking routes.

A previous study conducted by Joseph, Zimring, Harris-Kojetin and Kiefer (2005) examined how the number and presence of indoor and outdoor physical activity amenities in retirement communities in the United States influenced residents' patterns of physical activity. A survey was administered to 800 continuing care retirement community administrators to determine the presence and number of various features; 52% of the administrators replied to the survey. Outdoor features of interest included: walking paths, swimming pools, golf courses, outdoor tennis courts, garden plots, outdoor bowling areas, gardens, courtyards, and porches. Indoor features of interest included: a dedicated aerobics/exercise room, fitness room with equipment, indoor swimming pool, warm water therapy pool, indoor tennis courts, dance studio, indoor bowling area, multipurpose activity room, and a dedicated physical therapy room. The administrators were also asked to report the percentages of residents participating in various types of physical activity in a typical week (i.e., the proportion of residents who engage in 30 minutes or more of physical activity at least three times per week; the proportion of residents who participate in various types of physical activity at least once a week; and the proportion of residents who walk to meals on a regular basis). This study found that sites with more outdoor features, such as a golf course, swimming pool, paths, or gardens, had a significantly higher proportion of residents participating in various types of physical activities. However, after controlling for the number of physical activity programs offered, this relationship became non-significant,

suggesting that sites with more outdoor features were likely to also offer more physical activity programming, which may have contributed to an increase in physical activity participation. The presence of indoor physical activity facilities, such as an exercise room, physiotherapy room, pool, or dance studio, was also associated with a higher proportion of residents in all three levels of care participating in physical activities. Not surprisingly, residents' level of participation in certain activities was higher in sites where the room or facility associated with that activity was present. For example, residents' participation in aerobics was almost double in sites where an indoor exercise or fitness room was present than in sites without such a room. Interestingly, the presence of a physical therapy room was the only indoor feature associated with an increased number of nursing care residents who walked to meals. It was suggested that this relationship could be due to a greater overall emphasis on restorative care and physical activity in those sites. That is, sites with organizational support for physical activity are more likely to contain amenities, such as physiotherapy rooms, that encourage residents' participation in physical activity. This study demonstrated that assessing the "interactions between person-level characteristics, physical design, and organizational factors provides a better, if more complex, understanding of physical activity factors than looking at any one set of measures alone" (Joseph et al., 2005 p.162). The main limitation to this study was the reliance on proxies (here, nursing home administrators) to assess residents' participation in various types of physical activities. While these proxy responses provided a means to estimate general levels of physical activity among residents, these data were not validated with any other measurement methods. Thus, the proportion of residents participating in the various activities was determined but residents' total time spent being physically active remained unknown.

A cross-sectional study conducted by Cutler and Kane (2005) investigated the presence or absence of various features of outdoor spaces around 40 LTC homes in the United States and how these spaces were used by 1,988 residents living in 131 nursing units within these homes. Environmental assessments of residents' rooms, the nursing units, and the overall home were conducted to determine the number of amenities available and their accessibility for residents (e.g., whether outdoor spaces were accessible directly from the nursing unit). This environmental assessment was developed as part of an earlier study to measure quality of life outcomes in nursing homes. Almost all of the homes had an outdoor patio area and flower garden (98%), outdoor seating (95%), hard surface walking path at least three feet wide (88%), equipment for recreational activities (83%), and a secured or enclosed outdoor area (65%). Interviews with residents were conducted to determine how often they went outdoors. Findings indicated that approximately one third (32%) of the residents went outdoors less than once a month, and one in five (22%) went outdoors every day. Overall, most residents (61%) were satisfied with how often they went outdoors. Nursing home staff members were also surveyed to determine residents' participation in more specific physical activities (including planned exercise, social, and outdoor activities); physical activity data for all 1,988 residents were obtained. Again, the reliance on proxies to determine residents' participation in the specific physical activities was a limitation of this study; although, staff members responded that they did not know the residents' level of participation in certain activities for less than 2% of residents. While the relationships between level of amenities in these homes and residents' patterns of usage were not statistically analysed, the descriptive results provided insights into how residents interacted with the built environment. The authors found that residents were less likely to use outdoor spaces (e.g., patio areas, gardens) that were not accessible – that is, if there was no direct

access to the outdoor space from within the unit, or if it was located a far distance away from their rooms. For example, in one LTC home, the distance between the access point to the outdoor space (located on the ground floor) and the residents' rooms (located on the second and third floors) was considered to be a barrier to going outdoors. Automatic doors were found to facilitate residents' access to outdoor spaces, while in some nursing units, access to outdoor spaces was locked. Among the nursing units that had direct access to outdoor spaces, only 76% (n=44) of these outdoor areas were secured or enclosed. Since wandering behaviour is a concern for residents with dementia, the use of enclosed areas and camouflaged exits were key features needed in outdoor spaces to help support residents' safety and minimize exit-seeking behaviour. The impact of safe outdoor spaces around LTC homes on residents' physical activity has not yet been assessed, but as discussed earlier, studies with community-dwelling older adults have suggested that safer neighbourhoods are associated with increased levels of walking outdoors (Booth et al., 1997; King et al., 2003; Saelens et al., 2003; Li et al., 2005).

Previous examinations of indoor built environments in LTC homes have largely focussed on the homes' 'special care units', designed specifically for residents with dementia. These units are typically segregated from the rest of the LTC home, and have unique environmental design and building features tailored to meet these residents' needs. A couple of studies investigated how certain disruptive behaviours often found among seniors with dementia (e.g., agitation, wandering, anxiety) were influenced by various aspects of the physical design of these special care units (Caulkins, 2004; Klein, 2002; Morgan & Stewart, 1999). Klein (2002) conducted a review of the literature on the iatrogenic factors, or institutional hazards, associated with living in LTC homes. These factors were discussed in relation to: residents' immobility, use of medication, loss of autonomy, use of restraints, and

the physical environment. This review found that hallways that formed circuits or were well-connected encouraged walking among residents with dementia. This type of design enabled residents to wander in the hallways without getting 'stuck' at a dead end, which can lead to anxiety and confusion. Environmental barriers that reduced older adults' mobility were also identified in Klein's study, and included: increased glare or low lighting levels, clutter, limited walking space, low armchairs or chairs without arm rests, and lack of handrails.

A qualitative study conducted by Morgan & Stewart (1999) examined family and care providers' perceptions regarding the relationships between the physical and social environments of two American LTC homes' and the level of disruptive behaviour among LTC residents with dementia. Five themes related to the physical environment were found to influence residents' behaviour: safety, homelike setting, optimal stimulation, cues, and options for privacy and social interaction. The physical layout of the building affected the care providers' ability to easily observe and monitor the safety of residents. Homelike settings and units with fewer residents were associated with less anxiety and agitated behaviour among residents with dementia (e.g., less populated units had more optimal stimulation levels in terms of noise, activity, and unwanted social interactions). Care providers noted that residents on units where seating was available in corridors were less tired than when seating was not available, since these chairs provided visual cues for residents to stop and rest. Lastly, the need for opportunities for both privacy and social interactions was highlighted, and these opportunities varied depending on the availability of private rooms and shared accommodation.

Overall, these studies illustrate how certain features of the built environments of LTC homes can influence multiple aspects of residents' behaviour, including their mobility and

physical activity. The next section discusses how the built environment has been measured in previous studies.

Measurement of the Built Environment

Determining how to measure the built environment continues to be a major challenge for researchers. Depending on the type of built environment under investigation (e.g., indoor or outdoor environments), and which health outcomes are being examined (e.g., quality of life, physical activity, falls), there are countless aspects of the environment that can be assessed. A large gap in the literature exists regarding how to determine which aspects are important, relevant, and measurable. Cutler (2000) suggested using the four principles of universal design to help determine which aspects of the environment should be included in assessments of older adults' environments. The principles of universal design relate to creating environments that are functional for most people across the life course (from parents with baby strollers to elderly people in wheelchairs). Table 1 outlines these principles and provides examples of each related to older adults' environments.

Table 1.

Universal design principles

Principle	Description	Example
Adaptable	Adaptable environments can be modified according to the individual's changing needs and competencies over the life course.	Increased cueing features in corridors to assist older adults navigate through the building.
Supportive	Supportive environments allow individuals to negotiate the challenges present in the environment, yet these challenges are not so severe that individuals with decreased levels of functioning are discouraged or restricted from using the environment.	Functional corridor length.
Accessible	Accessible environments are accessible to residents with varying mobility abilities, and can accommodate residents using mobility aids.	Corridor is wide enough to allow residents with walkers or wheelchairs to safely pass each other.
Safe	A safe environment protects against hazards.	Handrails with proper dimensions can help prevent falls.

While some validated environmental assessments have been used to rate the built outdoor environment in communities and cities, few have been designed to assess indoor LTC home environments (Joseph et al., 2005). Edwards, Benjamin & Lockett (2006) compiled a list of over 20 studies that had used environmental checklists to assess environmental hazards that are of specific concern for seniors (e.g., related to falls prevention). However, many of these studies did not use standardized checklists, and most did not use an underlying typology to determine which items to include in the development

of the tool (Edwards et al., 2006). Most checklists relied on the subjective assessments of features in the environment (e.g., are the stairs unsafe?), rather than using objective measurements (e.g., length of stair tread) that could be compared with safety requirements established in laboratory studies. The checklists also tended to focus on public spaces or community-dwellers' private homes, rather than LTC homes.

A few assessment tools have previously been developed to measure the physical and social environments in the Special Care Units of LTC homes (Cutler, 2000), but these tools are specific to the needs and competencies of residents with dementia, and have not yet been adopted for LTC homes more generally. Some more generic environmental assessments for LTC homes include: multi-level checklists (Cutler & Kane, 2005), the Multiphasic Environmental Assessment Procedure (Moos & Lemke, 1996), and the Safety Scan for Common Areas in Residential Settings for Seniors (Scott, 2006).

Multi-level environmental checklists were developed by Cutler and Kane (2005) at the resident-level, unit-level, and facility-level to determine the presence or absence of various characteristics of the physical environment, which were then correlated to residents' quality of life. The unit-level checklist included 140 items measuring aspects of the outdoor spaces, nursing stations, corridors, lounge and dining spaces, noise, distances, and light levels. The facility-level checklist included 134 items that assessed all other outdoor and indoor spaces that were not captured in the unit-level checklists.

The Multiphasic Environmental Assessment Procedure was designed to measure physical and social environments in nursing homes, residential care facilities, and congregate housing, and was comprised of five different components: the physical and architectural feature checklist, the resident and staff information form, the policy and program information form, the sheltered care environment scale, and the rating scale (Moos & Lemke, 1996). The

physical environment portion includes measures of 153 features of indoor and outdoor spaces in the LTC homes, focussing on the presence or absence of these features, rather than on how these features are used by the residents. Data are collected by direct observation and are estimated to take two hours to collect. The rating scale captures the assessors' subjective observations regarding the LTC homes' attractiveness, and the interactions of residents and staff with their environment.

The 'Safety Scan for Common Areas in Residential Settings for Seniors' (hereafter referred to as the 'Safety Scan'), is a checklist designed to assess fall hazards within the indoor and outdoor built environments of LTC homes (Scott, 2006). While it has not yet been validated in any empirical studies, a modified version of the Safety Scan was used in the present study. Many of the fall-related items could also influence seniors' participation in physical activity and the scan provided a defined list of the various areas commonly found in LTC settings. No environmental assessments were identified in this review that measured how older adults use or interact with various features in the built environments of LTC homes.

Physical Activity

Older adults can attain numerous benefits by engaging in physical activity. These have been well-documented in both community-dwelling and LTC populations, and include: strengthened cardiac functioning, less risk for developing Alzheimer's Disease, increased muscle strength, increased functional mobility, increased balance, decreased falls and fear of falling, lower rates of malnutrition and decreased risk of death (Baum et al., 2003; Boyle, Buchman, Wilson, Bienias & Bennett, 2007; Fiatrone et al., 1994; Howe, Rochester, Jackson, Banks & Blair, 2007; Lazowski et al., 1999; Resnick, 2000; Schmid et al., 2003;

Schoenfelder & Ruenstein, 2004). A cohort study by Boyle et al. (2007) of over 1,000 community-dwelling seniors from 40 different retirement communities found that seniors' risk of developing a limitation in an ADL or IADL were both reduced by seven percent for each hour per week increase in physical activity (e.g., walking for exercise, gardening or yard work, bicycle riding, swimming, or water exercises).

A randomized control trial conducted by Lazowski et al. (1999) demonstrated that frail elderly living in LTC homes are capable of more than range-of-motion exercises, and can benefit from an exercise intervention consisting of i) progressive strength training, ii) balance training, iii) flexibility exercises, and iv) walking. Sixty-eight residents from five LTC homes had participated in the four-month trial. Those who received the exercise intervention achieved significant improvements in mobility, functional balance, upper and lower body flexibility, elbow flexion strength, and hip and knee extensor strength as compared to those who received the range-of-motion exercises only. The findings suggest that range-of-motion exercises are not sufficiently challenging for LTC residents to prevent declines in lower body strength, mobility, and balance.

Researchers have also found that residents in LTC homes who engaged in physical activity had higher physical functioning, less depression, and greater satisfaction with living conditions than inactive residents (Ruuskanen & Parkatti, 1994). However, engaging in physical activity, even walking, can be difficult for some frail older adults who have weak muscle strength and balance (Baum et al., 2003), and some have reportedly felt too old or frail to be physically active (Shutzer, 2004). Falls are very common among frail elderly, and a fear of falling may not only inhibit LTC residents from participating in physical activity, but may also inhibit care providers from encouraging active behaviour (MacRae et al., 1996; Scheonfelder, 2004). But exercise interventions have been shown to reduce the risk of falling

among older adults. A systematic review was conducted by Gillespie et al. (2003) to assess the effects of interventions to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care). A total of 62 randomized trials were included in the review, 21 of which examined the effects of exercise interventions on reducing the risk of falls. Results from trials involving community-dwelling seniors (three trials that included a muscle strengthening and balance intervention, and one trial that included a Tai Chi exercise intervention) indicated that these types of exercise interventions were effective at reducing the risk of falls among elderly people. None of the exercise intervention trials involving LTC residents were found to significantly reduce the risk for falls, but the direction of association suggests that some exercise interventions may be beneficial for reducing the risk of falls in this population. So while there are numerous benefits of physical activity among older adults, the exact dose of exercise that should be prescribed to frail elderly or residents in LTC homes has not been established (Baker et al., 2007). Disadvantages of prescribing an exact dose of exercise for LTC home residents include: potential for an increased risk of injury among residents, particularly among residents who begin exercising on their own without knowing how to do so properly and safely; and the expectation that the specific dose of exercise must be enforced within the LTC home, perhaps without adequate funding or organizational support. Also, residents in LTC often have individual needs and capabilities, and it would be difficult to prescribe one dose that would satisfy them all. Guidelines for physical activity in LTC homes must take into account the unique abilities of the resident, particularly those with poor health or physical limitations.

Physical activity guidelines have been developed that are helpful in determining how much physical activity community-dwelling older adults need in order to achieve health benefits. Current guidelines from the PHAC's Physical Activity Guide for Older Adults

recommend that seniors should engage in 30 to 60 minutes of moderate physical activity on most days, and should incorporate a variety of endurance, strength, balance, and flexibility based activities (PHAC, 2005b). These guidelines are useful in establishing a general sense of how much physical activity seniors should get, but there can be challenges in how these guidelines are applied. For instance, assessments of exercise intensity tend to be subjective and levels of intensity are not consistently defined. In one review (Taylor et al., 2004), moderate intensity was described as the level of effort required to walk briskly. Taylor's review also reported results from a 1998 UK national health survey indicating that the self-reported usual walking pace for 90% of seniors aged 85 years and older was 'steady average' or 'slow' (Department of Health, 2000). The UK national health survey found that fewer older adults living in LTC homes walked at a brisk pace for 15 continuous minutes during the previous four weeks than those living independently. Another study reported that LTC home residents' usual walking speed was less than one metre per second (Lazowski et al., 1999), and represents approximately 30 to 50% of seniors' maximum aerobic capacity (Fiatrone et al., 1994). Some would argue that this pace is too slow, and the intensity too low, to incur significant health benefits. Manson (2002) found that a decreased risk of premature mortality among older adults has been associated with walking speeds of 'fairly brisk' or 'fast'.

As mentioned in the PHAC guidelines, physical activity should incorporate a mixture of endurance, strength, and flexibility exercises. Walking was found to be a popular form of endurance activity among older adults living in both the community (Clark, 1999) and LTC settings (Hui & Rubenstein, 2006). Group chair exercises are common in LTC homes and typically incorporate strength and flexibility or range-of-motion exercises that are performed in a seated position. In LTC homes in Ontario, the frequency of these sessions range

anywhere from three times a week to one or twice a month (Lazowski et al., 1999). Reported levels of participation in structured physical activity programs (including group chair exercises) varied widely, from 10 to 15% (Lazowski et al., 1999), to 40% (Poon, Spence, Watchman & Carlson, 1999), to 78% (Cutler & Kane, 2005). The two former studies were conducted in different provinces in Canada, while the latter study was conducted in the United States. Other than the geographic information, insufficient data were provided in these three study reports to speculate on the reasons for differences in participation rates. No studies were found that assessed the total amount of physical activity (i.e., structured and unstructured physical activities) in the target LTC population.

Barriers to physical activity

A thorough examination of the social and organizational factors that influence older adults' participation in physical activity was outside the scope of the present study, but their influences still warrant acknowledgement. Examples of some social or organizational factors that impact older adults' physical activity include: policies regarding where residents are permitted to go (both inside and outside of the LTC home), levels of physical activity programming or funding for physical activity programs, care providers' time (which influences how much they can encourage residents to be independently mobile), and residents' level of social support (e.g., encouragements from care providers and family members) (Bauman, Sallis & Owen, 2002; Joseph et al., 2005; Lazowski et al., 1999).

Several demographic variables are important to consider when examining older adults' physical activity, such as age, gender, level of mobility, activity level and health status. Previous reviews of literature found that levels of physical activity tend to decrease with advancing age, and that men generally participate more often in physical activity than

women (Schutzer & Graves, 2004; Taylor et al., 2004). On the other hand, women have been found to participate in group exercise programs more than men (Joseph et al., 2005). Older adults face numerous personal barriers to physical activity. Health conditions, poor self-rated health, and pain are widely recognized as key deterrents of physical activity among community-dwelling older adults (Clark, 1999; Cohen-Mansfield, Marx & Guralnik, 2003). A review of the literature conducted by Shutzer (2004) examined community-dwelling older adults' perceived barriers and motivations to exercise that have gained empirical support. Findings suggested that older adults with more active lifestyles, fewer chronic health conditions, less pain, and greater levels of self-efficacy were more likely to adhere to regular exercise.

Rasinaho (2007) conducted a cross-sectional, quantitative study of 645 community-dwelling older adults in Finland to examine the motives and barriers to physical activity among older adults with severe, moderate, or no mobility limitations. Results indicated that 53% of older adults with severe mobility limitations were only minimally physically active (i.e., engaged in either 'no physical activity' or 'only light physical activity'), compared to just 11% of those with no mobility limitations ($p < .001$). Also, older adults with severe mobility limitations (i.e., those who had difficulty walking two kilometers and climbing a flight of stairs) reported having 'no barriers to physical activity' significantly less often than those with no mobility limitations (6% versus 56%, respectively, $p < .001$). One methodological limitation of this study was that gender and health status were not controlled for in the analysis. The group with severe mobility limitations had a higher proportion of females and a higher proportion of individuals with chronic health conditions or pain. These factors have been shown to influence both physical activity and mobility, and may have confounded the relationship between mobility and barriers to physical activity.

There is little research on barriers to physical activity among LTC residents (Lazowski et al., 1999). Mobility limitations, even the inability to transfer independently from a seated position, may lead older adults living in LTC homes to self-imposed restrictions on mobility (Fiatrone et al., 1994). Psychological barriers, such as fear of falling (Booth et al., 1997) and low self-efficacy (Rasinaho, 2007) are some of the personal factors that inhibit community-dwelling older adults from being physically active. Benjamin, Edwards and Bharti (2005) conducted a cross-sectional study examining how the Theory of Planned Behavior, health-status, and exercise intention among frail older community-dwelling adults influenced their participation in physical activity. Having a strong intention to continue exercising and positive attitudes about exercise were found to be some of the personal-level predictors of older adults' participation in physical activity.

The tendency to focus on personal factors has led to the development of interventions that place a heavy emphasis on modifying individual characteristics, without much attention to other environmental influences (King et al., 2005). Fewer studies assessing barriers to physical activity have focussed on environmental factors, but some factors that have been examined include: bad weather, perceptions that neighbourhoods were not suitable for exercise, and inaccessible exercise facilities (Rasinaho, 2007). Benjamin et al. (2005) also found that inclement weather and poorly maintained sidewalks were deterrents for frail older adults' participation in outdoor physical activity, and Shutzer's review (2004) identified that limited access to recreation facilities and foot paths were barriers to exercise related to the physical environment.

Measurement of Physical Activity

Several methods exist to measure physical activity, including: direct observation, pedometers, activity diaries or logs, and recall-based self-report questionnaires. These methods, and whether they have been used with older adult populations, will be described next.

When direct observation is used, the investigator observes the subject's usual behaviour over a specified time and records various measures of physical activity, such as the amount of time spent doing a particular activity and the number of times an activity is done. One advantage of this method is its ability to capture contextual information about the environment in which physical activity occurs. This technique has mostly been used with school-aged children (McKenzie, 2002). Its main limitation is that it is extremely time and resource intensive in terms of data collection, coding, and analysis, and is typically used for smaller studies, or when the activity of interest occurs at predictable times (e.g., recess, before or after school) (McKenzie, 2002).

Pedometers are small mechanical devices that count the number of steps individuals take. The device is clipped onto clothing at the hip and the horizontal springs inside the device detect the dropping action of each step. Most pedometers are calibrated so that the number of steps converts into the distance walked. These devices are inexpensive and easy to use, but they cannot measure non-walking related physical activity (e.g., upper body strength training), or the frequency and duration of each episode of physical activity. Some studies (Bassett & Strath, 2002; Stel et al., 2004) have shown that pedometers are not accurate when the participant walks slowly, or if they shuffle their feet (since the dropping action is not detected). This limits their utility with a more frail elderly population with physical

limitations (Bassett & Strath, 2002). Compliance with wearing the device could also present a challenge in this population (Stel et al., 2004).

Activity diaries and logs are examples of self-report techniques. Participants record certain information about their physical activities, such as the time spent doing an activity, and the intensity of that activity. Diaries and logs are inexpensive, but are time-intensive to code and analyse, and can be burdensome for participants to complete, potentially leading to low response rates (Matthews, 2002; Sallis & Saelens, 2000). This data collection method is subject to reliability and validity errors associated with incorrectly recalling physical activity behaviours, and the very act of recording their activities may influence participants' usual behaviour (Matthews, 2002). No studies were found that used this technique in a population of seniors living in LTC homes.

A recall-based questionnaire is another type of self-report technique and is "particularly useful for descriptive epidemiological studies designed to assess the prevalence of various activity patterns in large populations" (Matthews, 2002, p.115). Like the activity diaries and logs, these questionnaires are subject to reliability and validity errors associated with incorrectly recalling physical activity behaviours. When questions are administered through face-to-face interviews, the risk of misinterpretation is minimized and the response rate is maximized (Matthews, 2002). Self-report questionnaires were found to be less time consuming for respondents than the seven-day diary and were easier for older adults to use than pedometers (Stel et al., 2004). Sallis & Saelens (2000, p.5) also noted the "unique role of self-reports may be to assess the context and type of physical activities" (e.g., leisure activities, instrumental activities, etc.). Recall-based self-report questionnaires are widely used for assessing older adults' physical activity; however, they have more commonly been developed to study community-dwelling populations, or middle-aged adults (Sallis &

Saelens, 2000). Previously developed physical activity questionnaires are summarized in Table 2. These include: the Physical Activity Scale for the Elderly (PASE) (Washburn, Smith, Jette & Janney, 1993), the Community Health Activities Model Program for Seniors (CHAMPS) (Stewart et al., 2001), The Longitudinal Aging Study Amsterdam Physical Activity Questionnaire (LASPAQ) (Stel et al., 2004), the Yale Physical Activity Survey (YPAS) (Dipietro, 1993), and the Older Adults' Exercise Questionnaire (OAEQ) (Benjamin et al., 2005). At the time this research project was designed, no scales were found that assessed physical activity in long-term care settings. As the methodology chapter will discuss, modifications were made to the OAEQ by the author of this thesis for its use in this study.

Table 2.

Physical Activity Recall-Based Questionnaires

Questionnaire	Target population	Time frame	Activities assessed
Physical Activity Scale for the Elderly	Community-dwelling older adults in the US.	Previous seven days.	Walking outside, sport activities, muscle strength and endurance exercises, housework, home repairs, lawn/yard work/outdoor gardening, caregiving, and work for pay or volunteering.
Community Health Activities Model Program for Seniors	Community-dwelling older adults in the US.	A typical week in the past month.	Walking, jogging, dancing, golfing, riding a bicycle or stationary cycle, swimming/ water exercises, aerobic exercise, housework, gardening, yoga, tennis, and stretching/flexibility.
Longitudinal Aging Study Amsterdam Physical Activity Questionnaire	Community-dwelling older adults in Amsterdam.	Previous two weeks.	Walking outside, bicycling, gardening, housework, and sport activities.
Yale Physical Activity Survey	Community-dwelling older adults in the US.	A typical week in the past month.	Work, yard work, caretaking, exercise, and recreational activities.
Older Adult Exercise Questionnaire	Frail community-dwelling older adults in the Ottawa region.	Previous seven days.	Walking (indoors, mall, outdoors), swimming/ water exercises, dancing, physiotherapy, chair exercises, lifting objects, bending, lifting weights/using rubber resistance bands, gardening, housework, climbing stairs, stretching exercises, Tai chi , and yoga.

The construct validity of three of these questionnaires, CHAMPS, PASE, and YPAS, was assessed by Harada, Chiu, King & Stewart (2001) in a convenience sample of 87 community-dwelling seniors. Using pedometers, performance tests, and other self-report measures to assess seniors' overall energy expenditure, the three questionnaires were found to have acceptable levels of construct validity. Another study (Sallis & Saelens, 2000) found that the PASE had greater retest reliability than the YPAS ($r = 0.75$ versus $r = 0.56$). Criterion validity was assessed with doubly labelled water (a laboratory method for measuring energy expenditure) for the PASE, which demonstrated a high correlation ($r = 0.58$); while the YPAS was assessed with a pedometer, which demonstrated a much lower correlation ($r = 0.20$).

Summary

Several studies have demonstrated that older adults living in LTC homes can achieve health benefits by engaging in various forms of physical activity, including strength training, endurance, balance, and flexibility exercises. Group chair exercises involving range-of-motion exercises tend to be the norm in LTC homes, but some argue that residents need more intense exercise to achieve health benefits such as increased muscle strength or reductions in risk for falls. The optimal level of physical activity for LTC residents has not been established. Current guidelines suggest older adults should be physically active for 30 to 60 minutes a day at least three times per week. There was limited epidemiological research indicating seniors' level of physical activity, but descriptive studies suggested that many older adults in LTC homes do not meet these guidelines for physical activity. Barriers to physical activity include personal, social or organizational, and physical environmental factors. This literature review revealed the lack of research related to the physical or built

environments among LTC populations, particularly in relation to physical activity outcomes. Yet, many residents spend nearly all their time inside their LTC home, making them particularly susceptible to the homes' built environment. Residents in LTC homes also tend to have physical mobility limitations, which according to the docility hypothesis, makes them more vulnerable, or less able to adapt, to physical challenges present in their environment. Some environmental barriers (i.e., sources of inappropriately high environmental press) examined in previous studies included: stairs, ramps, icy sidewalks, and inclement weather. The present study will help determine whether appropriate levels of environmental press in the built environment are associated with greater levels of physical activity among older adults living in LTC homes. This can help inform future interventions and policies aimed at creating safe and healthy environments to support these seniors to be physically active.

CHAPTER THREE: METHODS

Relevant methods of the original study are outlined first, followed by methods for the present study. The latter includes a description of the research questions, hypothesis, research design, sample selection procedures, secondary data analysis, and primary data collection and analysis.

Original Study

The original study entitled, 'Physical Activity of Older Adults in Long-Term Care Facilities: A Consultation with Long-Term Care Facilities in the Ottawa Region', was a cross-sectional study that used mixed methods data collection (Benjamin et al., in press). Guided by socio-ecological and environmental press theories, the original study sought to examine organizational and environmental factors that influence physical activity among older adults living in LTC homes.

Sample Selection

Stratified cluster random sampling was used to identify 12 eligible LTC homes (stratified by non-profit and for-profit status) from a list of the 28 LTC homes in the Ottawa region. One additional LTC home, the pilot site, was purposefully selected based on availability, size (larger), and location (central). Administrators from nine LTC homes (including the pilot site) agreed to participate and were included in the final sample. Purposive sampling (a form of non-probability sampling) was used to select samples of residents, administrators, care providers, and family members. Full ethical approval was received prior to recruitment from the following three Research Ethics Boards (REBs): the

University of Ottawa Health Sciences and Science REB, the Sisters of Charity of Ottawa REB, and the Ottawa Public Health REB.

Eligibility Criteria

Inclusion Criteria for the LTC homes

LTC homes eligible for inclusion in the original study had to be designated a LTC home (e.g., nursing home, charitable home for the aged, or municipal home for the aged) and located in the city of Ottawa. The administrator of the LTC home had to grant the research team permission to access their premises for recruitment and study purposes.

Inclusion Criteria for Participants

Residents eligible to participate had to have lived in one of the participating LTC homes for at least three months. Residents had to be 65 years of age or older at the time of recruitment, and able to communicate in English or French. Lastly, residents had to provide written informed consent to participate. Clinical contacts (e.g., nurse, physiotherapist) were identified by each LTC home administrator to assist with recruitment. These contacts used their clinical judgment to determine whether the resident was capable of providing informed consent. Inclusion criteria for the administrators, care providers and family members who participated in the walkabout interviews or focus groups are shown in Appendix A.

Qualitative Assessment of Environmental Press in the Built Environment

A series of walkabout interviews with LTC home administrators and residents; as well as focus groups with care providers, family members, and residents were conducted in the original study to assess their perceptions of the facilitators of, and barriers to, physical activity among seniors living in LTC homes. These data collection methods offered insights into the interactions between older adults and the built environment that might not have been captured when examining seniors' physical activity and the LTC homes' built environment separately.

Quantitative Assessment of the Built Environment

The Safety Scan, introduced in the literature review, was originally developed by Scott (2006) to assess the safety of thirteen common areas in long-term care settings (e.g., parking lots, hallways, washrooms, etc.). It includes a checklist of 10 to 16 items per area, providing one overall assessment per LTC home. These items examine the safety of particular aspects of the physical environment (e.g., is the front entrance well-lit?). Permission to use and modify the Safety Scan for the original study was obtained from Scott. The author of this thesis was part of the research team involved with making the following modifications to the instrument. Each item on the Safety Scan was reviewed and only those relevant to environmental press were kept. The 'patient room' and 'washroom' areas were not included since these areas were not considered to be common areas where physical activity would likely occur. More precise measurements of various features of the built environment, including: type and weight of doors; chair dimensions (quantity, seat height, arm height); hallway dimensions (length, width); light level measurements; handrail dimensions (diameter, height, clearance from wall); transitions in flooring (surface type,

slope); and timing of elevator door closing, were included in the modified Safety Scan. To distinguish between the original Safety Scan and the modified Safety Scan, the modified version is hereafter referred to simply as 'the scan' (included in Appendix B).

The scan included a total of eleven common areas, with 13 to 28 descriptors per area (both quantitative and qualitative). Measurements were taken on each floor, although in the LTC homes that had multiple floors with identical layouts, only one floor per layout was assessed. This approach decreased the time required to conduct the environmental assessment, and minimized the amount of duplicate data.

Scan measurements were taken by four members of the original study's research team (but only two or three conducted the scan at each site). The author of this thesis was involved in conducting all of the scans included in this thesis. Measurements were taken using four instruments: measuring tape to measure lengths, a stopwatch to measure time, a fish scale to measure the weight of pull doors, and a light meter to measure light levels. A training manual (including definitions for key terms, calculations for measuring slope, and specific directives for each area) was created to help ensure measurements were taken consistently. Each scan took an average of three hours to complete.

A scoring system was developed as part of the present study to translate the scan measurements into an assessment of the level of environmental press present in the built environment of the LTC homes. The next section outlines the methods used in the present study, including the methods used to develop the scoring system.

Present Study

Research Questions

The primary research question addressed by the present study was: Do the types and duration of physical activities among seniors living in LTC homes vary with the level of environmental press in their built environment?

The secondary research questions were: 1) Which sources of environmental press related to the built environment were reported by administrators, care providers, family members, and residents of LTC homes in the Ottawa area?; 2) Which environmental characteristics contribute to different levels of environmental press in the built environments of LTC homes in the Ottawa area?; and 3) What types and duration of physical activities do seniors living in LTC homes in the Ottawa area engage in?

Hypothesis

Reflecting the primary research question, this study tested the hypothesis that older adults living in LTC homes with inappropriately high levels of environmental press engage in different types and duration of physical activity than older adults living in LTC homes with appropriate levels of environmental press. The null hypothesis was that the type and duration of physical activity among residents in LTC homes do not differ by level of environmental press in their built environment.

Research design

The present study was exploratory, descriptive and cross-sectional. Primary and secondary sources of qualitative and quantitative data were used. The primary research

question was addressed using a combination of secondary data on environmental press collected as part of the original study and new data regarding residents' participation in physical activity collected as part of the present study. Data from the original study were also analyzed to help answer the first and second secondary research questions. The third secondary research question was addressed using new data on residents' participation in physical activity, collected as part of the present study.

Sample Selection

The same LTC homes that participated in the original study were invited to participate in the present study. Once the LTC homes were recruited, a random sample of eligible residents was selected within each LTC home. In some LTC homes where fewer eligible residents were available than required, all residents who met the eligibility criteria were invited to participate.

Eligibility Criteria for the Residents

The same inclusion criteria for residents who were recruited in the original study were applied. Eligible residents had to: have lived in one of the participating LTC homes for at least three months, be aged 65 or older at the time of recruitment, be able to communicate in English or French, and provide written informed consent. In addition, residents had to be capable of ambulating with or without the assistance of a person or an assistive device (i.e., not wheelchair dependent). Residents who were wheelchair dependent were excluded. Since walking is a common form of physical activity among seniors, it was believed that if a relationship did exist between the built environment and physical activity, it would be most evident among ambulatory residents. Residents' level of mobility and cognitive ability were

assessed by the clinical contacts assigned to the study. Mobility was assessed using the physical ambulation portion of the Physical Self-Maintenance Scale (PSMS) (Lawton & Brody, 1969; see Appendix C). This scale has been frequently used in assessing physical mobility among older adults (Benjamin et al., 2005), and was shown to have good reliability and validity (McDowell & Newell, 1996). If the resident scored a three or less on the ambulation scale of the PSMS (i.e., was able to ambulate within the LTC or further), and four or less on the assistive device sub-scale of the PSMS (i.e., used one of the following assistive devices: railing, another person, cane, or walker), then they were eligible to participate in the study. Clinical contacts' judgement was also used to determine whether or not residents were cognitively capable of providing informed consent.

Sample Size Estimation

Sample size estimation was based on the primary research question. Due to the cluster sampling, standard sample size calculations were inflated by an estimate of the design effect to account for within- and between-cluster variation (Donner & Klar, 2000). The design effect was used to determine how many more residents per LTC home needed to be recruited. In order to estimate the design effect, the intraclass correlation coefficient, rho (ρ) (i.e., the ratio of between-cluster variance to the overall variance), of the outcome variable must be known. When $\rho=0$, all of the variance observed in the sample is due to within-cluster variation (i.e., the residents within a LTC home are no more different than those in other homes), and when $\rho=1$, all of the observed variance is from between-cluster variation (i.e., all of the residents within a cluster are identical) (Ukoumunne, Guilliford, Chinn, Sterne & Burney, 1999). However, no studies could be identified that published an intraclass correlation coefficient relevant to physical activity in LTC homes. Some have noted that

values of ρ typically range between 0 – 0.05 for studies with a large number of clusters (Ukoumunne et al., 1999), so a more conservative estimate of ρ=0.10 was used (see Appendix D for full calculations). Had this study not relied on secondary sources of data (e.g., environmental scans conducted in the Original Study), increasing the number of clusters (LTC homes) would have been considered in these calculations. This would have increased the between-cluster variation as well as the design effect. The sample size estimations were calculated using a Z of 0.05, and a power of 0.80, with the ability to detect a 30% difference in the proportion of physically active residents living in LTC homes with appropriate versus inappropriately high levels of environmental press. While no studies have been conducted that report the clinically importance difference in the proportion of physically active residents in LTC homes with appropriate versus inappropriately high environmental press, a 30% difference was selected based on previous studies reporting that the proportion of physically active residents in long-term care ranged from 10-40% (Lazowski et al., 1999; Poon et al., 1999).

Based on results from the original study, one of the LTC homes did not have any residents who satisfied the eligibility criteria for the present study, so only eight LTC homes were eligible to participate. Since the recruitment for the original study was completed at the time this study was designed, it was not possible to increase the number of LTC homes. So in order to assess whether the proportion of physical activity differs between two groups of LTC homes, and assuming there were four LTC homes per group, a total of 15 residents per home was needed. The total sample size estimate was inflated by 15% to account for non-responders (e.g., residents refusing to participate after being selected). Thus, attempts were made to recruit a total of 136 residents (or 17 per LTC home).

Ethical Considerations

Full ethics approval was obtained for this study from the same three Research Ethics Boards that approved the original study (letters of approval included in Appendix E). Permission to use secondary data from the original study was also granted.

Types of Data

The types of data collected as part of the present study included: type and duration of physical activity among a sample of residents living in LTC homes; and background characteristics (e.g., gender, age, length of stay, perceived health status, perceived activity level) of the residents included in the study.

The secondary types of data collected by the original study that were also used in the present study included: qualitative data on the facilitators and barriers to physical activity; characteristics of the LTC homes (e.g., number of beds); and quantitative measurements and qualitative descriptors of the built environment.

Secondary Data Analysis

The next sections describe the secondary data analysis, including the qualitative content-analysis of data from the focus groups, and the quantitative analysis of environmental scan data. These analyses addressed the first two secondary research questions identified earlier.

Qualitative Data Analysis

For the qualitative data, content-analysis was conducted to identify potential sources of environmental press that were revealed in the original study's consultations with administrators, care providers, family members, and residents of LTC homes. The transcripts were read to identify the barriers and facilitators related to the built environment. Findings were entered into a matrix and categorized according to type of respondent (e.g., administrator, resident) as well as three characteristics: supportive, accessible, and safe, that Cutler (2000) identified as useful for assessing built environments. The matrix allowed findings to be compared across respondents. Quotes were highlighted to add context to the findings. The qualitative analysis also helped inform: a) development of the scan scoring system, by identifying which areas and features of the built environment to include in the assessment of environmental press, and b) modifications to the questionnaire assessing older adults' level of physical activity, by identifying the types of physical activity opportunities commonly available to residents living in LTC homes.

Assessment of Environmental Press

Findings from the literature review, and data on patterns of use described in the qualitative analysis, suggested that a) residents engage in physical activity in the following areas, and b) features in the following areas can influence residents' participation in physical activity: 1) outdoor common areas, 2) the front entrance and lobby, 3) hallways, 4) dining rooms, 5) lounge or living rooms, 6) activity rooms, 7) exercise or physiotherapy rooms, and 8) elevators. A more detailed listing of the areas included and excluded from the present study is outlined in Table 3.

Table 3.

Scan Areas included in the Assessment of Environmental Press

Scan areas included in original study	Areas included in present study
Outdoor common areas	Yes
Front entrance/lobby	Yes
Hallways	Yes
Dining rooms	Yes
Kitchen areas	No
Lounge/living rooms	Yes
Libraries	No
Activity rooms	Yes
Exercise/physiotherapy rooms	Yes
Elevators	Yes
Gift shops	No

Since not all LTC homes had an exercise or physiotherapy room, only data on the availability of this type of room was included in the present study, and the features within this room were not included in the scan scoring system. The features and availability of libraries, kitchen areas, and gift shops were not included in the analysis since residents were not engaging in physical activity in these areas (as per the patterns of use described in the interviews and focus groups in the original study). Additionally, areas within Special Care Units were not assessed since residents living on these units were cognitively impaired and were ineligible for the present study. Furthermore, not all features within the included areas

were expected to influence residents' physical activity. Which features were included, and how the scoring system was developed to translate the findings from the scan into an assessment of the LTC homes' environmental press are described in the next section.

Environmental Press Scoring System. Presently, no quantitative instruments or scales exist to assess the level of environmental press in LTC homes. An environmental press scoring system for the scan had not previously been developed, thus one was created for the present study. This scoring system is outlined later and indicates which items and sub-items (i.e., specific features of the built environment) from the original study's scan were included in the assessment of environmental press, how these items were measured in the original study, the criteria for appropriate environmental press, and how each item was scored.

Based on the environmental characteristics that Cutler (2000) described as being important in assessing the built environment, the scan items were divided into three categories: supportive, accessible, and safe. Sub-items were included when an item had multiple measurements associated with it (e.g., if multiple characteristics of the item were assessed, or if the item was measured in multiple areas). Criteria were established for each item and sub-item to determine what was considered to be appropriate environmental press (i.e., not too high or too low). These criteria were based on published guidelines for seniors or, if not available, for people with physical disabilities (since seniors living in LTC homes often have mobility limitations similar to those with physical disabilities). Only criteria for inappropriately high environmental press were included since no criteria for inappropriately low press were found for this target population. If a measure did not satisfy the appropriate environmental press criteria, it was considered to have inappropriately high environmental press. Guidelines for a few items and sub-items were not found in the literature, and thus, the

following were excluded from the assessment of environmental press: number of disabled parking spaces and their distance from main entrance, chair arm height, presence or absence of front steps, hallway length, elevator door timing from fully open to fully closed, discrepancy between elevator floor and hallway floor, reach of elevator buttons, presence of clutter, and transitions in lighting.

In total, there were nine items and 25 sub-items. The sub-items categorized as appropriate environmental press were given zero points, and those categorized as inappropriately high environmental press were given one point. Then mean item scores were calculated by summing scores for sub-items divided by the number of sub-items. Finally, the mean item scores were summed to determine each LTC home's total environmental press score. Possible total environmental press scores ranged from 0 to 9, with higher scores indicating greater levels of inappropriately high environmental press. Explicit weights had not previously been developed for the items on the scan and thus have not been incorporated into the scoring system for the present study. The full scan scoring system, categorized by supportive, accessible, and safe items, is presented next in Table 4.

Table 4.

Scan Items included in the Assessment of Environmental Press

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
Supportive						
1.0 Hallway connectivity	N/A	Hallways (main level, and residents' room level).	Observation and floor plans were drawn for each unique hallway configuration assessed.	Circular or connecting hallway (i.e., no dead ends) encourages residents to travel the length of the hallway or use the hallways to walk for leisure.	Presence of circular routes, or connective hallways (Klein, 2002).	Hallways in each area assessed (i.e., in each sub-item) without circular or connective routes were categorized as inappropriately high environmental press and received one point.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
2.0 Chairs	2.1 Seat height	Entrance/ lobby; main floor lounge, living and dining rooms.	For the three most common types of chairs, the length from floor to the front of the seat was measured with measuring tape.	Appropriate chair dimensions can make it easier for residents to get in and out of a chair on their own.	Seat height between 43 and 49 cm (O'Keeffe, 2004; Mazza, 2004; Finlay, 1983).	This sub-item received one point if half or more of the chairs in the area assessed did not meet the appropriate environmental press criteria.
3.0 Exercise or physiotherapy room availability	N/A	Exercise or physiotherapy room.	Observation.	The availability of an exercise room supports physical activity by providing a designated space to do physical activity (without competing with other activities, or finding space for equipment).	Presence of at least one exercise or physiotherapy room for residents.	A LTC home without a designated exercise or physiotherapy room received one point for this item.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
Accessible						
4.0 Doors	4.1 Type	Entrance and lobby.	Observation.	The type of door in the entrance/ lobby can influence how easily residents can navigate through it.	Doors with an automatic open option (Ministry of Housing, British Columbia, 1998; O'Keeffe, 2004).	Each area that did not have a door with an automatic door option was categorized as inappropriately high environmental press and the sub-item received one point.
	4.2 Timing from open (90 degrees) to fully closed		Recorded the time it took for the door to fully close from a 90 degree open position with a stopwatch.	The timing of the door closing can influence how easily residents navigate through it.	Doors that take 4 seconds or longer to close (Ministry of Housing, British Columbia, 1998).	Each area that had a door that closed in less than 4 seconds was categorized as inappropriately high environmental press and the sub-item received one point.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
	4.3 Pull weight		Recorded greatest weight required to pull open the door using a fish scale.	Entrance/lobby doors that are too heavy for seniors to pull open independently can restrict their access to outdoor spaces.	Doors that weigh 8 pounds or less when to pull open (Ministry of Housing, British Columbia, 1998; O'Keeffe, 2004).	Each area that had a door that weighed more than 8 pounds was categorized as inappropriately high environmental press and the sub-item received one point.
5.0 Clear path for easy mobility	N/A	Entrance/ lobby; main floor lounge, living and dining rooms.	Observation.	Not having a clear path for easy mobility would discourage seniors from walking indoors.	Presence of a clear path for easy mobility (Ministry of Housing, British Columbia, 1998; O'Keeffe, 2004).	Each area that did not have a clear path for easy mobility was categorized as inappropriately high environmental press, and the received one point.
6.0 Slope of floor	N/A	Hallways (main level, and residents' room level).	Measuring tape.	If the slope of the floor is too steep, it can restrict seniors' ability to access the area(s).	Slope equal to or less than 8% (O'Keeffe, 2004).	Floors with a slope > 8% were categorized as inappropriately high environmental press and received one point.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
7.0 Hallways	7.1 Width	Hallways (main level, and residents' room level).	All unique hallways were assessed. Hallway width measured with measuring tape.	Hallways that are too narrow can restrict seniors' ability to navigate the hallway, especially when passing others in the opposite direction.	Hallway width 1.5m or greater (Ministry of Housing, British Columbia, 1998).	Hallways less than 1.5m in width were categorized as inappropriately high environmental press, and received one point.
8.0 Elevator doors	8.1 Number	Elevator.	Observation.	The LTC homes were multi-level, therefore ensuring that elevators are in place allows residents to access other floors in the LTC home more easily than using stairs.	Presence of at least one elevator available for residents' use.	This sub-item received one point for each LTC home that did not have an elevator available for residents.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
	8.2 Timing from fully open to *start* to close		Stopwatch. Each elevator door was assessed and the time from fully open to the start of closing (without pressing any buttons) was recorded.	Doors that allow enough time for residents to enter the elevator are more accessible, especially for seniors who use a mobility aid (e.g., walker or cane).	At least 4 seconds from completely open to start of door closing (Ministry of Housing, British Columbia, 1998).	Each elevator door that did not allow at least 4 seconds before starting to close was categorized as inappropriately high environmental press. A LTC home with more than half of their elevator doors categorized as inappropriately high environmental press, received one point for this sub-item.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
	8.3 Automatic door opener		Observation. All elevators were assessed to determine whether or not the door would automatically open if someone was in the way once it started to close.	Presence of an automatic door opener is a safety feature for elevator doors.	Presence of an automatic door opener on each elevator door (Ministry of Housing, British Columbia, 1998).	Each elevator that did not have an automatic door opener was categorized as inappropriately high environmental press. A LTC home with more than half of its elevators with inappropriately high environmental press received one point for this sub-item.
Safe						
9.0 Flooring surface	N/A	Outdoor common areas, entrance/lobby, lounge, living and dining rooms,	Observation. The type of flooring in each area was recorded but the changes in	Transitions in flooring type, colour, and texture can pose a trip hazard for seniors.	Uniform flooring (i.e., only one type of flooring material) used within each area. If carpeting present, it should be low-pile (O'Keeffe, 2004).	Areas that did not have uniform flooring were categorized as inappropriately high environmental press and received one point for

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
		hallways, and activity room.	flooring type between areas were not.			this sub-item.
10.0 Snow cleared, sanded areas	N/A	Outdoor common areas.	Observation.	Outdoor areas that are not maintained in the winter with snow clearing and sanding become fall hazards to seniors.	Areas described as being clear of snow and sanded/ salted (Ministry of Housing, British Columbia, 1998).	Outdoor areas that did not meet the appropriate environmental press criteria were categorized as inappropriately high environmental press and received one point for this item.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
11.0 Handrails	11.1 Presence: on one or both sides	Hallways (main level, and resident room level).	Observation.	Seniors are at a higher risk for falling in hallways that lack handrails. Or seniors may opt to navigate the hallway in a wheelchair, rather than walking, if they do not feel safe in the absence of handrails. Handrails on both sides of the hallway allow residents to use them when navigating the hallway in both directions.	Presence of handrails on both sides of the hallway.	The handrails in these areas were categorized as inappropriately high environmental press if any of the handrails did not meet all of the appropriate environmental press criteria. Areas with inappropriately high environmental press received one point for this sub-item.

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
	11.2 Textured markings on end of handrail		Observation.	An unexpected interruption or ending of a handrail may increase seniors' risk of falling.	Presence of textured markings on ending of all handrails (Ministry of Housing, British Columbia, 1998; Maki et al., 2006).	
	11.3 Diameter		Measurements were taken for each unique type of handrail present for all areas assessed using measuring tape.	Seniors are safer and easier to use when handrails have appropriate dimensions.	Between 3.5 and 5.0 cm in diameter (Maki et al., 2006; Ministry of Housing, British Columbia, 1998; O'Keeffe, 2004).	
	11.4Height from floor				Between 80.0 and 92.0 cm in height (Maki et al., 2006; Ministry of Housing, British Columbia, 1998).	

Scan items	Sub-items	Area(s) assessed	Method of measurement	Rationale for item inclusion/ exclusion	Appropriate environmental press criteria	Scan scoring method
	11.5 Clearance from wall				Minimum 4.0 cm from the wall (Maki et al., 2006 ; Ministry of Housing, British Columbia, 1998; O'Keeffe, 2004).	
12.0 Number of loose or uneven rugs or carpets	N/A	Entrance/ lobby	Observation.	Loose or uneven rugs are fall hazards, especially for seniors who use walkers or shuffle their feet. Seniors may be discouraged from walking in areas where these hazards are present.	No loose or uneven rugs present (O'Keeffe, 2004).	Lobbies that had any loose or uneven rugs were categorized as inappropriately high environmental press and the item received one point.

Findings for each of the scan items and sub-items included in the assessment of environmental press and the corresponding appropriate environmental press criteria were computed. Any items or sub-items that did not vary across the seven LTC homes (e.g., clear path for easy mobility) were removed from the scan scoring system, since these items do not contribute to the overall variability of scores across LTC homes. The final list of items included in the scan scoring system is presented in the results chapter. The mean total environmental press score was used as a cut point to divide the seven LTC homes into two groups. LTC homes with scores between 0 and 3.3 were categorized as having appropriate levels of environmental press, and LTC homes with scores greater than 3.3 were categorized as having inappropriately high levels of environmental press.

Primary Data Collection

Measures of Older Adults' Physical Activity

Several methods to measure older adults' participation in physical activity were considered, including: direct observation, pedometers, activity diaries or logs, and recall-based self-report questionnaires. Most of these methods were not viable options. Direct observation of each resident for the week-long period was not possible given the investigator's resource and time restraints. Previous studies have demonstrated the inaccuracy of pedometers when used with the elderly, particularly when measuring slow gait speed (Stel et al., 2004). Furthermore, these instruments only measure walking exercises, excluding other types of activities pertinent for older adults in long-term care, such as chair exercises or strength training (Cyarto, Myers & Tudor-Locke, 2004). Activity diaries and

logs were not selected in order to minimize time and cognitive demands on the residents. One study found that a self-report questionnaire was easier to use than a seven-day activity diary for older adults (Stel et al., 2004). As described in the literature review, all existing self-report questionnaires that assess physical activity among the elderly have focused on community-dwelling older adults, rather than the long-term care population (Benjamin et al., 2005; Richardson, Ainsworth, Wu, Jacobs & Leon, 1995; Sallis & Saelens, 2000; Schuler, Richardson, Ochoa & Wang, 2001; Stel et al., 2004; Washburn et al., 1993). Despite this limitation, a self-report questionnaire was considered the most appropriate for the present study.

The Older Adults' Exercise Questionnaire (OAEQ) was selected to assess long-term care residents' participation in physical activity, since it was the one most relevant to the present study's target population (i.e., frail older adults in the Ottawa area) (Benjamin et al., 2005). The OAEQ was developed based on the 1988 Health Survey (Ministry of Health, Ontario, 1988) and assessed the type, frequency, duration, and subjective intensity of several endurance, strength, and flexibility exercises performed in the past seven days. During the original development process, the OAEQ was verified for face and content validity using a panel review of nine experts in various areas (fall prevention, gerontology, statistics, kinesiology, and health behaviour management). However, since the OAEQ was originally developed for a community-dwelling population, it required modifications to reflect the types of activities available for residents living in LTC homes. The author of the thesis made these modifications, described next. Walking indoors was one common activity described in the original study's focus groups (during the descriptions of residents' typical days), and was added to the OAEQ. Activities typically limited to the community-dwelling population were removed (e.g., gardening, running, swimming, aquafitness class, and housework). The

modified OAEQ (hereafter referred to as the MOAEQ) assessed a combination of 12 different types of physical activities: 1) walking indoors for leisure; 2) instrumental walking indoors; 3) walking outdoors for leisure; 4) instrumental walking outdoors; 5) physiotherapy – involving either cardiovascular, strength training, or stretching exercises; 6) chair exercises – alone or in a group; 7) dancing; 8) stair climbing; 9) strength training – alone, 10) stretching – alone, 11) yoga – alone or in a group, and 12) Tai Chi – alone or in a group. Similar to previous studies (Poon et al., 1999), the measure of intensity was removed from the questionnaire, since it was assumed that the residents who engaged in physical activity would do so at low levels of intensity (Taylor et al., 2004). Removing the intensity measure reduced the length and complexity of the questionnaire, making it more suitable for the LTC population. It was also considered less challenging for the residents to complete the questionnaires during face-to-face interviews, allowing the investigator (rather than the resident) to record the responses. Administering the questionnaire during face-to-face interviews was expected to help increase response rates, promote accurate form completion, and accommodate illiterate and/or visually-impaired seniors (Streiner & Norman, 2003). The MOAEQ was pilot-tested with one older community-dwelling adult to test for clarity, ease of understanding and flow logic; and to determine the estimated length of time to complete the interview. This individual's data were not included in the analysis. The MOAEQ was translated into French by the author and a bilingual colleague, and it was approved by the three REBs. See Appendix F for English and French versions of the MOAEQ.

Measurement of Older Adults' Characteristics

The MOAEQ collected additional background information on each participant, including: the type of assistance they received with their physical activity (e.g., from

recreation staff, a physiotherapist, nurse, etc.), personal characteristics (age, gender, and length of stay), and perceived health and activity levels. Participants were asked to rate their perceived health status and perceived activity level as compared to other residents in their LTC home who were able to walk. They responded using the following five-point Likert scales: for self-perceived health status, 1 – poor, 2 – fair, 3 – good, 4 – very good, and 5 – excellent; for self-perceived activity level, 1 – more active than the others, 2 – a little more active than the others, 3 – about the same as the others, 4 – a little less active than the others, and 5 – a lot less active than the others. The background questions, particularly those concerning perceived health and activity levels, were asked at the end of the interview to avoid introducing a social response bias into respondents' answers about their participation in physical activity. For instance, if they reported that they were 'more active than the others' they might feel they needed to reflect this in their answers, which might have led them to over-estimate their participation in physical activities.

Recruitment

Administrators from the selected LTC homes were contacted by telephone and invited to participate in this extension of the original study (script in Appendix G), and one-page letters of information were also sent to them (Appendix H). Letters of permission were obtained from each administrator who agreed to participate (sample letter in Appendix I).

Once the LTC homes were recruited, a sample of residents was selected from each LTC home. The sampling frame consisted of all eligible residents from the participating LTC homes. The administrator from each LTC home was responsible for designating a clinical contact (e.g., nurse, physiotherapist) to assist with recruitment. The clinical contact compiled a list of all residents who met the eligibility criteria. A systematic sampling technique (using

a random number that was computer-generated) was used to select every 'n^{th}' resident on the list. In the LTC homes where the total number of eligible residents was 17 or fewer, they were all invited to participate. Residents were approached by the clinical contact and given a letter of information describing study details (Appendix J). Only the names of residents who agreed to participate were shared with the investigator.

Data Collection

The interviews were completed in each resident's language of choice, between November 2006 and July 2007 by the author (in English) and a trained research assistant (in French). The research assistant had also been part of the research team involved with the original study's focus groups and environmental scans and, as such, was familiar with the target population and subject matter. Two training sessions were conducted by the author of this thesis to help the research assistant become familiar with the requirements of data collection. During the first session, the author reviewed and explained each item on the physical activity questionnaire. A mock interview, whereby the research assistant was the interviewer and the author was the interviewee, was conducted in French as part of the second training session. Efforts to maintain similar interviewing styles were discussed, and were strengthened by using the exact wording written on the questionnaire sheet. Questionnaires completed by the research assistant were reviewed by the author shortly after completion in order to identify and address any issues or concerns.

To administer the questionnaires, the investigators met with each of the selected residents at their LTC home, usually in their room, and reviewed details of the study with them. Written informed consent was obtained prior to administering the questionnaire (Appendix K). In cases where residents were visually impaired or illiterate, consent forms

were read aloud to them in the presence of a witness. Residents were also given a copy of the signed consent form. Participants reported on their physical activity during the seven-day period prior to the interview. To minimize fatigue and response burden, the questionnaire was designed to take between 15 and 30 minutes to complete. Respondents were reminded at the start of the interview that they could stop the interview at any time, without penalty. If respondents revealed the possibility of a serious health concern, the investigator asked for their permission to notify one of the nurses on the floor. Field notes were recorded immediately after each interview was completed to capture any additional comments or observations.

Primary Data Analysis

Physical Activity Data Entry

A database was developed using the Statistical Package for Social Sciences (SPSS) for Windows (15.0). Numerical codes were created for all qualitative data points (e.g., gender, etc.). A pre-coded questionnaire was used to facilitate the entry of completed questionnaires directly into the database.

Double entry was completed for fourteen randomly selected questionnaires (two from each LTC home). The error rate was 0.6%. That is, nine out of the 1526 data points had been mis-entered (i.e., the complete variable was one data point). One mis-entered data point was the location where the resident walked. An error in the frequency of one resident's instrumental indoor walking accounted for two mis-entered data points (since the total time for this activity was affected by the original error). These types of errors were corrected by manually checking all questionnaires for the 'walking indoors – instrumental' variable. Lastly, six mis-entered data points related to stretching exercises. This variable was

particularly complex since the residents who did "stretching in a group" were doing this as part of the "group chair exercises". Thus, care was needed not to double count the time spent doing this activity. As a result of the double entry exercise, subsequent data entry was refined by creating a new variable that described the combination of exercises included in the chair exercise session (e.g., lifting weights and/or stretching, or none). During the entry of this new variable, the 'chair exercises', 'lifting', and 'stretching' variables for all questionnaires were manually verified for accuracy.

Data cleaning also included checking for out-of-range values; none were found. However, 43 of the total data points (0.5%) were missing. Typically this meant that residents were not able to estimate the frequency and/or duration of a particular activity. For the 43 missing data points, a means substitution imputative procedure was used; the average frequency and duration of physical activity of other residents in the same LTC home who also reported doing that particular activity were calculated and replaced the missing values. The variables with imputed data were renamed, thus preserving the original data. In the case where no other resident reported doing the same activity, imputation was not possible and the data point (i.e., for frequency or duration) was given a value of zero. In the latter case, the activity did not contribute to this resident's overall mean total time for physical activity, but evidence of their participation in the activity was still recorded.

Presentation of Findings

Descriptive statistics (e.g., means, standard deviations, and/or percentages) were used for characteristics of the LTC homes (e.g., number of beds, etc.) and resident characteristics (age, gender, time spent doing physical activity, etc.). The standard deviation was used to

present the amount of variability within each home and the standard error of the mean was used across homes.

To maintain the anonymity of study homes, the actual mean values were presented in the following categories: number of beds (<150, 150 – 250, and >250); age of building in years (0-5, 6-10, 11-20, 21+); and number of years from last major renovation (0-5, 6-10, 11-20, 21+, or not applicable if no major renovations have been done). Background information about the residents (e.g., age, gender, length of stay, level of mobility, assistance with exercise) as well as their perceived health status, activity level, and their participation in physical activity (i.e., type of activity, frequency, and duration) were aggregated for each LTC home and presented descriptively.

Similar to the original OAEQ scoring system, cumulative total physical activity scores were used to determine each resident's total time for physical activity in the prior week. Total physical activity scores were calculated by summing the product of the frequency (f) and duration (d) ($\sum f \times d$) for each type of activity included in the MOAEQ. The mean duration, mean frequency, and both mean and median total time per week were calculated for each activity included in the MOAEQ. Residents who did not participate in a particular activity contributed a value of zero to the mean and median calculations, thus generating an overall assessment of residents' participation in physical activity, rather than only for those who did engage in the various types of physical activities. For each LTC home, both the mean and median total time for residents' physical activity were calculated since median values are less susceptible to extreme cases, compared to mean values, particularly when the sample size is small.

When residents gave a range (e.g., five to ten minutes) for the estimated duration of a certain activity, the mean value of this range was entered into the database. Also, when

entering the values for the frequency of instrumental walking, the values often had to be 'doubled' to indicate when residents walked both to and from a particular location. For instance, when residents reported walking to and from the dining room three times a day, this was recorded as six trips (three trips multiplied by two). Also, since most residents made more than one type of instrumental indoor walking trip, the mean frequency and duration results would not be very informative, as they would not distinguish between single trips of very long duration and several short trips. Thus, the mean frequencies of instrumental indoor walking were calculated separately for trips of three different durations: less than five minutes, between five and ten minutes, and over ten minutes in length. Lastly, while not part of the MOAEQ, most residents would indicate their walking destination (e.g., in the hallways, to and from the dining room), so a new variable was created to capture this information.

Statistical analyses were conducted to assess the differences between residents' physical activity in LTC homes with appropriate versus inappropriately high levels of environmental press. Multiple types of tests were carried out, depending on the type of data. Pearson chi-square tests were conducted for nominal data (e.g., proportion of residents participating in physiotherapy) or the non-parametric alternative, the Fisher's exact test, when the sample size was insufficient. McNemar's test was used to compare proportions of within the same sample of residents, and two-sided t-tests were conducted for continuous data (e.g., mean total time). Results were considered statistically significant at the $p < .05$ level.

Confounding

Attempts to control for confounding were conducted in both the design and analytical stages. Restriction was used in the design stage, whereby clear eligibility criteria were used to include residents with similar characteristics (e.g., cognitive abilities, age), in order to reduce the variability of those potential confounders. Restriction was also used in the calculation of the total physical activity scores. Total scores were computed both with and without the walking outdoors item to avoid the confounding effects related to the outdoor environment (since one LTC home was under construction and its outdoor environment was inaccessible), and the weather (while most interviews were conducted in the winter, five of the seven interviews conducted in the spring or summer were done at LTC homes with appropriate environmental press).

Stratification is a common method to evaluate and control for confounding in the analysis phase of a study. This method allows the investigator to examine the associations within homogeneous categories (or strata) of the confounder (Aschengrau & Seagle, 2003). Stratified analyses were conducted on the following variables (categories presented in parentheses): age (<85 years versus ≥ 85 years), gender (female versus male), length of stay in the LTC home (< 45 months versus ≥ 45 months), health status (excellent or very good or good versus fair or poor), activity level (more active than the others versus equally or less active than the others), and level of mobility (mobility aid use versus no mobility aid use). These exposure variables were assessed as confounders because, as detailed in the literature review, they have been shown to influence older adults' physical activity.

To determine whether effect modification or confounding was present, stratum-specific chi-square estimates were computed. Similarities between stratum-specific estimates for each variable were visually assessed. The Breslow-Day statistic was calculated to

determine the homogeneity of odds ratios between the strata. If the strata were found to be homogeneous, then effect modification was not present. Mantel-Haenszel pooled estimates and 95% confidence intervals were then calculated, which provided an estimate of the total association given the differences between strata (e.g., due to sampling variability) (Pagano & Gauvreau, 2000). Confounding was present when the crude summary estimate was outside the range of the associated stratum-specific estimates. Confounding was not assessed when effect modification was present. The findings of these analyses are presented in the following chapter.

CHAPTER FOUR: RESULTS

Findings from the qualitative analysis of data obtained from the original study's focus groups and walkabout interviews are presented, followed by findings from the quantitative analysis of the environmental scans and physical activity questionnaires. These findings answered the secondary research questions, which then informed the analysis of the primary research question of the present study (i.e., whether differences in residents' participation in physical activity existed between LTC homes with appropriate and inappropriately high levels of environmental press).

Secondary Data Analysis

Qualitative Analysis

Content analysis was conducted of the data obtained from the administrator walk-about interviews and the focus groups. This analysis answered the first secondary research question and identified which sources of environmental press related to the built environment were reported by administrators, care providers, family members, and residents of LTC homes in the Ottawa area. These discussions focused on barriers to, and facilitators of, physical activity in LTC homes. The barriers related to the built environment were potential sources of inappropriately high environmental press, and the facilitators were potential sources of appropriate environmental press. Findings were categorized according to the three environmental characteristics used in the scan scoring system: supportive, accessible, and safe.

Supportive Environments

Barriers identified in the walkabout interviews and focus groups related to the theme of supportive environments included: a lack of space to manoeuvre, no designated room or space for physical activity, non-circular hallways, a lack of destinations, and inclement weather. Lack of space for physical activity was the most common barrier in the built environment identified by all types of participants (i.e., administrators, family members, residents, and staff). Space was either not available or not large enough for residents' physical activity needs. Activities were sometimes held in dining rooms or living rooms. One respondent noted the challenges of shared spaces:

> "...our [physical activity] programs are limited to the lounge. Well, you've got to deal with people who want TV, you know and you have to respect that, and so there's couches and chairs, but you have wheelchair and Geri-chair residents in those, so space is limited... you're not meeting that need of all those who want to be there just because of limited space."

Even LTC homes with therapy rooms, respondents often mentioned that the rooms were not big enough for the number of residents who received, or who wished to receive, physiotherapy.

A non-circular hallway configuration was identified by one administrator as a barrier, particularly for residents with dementia who tend to "get caught down there [at the end of the hallway], and getting them turned around can be a difficulty". The lack of destinations relates to not having a specific place for residents to walk to. In one LTC home, residents could use the outdoor grounds when it was nice outside, but there were not many places for them to walk indoors. Inclement weather was also identified as a barrier to physical activity.

The environmental facilitators of physical activity identified in the walkabout interviews and focus groups included: pleasant aesthetics or enjoyable scenery; the use of

different colours on walls and floors; the presence of a physiotherapy room with proper equipment (e.g., bicycle, treadmill); the presence of wide, circular hallways conducive to walking; and the distance between residents' rooms and living or dining rooms. These will be discussed below.

The aesthetics or scenery of the LTC homes and surroundings were common features mentioned throughout the discussions. Newer buildings, buildings with bright rooms, nice outdoor spaces or landscaping, and proximity to nature were aspects of the built environment that boosted residents' morale, and encouraged them to be physically active. An administrator from one LTC noted that residents were more motivated to attend strength-training sessions when they took place in a bright sunroom, rather than in a room with no natural light.

Another feature of the built environment that administrators identified as helping residents to be physically active was the use of different colours on the walls to distinguish between areas within a care unit. One LTC home used this technique to help residents orient themselves and navigate the hallways. Circular hallways were described as another feature that supported physical activity. One family member described these types of hallways as "more conducive to walking because they're sort of like a horseshoe". According to one administrator, circular hallways were deliberately included in the design of the buildings to help increase physical activity.

The distance between residents' rooms and the living or dining rooms was another feature highlighted in discussions with staff members. One respondent believed that shorter distances between the two areas encouraged residents to walk, since "they don't have to walk 20 miles to get to their living room and their dining room". Another respondent believed that the longer distance between the two areas in their building was a good way to incorporate

physical activity into the residents' daily routines. The focus group discussions revealed that walking (or self-propelling in a wheelchair) to the dining room was an activity that the majority of residents in each of the LTC homes did multiple times a day.

Accessible Environments

The barriers identified in the walkabout interviews and focus groups related to the theme of accessible environments included: steep ramps, inaccessible or isolated physiotherapy and exercise rooms, carpeting, heavy doors, narrow hallways, and small elevators. Ramps were frequently identified as a characteristic of the built environment that influenced physical activity. One resident reported purposively using the ramps everyday in order to maintain this ability, "I deliberately go up and down the ramps often, because I think it's going to help me to be able to continue to do it". Yet for most residents in LTC homes, access to certain areas was limited if the ramp they had to navigate was too steep. As one resident noted "...you need to get somebody to take you down [the ramp]".

Isolated rooms for physiotherapy and exercise were identified as a barrier to physical activity. One of the LTC homes only had extra space for a physiotherapy room in the basement and many residents felt that this location was too far away from their floor. In another LTC home, the physiotherapy room was inaccessible for residents who did not have scheduled physiotherapy sessions. Even if a resident could hire their own therapist, the room was not large enough to accommodate multiple patients.

A staff member at one LTC home mentioned that carpeting was another barrier to physical activity, since some residents had difficulty using their walkers on carpeted surfaces. Heavy doors, narrow hallways, and small elevators were also identified as key

barriers that restricted access to certain areas or discouraged residents from walking to and from various areas within the LTC homes.

Administrators of the LTC homes identified a couple of features of the built environment related to the theme of accessible environments that facilitated residents' physical activity. These included: wide and light-weight or automatic doors (so that residents could easily navigate through the doors), and the presence of lounges on every floor (so that smaller group activities could be held there and residents could walk there easily). The other focus group participants did not identify any access-related features of the built environment that supported residents' physical activity.

Safe Environments

The barriers related to the theme of safe environments that were identified in the walkabout interviews and focus groups were primarily fall and trip hazards including: winter mats not taped down, uneven sills between doorways, different flooring surfaces, features of the outdoor environments (e.g., sloping sidewalks, curbs, grass, and construction), clutter in halls (e.g., carts or lifts), and non-standard handrail heights. These barriers were identified by the LTC home administrators and staff members of four LTC homes. One respondent noted that it was not safe for residents to walk outdoors by themselves due to hazards in the outdoor environment (e.g., sloping sidewalks and paths, walking area not fenced in). Staff members at one LTC home remarked that while the outdoor environment was very nice, it was not safe for residents to go outdoors alone. "[So it's not safe?] Not to go by themselves, some of them yes, but most of them not. It's not fenced in..."

Only a couple of features of the built environment related to the theme of safe environments were identified as facilitators of physical activity. Administrators in one LTC

home noted that the presence of handrails on both sides of the hallways helped residents' mobility within the home.

> "[There are] handrails all the way around, so there's you know... anybody that needs a handrail, it's there for them. And still lots of room on this floor for someone to go past them, if they're taking their time."

Another LTC home administrator noted that secure outdoor walking paths also helped promote residents' physical activity. Overall, only a few facilitators related to the theme of safe-environments were highlighted in the walkabout interviews or focus group discussions.

Assessment of Environmental Press

The next section begins by presenting the descriptive statistics for the LTC home characteristics. Results from secondary data analysis of the scan are presented next, which address the secondary research question related to determining which environmental characteristics contribute to different levels of environmental press in the built environments of LTC homes in the Ottawa area.

LTC Home Characteristics

Eight long-term care administrators were contacted and invited to participate in this study and seven accepted. The administrator who declined to participate was new to the position and was not involved with the original study. This administrator cited increased workload and administrative burden as reasons for not participating. Table 5 presents descriptive characteristics of the seven LTC homes included in this study. LTC homes are identified with a number (LTC home ID), and the results are presented in categories to

maintain LTC homes' confidentiality. Most of the LTC homes were mid-sized (150-250 beds). Four of the homes were built or had a major renovation in the last ten years.

Table 5.

LTC Home Characteristics

LTC home ID	Number of beds	Age of building (in years)	Years since last major renovation
1	150-250	>20	11-20
2	150-250	>20	6-10
3	150-250	0-5	N/A
4	150-250	>20	>20
5	>250	>20	0-5
6	150-250	6-10	N/A
7	<150	>20	Unknown

Level of Environmental Press

Several items on the scan had appropriate levels of environmental press in each of the LTC homes, and thus did not contribute to the overall variability of environmental press scores. For this reason, the following items and sub-items were not included in the total environmental press score: snow cleared or sanded at front entrance, clear path for easy mobility, chair seat height in dining rooms, slope of flooring in hallways, availability of an elevator, and an automatic elevator door opener.

The detailed results of the scan scoring system are presented in Table 6, along with the breakdown of the environmental press scores for each item and sub-item relating to the three environmental domains of interest. Items 1.0 to 3.4 are associated with supportive environments, items 4.0 to 6.2 are associated with accessible environments, and items 7.0 to 9.2 are associated with safe environments. Scores for each item and sub-item ranged from zero (appropriate environmental press) to one (inappropriately high environmental press), with higher scores indicating greater levels of inappropriately high environmental press. Scores for insufficient levels of environmental press were not included in the scan scoring system. If the item was not available in the LTC home it was scored as 'n/a' and treated as a missing value.

Table 6.

Detailed Breakdown of LTC Homes' Environmental Press Scores

Scan scoring system items	LTC home ID						
	1	2	3	4	5	6	7
1.0 Hallway connectivity item							
1.1 Main level	1	1	0	1	1	1	1
1.2 Resident room level	0	0	1	1	0	1	1
Hallway connectivity score	0.5	0.5	0.5	1	0.5	1	1
2.0 Physio or exercise room item							
2.1 Physio or exercise room	0	0	0	1	1	1	1
Physio or exercise room score	0	0	0	1	1	1	1
3.0 Chair item							
3.1 Entrance chairs	0.0	0.67	0.33	0.5	0.0	0.33	1.0
3.2 Lobby chairs	0.0	0.0	0.33	0.0	1.0	0.33	1.0
3.3 Living room chairs– main level	0.67	0.67	0.0	0.67	0.67	0.33	0.67
3.4 Living room chairs– room level	0.67	0.33	1.0	0.5	0.5	0.0	0.0
Chairs score	0.34	0.42	0.42	0.42	0.54	0.25	0.67
Total supportive-related score	0.84	0.92	0.92	2.42	2.04	2.25	2.67
4.0 Doors item							
4.1 Entrance door (type)	0	0	0	0	0	0	1
4.2 Entrance door (weight)	0	0	0	1	0	0	1
4.3 Entrance door (time to close)	0	0	0	0	0	0	1
4.4 Lobby door (type)	0	1	0	0	0	0	1
4.5 Lobby door (weight)	0	0	0	0	0	0	1
4.6 Lobby door (time to close)	0	0	0	0	0	0	1
Doors score	0	0.17	0	0.17	0	0	1.0
5.0 Elevator item							
5.1 Elevator door 1 timing	0	0	0	0	0	0	0
5.2 Elevator door 2 timing	0	0	1	0	1	0	n/a
5.3 Elevator door 3 timing	0	0	1	0	n/a	n/a	n/a
5.4 Elevator door 4 timing	n/a	0	n/a	0	n/a	n/a	n/a
Elevator item sub-total	0	0	0.67	0	0.5	0	0
6.0 Hallways item							
6.1 Minimum hallway width – main	0	0	0	0	0	0	1
6.2 Minimum hallway width – room	0	0	0	0	0	0	1
Hallway item sub-total	0	0	0	0	0	0	1
Total accessible-related score	0	0.17	0.67	0.17	0.5	0	2.0
7.0 Rugs item							
7.1 Entrance/lobby rugs	0	0	0	0	1	1	1
Rugs score	0	0	0	0	1	1	1
8.0 Type of flooring item							
8.1 Outdoor common area	1	1	0	0	0	0	1
8.2 Entrance/lobby	0	1	1	1	0	1	1
8.3 Dining room	0	0	0	1	0	0	0
Type of flooring score	0.33	0.67	0.33	0.67	0	0.33	0.67
9.0 Handrails item							
9.1 Main level	0.25	0	0	0.25	0.25	0.5	0.5
9.2 Resident room level	0.25	0	0	0.25	0	0.25	0.5
Handrails score	0.25	0	0	0.25	0.13	0.38	0.5
Total safe-related score	0.58	0.67	0.33	0.92	1.13	1.71	2.17
Total environmental press score	1.42	1.76	1.92	3.51	3.67	3.96	6.84
Appropriate (A) or inappropriately high (I) environmental press	A	A	A	I	I	I	I

For the supportive environment category, there was considerable variability across the seven LTC homes for two items: connectivity of the hallways and the presence of an exercise room. No LTC homes had connective hallways on both the main and resident room levels. Only three of the homes had a room designated for physiotherapy care; none had rooms specifically designated for general exercises and physical activity. Each LTC home had some chairs that did not meet the appropriate environmental press criteria for seat height, but all of the chairs assessed in the dining rooms met the appropriate environmental press criteria.

For the items related to accessible environments, the doors, elevators, and width of the hallways satisfied the appropriate environmental press criteria in most LTC homes. Only one did not have an automatic door option in the entrance or lobby, and its hallways were slightly narrower than the recommended minimum width. In most LTC homes, the accessible-related items did not contribute much to the overall environmental press score (since items and sub-items with appropriate levels of environmental press were scored as zero and thus did not increase the environmental press scores).

For the items related to safe environments, the presence of loose or uneven rugs, multiple types of flooring, and handrails that did not meet the appropriate environmental press criteria all contributed to the overall environmental press scores. Loose rugs were present in the front entrance or lobby in three LTC homes. The flooring was uniform in a number of areas within the LTC homes, including the hallways, living rooms, activity rooms, exercise/physiotherapy rooms (where available), and elevators. But almost all of the LTC homes used more than one type of flooring in the following areas: outdoor common areas, front entrance or lobby, or dining room. All LTC homes had the handrails at an appropriate height; however, in one home this was not consistent along the length of hallway. Another

LTC home had handrails that were several centimetres wider than the recommended diameter. Overall, three LTC homes were categorized as having appropriate levels of environmental press and four had inappropriately high levels of environmental press.

Physical Activity Data Analysis

Findings from the present study are outlined below, including the recruitment and response rate for the face-to-face questionnaire, descriptive statistics for the resident characteristics, and a summary of residents' participation in physical activity. Results from each of the LTC homes are initially presented individually to answer the secondary research question related to the type and duration of physical activity that seniors living in LTC homes in the Ottawa area engage in. Then the grouped results for LTC homes with appropriate versus inappropriately high levels of environmental press are presented, along with results of the stratified analyses, to address the primary research question.

Recruitment Process and Response Rate

Between November 2006 and March 2007, clinical contacts from seven LTC homes identified all residents within their home who met the eligibility criteria (with the aim of recruiting a total of 17 residents per LTC home). Approximately 9% of the total LTC population in the present study met the eligibility criteria. Only one LTC home had a pool of eligible residents larger than 17 and thus required random sampling. In the remaining six LTC homes, all eligible residents were invited to participate. In total, clinical contacts invited 109 residents to participate: nine declined. Only the names of those who agreed to participate were shared with the researcher. Thus, reasons for refusal and background characteristics

(e.g., gender, language) were not available for the nine residents who declined to participate at this initial stage. The researcher approached a total of 100 residents between November 2006 and July 2007.

Exclusions. An additional nine residents were excluded post-recruitment because they did not meet the inclusion criteria. While obtaining informed consent, it was determined that three residents were not cognitively able to provide informed consent and answer the questions, and three residents were not able to communicate well enough in English or French. The remaining three residents were excluded after the interview was conducted because it became evident to the investigator that they did not meet the eligibility criteria regarding their cognitive ability (n=2), or their mobility (n=1). Of these nine excluded residents, three were French-speaking, and six were English-speaking. This group of excluded residents was comprised of one male (11%) and eight females (89%).

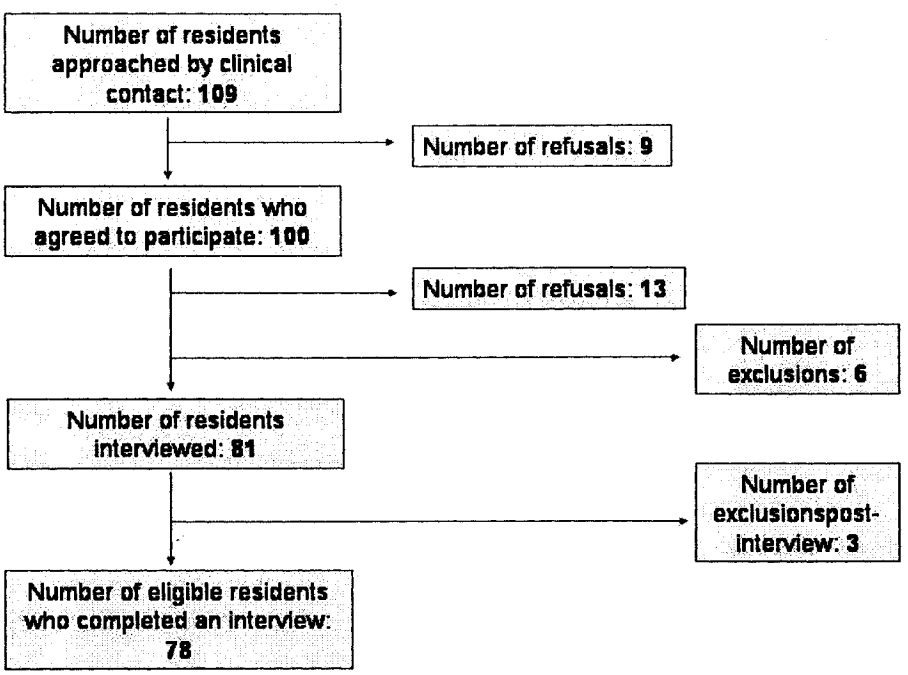
Refusals. Of the remaining 91 eligible residents approached by the researchers, 13 (14.3%) declined to participate because they were not feeling well (n=4); were not interested (n=2); were too busy (n=2); or felt they were not active enough to participate (n=2). Three did not provide an explanation for the refusal. For those who were not feeling well or were too busy, the researchers offered to come back at another time, but these residents refused that option as well. In total, one male (8%) and 12 females (92%) declined to participate; and of these, eight (62%) were Francophone and five (39%) were Anglophone.

Final Sample. Out of the 109 residents who were initially judged eligible for inclusion, nine were excluded post-recruitment because they did not meet the inclusion criteria, leaving 100. A further nine people declined the clinical contacts' invitation to participate in this study. From the remaining 91 eligible residents, thirteen refused to

participate, resulting in a total of 78 residents who completed the questionnaire, and an overall response rate of 78%. Thirteen (17%) interviews were completed in French, and 65 (83%) were completed in English. See the flow chart in Figure 2 for an overview of the response rate.

Figure 2.

Response Rate Flow Chart



Sample Characteristics

Resident characteristics are presented in Table 7 for each of the seven LTC homes. In each LTC home, the number of residents included in the final sample ranged from four to seventeen. Two LTC homes had less than ten residents eligible to participate. The number of exclusions and refusals are also presented. The mean age of the residents was 87 years (SE 0.8) and ranged from 73 to 102 years. Approximately 79% of the residents were female.

Residents were asked to rate their health status and activity level as compared to other residents in their home who were able to walk. Most of the respondents (76%, n=59) described themselves as either being in 'excellent', 'very good', or 'good' health compared to other residents in their LTC home who could walk, while 24% (n=19) reported having fair or poor health status. Many residents described themselves as 'more active' (60%, n= 47) or 'about the same' (26%, n= 20) as other residents in their home who were able to walk. Nearly 80% reported the use of a mobility aid. About two-thirds of residents (68%) received assistance with their exercises.

Table 7.

Residents' Characteristics across the Seven LTC Homes

	LTC home ID							
Characteristics	1	2	3	4	5	6	7	Total
Total sample (N)	10	10	8	15	17	14	4	78
Mean age, in years	88	86	82	90	87	90	85	87
(SD)	(5.1)	(7.4)	(7.2)	(5.7)	(8.1)	(6.3)	(4.4)	-
[SE]	-	-	-	-	-	-	-	[0.8]
Age range	78-95	74-102	73-93	74-97	74-101	79-100	79-89	73-102
Gender (% F)	90	60	75	93	88	79	25	79
Mean length of stay, in	77	38	33	37	53	33	20	45
months (SD)	(68.0)	(27.9)	(16.1)	(36.9)	(33.7)	(27.2)	(13.7)	-
[SE]	-	-	-	-	-	-	-	[5.3]
Excellent to good	70	80	88	73	76	79	50	76
health status % (n)	(7)	(8)	(7)	(11)	(13)	(11)	(2)	(59)
More active than	50	70	50	33	71	86	50	60
others % (n)	(5)	(7)	(4)	(5)	(12)	(12)	(2)	(47)
Use of mobility aid	50	70	88	93	88	86	50	80
% (n)	(5)	(7)	(7)	(14)	(15)	(12)	(2)	(62)
Received assistance	70	70	63	47	82	64	100	68
with exercise % (n)	(7)	(7)	(5)	(7)	(12)	(9)	(4)	(53)

The 13 who refused to participate post-recruitment were slightly younger (mean age 85 years) than those in the final sample (87 years). Compared to the final sample, larger proportions of residents who declined to participate were Francophone (62% versus 17%) and female (92% versus 80%).

Physical Activity across Long-Term Care Homes

The mean and median total time for physical activity per week, as well as the proportion of residents who engaged in various types of physical activities, and the average amount of time per week spent doing these activities (including the mean frequency per week, the mean duration per activity, and the total mean time spent doing the activity per week) are presented in Table 8.

Table 8.

Residents' Participation in Physical Activity in Prior Seven Days by LTC Home

Physical activity	LTC home ID							
	1 (N=10)	2 (N=10)	3 (N=8)	4 (N=15)	5 (N=17)	6 (N=14)	7 (N=4)	Total (N=78)
Mean total time for physical activity	375	499	389	414	640	536	317	483
per week (SD)	(180.6)	(276.5)	(167.3)	(222.8)	(523.1)	(300.3)	(178.5)	-
[SE]	-	-	-	-	-	-	-	[37.3]
Median total time, in minutes	382	451	429	328	393	508	323	392
Walking indoors,	90	100	100	87	100	100	100	96
instrumental % (n)	(9)	(10)	(8)	(13)	(17)	(14)	(4)	(75)
Mean frequency per week	51	46	62	39	56	53	43	50
(SD)	(27.6)	(11.7)	(16.8)	25.0)	(36.7)	(21.9)	(32.9)	-
[SE]	-	-	-	-	-	-	-	[3.0]
Mean duration per session, in minutes	4	11	8	15	20	16	7	13
(SD)	(2.7)	(8.3)	(6.0)	(13.0)	(21.6)	(22.2)	(3.6)	-
[SE]	-	-	-	-	-	-	-	[1.8]
Mean total time, in minutes	191	254	189	292	372	258	154	268
(SD)	(145.1)	(159.9)	(105.8)	(230.1)	(414.4)	(141.9)	(124.8)	-
[SE]	-	-	-	-	-	-	-	[27.8]
Walking indoors, leisure % (n)	60 (6)	70 (7)	100 (8)	53 (8)	65 (11)	50 (7)	75 (3)	64 (50)
Mean frequency per week	8	8	16.2	5.2	14	10	5	10
(SD)	(7.7)	(7.6)	(22.3)	(6.9)	(21.2)	(18.8)	(8.1)	-

Physical activity	LTC home ID							
	1 (N=10)	2 (N=10)	3 (N=8)	4 (N=15)	5 (N=17)	6 (N=14)	7 (N=4)	Total (N=78)
[SE]	-	-	-	-	-	-	-	[1.7]
Mean duration per session, in minutes	13	12	9.6	6.5	8	8	7	9
(SD)	(15.2)	(9.6)	(5.8)	(8.4)	(10.9)	(9.0)	(5.5)	-
[SE]	-	-	-	-	-	-	-	[1.1]
Mean total time, in minutes	142	130 (115.3)	122 (108.5)	55	131 (192.8)	119 (174.6)	62	111
(SD)	(135.7)	-	-	(76.4)	-	-	(104.7)	-
[SE]	-			-			-	[16.1]
Total walking outdoors % (n)	40 (4)	30 (3)	38 (3)	27 (4)	25 (4)	36 (5)	25 (1)	31 (24)
Walking outdoors,	20	20	25	13	24	14	25	19
instrumental % (n)	(2)	(2)	(2)	(2)	(4)	(2)	(1)	(15)
Mean frequency per week	0	0	0	0.3	0.6	0.1	0	0
(SD)	(0.4)	(0.4)	(0.7)	(0.7)	(1.4)	(0.4)	(0.5)	-
[SE]	-	-	-	-	-	-	-	[0.1]
Mean duration per session, in minutes	0	2	1	1.3	14.5	5.7	30	6
(SD)	(0)	(3.2)	(3.5)	(4.0)	(33.6)	(16.5)	(60.0)	-
[SE]	-	-	-	-	-	-	-	[2.5]
Mean total time, in minutes	0	2	1	2.7	23.2	5.7	30	9
(SD)	(0)	(3.2)	(3.5)	(8.0)	(51.5)	(16.5)	(60.0)	-
[SE]	-	-	-	-	-	-	-	[3.3]
Walking outdoors, leisure % (n)	30 (3)	10 (1)	25 (2)	13 (2)	6 (1)	29 (4)	0 (0)	17 (13)
Mean frequency per week	0.5	1	1	0	0	1	0	1
(SD)	(0.9)	(4.4)	(2.4)	(1.3)	(0.7)	(2.5)	(0)	-
[SE]	-	-	-	-	-	-	-	[0.2]
Mean duration per session, in minutes	5	3	4	4	2	11	0	5
(SD)	(7.3)	(9.5)	(7.4)	(10.6)	9.7)	(20.2)	(0)	-
[SE]	-	-	-	-	-	-	-	[1.3]
Mean total time, in minutes	8	42	19	12	7	38	0	19
(SD)	(12.5)	(132.8)	(49.1)	(39.0)	(29.1)	(71.2)	(0)	-
[SE]	-	-	-	-	-	-	-	[7.0]
Total Stretching* % (n)	30 (3)	70 (7)	63 (5)	60 (9)	88 (15)	50 (7)	75 (3)	69 (49)
Total chair exercises** %	30	60	50	33	71	36	75	49

Physical activity	LTC home ID							
	1 (N=10)	2 (N=10)	3 (N=8)	4 (N=15)	5 (N=17)	6 (N=14)	7 (N=4)	Total (N=78)
(n)	(3)	(6)	(4)	(5)	(12)	(5)	(3)	(38)
Mean total time, in minutes	9.0	32	26	29	61	84	45	44
(SD)	(20.2)	(28.7)	(29.7)	(54.7)	(55.1)	(126.8)	(30.0)	-
[SE]	-	-	-	-	-	-	-	[7.8]
Total strength training* % (n)	30 (3)	50 (5)	38 (3)	13 (2)	35 (6)	43 (6)	50 (2)	35 (27)
Physiotherapy (all types)** % (n)	40 (4)	50 (5)	63 (5)	13 (2)	12 (2)	29 (4)	25 (1)	30 (23)
Mean total time, in minutes	12	27	25	3	5	10	6	11
(SD)	(21.0)	(35.2)	(27.3)	(8.4)	(15.2)	(22.0)	(12.5)	-
[SE]	-	-	-	-	-	-	-	[2.5]

*Since strength training and stretching both occurred in physiotherapy and chair exercises, mean total times are presented separately for each sub-activity later.
**Mean frequency/week and duration/session could not be estimated for these activities because they are aggregate measures of two or three types of sub-activities.

Residents reported an average of 483 minutes of physical activity (SD 329.3) in the seven days prior to being interviewed. There was a wide range in the mean total time for physical activity across the seven LTC homes, ranging from 317 to 640 minutes per week. The median total time for physical activity was 392 minutes per week and ranged from 323 to 508 minutes.

How residents' participation in physical activity differed across demographic characteristics is described next. As described earlier, since the outdoor environment was off-limits in one LTC home (due to construction), results are presented with and without the outdoor walking item. Perhaps surprisingly, older residents (85 or more years of age) accumulated slightly more time being physically active in the previous seven days than their younger counterparts (on average 494 and 462 minutes per week, respectively), but this difference was not statistically different (t= - .396, p= .693). Removing the 'walking outdoors' item did not significantly change these results (458 versus 451 minutes,

respectively, t= - .940, p= .925). These results do not control for distance walked or intensity of physical activity.

On average, females spent more time being physically active in the last week than males (505 versus 400 minutes per week, t= -1.134, p= .260). The difference increased when the 'walking outdoors' item was removed (mean = 486 versus 339 minutes per week), but remained statistically insignificant (t= -1.698, p= .094). On average, females were slightly older than males (88 and 85 years, t= -1.111, p= .270) and had lived in their LTC home for a longer period of time (49 versus 29 months, t= -1.517, p= .133). In comparison with females, the proportion of males participating in the various types of physical activities was higher for nine of the ten activities[2]. The only activity in which a significantly greater proportion of females participated was group chair exercises (52% versus 19%, Fisher's exact test, p= .024).

Residents with better health status spent more time in the prior week being physically active than those with fair or poor health status (mean = 520 versus 370 minutes per week, t= -1.754, p= .083). This difference remained statistically insignificant after removing the 'walking outdoors' item (mean = 487 versus 361 minutes per week, t= -1.533, p= .129).

On average, residents who had lived in a LTC home for less than 45 months spent the same amount of time being physically active as those who had lived there longer (483 versus 484 minutes per week, t= -.006, p= .995). Removing the outdoor walking item did not shift the comparison of groups (mean = 454 versus 459 minutes per week, t= -0.074, p= .941). Length of stay did not increase with advancing age, as both younger (< 85 years) and older (≥ 85 years) residents had lived at the LTC home for an average of 45 months.

[2] Not including yoga or Tai Chi, since no residents participated in these activities.

Residents who used an assistive device or mobility aid spent more time being physically active than those who did not use an assistive device (mean = 517 versus 354 minutes per week) but this difference was not statistically significant (t= -1.792, p= .077). This difference persisted after the 'walking outdoors' item was removed from the total physical activity scores (mean = 488 versus 331 minutes per week), but remained not statistically significant (t= -1.814, p= .074).

Residents who described themselves as 'more active than the others' spent more time in the last week, on average, being physically active than those equally or less active than the others (532 versus 410 minutes per week, t= 1.613, p= .111). These results did not differ significantly after removing the outdoor walking item (488 versus 407 minutes per week, t= 1.110, p= .271).

Walking

Every participant reported walking indoors in the seven days prior to being interviewed. Significantly more residents walked indoors for instrumental purposes (96%, n= 75) than for leisure (64%, n= 50) (McNemar's test, p= .0001).

Instrumental Walking Indoors. The proportion of residents who reported instrumental walking indoors ranged from 87% to 100% across the seven LTC homes, making this the most common type of physical activity. On average, residents did this type of walking 50 times per week (SD 26.5), for an average of 13 minutes each trip (SD 15.9), which contributed to 268 minutes of physical activity per week (SD 245.8). In the prior week, 65% of all residents (n= 51) had made at least one instrumental walking trip between five to ten minutes in length, 44% (n= 34) had made at least one walking trip that was less than five

minutes in length. Few residents (13%, n= 10) had made one such trip over ten minutes in length in the prior week.

The dining room was the most common location to which residents walked. Most residents, 92% (n= 72), had walked there in the previous seven days, and 67% of these residents (n= 48) had walked to or from the dining room six times each day (i.e., three meals a day). For one in three residents (31%, n= 24), walking to the dining room represented their only form of instrumental walking indoors, and for a small number of residents (4%, n= 3), this represented their only form of indoor walking (i.e., either instrumental or for leisure) performed in the seven days prior to their interview.

Leisure Walking Indoors. Across the seven LTC homes, the proportion of residents who reported walking indoors for leisure ranged from 50% to 100%. On average, residents were walking indoors for leisure approximately 10 times per week (SD 15.4), for an average of nine minutes each trip (SD 9.9). This activity contributed to an average of 111 minutes of physical activity per week (SD 141.9). All residents who reported walking indoors for leisure did so in the LTC homes' corridors.

Walking Outdoors. Compared to walking indoors, fewer residents reported doing any walking outdoors in the previous seven days (30.8%, n= 24). This activity contributed to an average of 27.1 minutes of physical activity per week (SD 68.1). Similar to indoor walking patterns, walking outdoors was more commonly reported for instrumental than leisure purposes (19.2% versus 16.7%), but this was not statistically significant (McNemar's test, p= .824). The proportion of residents walking outdoors for instrumental purposes ranged from 13.3% to 25.0% across LTC homes. Overall, residents did this type of walking less than once

per week (SD 0.8), for an average of six minutes per trip (SD 22.0), which contributed to an average of nine minutes of physical activity per week (SD 29.2). Over half of the trips made (53.8%, n= 7) were over ten minutes in length, suggesting that outdoor walks for instrumental purposes tended to be longer than indoor instrumental walks. Residents walked outdoors for leisure an average of once per week (SD 2.2), for about five minutes per trip (SD 11.9), which contributed to an average of 19 minutes of physical activity per week (SD 61.8).

Stretching

Almost two-thirds of the residents (63%, n= 49) reported that they did some stretching in the previous seven days either on their own, in physiotherapy, and/or in group chair exercises (these activities were not mutually exclusive). Several residents did stretching exercises on their own (28%, n= 22), an average of 1.7 times per week (SD 3.0), for three minutes (SD 4.8) per session. This activity contributed to an average of 14 minutes of physical activity a week (SD 29.5).

Chair Exercises

Chair exercises were a very popular form of physical activity among residents in all seven LTC homes. Almost half of the residents (49%, n= 38) had participated in this activity. These exercises were most commonly done in a group session (45%, n= 35) and residents attended these group sessions an average of once a week. Sessions ranged from 30 to 60 minutes in length, and often incorporated strength training and/or stretching exercises. Overall, this activity contributed to an average of 44 minutes of physical activity per week (SD 69.0). On average, residents engaged in group chair exercises once per week (SD 1.2),

and this contributed to an average of 39 minutes (SD 56.9) of physical activity per week. The frequency and duration of the group chair exercises varied not only between LTC homes, but also within the same LTC home. The specific type of exercises (e.g., strength training and/or stretching) included in the chair exercises was not consistent among residents either within or between LTC homes. The chair exercises included: both strength training and stretching for 19 residents (24%), stretching for nine residents (12%), and strength training for two residents (3%). For five residents (6%) the chair exercise sessions did not include either stretching or strength training.

Strength Training

In total, 27 (35%) residents reported doing some form of strength training in the previous seven days, either on their own, in physiotherapy and/or group chair exercise (these activities were not mutually exclusive). Three residents (4%) reported doing strength-training exercises on their own, but only one of them could estimate the frequency and duration of this exercise. Overall, strength training alone did not significantly contribute to residents' total mean amount of physical activity (less than one minute per week, SD 2.0). Strength training in group chair exercises was described earlier, and in physiotherapy will be described next.

Physiotherapy

At least one resident from each of the LTC homes (30%, n= 23) reported receiving physiotherapy, which contributed an average of 11 minutes (SD 22.1) to residents' total physical activity time in the previous week. Residents who received physiotherapy participated in only one of the three types of physiotherapy exercises: cardiovascular,

strength training, or stretching. Physiotherapy with cardiovascular exercises was the most common form the respondents received, with 13% (n= 10) having engaged in this in the previous seven days. Half of these residents came from the same LTC home. On average, residents did cardiovascular physiotherapy less than once a week (SD 1.3), for two minutes (SD 6.0), which contributed to an average of six minutes of physical activity per week (SD 16.4). Physiotherapy with stretching was the next most common form (10%, n= 8), which was done an average of 0.2 times per week (SD 0.6) for three minutes (SD 10.2), and contributed to an average of five minutes (SD 16.3) of physical activity a week. Physiotherapy with strength training was the least common type of physiotherapy (6%, n= 5), which was done an average of 0.1 times per week (SD 0.5) for one minute (SD 3.7), and contributed to an average of one minute (SD 5.4) of physical activity per week.

Rates of participation in physiotherapy were not statistically significantly higher for any of the demographic sub-groups. Slightly more of the following types of residents received physiotherapy: younger residents compared to older residents (36% versus 26%, Fisher's exact test, p= .431); residents who were equally or less active than the others, compared to those who were more active than the others (36% versus 26%, Fisher's exact test, p= .448), and residents who did not use a mobility aid compared to those who used a mobility aid (38% versus 27%, Fisher's exact test, p= .540). Proportions of those receiving physiotherapy were almost equal regardless of the resident's gender, health status, and length of stay.

Other activities

There were a few other activities that residents reported doing in the previous seven days. A total of 9 (12%) residents reported using stairs. On average, stair climbing

contributed to five minutes (SD 24.8) of residents' physical activity a week. In some LTC homes, residents reported that they were not permitted to use the stairs. A couple of residents used stairs at locations outside the LTC home (e.g., family member's house). Almost no residents in any of the LTC homes reported dancing in the last seven days (4%, n= 3). This activity was not a significant source of physical activity, which contributed an average of less than one minute (SD 1.3) of physical activity a week. No residents reported doing yoga or Tai Chi in the previous seven days. A few of them reported that they had participated in these activities prior to moving into the LTC home, but the majority of residents were not familiar with these activities. When asked whether there were any other physical activities that they engaged in within the past seven days, most residents (81%, n= 63) said no. The other residents mentioned activities of daily living (such as making the bed, opening the curtains), or other pastimes (such as knitting, bridge). Overall, these other activities did not contribute to residents' total time for physical activity in the prior week.

Physical Activity by Levels of Environmental Press

The following section presents the results for the two groups of LTC homes: those with appropriate levels of environmental press and those with inappropriately high levels of environmental press. Facility characteristics were similar between the two groups. The mean number of beds (approximately 185), mean age of building (over 20 years), and mean number of years from last renovation (six to ten years) were approximately the same in both groups of LTC homes. Residents' characteristics are presented in Table 9.

Table 9.

Residents' Characteristics by Environmental Press

Characteristic	Level of environmental press		Total (n=78)	Statistic*
	Appropriate (n=28)	Inappropriately high (n=50)		
Mean age (SD) [SE]	85 (6.8)	88 (6.7)	87 [0.8]	t= -1.920 df = 76 p=.059
Gender, % F (n)	75 (21)	82 (41)	79 (62)	χ^2= .539 df=1 p= .463
Mean length of stay, in months (SD) [SE]	48 (48.3)	43 (45.9)	45 [5.3]	t= .499 df= 76 p= .619
Health status % (n)				χ^2 = .204
Good health	79 (22)	74 (37)	76 (59)	df=1
Fair or poor health	21 (6)	26 (13)	24 (19)	p= .652
Activity level % (n)				χ^2 = .177
More active than others	57 (16)	62 (31)	60 (47)	df=1
Same as or less than other	43 (12)	38 (19)	40 (31)	p= .674
Use of mobility aid % (n)				χ^2 = 3.62
Cane or walker	68 (19)	86 (43)	80 (62)	df=1
No mobility aid	32 (9)	14 (7)	20 (16)	p= .057
Assistance with exercise % (n)				χ^2 = 0
Yes	68 (19)	68 (34)	68 (53)	df=1
No	32 (9)	32 (34)	32 (25)	p= .990

Note: t= two-sided t-test statistic; df= degrees of freedom.
* Statistically significant at the p< .05 level.

No statistically significant differences existed between residents' demographic characteristics in the two groups of LTC homes. As shown in Table 9, residents who lived in LTC homes with appropriate environmental press were an average of three years younger than those who lived in LTC homes with inappropriately high environmental press. There was a slightly higher proportion of females in the LTC homes with inappropriately high environmental press, and residents in those LTC homes had stayed, on average, five months less than residents in homes with appropriate levels of environmental press.

In terms of health status, a slightly greater proportion of residents living in LTC homes with appropriate environmental press reported having excellent, very good, or good health compared to those living in LTC homes with inappropriately high environmental press. Residents' self-perceived activity levels were comparable between the two groups. The use of mobility aids was more common among residents living in LTC homes with inappropriately high levels of environmental press and this difference approached significance (see Table 9). The proportion of residents who received assistance with their exercises was equal in both groups of LTC homes, but the type of care provider who offered assistance differed slightly. Half of the residents (n= 14) living in LTC homes with appropriate levels of environmental press received assistance from a physiotherapist in contrast with only 28% (n= 14) of residents in homes with inappropriately high environmental press (chi-square= 3.775, p= .052). Residents in LTC homes with inappropriately high environmental press more commonly received assistance from a recreologist (38%, n= 19) than residents in homes with appropriate environmental press (32%, n= 9) (chi-square= .268, p= .605). The number of residents receiving assistance with exercise from other types of care providers was small across both groups of LTC homes.

Overall Physical Activity

Residents living in LTC homes with inappropriately high levels of environmental press accumulated an average of 517 minutes of physical activity in the previous seven days (median 390 minutes per week), while those living in homes with appropriate levels of environmental press accumulated 423 minutes of physical activity over the same period of time (median 401 minutes per week). The difference in mean total time physical activity scores were not statistically significant between the two groups of LTC homes ($t = -1.210$, $p = .230$).

A comparison of residents' participation in physical activity in the prior week between LTC homes with appropriate and inappropriately high environmental press is presented in Table 10. Specifically, the proportion of residents who participated in the various activities, and the mean and median total time spent doing these activities in the previous week are presented. For most activities, the proportion of residents participating in them was greater among those living in LTC homes with appropriate levels of environmental press.

Table 10.

Physical Activity Participation by Level of Environmental Press

Physical activities	Environmental press		Statistic*
	Appropriate (N=28)	Inappropriately high (N=50)	
Walking indoors , instrumental % (n)	96 (27)	96 (48)	Fisher's, p= 1.0
Mean total time, in minutes per week (SD)	213 (139.4)	299 (285.6)	t= -1.491, p= .140
Walking indoors, leisure % (n)	75 (21)	58 (29)	Fisher's; p= .149
Mean total time, in minutes per week (SD)	132 (117.0)	99 (154.0)	t= .970, p= .335
Walking outdoors, instrumental % (n)	21 (6)	18 (9)	Fisher's, p= .769
Mean total time, in minutes per week (SD)	1 (2.6)	13 (35.8)	t= -1.733, p= .087
Walking outdoors, leisure % (n)	21 (6)	14 (7)	Fisher's, p= .528
Mean total time, in minutes per week (SD)	23 (82.4)	17 (47.4)	t= .432, p= .667
Total stretching [a] % (n)	54 (15)	68 (34)	Fisher's, p= .230
Stretching, alone % (n)	11 (3)	38 (19)	Fisher's, p= .017*
Mean total time, in minutes per week (SD)	6 (20.7)	18 (32.8)	t= -1.878, p= .064
Group chair exercises % (n)	43 (12)	46 (23)	Fisher's, p= .817
Mean total time, in minutes per week (SD)	29 (27.2)	48 (66.5)	t= -2.022, p= .047*
Total strength training [a] % (n)	39 (11)	34 (17)	Fisher's, p= .806
Physiotherapy % (n)	50 (14)	18 (9)	Fisher's, p= .004*
Mean total time, in minutes per week (SD)	21 (28.3)	6 (15.6)	t= 3.052, p= .003*

Note: Fisher's = Fisher's exact test
Note: t statistic represents results from two-sided t-test, degrees of freedom = 76.
[a] These activities are not mutually exclusive, since strength training and stretching both occurred in physiotherapy and chair exercises. Mean total times are presented separately later.
* Statistically significant at p< .05.

Walking

As described earlier, more residents walked indoors for instrumental purposes than for leisure. However, this difference was only significant among residents living in homes with inappropriately high environmental press (96% versus 58%, McNemar's test, p= .0001). A higher proportion of residents in LTC homes with appropriate levels of environmental press walked indoors for leisure as compared to those living in LTC homes with inappropriately high levels of environmental press (75% versus 58%), but this difference was not statistically significant (Fisher's exact test, p= .149).

Approximately 96% of residents in both groups of LTC homes walked indoors for instrumental purposes. On average, residents in LTC homes with appropriate environmental press did this type of walking ten times per week, for an average of 12 minutes per session, averaging a total of 213 minutes per week. Residents in LTC homes with inappropriately high environmental press did this type of walking an average of nine times per week, for seven minutes per session, resulting in a total average of 299 minutes per week. In the prior week, more residents living in LTC homes with inappropriately high environmental press had walked for trips five to ten minutes in length (76% versus 50%, Fisher's exact test, p= .025) and trips over ten minutes in length (16% versus 7%, Fisher's exact test, p= .316), compared to residents living in LTC homes with appropriate environmental press.

Compared to residents living in homes with inappropriately high environmental press, slightly more residents in homes with appropriate environmental press walked outdoors (36% versus 28%, Fisher's exact test, p= .610), and this was consistent for both outdoor leisure walking (21% versus 14%, Fisher's exact test, p=.528) and outdoor instrumental walking (21% versus 18%, Fisher's exact test, p=.769). However, residents in LTC homes with inappropriately high environmental press spent more time walking outdoors

per week, on average, than those in LTC homes with appropriate environmental press (29 versus 23 minutes per week), but this difference was not statistically significant (Fisher's exact test, p= .694).

Stretching

A significantly larger proportion of residents in LTC homes with inappropriately high levels of environmental press reported stretching alone compared to those living in LTC homes with appropriate environmental press (38% versus 11%, Fisher's exact test, p= .017). Similarly, residents in homes with inappropriately high environmental press stretched alone more frequently (twice versus once per week, t= -2.044, p= .044) and for longer periods of time (three versus one minute per session, t= -2.299, p= .024) than those living in homes with appropriate environmental press. Overall, this contributed to more time being physically active per week (18 versus six minutes per week), but this did not reach statistical significance (t= -1.878, p= .064).

Chair Exercises

Residents performed chair exercises either alone or in a group. Approximately the same proportion of residents in both groups of LTC homes participated in chair exercises (46% and 50% of residents in homes with appropriate and inappropriately high environmental press, respectively, Fisher's exact test, p= .816). The proportion of residents who did chair exercises on their own was very small and did not differ significantly between LTC homes with appropriate and inappropriately high environmental press (4% and 6%, respectively, Fisher's exact test, p= 1.0). Group chair exercises were more popular among residents in both groups of homes and were attended on average once per week. A slightly

larger proportion of residents living in LTC homes with inappropriately high environmental press attended group chair exercise classes (46% versus 43%, p= .817). Residents in homes with inappropriately high environmental press spent over twice as much time per week doing chair exercises compared to residents living in homes with appropriate environmental press (48 versus 22 minutes per week, t= -2.022, p= .047).

Stretching and strength training were common activities performed during group chair exercises. Of the residents that did this activity, similar proportions of residents living in LTC homes with appropriate and inappropriately high levels of environmental press reported doing some stretching exercises during the group classes (39% and 34%, Fisher's exact test, p=.806). A small proportion of residents in LTC homes with appropriate and inappropriately high levels of environmental press reported doing strength training during group classes (29% and 26%, Fisher's exact test, p=.797).

Physiotherapy

A significantly higher proportion of residents living in LTC homes with appropriate levels of environmental press reported receiving any type of physiotherapy in the previous seven days (50% versus 18%, Fisher's exact test, p= .004). Dedicated physiotherapy rooms were only found in homes categorized as having appropriate levels of environmental press. When levels of environmental press were recalculated without the physiotherapy room item, the difference in residents' participation rates became insignificant (Fisher's exact test, p= 1.0).

In a further examination of the various types of physiotherapy, group differences were only significant for cardiovascular physiotherapy (25% in appropriate environmental press versus 6% in inappropriately high environmental press, Fisher's exact test, p= .030).

There were no significant group differences for physiotherapy with strength training (7% versus 6%, Fisher's exact test, p= 1.0), or physiotherapy with stretching (18% versus 6%, Fisher's exact test, p= .127). In total, residents in both groups of LTC homes spent approximately 44 minutes per week receiving any type of physiotherapy.

Strength Training

For residents in both groups of homes, strength training most commonly occurred during group chair exercises, as compared to on their own or during physiotherapy sessions. Participation in strength training in group chair exercises and physiotherapy were described earlier. Few residents in either home did any strength training on their own (11% versus 2% of residents living in homes with appropriate and inappropriately high environmental press, respectively, Fisher's exact test, p= .129).

Stair Climbing

Slightly more residents living in LTC homes with appropriate levels of environmental press reported climbing stairs than those living in homes with inappropriately high environmental press (14% versus 10%, Fisher's exact test, p= .715), and these residents did so more frequently (three versus one time per week, t= .823, p= .413). Overall, climbing stairs only contributed to a small amount of time towards physical activity in the two groups of LTC homes (six versus four minutes per week, t= .391, p= .697).

Stratified Analysis

The presence of effect modification was not detected via the Breslow-Day statistic. Thus, pooled Mantel-Haenszel estimates for residents' participation in the various types of

physical activities were calculated and are presented in Table 11. Differences between residents' participation in physiotherapy, cardiovascular-based physiotherapy, and stretching alone across the two groups of LTC homes remained significant even after controlling for age, gender, length of stay in LTC, health status, activity level, and level of mobility.

Table 11.

Pooled Mantel-Haenszel Estimates for Residents' Participation in Physical Activity

Demographic Characteristics	Pooled Mantel-Haenszel estimates for differences in participation in physical activity across LTC homes (95% CI)							
	Walking indoors, instrumental	Walking indoors, leisure	Walking outdoors, instrumental	Walking outdoors, leisure	Stretching, alone	Group chair exercises	Strength training	Physiotherapy
Age	.890	.450	.807	.434	4.965	1.127	.794	.226
	(.09, 9.14)	(.16, 1.27)	(.25, 2.63)	(.12, 1.58)	(1.31, 18.83)	(.44, 2.88)	(.30, 2.09)	(.08, .64)
	p=.922	p=.132	p=.723	p=.205	p= .018*	p=.802	p=.640	p= .005*
Gender	.975	.469	.856	.624	6.498	1.038	.736	.222
	(.08, 11.42)	(.17, 1.30)	(.264, 2.78)	(.19, 2.10)	(1.53, 27.64)	(.39, 2.75)	(.28, 1.96)	(.08, .62)
	p=.984	p=.147	p=.796	p=.445	p= .011*	p=.940	p=.541	p= .004*
Length of Stay in LTC	1.143	.399	.781	.594	4.568	1.138	.836	.215
	(.10, 13.67)	(.14, 1.17)	(.25, 2.49)	(.18, 2.02)	(1.23, 16.95)	(.44, 2.92)	(.32, 2.21)	(.08, .62)
	p= .916	p= .095	p= .676	p= .404	p= .023*	p= .788	p= .718	p=.004*
Health Status	.917	.471	.815	.611	6.004	1.116	.784	.216
	(.09, 9.49)	(.170, 1.30)	(.26, 2.60)	(.18, 2.05)	(1.52, 23.72)	(.44, 2.85)	(.30, 2.04)	(.08, .61)
	p= .942	p= .147	p= .729	p= .425	p= .011*	p= .819	p= .618	p= .004*
Activity Level	.773	.432	.742	.564	4.809	1.125	.733	.221
	(.06, 9.58)	(.15, 1.24)	(.23, 2.44)	(.17, 1.93)	(1.30, 17.79)	(.44, 2.86)	(.27, 2.00)	(.08, .62)
	p= .841	p= .117	p= .623	p= .360	p=.019*	p= .804	p= .543	p= .004*
Level of Mobility	.714	.356	.953	.530	4.918	1.001	.702	.233
	(.04, 11.50)	(.12, 1.09)	(.28, 3.23)	(.15, 1.87)	(1.27, 19.05)	(.39, 2.60)	(.26, 1.88)	(.08, .66)
	p=.812	p=.070	p=.939	p=.324	p= .021*	p=.998	p=.482	p= .006*

*Statistically significant at the p< .05 level.

Summary of Findings

Findings from the qualitative analysis and environmental scans revealed that environmental barriers to physical activity and sources of inappropriately high environmental press in LTC homes related mostly to safety hazards, lack of accessible exercise space, and lack of supportive design features (e.g., well-connected hallways). Four of the LTC homes included in the present study were categorized as having inappropriately high levels of environmental press and three LTC homes had appropriate levels of environmental press. The mean age of the buildings, the mean number of beds, or the mean number of years since its last major renovation were similar between the two groups of LTC homes.

Older adults living in LTC homes included in the present study were mostly female, used mobility aids, and described themselves as having good to excellent health. Residents' demographics did not differ significantly between the two groups of LTC homes.

Regardless of where residents lived, the most popular forms of physical activity were walking indoors and group chair exercises. No residents reported doing yoga or Tai Chi, and very few reported doing strength-training exercises in the prior week. Overall, there was no statistically significant difference between residents' total time being physically active per week between LTC homes with appropriate and inappropriately high environmental press. Residents living in homes with appropriate environmental press received physiotherapy treatment more often, and stretched alone less often, than those living in homes with inappropriately high environmental press. These differences persisted after controlling for residents' demographic characteristics. No evidence of confounding or effect modification were detected.

CHAPTER FIVE: DISCUSSION

The influence of the built environment on residents' overall participation in physical activity is discussed first, then for specific types of activities. Wherever possible, evidence from the literature was used to further examine these influences. The strengths and limitations of the present study are also outlined, followed by future research directions, practical considerations for LTC settings and the study conclusions.

Environmental Press and Physical Activity

The levels of environmental press assessed in this study did not significantly influence the overall duration of residents' participation in physical activity. In general, residents in both groups of homes were participating in the same types of physical activities, although the rates of participation differed for a couple activities. How the environmental features influenced various types of physical activities will be discussed later. But first, residents' overall participation in physical activity assessed in the present study is compared with that assessed in previous studies.

Participation in Physical Activity

The total amount of physical activity accumulated during the prior seven days, and the general types of activities engaged in, were similar across the two groups of LTC homes. Overall, residents in the seven LTC homes reported a total average of 483 minutes of physical activity in the previous week (SD 329.3). The level of physical activity was higher than that found in another study conducted by Benjamin et al. (2005), in which frail elderly community-dwellers averaged 170 minutes of physical activity per week (SD 142.4). Some

of the types of exercises included in Benjamin's study differed from those included in the present study, which could explain the difference in the duration of physical activity per week. Also, since the types of activities were tailored to community-dwelling older adults, and only exercises that were 'somewhat moderate' to 'vigorous' in intensity were included in this estimate, Benjamin's estimate of older adults' total physical activity per week did not capture all of the types of physical activities included in the present study. This could explain why more minutes of physical activity were reported by residents in the present study. In another study (Joseph et al., 2005), almost a quarter of residents (23%) living in nursing care engaged in at least 30 minutes of physical activity three or more times a week. This was quite a bit lower than what was reported in the present study. However, cumulative physical activity was not captured in Joseph's study, and the eligibility criteria for Joseph's study included residents in wheelchairs, who tend to be less physically active than those not dependent on wheelchairs. In the next section, residents' participation in the various types of physical activities will be compared with other studies, and how features of the built environment influenced these activities will also be discussed.

Walking

Most of the linkages between the built environment and physical activity relate to walking behaviour. Walking indoors for instrumental purposes was the most common type of physical activity for residents in both groups of LTC homes and contributed the largest amount of time to residents' total amount of physical activity per week. Almost all (92%) of the residents reported walking to the dining room in the prior seven days, and most walked there three times a day. In one study, only 29% of all nursing care residents reported regularly walking to their meals (Joseph et al., 2005). As noted earlier, Joseph's estimate

may be lower than that found in the present study due to the eligibility criteria differences related to residents' level of mobility.

For most residents in the present study, walking to the dining room was an important part of their daily routine. The amount of time spent walking to the dining room was on average 203 minutes per week (SD 183.1), but this varied depending on residents' mobility level and the distance between their room and the dining room. Some LTC homes had a dining room on every floor; others had one centralized dining room on the main floor. There were advantages and disadvantages to both layouts. Homes with dining rooms on every floor reported that it was easier to get residents to the dining room, while homes with a more centralized dining room reported that residents were getting more physical activity by walking longer to get to and from their meals. In addition to the location of the dining room, the care staff's resident load and the mealtime schedule could also influence whether or not walking to the dining room is supported. With the appropriate patient load and a flexible mealtime schedule, care staff would more likely be able to take the time to assist residents in walking to the dining room, rather than wheeling them in a wheelchair.

Walking for leisure was another popular form of exercise in both homes. In homes with appropriate environmental press, there was no significant difference in the proportion of residents who walked for instrumental purposes and for leisure. However, in homes with inappropriately high environmental press (e.g., no circular hallways, inappropriately high handrails, etc.), significantly fewer residents walked indoors for leisure than for instrumental purposes. These findings could indicate that environments with inappropriately high environmental press discourage residents from walking for leisure. Properly installed handrails that have appropriate dimensions (in terms of height, diameter, etc.) were identified in the qualitative analysis as encouraging physical activity because they helped residents

navigate hallways independently and safely. Laboratory studies on handrails have been conducted mainly on stairs (rather than in corridors), and these studies confirm that handrails at proper heights can help seniors recover their balance after a slip or trip (Maki et al., 2006). Indoor stairwells and the stairs' handrails were not assessed in the present study. Another barrier to leisure walking suggested by focus group respondents was that residents do not have anywhere to walk to indoors. Having an appealing destination inside a LTC home (e.g., large window with a view, sunroom, or dining room) can give residents an incentive to walk indoors (Cunningham, Michael, Farquhar & Lapidus, 2005). Several respondents also noted that a pleasant atmosphere and aesthetics in the LTC home helped promote residents' physical activity. Previous studies supported this notion and found that aesthetically pleasant neighbourhoods with nice scenery or close to nature encouraged physical activity (Cunningham et al., 2005). This could be an important consideration in the planning of physical activity interventions, as well as in the design or redesign of LTC homes.

Most of the safety-related barriers identified in the interviews and focus group discussions were fall and trip hazards (e.g., loose mats, clutter) for older adults, particularly for those who used mobility aids or who tended to shuffle their feet when they walked. Similar to the tendency for older community-dwelling adults to avoid walking on unsafe pathways or areas where environmental challenges exist (Booth et al., 1997; Li et al., 2005; Saelens et al., 2003; Shumway-Cook et al., 2003), older adults living in LTC homes may avoid walking in areas (e.g., hallways, outdoor paths) where fall or trip hazards exist. For instance, findings from the present study's qualitative analysis revealed that residents with limited mobility may have difficulty navigating ramps and avoid walking in areas where they exist. On the other hand, some residents reported purposively walking on ramps in order to maintain this ability. For example, Joseph & Zimring (2007) found that older adults preferred

walking for recreation on paths that included an environmental challenge, such as a moderate slope or hill. This paradox illustrates how characteristics in the built environment do not inherently contribute to inappropriately high levels of environmental press. It is only when examining how individuals interact with the built environment that these characteristics display appropriate or inappropriately high levels of environmental press. This also highlights the difficulties in trying to make LTC environments suitable to a wide range of people (residents, visitors, staff) with varying levels of functional abilities. Thus, differing levels of environmental press may be needed within each LTC home to accommodate individuals with different functional abilities.

Also, non-circular or poorly connected hallways may be less conducive to walking than hallways that have more continuous pathways. All LTC homes in this study had at least one hallway that was continuous or circular. As residents described the duration of their walking, some would refer to the number of 'loops' they walked. The connectivity of hallways is particularly relevant in special care units where residents with dementia often wander the hallways (Klein, 2002). These residents can sometimes get 'stuck' at the end of hallways that do not have circular routes and have a hard time getting turned around. Circular hallways, or hallways that are more continuous without any dead-ends, make it easier for residents to navigate, and may create a more pleasant walking experience. Older adults without cognitive impairments also benefit from this type of hallway design. Joseph & Zimring (2007) found that LTC residents more frequently chose to walk on paths with high connectivity more than paths with lower connectivity. Similarly, this tendency was also found among community-dwelling older adults, where neighbourhoods with higher street connectivity were associated with higher levels of walking (Saelens et al., 2003). Still, path

and hallway designs are important considerations for promoting physical activity in LTC settings, regardless of residents' cognitive status.

Inclement weather and poorly maintained or icy pathways were highlighted in focus group discussions as deterrents to walking outdoors. These were also found to be barriers to physical activity among older adults in the study by Benjamin et al. (2005). Since one of the LTC homes' outdoor environment was under construction at the time the interviews were conducted, sub-group analyses were conducted that excluded the outdoor walking item. But this did not significantly change results between the two groups of LTC homes. Secure outdoor walking areas (i.e., fenced or locked) were additional facilitators for residents' physical activity identified in the qualitative analysis; however, the safety and security of outdoor walking areas (e.g., presence of a secure fence or gate surrounding the area, properly maintained pathways, width of pathways, etc.) were not assessed in the present study. The median duration of leisure outdoor walking trips was 30 minutes and 10 minutes for instrumental outdoor walking trips. Since leisure outdoor walks tended to be longer in duration than outdoor walks for instrumental purposes, residents may gain more physiological benefits from walking for leisure purposes than for instrumental purposes only. Outdoor environments should be designed to include environmental features that support leisure walking.

Differences between residents' demographic characteristics between the two groups of LTC homes could also have influenced residents' physical activity, particularly their walking. While not statistically significant, residents in LTC homes with inappropriately high environmental press were older and a greater proportion of them used mobility aids than those living in LTC homes with appropriate environmental press. In general, residents who are older and who use mobility aids likely walk slower than younger residents and those who

do not use mobility aids. So even when walking equal distances, older residents and those who use mobility aids would report a greater amount of time for their walking trips than younger residents and those who do not use mobility aids. Differences in age and use of mobility aids between LTC homes could help explain why more residents in LTC homes with inappropriately high environmental press walked indoors for instrumental purposes for longer durations (i.e., trips five to ten minutes in length as well as for trips over ten minutes in length). Or perhaps the use of mobility aids had a positive effect on older adults' physical activity by making them feel safer and at less risk for falling, which permitted them to walk for longer periods of time.

Physiotherapy

Approximately 30% of residents in the present study received physiotherapy in the prior week. This was similar to another study by Joseph et al. (2005), which indicated that 20% of residents received physiotherapy at least once in the previous week. While physiotherapy could be performed in residents' rooms or in the hallway, LTC homes with a dedicated room for physiotherapy had increased proportion of residents receiving this type of therapy. When this item was removed from the assessment of environmental press, this difference became not statistically significant. This suggests that levels of environmental press in other parts of the LTC home may not significantly contribute to residents' participation in physiotherapy. LTC homes with dedicated physiotherapy rooms may have more resources (e.g., staff, funding, level of programming) dedicated to this activity than those without such a room. However, these resources for physiotherapy were not examined in the present study.

Chair Exercises

Levels of programming may also have influenced residents' participation in other structured physical activities, such as group chair exercises, yoga and Tai Chi. All of the LTC homes included in the present study offered some form of a group chair exercise program. This was consistent with a previous needs assessment conducted in London, Ontario, which found that 98% of LTC homes offered such a program (Lazowski et al., 1999). Chair exercises were popular activities among residents in both groups of LTC homes. Almost half of the residents (45%) interviewed in the present study had participated in group chair exercises in the previous seven days. This was higher than the previously reported participation rates of 10 to15% (Lazowski et al., 1999) and 40% (Poon et al., 1999) among LTC home residents living in Canada. These two studies included all residents living in the LTC homes and did not exclude residents who were wheelchair dependent. However, since residents who were wheelchair dependent were still capable of participating in these exercises, the exclusion of these residents in the current study likely does not fully explain the variation in participation rates. In Benjamin's study (2005), approximately 29% of community-dwelling older adults had participated in group chair exercises. Group chair exercises may be more popular among residents because the classes are more accessible, since they are held in the same building in which they live. Residents in the present study spent approximately 44 minutes in group chair exercise sessions per week. However, these estimates represented the length of the group session; whether or not residents were physically active throughout the entire duration of the class remains unknown. Results from Benjamin's (2005) study suggested that a typical 30-minute group chair exercise session consisted of 5-10 minutes for administrative purposes, leaving approximately 20-25 minutes for exercise.

Results from the qualitative analysis revealed that a lack of space, such as holding exercise classes in rooms filled with furniture or clutter, could discourage residents from engaging in group chair exercises. Challenges, such as competing preferences for which activity will occur in a particular room (e.g., watching television versus having a group chair exercise class in the lounge) or dealing with space that is not big enough to accommodate an exercise class for all interested residents, may arise when LTC homes do not have a specific room designated for exercise or physical activity. These barriers may also influence residents' participation in strength training and stretching, described next.

Strength Training and Stretching

In the present study, strength training and stretching were commonly performed during group chair exercise sessions. The level of participation in strength training was still quite low among LTC home residents. About one-third (36%) of residents included in the present study had participated in strength training in the previous seven days. On the other hand, almost two-thirds of residents reported doing stretching exercises in the previous week. Benjamin et al. (2005) found that 43% of older adults did flexibility exercises in a class and 41% did them on their own. A significantly greater proportion of residents in LTC homes with inappropriately high environmental press stretched on their own compared to those living in homes with appropriate environmental press. While most residents reported doing stretching in their rooms, it was not clear which particular environmental characteristics influenced residents' participation in stretching on their own since residents' rooms were not included in the environmental scan. Given the documented benefits of strength training and flexibility exercises, more research is needed to determine how other features of the built environment, such as the size of residents' rooms, could influence residents' participation in

physical activity. This may reveal ways in which the built environment could be modified to encourage resident's physical activity, such as by designating a specific room for exercise or designing larger private rooms to allow enough space for residents to do strength training or flexibility exercises in their room. Residents' participation in strength training may also depend on the accessibility of strength-training equipment and whether or not residents have access to this type of equipment in their own rooms or if it is restricted to supervised exercise sessions. The tension between residents' safety and freedom is also highlighted here. For instance, safety concerns may lead staff to discourage residents from doing strength training on their own, but restricting this activity to supervised sessions may make residents less likely to engage in strength training.

Other Physical Activities

No residents in any of the seven LTC homes participated in yoga or Tai Chi in the prior week. Most were not even familiar with these activities. This was similar to other studies, which reported the level of participation in yoga or Tai Chi to be between zero (Benjamin et al., 2005) and one percent (Joseph et al., 2005). The benefits of Tai Chi in particular have been well documented and include improved balance, flexibility, and muscle strength (Nowalk, Prendergast, Bayles, D'Amico & Colvin, 2001). LTC home administrators may want to consider incorporating these activities in their activity programs.

Study Strengths and Limitations

The present study is one of the first studies to operationalize the concept of environmental press with respect to physical activity in LTC settings. It set out criteria for identifying LTC homes with appropriate levels of environmental press and used these to

translate findings from an environmental scan into a measure of the homes' level of environmental press. It is also one of few studies that assessed LTC home residents' participation in physical activity. While more intervention studies have identified the benefits of physical activity among this population, few epidemiological studies have been conducted that examine the types and duration of physical activity (both formal and informal activities) among older adults living in LTC homes. This type of information is particularly important since it is not captured in most large-scale population health surveys (e.g., Canadian Community Health Survey, National Population Health Survey).

Study limitations were present in the design, measurement, and analytical phases. The limitations associated with the environmental scan, the physical activity questionnaire, and the data analysis will be discussed next.

Design Limitations

The small sample size in the present study increased the risk of committing a Type II error (i.e., not being able to detect differences in residents' participation in various types of physical activity when they do exist). The small sample size stemmed from the study's focus on residents who were not wheelchair dependent or cognitively impaired; the eligible sub-population only represented approximately 10% of the total population living in the seven LTC homes included in this study. Thus, recruiting more LTC homes would not have resolved this issue.

The timing of the interviews may also have influenced residents' willingness to participate. The longer the time lag between the initial recruitment by the clinical contact and the time the researcher conducted the interview, the greater the chance of losing the residents' interest in the study. Of the 13 refusals, seven (54%) were approached by the

researcher between June and July 2007 (four to six months after the initial recruitment invitation). In an effort to increase the response rate, the clinical contact reminded the residents about the study a day or two prior to the researcher's visit. However, residents may have lost interest in the study, or their schedule may have changed during that time period.

Though only a small proportion of LTC residents were targeted in this study, levels of environmental press were thought to more likely influence these residents' participation in physical activity than those dependent on wheelchairs. Residents with cognitive impairments may also be influenced by levels of environmental press, but their unique environmental needs require separate investigation. Residents who are not wheelchair dependent or cognitively impaired were also considered more likely to return to their home in the community after recovering or rehabilitating from the circumstances that originally brought them into the LTC home. Arguably, older adults returning to a home environment are likely to encounter greater levels of inappropriately high environmental press than that found in the LTC home. For instance, homes in the community generally have more stairs, clutter or other trip hazards, and may lack properly installed handrails. So, older adults returning to these environments need to have the functional ability to adapt to these environments. Functional mobility can be supported if they are encouraged to be physically active while living in the LTC home. Increasing older adults' participation in physical activity can reduce health care costs by supporting their return to independent-living as well as by reducing their risk for developing certain health conditions, such as cardiovascular disease, cancer, and falls.

Measurement Limitations

Two instruments were used in the present study, both of which had limitations in terms of their reliability and validity. The environmental scan had not been assessed

previously for internal or external validity, although inter-rater reliability was found to be good. The findings from the secondary analyses provided some evidence of content validity since the sources of environmental press identified in the interviews and focus group discussions were included in the scan. Construct validity may be enhanced by including additional items to the scan that contribute to levels of environmental press. More research is needed to inform the development of comprehensive guidelines outlining the criteria for appropriate environmental press in LTC settings, particularly for the items excluded from the present study (e.g., hallway length, timing of door closing, etc.). This, in turn, would assist with the refinement of the environmental scan.

The scoring system used in the present study yielded an overall score for each LTC home, albeit including only areas within the home that the participants were expected to regularly use. In future studies, depending on the size, layout, and design of LTC homes under investigation, as well as the population of interest (e.g., residents with dementia, ambulatory residents, etc.) it would be useful to tailor the scan scores according to: a) each unit or floor within the home, or b) each resident living in the home. More tailored scores would increase the variability of the environmental press scores within LTC homes, which in turn would increase the predictive power of the analysis. In a study conducted by Cutler and Kane (2005) environmental assessments were executed at multiple levels, including: the facility-level, the nursing unit-level, and the resident-level. This multi-level approach allowed the researchers to observe the degree of variability that existed not only between LTC homes, but within the homes as well.

The scan scoring system was also limited in that it only assessed variables related to three environmental characteristics: accessible, supportive, and safe. More research is needed in order to determine whether other constructs should be included in future environmental

assessments. The availability, functionality, aesthetic interest, and conduciveness to privacy and social relationships were additional characteristics of the built environment that Cutler and Kane (2005) suggested should be assessed.

The physical activity questionnaire (the MOAEQ) was not assessed for reliability or validity, and the original OAEQ had only been assessed for content validity in a community-dwelling population. Residents in the present study were generally cooperative and happy to participate in the face-to-face interviews, but some felt that they were not active enough to participate in the study. Many residents had difficulty estimating the duration of their physical activities and some would either give a range of time (e.g., five to ten minutes) or no estimate at all. Researchers have suggested that participation in non-structured physical activities (e.g., walking indoors for leisure) tends to be underreported or less easily recalled than more structured or organized exercises (e.g., group chair exercises) (Matthews, 2002). Thus, residents in the present study may have underreported their participation in less structured activities. Additional prompts or probes may need to be used in future studies when asking residents about their involvement in these types of informal physical activities.

Some residents may have misinterpreted the questions related to rating their health status and activity level. They were asked to rate these compared to other residents who were able to walk, yet some may have compared themselves to all other residents in their LTC home. Thus these ratings may be somewhat elevated (e.g., if they described themselves as more active than other residents who were in wheelchairs rather than only the residents that could walk).

Another methodological limitation of the present study was the decision not to collect information related to specific health conditions (e.g., heart disease, arthritis), which could be confounding factors in the relationship between seniors' physical activity and the level of

environmental press. In order to reduce residents' level of discomfort with disclosing personal health information, data on seniors' self-reported health status were collected instead. Self-report health has been shown to be a good indicator of older adults' general health (Cutler, 2000). This study also did not assess the different levels of programming offered within the LTC homes. While all homes did offer some form of chair exercise program and physiotherapy, the specific activities performed during these sessions, the frequency of the sessions, and the duration of each session may have varied. For example, during chair exercises, some participants may have lifted weights while others did not, thus varying the strength-training benefits of the exercise. A previous study found that the positive association between number of amenities and level of physical activity was minimized after controlling for the level of programming (Joseph et al., 2005). Thus, the number and types of programming available in the LTC home should be controlled for in future studies.

Inclement weather, particularly rain, snow and ice, were found to be key deterrents for residents to walk outdoors. Since the majority (91%) of the interviews with residents were conducted in the winter, this could have contributed to the low participation rates in walking outdoors. The small number of interviews conducted in the spring and summer precluded further investigation into the degree to which this affected the results. The walking outdoors item was removed in some sub-group analyses, but this did not significantly change the results. Future studies that purposively measure residents' physical activity over time and seasons may shed some light on residents' physical activity preferences, which may have implications for the design of both indoor and outdoor LTC settings. For instance, if a marked increase in residents walking outdoors is observed in the summer-time compared to

the winter-time, LTC home designers should consider creating an indoor walking area as an alternative for residents to use in inclement weather.

Caution must be used when interpreting the total physical activity scores since the calculation of these scores assumed that each type of activity contributed equally to residents' total amount of physical activity per week. For example, a resident who walked three times a week for ten minutes each time would have accumulated the same total time for physical activity per week as one who did physiotherapy once a week for 30 minutes. Weighting formulae may need to be developed for calculating the total physical activity scores to better reflect residents' participation in physical activity that meets current guidelines for older adults. The calculation of total physical activity scores in the present study also did not factor into the distance walked or the residents' gait speed, both of which could considerably affect the estimated duration of walking trips and the associated benefits on residents' health. Lastly, the use of imputed data reduced the within-cluster variability of residents' physical activity scores. This resulted in more homogenous physical activity scores within the LTC homes, which reduced the power for statistical analyses.

Analytical Limitations

Multiple statistical tests were conducted in this study, which increased the risk of a Type I error (rejecting the null hypothesis when no difference exists). By using a $Z = 0.05$ level of significance, there is a 5% chance of incorrectly concluding that a statistically significant difference exists. The Bonferroni correction is sometimes used to minimize this risk by increasing the level of significance for each individual test (so only large differences are found to be statistically signicant) (Pagano & Gauvreau, 2000). However, since very few of the results were statistically significant, and the magnitude of the effect sizes of those that

were statistically significant, it was believed that this correction would not have significantly changed the findings of this study.

The LTC homes were divided into two groups (appropriate and inappropriately high environmental press) based on the mean cut point of the scan scores. It is unknown whether this cut-point would represent a clinically important difference between levels of environmental press in other studies. Examining a larger number of LTC homes with a wider range of levels of environmental press would help determine the clinically important cut-point to distinguish between homes with appropriate and inappropriately high environmental press.

The criteria used to calculate the scan scores were based on building code standards for seniors or people with physical disabilities, and published guidelines for creating senior-friendly environments. Most of the homes included in the study met the appropriate environmental press criteria that were based on building codes (e.g., elevator door timing, hallway width, etc.). But fulfilling the minimum building code requirements may not be enough to create an environment with an appropriate level of environmental press for physical activity. A number of additional environmental characteristics may be important to consider and will be discussed next.

Future Research

The findings from the present study suggest a number of methodological considerations for future research. Future research questions could include: Which features of the built environment would help support residents' physical activity? What are the rates of physical activity participation among residents in wheelchairs or with cognitive impairments? Do levels of environmental press influence their participation in physical

activity differently than for the residents included in this study? How can the level of environmental press in the built environments of LTC homes be tailored to match the functional abilities of the various people that live, work and visit in the homes? What are the costs and cost benefits of constructing LTC homes with appropriate environmental press compared to those with inappropriately high environmental press?

The use of the term 'environmental press' may need to be reconsidered in future studies. While the term was created to be neutral, there is an inherent negative connotation to it, regardless of whether the sources of environmental press are appropriate or inappropriately high or low. More research is needed that examines which features of the built environment encourage or support older adults' participation in physical activity in LTC settings. For example, aesthetically pleasing exercise rooms or well-connected walking paths may support residents' physical activity. The term 'environmental pull' may be more suitable to describe these types of motivating factors. Intuitively, this term implies that sources of 'environmental pull' attract or encourage residents to be physically active.

Instruments need to be developed and validated to improve researchers' ability to assess all of the important features of the built environment that influence older adults' physical activity. Preliminary studies at the community-level have suggested that environmental features such as street connectivity, access to facilities, and neighbourhood aesthetics can have an impact on older adults' physical activity (Booth et al., 1997; Li et al., 2005; Saelens et al., 2003). This reinforces that environmental scans and criteria for appropriate environmental press should include items beyond those outlined in building codes. Additional refinements may be needed to the methods used to assess levels of environmental press. More research is needed to determine precisely which items influence physical activity in LTC settings, which items should be included in future scans, and what

the appropriate environmental press criteria are for these items. Future scans assessing the level of environmental press present in the built environments of long-term care facilities should also consider the following items: handrail shape (Maki et al., 2006), width of doors and elevator doors (Ministry of Housing, British Columbia, 1998), signage and other cueing features (O'Keeffe, 2004), aesthetics and destinations for walking (Cunningham et al., 2005), and the degree of hallway or path centrality and connectedness (Joseph & Zimring, 2007).

Validated instruments to assess older adults' participation in physical activity in LTC homes also need to be developed, with special consideration to residents' limited ability to recall informal or unstructured physical activities. While proxies (e.g., care providers or family members) have been used in the past for providing more general assessments of residents' participation in physical activity (Joseph et al., 2005), the use of proxies was not pursued in the present study because it was believed that they would not be able to provide enough detail regarding the frequency and duration of resident's participation in physical activity over the full week-long period under investigation. Cutler (2000) also noted the potential for systematic errors when relying on proxies to provide physical activity data. However, given the high prevalence of cognitive impairment or dementia in LTC settings, the use of proxies to assess residents' participation in physical activity may be warranted when assessing rates of physical activity for the entire population of residents living in LTC homes.

Practical Considerations

LTC home designers, planners, and decision-makers should consider a number of changes to achieve an appropriate level of environmental press in LTC homes, including minimizing environmental hazards and creating designated rooms for physical activity.

Findings from the present study may also be used to help administrators and care providers in LTC homes with inappropriately high levels of environmental press to become more aware of how certain features in the built environment can influence the residents' physical activity. This may lead to the development of new interventions that help residents better negotiate the built environment. The findings from this study also highlight the need to consider aspects of environmental press in the development of building codes for spaces dedicated for older adults.

Despite its popularity, few other studies have examined instrumental or leisure walking among older adults living in LTC homes or how to promote this type of activity. Most exercise intervention studies have focussed on more structured types of exercises, such as group exercise classes or scheduled walking programs. How buildings are designed, how many amenities are available, and the level of hallway or path connectedness could all influence these types of walking among LTC residents. In terms of encouraging instrumental walking, staff should encourage residents to walk to meals as much as possible, since this was found to be an activity that most residents participate in, and would be important for residents to maintain this ability. LTC home planners and designers should consider how hallways can be designed to optimize traffic flow patterns so that staff are not inclined to wheel residents to the dining room as a way of managing traffic flow problems. In terms of encouraging leisure walking, LTC home planners and designers should take into account the aesthetic appeal of the built environments of LTC homes, particularly in areas for walking, since pleasant aesthetics may encourage residents to be more physically active. Pleasant aesthetics include elements of natural light, minimized clutter, a nice view, and proximity to nature. LTC home administrators should also consider how the homes' policies interact with the relationship between the built environment and physical activity. For instance, if a

communicable disease outbreak occurs on one floor and residents are under quarantine (i.e., restricted to their nursing unit), do they still have access to opportunities to be physically active? Are there supports in place to encourage residents to maintain their physical activity during these periods of time? These are important considerations from a policy perspective as well as a building design perspective.

Conclusions

This exploratory, cross-sectional study examined the types and duration of physical activity between 78 residents living in LTC homes with appropriate and inappropriately high levels of environmental press. No statistically significant differences were found in residents' total time for physical activity per week between the two groups of LTC homes. Residents living in homes with appropriate environmental press reported receiving more physiotherapy and reported doing less stretching exercises on their own than those living in homes with inappropriately high environmental press. These differences persisted after controlling for age, gender, health status, and other demographic characteristics.

A number of areas for future research were highlighted in order to advance this field and to help inform interventions aimed at promoting physical activity among older adults living in LTC homes. Those designing interventions to promote physical activity among older adults in LTC settings should pay attention to the influences of the built environment and design programs that help residents adapt to the levels of environmental press in their environment (whether their environment is the LTC home, or their home in the community should they return there). Ultimately, creating LTC homes with appropriate levels of environmental press may lead to reduced health care costs and improved quality of life for residents.

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APPENDICES

APPENDIX A

Inclusion Criteria used in the Original Study

Administrators

- Employed as an administrator in one of the facilities for at least six months;
- Understands and can communicate in English or French;
- Provides written informed consent to participate in the study.

Care Providers

- Caregivers include: Registered Nurses, Registered Practical Nurses, Health Care Aides, Personal Care Attendants, Recreational Therapists, activity assistants, Occupational Therapists, Physiotherapists, and Physicians;
- Employed in one of the selected long-term care facilities for at least six months;
- Understands and can communicate in English or French;
- Provides written informed consent to participate in the study.

Family Members

- Spouse, significant other, child, friend or grandchild of a resident, who visits the resident at least once per month. Clinical contact judgment will be used to determine if the participants meet this inclusion criterion;
- >18 years of age;
- Understands and can communicate in English or French;
- Provides written informed consent to participate in the study.

APPENDIX B

Modified Safety Scan

Facility ID Number: _____
Date of scan: _____
Start time: _____ End time: _____
Name of person doing scan: _____

Area	Total Number	Number Scanned
1. Outdoor Common Areas		
2. Indoor Front Entrance/Lobby		
3. Hallways		
4. Dining room		
5. Activity room		
6. Lounge/living room		
7. Library		
8. Kitchen area		
9. Elevators		
10. Gift shop		
11. Exercise Room		
12. Other Areas (specify)		

Attach only the modules used in this safety scan. For any item in the module not applicable, please check N/A. Do not leave blanks. Use space on the bottom of the form for items not included. Use a separate module for each place assessed. For example, if 2 hallways are inspected, use 2 hallway module forms.

Module 1: Outdoor Common Areas (sidewalks, walkways, etc.)

1. Surface of walkways/entrance way: (check all that apply)

☐ Pavement or cement ☐ Interlocking brick
☐ Chip stone ☐ Other (describe) _____
☐ Unpaved

2. a) Exterior Door Type and Number: (check all that apply)

☐ Sliding door: how many ____ ☐ Automatic door: how many ____
☐ Pull door: how many ____ ☐ Other: _____: how many ___

b) Force required to open door: (Repeat on back of page for all doors)

Door 1: Door weight _____lbs → _____ kPa
Door 2: Door weight _____lbs → _____ kPa
Door 3: Door weight _____lbs → _____ kPa

c) Time for door to close from fully open/90 degree position:

Door 1: _____ sec
Door 2: _____ sec
Door 3: _____ sec

ITEM	Y	N	NA	COMMENTS
3. **Are there disabled parking spaces near the main entrance?** → If yes, how many: _____ Distance from main entrance: _____ steps				
4. **Is there a drive-in to drop off/pick up passengers?**				
5. a) **Are there seating places between the outdoor common areas and the main entrance?** (describe) → If yes, how many _____ Height of the seat of the chair: Chair 1: _____cm; Chair 2: _____ cm; Chair 3:_____cm b) **Do the chairs have arms?** Height of the arms of the chair: Chair 1: _____cm; Chair 2: _____cm; Chair 3:____cm				
6. a) **Are there any front steps?** → If yes, how many _____ b) **Are stair edges marked by a contrasting colour?** c) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides? Height of handrail _____cm; Diameter _____cm				
7. **If there is snow**: a) Are the outdoor common areas and the main entrance cleared? b) Are the outdoor common areas salted or sanded?				

Module 2: Indoor Front Entrance/Lobby

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

2. a) Interior Door Type and Number: (check all that apply)

☐ Sliding door: how many ____
☐ Pull door: how many ____
☐ Automatic door: how many ____
☐ Other: _____: how many ___

b) Force required to open door: (Repeat on back of page for all doors)

Door 1: Door weight _____lbs → _____ kPa
Door 2: Door weight _____lbs → _____ kPa
Door 3: Door weight _____lbs → _____ kPa

c) Time for door to close from fully open/90 degree position:

Door 1: _____ sec
Door 2: _____ sec
Door 3: _____ sec

(Continued on next page)

Module 2: Indoor Front Entrance/Lobby

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped/glued down all around? _____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. **Is there a place to sit after entering?** → If yes, how many _____ (describe) Height of the seat of the chair: Chair 1: ____cm; Chair 2: ___ cm; Chair 3:___cm				
b) **Do the chairs have arms?** Height of the arms of the chair: Chair 1: ____cm; Chair 2: ___ cm; Chair 3:___cm				
7. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ___ cm				
8. Is there any section of wall with no handrail or other support for 1 meter (2 steps)?				
9. **Any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot ____lux (describe) At the dimmest spot ____lux (describe)				

Module 3: Hallways (Specify location): _____

Length of hallway: _____ **steps →** _____ **m**
Width of hallway: _____ **cm**

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Is there any clutter (furniture/cords, etc) in the area?**				
6. **Are there any transitions in the slope of the floor?** → If yes, how many _____ Describe type of transition (ramp, steps, etc.)				
7. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
8. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
9. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				

Module 4: Dining Room

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? ____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ___cm; Chair 2: ___ cm; Chair 3:___cm Height of the **arms** of the chair: Chair 1: ___cm; Chair 2: ___ cm; Chair 3: ___cm				

Module 5: Activity room

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm Height of the **arms** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm				

Module 6: Lounge/living room

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm Height of the **arms** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm				

Module 7: Library

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** → If yes, how many _____ What is the luminance at floor level: At the brightest spot_____ lux (describe) At the dimmest spot_____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm Height of the **arms** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm				

Module 8: Kitchen area (Assess only if accessed by residents/clients)

1. Type of flooring: (check all that apply)

☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____ (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?**				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. a) **Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) **Do the handrails have any texture or markings to signal when they are ending?** Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3:____cm Height of the **arms** of the chair: Chair 1: ____cm; Chair 2: ____ cm; Chair 3: ____cm				
10. **Does the floor in front of sink have non-skid strips or secure mat?**				
11. **Are all items used by seniors accessible without reaching below hips or above head?**				

Module 9: Elevators (specify location): _____

1. Number of elevators: _____

2. Elevator Closing (without pressing floor selection)
Number of seconds from fully opened until it **begins closing**:

Elevator 1	Elevator 2	Elevator 3	Elevator 4

Number of seconds from time elevator door is fully opened to **fully closed**:

Elevator 1	Elevator 2	Elevator 3	Elevator 4

3. Elevator Level
Discrepancy between floor of elevator and floor at **every** level (in cm):

	Elevator 1	Elevator 2	Elevator 3	Elevator 4
Level 1				
Level 2				
Level 3				
Level 4				

4. Type of flooring inside elevator: (check all that apply)
☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
5. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
6. **Are the entrance buttons within easy reach of a person standing or in a wheel chair?**				
7. **Is there an automatic opener if someone is in doorway when door closes?**				
8. **Are there any transitions in lighting?** Lighting inside elevator 1 at floor level ____ lux Lighting inside elevator 2 at floor level ____ lux (Repeat on back for each elevator)				
9. a) **Are handrails present in the elevator?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides? Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall __ cm				

Module 10: Gift shop

1. Type of flooring: (check all that apply)
☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

☐ Wall to wall Carpet

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? (describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? _____				
4. **Is there a clear path for easy mobility?** What is the width of the aisle(s) ____cm				
5. **Any clutter (furniture/cords, etc) in the area?**				
6. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
7. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				

Module 11: Exercise Room

1. Type of flooring: (check all that apply)
☐ Cement
☐ Linoleum
☐ Tile (Ceramic)
☐ Marble
☐ Wall to wall Carpet
☐ Combination of carpet and other floor surface (describe)_____
☐ Other (describe) _____

ITEM	Y	N	NA	COMMENTS
2. **Are there any transitions in flooring type?** → If yes, how many different flooring surfaces are there? _____(describe)				
3. **Are there any rugs or carpets?** → If yes, how many are: a) loose _____ b) taped down all around? ____ c) uneven? ____				
4. **Is there a clear path for easy mobility?**				
5. **Is there any clutter (furniture/cords, etc) in the area?**				
6. **a) Are handrails present?** → If yes, are they on: (check one) ☐ one side, or ☐ both sides?				
b) Do the handrails have any texture or markings to signal when they are ending? Height of handrail ____cm; Diameter ____ cm; Clearance from handrail to surface of wall ____ cm				
7. **Is there any section of wall with no handrail or other support for 1 meter (2 steps)?**				
8. **Are there any transitions in lighting intensity?** What is the luminance at floor level: At the brightest spot _____ lux (describe) At the dimmest spot _____ lux (describe)				
9. **Do the chairs have arms?** Height of the **seat** of the chair: Chair 1: ___cm; Chair 2: ___ cm; Chair 3:___cm Height of the **arms** of the chair: Chair 1: ___cm; Chair 2: ___cm; Chair 3:___cm				
10. **a) Is the weight equipment in good repair?**				
b) Is the exercise room supervised?				
c) Are there reminders on wall on how to use weights?				

TRAINING MANUAL

DEFINITIONS

FLOORING TRANSITION: Any change in the flooring type that results in a change of surface texture, friction, visual pattern, or elevation.

LIGHT TRANSITION: Any change in the intensity of lighting that results in a visible shadow or glare on the floor.

CLUTTER: Any scattered or removable object that poses a trip or fall hazard.

CLEAR PATH FOR MOBILITY: A path large enough to navigate if using a walking aid (e.g. walker, cane, etc.).

Module 1

1. To measure distance from main entrance: Measure distance from closest handicap parking space to the front door (if no measuring wheel available, 2 steps ~ 1 m).
2. To measure force required to open door: Take a measurement for all doors (continue on back of page, if necessary).

Modules 1-11

1. To measure height of handrail: Measure distance from floor/ground to the top of the handrail (in cm).

Modules 1,2, 4-8, 11

1. To measure the seating places/chairs that are used by the residents: If more than one seating place/chair is present, record measurements for the most common type of seating place/chair, as well as for the second and third most common. Describe the type of seating (e.g. bench, armchair) in the 'Comments' section.
2. To measure the height of the seat of the chair: Measure the distance from the floor/ground to the top of the seat (in centimeters).
3. To measure the height of the chair arms: Measure the distance from the floor to the top of the arms (where the arms rest) (in cm).

Modules 2-11

1. To measure luminance: Place the light meter at floor level and record reading in lux.
2. (For modules 2-8, 10,11) To measure luminance at the brightest/dimmest spot – this is a subjective judgment. In the 'Comments' section, describe this area.

Module 3

1. Sketch the layout of the hallways on a particular floor.
2. To measure length of hallway: Measure distance of total hallway surface (where 2 steps ~ one meter). If there is a T-junction, measure both 'arms', but do not measure any length of hallway surface more than once.
3. To measure width of hallway: Measure distance between the walls (in cm).

Module 9

1. To measure elevator closing time, and elevator level: Take a measurement of each elevator, at every floor in the long-term care facility.

For calculating slope:

'm= rise/run'
In degrees: $\tan^{-1}$(rise/run)
e.g. for a 45degree slope: $\tan^{-1}(1/1) = 45$

APPENDIX C

Physical Ambulation Portion of the Physical Self-Maintenance Scale

Physical Ambulation	**1 2 3 4 5**
1) Goes about grounds or city	
2) Ambulates within residence or about one block	
3) Ambulates with the assistance of: (check all that apply)	
- 1. another person	1 2 3 4 5
- 2. railing	
- 3. cane	
- 4. walker	
- 5. wheelchair	
(1) gets in and out of chair by self	1 2
(2) needs assistance (i.e. a person) to get in/out of chair	
4) Sits unsupported in a chair or wheelchair, but cannot propel self without assistance	
5) Bedridden more than half the time	

Adopted from: Lawton MP, Brody EM. Assessment of older people. Self-Maintaining and Instrumental Activities of Daily Living. Gerontologist 1969, 9:180 Table 1.

APPENDIX D

Sample Size Calculations

Calculations were conducted to detect a 30% difference in proportions (P), whereby:

- $P_1 = 0.40$, $P_2 = 0.10$
- the estimated intraclass correlation coefficient (ρ) = 0.1,
- the average estimated cluster size (m) = 8.

The number of individuals needed per group, n', was:

$$n' = \frac{(t_{\alpha/2} + t_{\beta})^2 [P_1 (1 - P_1) + P_2 (1 - P_2)] [1 + (m - 1) \rho]}{(P_1 - P_2)^2}$$

$$= \frac{(2.228 + 0.879)^2 (0.4*0.6 + 0.1*0.9) (1 + (8-1)0.1)}{(0.4 - 0.1)^2}$$

$= 9.653449* .33*1.7 / 0.09$
$= 60.17$
Therefore, 60 people are needed per group (a total of 120).

The number of people per cluster needed was:
= 120people from 8 clusters
= 15 people per cluster were needed

To adjust for a 15% non-response rate:
$120*0.15 = 18$
$120 + 18 = 138$

Total sample size required:
138 people from 8 clusters
= 17.25
Therefore, 17 residents per LTC home needed to be recruited for this study.

APPENDIX E

Ethics Approvals

Université d'Ottawa University of Ottawa
Service de subventions de recherche et déontologie Research Grants and Ethics Services

HEALTH SCIENCES AND SCIENCE RESEARCH ETHICS BOARD

CERTIFICATE OF ETHICAL APPROVAL

This is to certify that the University of Ottawa Health Sciences and Science Research Ethics Board has examined the application for ethical approval of the research project entitled **Association between the Built Environment and Physical Activity among Older Adults Living in Long-Term Care Facilities (file H 06-06-04)** submitted by Kate Morgan and supervised by Nancy Edwards of the School of Nursing. The Board found that this research project met appropriate ethical standards as outlined in the Tri-Council Policy Statement and in the Procedures of the University of Ottawa Research Ethics Boards, and accordingly gave it a Category 1a (approval). This certification is valid one year from the date indicated below.

Rita D'Alessandro
Protocol Officer for Ethics in Research
For Dr. Daniel Lagarec, Chair of the
Health Sciences and Science REB

October 17, 2006
Date

550, rue Cumberland 550 Cumberland Street
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http://www.uottawa.ca/services/research/rge/index.html

SERVICE DE SANTÉ
SCO
HEALTH SERVICE

Centre de santé Élisabeth-Bruyère Health Centre
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Téléc./FAX: (613) 562-6367

Hôpital Saint-Vincent Hospital
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SCO Health Service Foundation
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Affilié à / *Affiliated with*

uOttawa
L'Université canadienne
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November 13, 2006

Dr. Nancy Edwards
Professor, School of Nursing
Department of Epidemiology and
Community Medicine
University of Ottawa
451 Smyth Road
Ottawa, ON
K1H 8M5

RE: Association between the built environment and physical activity among older adults living in long-term care facilities.

Dear Dr. Edwards,

Your letter of November 8, 2006, and related documentation, in response to the conditional letter of October 31st, 2006, answered all the issues raised by the Research Ethics Board reviewers.

It is therefore with pleasure that the SCO Health Service Research Ethics Board (REB) gives ethical approval for one year to proceed with the above title study.

Please note that any future changes to the protocol must be submitted to the REB for approval. You are also expected to provide notification of the termination of the study.

We wish you the best of luck with this study.

Best regards,

Dr. Richard Blair, C. Psych.
Director Ethics
Chair, Research Ethics Board
SCO Health Service

RB/lgr

Cc: Kate Morgan

Research Ethics Board
Ottawa Public Health
100 Constellation Crescent
7th Floor West
Ottawa, ON K2G 6J8

January 03, 2007

Kate Morgan

Re: Association between the built environment and physical activity among older adults living in long-term care facilities

Dear Kate Morgan:

I am pleased to inform you that the changes to your project have been approved. Renewal is valid for a period of one year. No further changes, amendments or addenda may be made to the study protocol without the approval of the Ottawa Public Health Research Ethics Board.

The Tri-Council Policy Statement requires a greater involvement of Research Ethics Boards in research studies over the course of their execution. You must inform the Research Ethics Board of adverse events encountered during the study, or of significant new information that becomes available after the Research Ethics Board's review. The Research Ethics Board will review the new information to determine if the study protocol should be modified, discontinued or should continue as originally approved. Please do not hesitate to contact Susan Moxley, Secretariat to the Research Ethics Board at Susan.Moxley@ottawa.ca or 580-2424, ext. 26108 if you require further information.

Sincerely,

Peter Monette
Chair, Research Ethics Board
Ottawa Public Health

cc: Susan Moxley, Secretariat

Attachments: 2

APPENDIX F

Modified Older Adult Exercise Questionnaire

Part 1. Information on Resident's Exercise

Instructions to Resident: I would like to know more about your exercising. Exercise can be any type of activity that you do for the purpose of maintaining or improving your health, strength, flexibility, or fitness level. Usually these activities can be done alone, in a group, or in physiotherapy. I am going to read you a list of several different types of activities and ask you how often you did any of these in the past seven days.

Example 1 – Did you do any "walking indoors" in the past week?

→ (If yes) Did you walk indoors for leisure? (If yes) How many times did you walk indoors in the past week? … and can you tell me how long you spent doing this activity?

→ (If no) Move on to the next activity in the table.

Exercises	Yes/ No	Additional Details	Yes/ No	Frequency	Duration
Walking indoors		If yes: → For leisure			
		→ For a specific reason (e.g., walking to church/mass, walking to the dining room, or activity room)			
Walking outdoors		If yes: → For leisure			
		→ For a specific reason (e.g., walking to the parking lot, walking to an outdoor activity)			
Dancing					
Physiotherapy exercises (e.g., stationary bike, treadmill, etc.)					
Chair exercises		If yes: → Did you do them alone?			
		→ or in a group?			
		→ or in physiotherapy sessions?			
Stair climbing		If yes: → How many steps did you climb?__			
Lifting weights or using resistance rubber bands		If yes: → Did you do them alone?			
		→ or in a group?			
		→ or in physiotherapy sessions?			
Stretching exercises		If yes: → Did you do them alone?			
		→ or in a group?			
		→ or in physiotherapy sessions?			
Tai Chi		If yes: → Did you do it alone?			
		→ or in a group?			
Yoga		If yes: → Did you do it alone?			
		→ or in a group?			
Other activities		Specify: _____			

Part 2. Background Information on Resident's Exercise

Now I would like to ask you a couple more questions about your exercise…

Questions	**Answers**
1. Does anyone assist you with your exercises? If yes, go to 1. a)	Yes No
1. a) Who assists you with your exercises?	(check all that apply) ☐ Nurse ☐ Physiotherapist ☐ Occupational therapist ☐ Recreation staff ☐ Family member ☐ Other: (specify_____)

Part 3. Perceived Health Status

My next question is related to how you perceive your current health…

1. Compared to other people living in long-term care facilities who are able to walk, how would you rate your overall health at the present time: excellent, very good, good, fair, or poor?			
(1)Excellent	(2)Very Good	(3)Good	(4)Fair
(5)Poor			

Part 4. Perceived Activity Level

For my next question, I would like to know about your level of activity…

1. Compared to other people living in long-term care facilities who are able to walk, how would you rate your overall level of activity at the present time: a lot more active, a little more active, about the same, a little less active, or a lot less active?			
(1)A lot more active	(2)A little more active	(3)About the same	(4)A little less active
(5)A lot less active			

Part 5. Background Characteristics

I have a couple more questions for you before we finish off…

Questions	**Response**
1. How long have you lived in this long-term care facility?	Duration:_____
2. What is your year of birth?	Year:_____
Record gender (do not ask)	Gender:_____

Thank you for participating in this study – it will help me out a lot!

L'échelle modifiée d'exercices pour les adultes aînées

Directives pour les résidents: Je veux savoir plus à propos de vos activités physiques. Les activités physiques peuvent être n'importe quelles activités que vous fassiez pour maintenir ou, améliorer, votre santé, force, flexibilité ou, votre forme physique. D'habitude, vous pouvez faire ces exercices tout(e) seul(e), dans un groupe ou, dans les classes de physiothérapies. Je vais lire une liste des différentes activités et vous demandez combien de fois vous avez fait ces activités dans la semaine passée.

Exemple 1) Est-ce que vous avez _____ dans la semaine passée?
Si oui: Combien de fois est-ce que vous avez _____ dans la semaine passée? Et est-ce que vous pouvez me dire combien de fois vous avez fait cette activité?
Si non: Continuer avec la prochaine activité dans le tableau.

Les Activités Physiques	Oui / Non	Activités Détaillées	Oui/ Non	Nombre d'occasions	Durée
Marché à l'intérieur		Si oui → Pour le loisir, ou			
		→ Pour une raison spécifique (par exemple, marcher à l'église/mass, marcher à la salle de manger ou la salle d'activités)			
Marché dehors		Si oui → Pour le loisir			
		→ Pour une raison spécifique (par exemple, marcher au parc de stationnement, marcher à une activité dehors)			
Dansé					
Fait des exercices de physiothérapies (par exemple, la bicyclette, le tapis roulante)					
Fait des exercices dans une chaise		Si oui → Est-ce que vous l'avez fait tout(e) seul(e)?			
		→ ou dans un groupe?			
		→ ou dans les séances de physiothérapies?			
Monté les escaliers ou marches?		Si oui → Combien de marches avez-vous monté?			
Soulevé des poids ou utiliser les bandes de résistances?		Si oui → Est-ce que vous l'avez fait tout(e) seul(e)?			
		→ ou dans un groupe?			
		→ ou dans les séances de physiothérapies?			
Fait les étirements?		Si oui → Est-ce que vous l'avez fait tout(e) seul(e)?			
		→ ou dans un groupe?			
		→ ou dans les séances de physiothérapies?			
Fait du Tai Chi?		Si oui → Est-ce que vous l'avez fait tout(e) seul(e)?			
		→ ou dans un groupe?			
Fait du Yoga?		Si oui → Est-ce que vous l'avez fait tout(e) seul(e)?			
		→ ou dans un groupe?			
Fait d'autres activités pas mentionnées?		Spécifie : _____			

Les Questions Générales
Maintenant, je veux vous demandé des questions générales à propos de votre activité physique.

Questions	Réponses
1. Est-ce qu'il y a quelqu'un qui vous aide avec vos activités physiques?	Oui Non
1. a) Si oui → Qui vous-aide?	(Noter tous ceux qui appliquent) ☐ Infirmier ou infirmière ☐ Physiothérapeute ☐ Ergothérapeute ☐ Personnel de recréation ☐ Membre de famille ☐ Autre : (spécifie _____)

État de Santé Perçu

La prochaine question est reliée à comment vous percevez votre niveau de santé…

1. Comparé aux autres personnes qui habitent dans les établissements de soins de longues durées qui sont capable de marcher, comment est-ce que vous évaluez votre santé en ce moment : Excellente, très bonne, bonne, assez bonne, pire.
(1) Excellente (2) très bonne (3) bonne (4) assez bonne (5) pire

Niveau d'Activité Perçu

La prochaine question est reliée à comment vous percevez votre niveau d'activité…

1. Comparé aux autres personnes qui habitent dans les établissements de soins de longues durées qui sont capable de marcher, comment est-ce que vous évaluez votre niveau d'activité en ce moment: beaucoup plus actif, un peu plus actif, pareil, un peu moins actif, beaucoup moins actif.
(1) beaucoup plus actif (2) un peu plus actif (3) pareil (4) un peu moins actif (5) beaucoup moins actif.

Caractéristiques générales

J'ai deux autres questions avant qu'on finisse…

Questions	Réponses
1. Combien de temps est-ce que vous avez habité à cet établissement?	Durée : _____
2. Quelle est l'année de votre naissance?	Année : _____
<Noter leur genre>	Genre : _____

Merci d'avoir participer dans cette étude – ça va m'aider beaucoup!

APPENDIX G

Administrator Recruitment Script

Hello (administrator's name),

My name is Kate Morgan. I am a graduate student at the University of Ottawa.
Is this a good time to speak to you? Yes _____ → proceed.
No_____ → call back time: _____

Script:
I am a research assistant working on a Pilot Study that your long-term care facility is currently involved with, called Physical Activity of Older Adults in Long-Term Care facilities. I am also completing my Master's in Epidemiology and for my thesis I would like to further examine the topic of physical activity in long-term care. My hope is to interview a sample of residents at your facility to ask them about their patterns of physical activity. Similar to the Pilot Study, this thesis may help inform the development of an inter-provincial project that will examine the effectiveness of strategies to promote physical activity.

Your participation would involve the following activities:
- Providing a letter granting access to your premises,
- A 30-minute individual interview with 17 residents of your long-term care facility.

This study has been reviewed by the Research and Ethics Board at the University of Ottawa. Should you agree to participate, all information that your residents provide will be held strictly confidential. Interviews will be held onsite, in English or French, and responses to interview questions will be recorded with pen and paper. Similar to the procedures in the Pilot Study, I will be asking the participating administrators to identify a clinical contact who could identify residents that meet the required eligibility criteria and who are capable of providing an informed consent. I will then help the clinical contact obtain a random sample of 17 residents, and these residents will be approached by the clinical contact to determine their interest in participating in the study. The interviews will be held in a private room at the facility, and should take approximately 30 minutes to complete.

Do you have any questions concerning the study? Yes_____ No_____

Do you think that you may be interested in participating in this study?
If No _____ → Thank the administrator for their time.
If Yes_____ → proceed.

If you wish, I can send you a one page summary of the of the research project. I will also send you a sample letter of permission, which you can then print and sign

If you have any questions please do not hesitate to contact Kate Morgan, Student Investigator, Tel: XXX, e-mail: XXX or Nancy Edwards, Thesis Supervisor, Tel: XXX. Thank you for your consideration.

APPENDIX H

Letter of Information for Administrators

Project Title: Association between the built environment and physical activity among older adults living in long-term care facilities

Many benefits of physical activity, such as reduced risk for heart disease, osteoporosis, stroke, diabetes, and Alzheimer's disease, can be achieved among older adults living in long-term care facilities. This study will be completed as part of my Master's of Epidemiology thesis. It was designed to complement a Pilot Study that your long-term care facility was recently involved with, called Physical Activity of Older Adults in Long-Term Care facilities. The Pilot Study was co-lead by my thesis supervisor Nancy Edwards.

The primary objective of my thesis is:
1) To assess whether the levels of physical activity among seniors living in long-term care facilities in the Ottawa area vary with the nature of the facilities' built environment.

A research assistant from the Community Health Research Unit or I will conduct a 30-minute face-to-face interview with a sample of 17 residents from your facility to obtain information on their patterns of physical activity in the previous seven days, their perceived health status, and their perceived activity level. We will be responsible for obtaining informed written consent from participants prior to beginning the interview. All information that your residents provide will be held strictly confidential.

Participating administrators will be asked to identify a clinical contact (e.g., a nurse, recreation manager, recreation therapist, physiotherapist, etc.) that could identify eligible participants, and approach those selected from a random sample to determine their interest in participating in this study.

The Research and Ethics Board (REB) at the University of Ottawa reviewed this thesis in the Summer 2006 and granted conditional approval. The REB requires letters of permission from each of the participating facilities' administrators prior to granting final approval. Ethics approval will also be obtained from SCO REB and the City of Ottawa REB. It is anticipated that data collection will commence in the Fall of 2006.

Results from this thesis will lead to a greater understanding of some of the environmental factors that influence physical activity among seniors in long-term care settings.

Thank you for your consideration,

Kate Morgan
MSc Candidate
Department of Epidemiology and Community Medicine, University of Ottawa

APPENDIX I

Sample Letter of Permission

RE: Permission to Access Premises for Proposed Research Project: The association between the built environment and physical activity among older adults living in long-term care facilities.

Dear Ms. Morgan,

We would be pleased to be a site for your proposed research project: The association between the built environment and physical activity among older adults living in long-term care facilities.

Pending ethical approval from the Research and Ethics Board of the University of Ottawa, we grant permission to you and your research assistants to access our premises for study purposes.

We will identify a clinical contact in our facility that will assist you in selecting a sample of residents who are interested in participating in your study.

We look forward to having you at our facility.

Sincerely,

[signature and title]

APPENDIX J

Letter of Information for Residents

Title of the Study: Association between the built environment and physical activity among older adults living in long-term care facilities *(printed in size 14 font)*

My name is Kate Morgan and I am a student at the University of Ottawa. I am conducting a study for my Master's of Epidemiology. This study will examine the relationship between the built environment and physical activity in long-term care facilities.

To be eligible to participate, you must be 65 years or older, have lived in this long-term care facility for at least three months, and be able to walk on your own or with some help (e.g. a cane, walker, or another person). Residents who do engage in physical activity, as well as those who do not, are eligible for this study.

Your participation is completely voluntary. You may refuse to answer any questions that you do not feel comfortable with. You may stop participating in the study at any time. Your participation in this study will have no impact on the care you receive at your long-term care facility. Your participation will not have a direct benefit to you. However, the results of the study may help long-term care residents in the future.

If you decide to participate, you will be asked questions about your physical activity and your general health. These questions will be read to you and your answers will be recorded using pen and paper. In total, it should take approximately 30 minutes. The interview will take place at your facility.

All information collected will remain confidential. Your name and the name of your facility will not be recorded with your responses or identified in any way. A unique ID number will be assigned to your interview. A list with your name, address, and signed consent form will be kept separate from your answers in a locked filing cabinet at the University of Ottawa until completion of the study. If this research is published, only group results will be presented.

If you have any questions or concerns, please contact Kate Morgan at XXX, email: ;or Nancy Edwards, thesis supervisor, at XXX, email: XXX.

Lettre de Renseignements pour les Résidents

Titre de l'étude : L'Association entre l'environnement physique et l'activité physique pour les résidents dans les établissements de soins de longues durées.

Je m'appelle Kate Morgan, et je suis en train de compléter ma maîtresse en Épidémiologie à l'Université d'Ottawa. Pour ma thèse, je fais une étude qui examine l'association entre l'environnement physique et l'activité physique pour les résidents dans les établissements de soins de longues durées.

Pour remplir les conditions requises pour participer dans cette étude, vous devrez avoir 65 ans ou plus, et résider à cet établissement au moins trois mois. Vous devrez être capable de marcher tout(e) seul(e) OU avec l'aide d'une canne, une marchette ou, une autre personne. Les résidents qui font de l'activité physique, même les résidents qui ne le font pas, peuvent participer dans cette étude.

Votre participation est volontaire et vous avez le choix de refuser de répondre à n'importe quelle question ou de vous retirer de l'étude en tout temps, sans crainte de représailles. Votre participation n'aura aucun impact avec les soins que vous recevrez à votre établissement. Aussi, votre participation n'aura aucun avantage direct pour vous, mais les résultats de cette étude peuvent aider les résidents à l'avenir.

Si vous décidez de participer, on vous demandera des questions à propos de votre activité physique et votre santé en générale. Ces questions seront lues à vous et vos réponses seront notées avec le stylo et papier. En totale, ça doit prendre environ 30 minutes pour répondre à toutes les questions. Cette entrevue aura lieu à votre établissement.

Tous renseignements seront gardés en confidentialité jusqu'au degré possible en vertu de la loi. Votre nom, même le nom de votre établissement, ne seront pas inscrits ni identifiés de quelque façon que ce soit. Nous attribuerons un numéro d'identification unique à votre entrevue. Une liste avec votre nom, adresse, et lettre de consentement seraient maintenues en sécurité, et séparée de vos réponses, dans un classeur verrouillé se trouvant dans le bureau de la Dre Nancy Edwards à l'Université d'Ottawa, jusqu'au fin de cette étude. Si cette recherche est publiée, seuls les résultats groupés seront présentés.

Les données sur papier et sur ordinateur seront conservées pendant une période de cinq ans à la suite de la publication des résultats. Au terme de cette période, toutes les données (dans les documents imprimés et sur ordinateur) seront détruites.

Si vous avez des questions à propos de cette étude, vous pouvez communiquer avec Kate Morgan, XXX, adresse électronique : XXX ou la Dre Nancy Edwards, surveillante de la thèse, XXX, no tél.: XXX ou adresse électronique: XXX.

APPENDIX K

Consent Form for Residents

Title of the Study: Association between the built environment and physical activity among older adults living in long-term care facilities *(printed in size 14 font)*

A student investigator from the University of Ottawa is inviting you to participate in a study. This study is being completed as part of a Master's of Epidemiology degree. It will examine physical activity among seniors residing in long-term care facilities.

Your participation will involve one (1) face-to-face interview with the student investigator. The interview will be held at your facility and will take approximately 30 minutes to complete. Your participation will not have a direct benefit for you. However, it is anticipated that the results of this study will inform future research and practice that will benefit seniors residing in long-term care facilities.

No legal, physical or social risks or discomforts are expected from your participation. If you feel tired or unwell during the interview you may stop the interview and return to your unit. During the interview, if you reveal the possibility of a serious health concern, the student investigator will be obliged to bring it to the clinician's attention. You may withdraw from the study at any time. If you decide to withdraw, none of your information will be used. Individual results will not be shared with any other individual(s) outside of the research team. Only group results will be presented or published.

All information will be kept confidential. Neither your name nor the name of your facility will be recorded with your responses or identified in any way. A unique ID number will be assigned to your interview. All data will be kept locked in a secure location in a locked filing cabinet in the office of Dr. Nancy Edwards at the University of Ottawa. Paper and computer data will be retained for a period of five years following publication of the results. At this time, all data (paper copies and computer data) will be destroyed.

Your participation is voluntary. You may refuse to answer any questions and/or withdraw from the interview at any time, without penalty.

Are you willing to participate in the interview?
__ Yes __No

If you have questions about the study, you may contact Kate Morgan, Student Investigator at Tel: a; or Dr. Nancy Edwards, Thesis Supervisor, at the University of Ottawa, 451 Smyth Road, Ottawa Ontario, K1H 8M5, Room 1118, Tel: 613-562-5800 ext 8395 or e-mail nedwards@uottawa.ca.

For ethical concerns, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 159, Ottawa, ON K1N 6N5, telephone: 613-562-5841 or ethics@uottawa.ca.

I have signed two copies of the consent form, one of which I may keep.

_____	_____
Participant's Signature	Date
_____	_____
Student Investigator's Signature	Date

OR

The consent has been read to me by a member of the research team in the presence of _____ (witness's name)

I_____ (participant's name) consent to participate in the proposed research project entitled "Association between the built environment and physical activity among older adults living in long-term care facilities".

Are you willing to participate in the interview?
__ Yes __ No

_____	_____
Participant's Signature	Date
_____	_____
Witness's Signature	Date
_____	_____
Student Investigator's Signature	Date

Titre de l'étude : L'Association entre l'environnement physique et l'activité physique pour les résidents dans les établissements de soins de longues durées.

Une étudiante de l'Université d'Ottawa vous invite de participer dans une étude visant à examiner l'activité physique des résidents dans les établissements de soins de longues durées. Cette étude aidera à compléter un degré en Épidémiologie.

Votre participation comportera d'une (1) entrevue avec l'étudiante. Cette entrevue aura lieu à votre établissement et prendra environ 30 minutes. Votre participation n'aura aucun avantage direct pour vous, mais les résultats de cette étude peuvent aider les résidents à l'avenir.

Votre participation ne devrait comporter aucun risque ou inconvénient sur les plans juridique, physique et social. Si vous vous sentez fatigué(e) ou éprouvez un malaise pendant l'entrevue, vous pouvez arrêter l'entrevue et retourner à votre chambre. Vous pouvez vous retirer de l'étude à tout moment. Si vous décidez de vous retirer, nous n'utiliserons aucune de vos réponses. Aucun résultat individuel ne sera communiqué à qui que ce soit à l'extérieur de l'équipe de recherche. Seuls des résultats groupés seront présentés ou publiés.

Tous renseignements seront gardés en confidentialité jusqu'au degré possible en vertu de la loi. Votre nom, même le nom de votre établissement, ne seront pas inscrits ni identifiés de quelque façon que ce soit. Nous attribuerons un numéro d'identification unique à votre groupe de discussion. Toutes les données seront maintenues en sécurité dans un classeur verrouillé se trouvant dans le bureau de la D[re] Nancy Edwards à l'Université d'Ottawa. Les données sur papier et sur ordinateur seront conservées pendant une période de cinq ans à la suite de la publication des résultats. Au terme de cette période, toutes les données (dans les documents imprimés et sur ordinateur) seront détruites.

Votre participation est volontaire et vous avez le choix de refuser de répondre à n'importe quelle question ou de vous retirer de l'entrevue en tout temps, sans crainte de représailles.

Désirez-vous participer à l'entrevue ?
__ Oui __ Non

Si vous avez des questions à propos de cette étude, vous pouvez communiquer avec Kate Morgan, no de tél. adresse électronique la Dre Nancy Edwards, surveillante de la thèse, à l'Université d'Ottawa, 451, chemin Smyth, Ottawa (Ontario), K1H 8M5, pièce 1118, no tél. (613) 562-5800, poste 8395 ou adresse électronique : nedwards@uottawa.ca. Pour exprimer toute préoccupation concernant l'éthique, vous pouvez communiquer avec le Secrétariat, Comité d'éthique de la recherche de l'Université d'Ottawa, 550 rue Cumberland, Salle 159, K1N 6N5, (613) 562-5841 ou ethics@uottawa.ca.

J'ai signé les deux copies du formulaire de consentement et je peux garder l'une d'entre elles.

_____ _____

Signature du (de la) chercheur(e) Date

_____ _____

Signature du (de la) participant(e) Date

OU

Ce consentement m'a été lu par un membre de l'équipe de recherche en présence de _____ (nom du témoin)

Je, _____ (nom de la personne qui consent) consent à participer au projet de recherche proposé intitulé « L'Association entre l'environnement physique et l'activité physique pour les résidents dans les établissements de soins de longues durées»

Désirez-vous participer à l'entrevue?
__ Oui __ Non

_____ _____

Signature du (de la) chercheur(e) Date

_____ _____

Signature du (de la) participant(e) Date

_____ _____

Signature du témoin Date