Canadian Policy and Aging in Place: The Importance of Assistive Technology and Information and Communication Technology

by

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Abstract

This capstone project critically analyzes Canadian policy and aging in place in relation to home and community services through the implementation of information and communication technology. A review of the literature reveals that policy and funding arrangements may be impeding the delivery of health and community care services and the accessibility of assistive technology and information and communication technology that support aging in place. It is proposed that underlying factors have created a long history of favouring acute care over home and community care and this tendency is currently reflected in reactive initiatives concerning the potential of assistive technology and information and communication technology. The project provides recommendations for future policy initiatives in regards to a technology strategy specifically designed for home and community care's prevention and maintenance function with the intention of improving opportunities for aging in place.

Keywords: Aging in place; assistive technology; information and communication technology; Canadian public policy; home and community care; health care

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Table of Contents

List of Acronyms

ADL — Activities of Daily Living

AIP — Aging in Place

AT — Assistive Technology

CAPT — Canadian Drugs and Technology in Health

CHCA — Canadian Home Care Association

CHST — Canada Health and Social Transfer

EHC — Electronic Health Record

EHCS — Extended Health Care Services

HTA — Health Technology Assessment

HCPCP — Health Care Policy Contribution Program

QALY — Incremental cost per quality adjusted life year

ICT — Information and Communication Technology

IADL — Instrumental Activities of Daily Living

NIFTE — National Institute for Telehealth Guidelines

NTOIP — The Canadian National Telehealth Outcome Indicators Project

RAI-HCI — Resident Assessment Instrument-Home Care

WSD — Whole Systems Demonstrator

Chapter 1.   Introduction and Purpose

Introduction

Older adults aged 65 years and over represent the fastest growing segment of Canada's population (Turcotte & Schellenberg, 2006). Between 1981 and 2011, the number of seniors in Canada increased from 2.4 million, or 10% of the population, to 5 million, or 15% of the population (Milan, Wong, & Vezina, 2014). By 2031, this number is projected to reach 9.6 million, representing 23% of the total population (Milan et al., 2014). The aging population represents gains in longevity resulting from the successes of Canada's health and social systems: however, this demographic shift also creates unprecedented challenges for these systems. Within a financial climate of limited resources, innovative and strategic policies are required to address the changing needs, abilities, and expectations associated with aging (B.C. Ministry of Health, 2005; Cloutier-Fisher, Foster, & Hultsch, 2009; Ombudsperson, 2012). Older adults are living longer, more active lives with fewer disabilities than previous generations (Sixsmith & Gutman, 2013; Ombudsperson, 2012). The majority express a preference to age in place (AIP), to live independently at home or within their community for as long as possible (Sixsmith & Sixsmith, 2008; Farber & Shinkle, 2011; Piau, Campo, Rumeau, Vellas, and Nourhashemi, 2014).

The role of technology within this context has experienced increased interest and recognition over the past three decades with the evolution of assistive technology (AT) and advances in information and communication technology (ICT) inspiring alternative approaches to health care. Research indicates that ICTs, such as telehealth, enable older adults to AIP by increasing accessibility to health care services while also creating supportive physical and social environments within the home and community. This area presents an opportunity for Canadian policy to enhance older adults' ability to AIP by supporting the use of ICT within home and community care services. By focusing on

preventative applications of ICT within home and community care services, policy has the potential to increase older adults' quality of life while also improving the cost-effectiveness of the Canadian health care system; however, policy and funding arrangements may be impeding the delivery of home and community care services, generally, and ICTs, specifically, to older adults.

The convergence of population aging with the rapid acceleration of technological development has resulted in the emergence of gerontechnology as both a necessity and an opportunity for aging societies. Residing at the crossroads of advancing technology and advancing age (Harrington and Harrington, 2000), this interdisciplinary field of scientific research presents technology as a means to improving older adults' quality of life while also facilitating their participation as active citizens within their respective communities (Bouma, Taipale, Fozard, Bouwhuis, and van Bronswijkl, 2007).In recent decades, AT emerged within gerontechnological research as an effective tool for addressing challenges associated with population aging (Sixsmith & Gutman, 2013). AT is an umbrella term referring to devices, products, and services that enhance a person's ability to function and participate within society (Beech & Roberts, 2008; CAOT, 2012; Scherer, 2001; Sixsmith & Gutman, 2013). AT is "technological tools that restore or extend human functions" (Posse & Mann, 2005, p.221) and includes anything from low technology devices of simple designs, such as eyeglasses, magnifying devices, or walkers, to high technology systems of more sophisticated designs, such as smart homes (Jacobs, Hailey, & Jones, 2003; CAOT, 2012; FAST, 2013; Piau, Campo, Rumeau, Vellas, & Nourhashemi, 2014). The introduction of more complex technologies, such as ICT, has transformed the landscape of AT as well as the experiences and expectations of aging Canadians (CAOT, 2012). ICTs include all computer, networking, telecommunications, Internet, programming, and information systems technologies that enable users to access, store, transmit, and manipulate information. The inclusiveness of AT and ICT's definitions reflect the diverse range of preferences, needs, and abilities that these technologies may accommodate (Beech & Roberts, 2008).

The majority of older Canadians express a preference to AIP in order to sustain connectivity with family, friends, and community (Sixsmith & Sixsmith, 2008; Farber & Shinkle, 2011; Piau et al., 2014). Recent research recognizes ICTs potential to increase

2

older adults' ability to AIP while also improving the cost-effectiveness and quality of health and social services within the home environment (Cloutier-Fisher et al., 2009: Sixsmith, & Gutman, 2013; Kitchner, Ng, Lee, and Harrington, 2008). The implementation ICT within home and community care potentially creates a supportive environment in which older adults are better able to live within their preferred surroundings. It does so by: increasing autonomy, self-confidence, and mobility; increasing or maintaining health and functional capacity; promoting active and healthy lifestyles, thus reducing the risk of disability and institutionalization; enhancing security; preventing social isolation; and maintaining support networks (AAL Joint Programme, 2009; Beech & Roberts, 2008). By augmenting and/or replacing diminished sensory, mobility, communication, and cognitive functions, ICT may enhance older adults' ability to not only AIP but to also engage with society.

Purpose of Capstone Project

As Canada ages, "health care system policy and decision makers will continue to be challenged to innovate and reform how health care is provided" (CIHI, 2011, p.10). Within the current health care climate of restructuring and downsizing, preventative home and community care services are gaining recognition as cost-effective alternatives to reactive institutional models of care (Duncan & Retter, 2006). Since Canadians are living longer and healthier lives with the desire to AIP, considerable growth in the demand for and complexity of home and community care is expected. Therefore, innovative interventions improving home and community care are crucial to the future of Canada's health care system. ICTs have emerged within the AT landscape and are increasingly recognized not only as tools for adapting to the physical environment, but also as avenues to home and community care services. The Center for Technology and Aging (2009) states, "Technology is an enabler in creating systems of health and long-term care that are more integrated and reliable, and that address the needs of older adults in a more efficient and effective way" (p.3).

The purpose of this capstone project is to provide a comprehensive understanding of policy and funding arrangements that either foster or impede the delivery of health and community care services as well as the development and

implementation of ICTs that support AIP (Shiner, 2007). The policy analysis will apply a multidisciplinary inquiry as to the socio-demographic, technological, legislative, and economic issues that influence policy. The analysis will:

- Critically review the current literature on the heterogeneity of Canadian seniors and their needs and abilities, the preference to AIP, the emergence of ICT and evidence as to its effectiveness for AIP.

- Describe the evolution of Canada's health care system in relation to home and community care's role in sustaining the system and creating opportunities for AIP.

- Articulate the emerging issues within home and community care and the ways in which ICT can address these issues.

- Investigate policies concerning ICT and home and community care.

- Identify the underlying factors that have created a long history of favouring acute care over home and community care and how this is currently reflected in emerging policy initiatives concerning the potential of ICT within the home care sector.

- Provide recommendations for future policy initiatives in regards to a technology strategy specifically designed for home and community care's prevention and maintenance function with the intention of improving opportunities for AIP.

Research Questions

What is the demographic composition of older adults residing in Canada?

What are Canadians' preferences for care arrangements in later life?

What is the current ICT landscape in Canada?

Do policy and funding arrangements impede the delivery of home and community care services, generally, and ICT, specifically, to older adults residing in Canada?

Chapter 2.   Methodology

This capstone project critically analysed Canadian policy in relation to AIP, home and community care, and the significance of ICT. Policy analysis "is a generic name for a range of techniques and tools to study the characteristics of established policies, how the policies came to be and what their consequences are" (Colliins, 2005, p.192). While there are many different methodologies for policy analysis, this capstone project utilizes a multidisciplinary inquiry into how to foster ICT innovation for AIP within the Canadian context. The literature review, policy analysis, and discussion are the key components of this capstone project. The literature review provided an overview of available research concerning the heterogeneity of Canadian seniors, the preference to age in place, the shift in preference in location of care from hospital to home, and the current ICT landscape. The research question, "Do policy and funding arrangements impede the delivery of home and community care services, generally, and ICT, specifically, to older adults residing in Canada?", drove the policy analysis. In order to create a better understanding of the funding and policy arrangements, the analysis examined the complexity of AIP policy in relation to Canada's socio-demographic composition, ICT for AIP research and development, the economic environment, technological infrastructure, legislative influences, ethical and cultural issues, and health care. A policy review compared circumstances of two Canadian provinces (British Columbia and Alberta)

A broad range of sources and perspectives were included in this review. Searches of key databases for empirical (research based) and non-empirical (non-research based) sources provided the basis of the research. Databases searched included: Academic Search Primer, AgeLine, Canadian Public Policy Collection, Cochrane Review, and Google Scholar. In addition, a library search was conducted of books and gray literature published on this topic area. Published peer reviewed research articles, scholarly and non-scholarly books, grey literature, relevant websites, and policy and government publications were included in this review.

The eligibility criteria included a) mention of concepts relative to the topic area b) policies pertaining to Canada, health policy, and technology c) materials that focus on older adults aged 65 years and older. There was no restriction on inclusion based on year of publication. Key words included: aging in place, information and communication technology, assistive technology, Canadian public policy, home and community care, health care, and technology innovation.

Chapter 3. Literature Review

What is the demographic composition of older adults residing in Canada?

Canada's Aging Population

Population aging represents the most significant demographic phenomenon in North America during the late 20th century. It "is a pervasive trend as it affects virtually all individuals and their communities by influencing numerous dimensions of social and economic life" (Cloutier-Fisher, et al., 2009, p.13). Canadians aged 65 years and older (65+) represent the fastest growing segment of the population (Chappell & Hollander, 2013). Due to low fertility rates, longer life expectancy, and the baby boom generation, as well as social and economic shifts, the number of seniors in Canada increased from 2.4 to 4.2 million between 1981 and 2005, and their share of the total population increased from 9.6% to 13.1% (Statistics Canada, 2006). As of 2010, 15.3% of Canada's population was 65 years of age or older, and this number is projected to reach 24.1% by the year 2030 (Chappell & Hollander, 2013). Since the early 1900s, life expectancy, defined as the length of time that we live, has been rising (Chappell & Hollander, 2013). As of 2006, the average life expectancy was 81, which is an increase of 5 years since 1981 (Chappell & Hollander, 2013; Cloutier-Fisher et al., 2009). Similarly, life expectancy at 65 is improving among Canadians, with women expected to survive another 20.8 years and men another 17.4 years as of 2003 (Cloutier-Fisher et al., 2009).

These statistics are often used to present population aging as an apocalyptic demographic phenomenon. Apocalyptic demography stresses that Canada's current health care system is unsustainable because aging is associated with greater demands for health care services and increasing health spending (CIHI, 2011). This perception that rapid population aging inevitably leads to a social and economic crisis over-

emphasizes the negative effects of demographic change (Cloutier-Fisher et al, 2009). Underlying this tendency is the "medicalization" of aging, which equates older adults with health problems and ever-expanding health care needs (Cloutier-Fisher et al, 2009). However, Canada's population has aged over an extended period of time, enabling the development of health, social, and technological infrastructures that potentially supply the resources for Canadians to adapt to the changing demographics. In addition, this apocalyptic vision of Canada's future ignores the fact that older adults are a heterogeneous group with diverse experiences, expectations, abilities, and needs due to variations in geography, race or ethnicity, socio-economic status, and disability, to list a few (Bernard & Scharf, 2007; Cloutier-Fisher et al., 2009). For example, while every province and territory across Canada is aging, population aging has not occurred uniformly across each jurisdiction (CIHI, 2011). Health care needs and priorities differ among provinces; consequently, each province has implemented specialized policies in accordance with their unique circumstances (Health Council of Canada, 2012a). Despite this variation, a unifying challenge for all Canadian provinces and territories concerns the delivery of home and community services to older adults residing in rural areas.

Aging in Rural Canadian Communities

While the majority of Canadians reside in urban settings, many rural communities are demonstrating an increased number of older adults (Dandy & Bollman, 2008). In recent decades, definitions of "rural" have evolved from referring to agricultural features to definitions that center around geographic elements of population size, density, and distance (Dandy & Bollman, 2008; Duncan & Retter, 2006: Forbes and Edge, 2009). According to Statistics Canada, a "rural and small town" refers to a town and/or municipality outside the commuting zone of centres with a population of 10,000 or more (Duncan & Retter, 2006; du Plessis, Beshiri, Bollman, & Clemenson, 2001). There are approximately 3,000 rural communities throughout Canada, 52% of which have fewer than 1,000 residents and 40% of which are located outside of commuting distance to an urban centre (Duncan & Retter, 2006). These rural communities are simultaneously experiencing a greater decline in the general population and a faster growing proportion of seniors than urban areas (Forbes and Edge, 2009). As of 2006, 23% of Canadian older adults resided in rural settings and 15% of rural populations were 65 years or

older, compared to 13% of urban populations (Dandy & Bollman, 2008). Statistics Canada (2006) predicts that by 2021, one in four will reside in a rural area and 30% to 40% of people who live in these areas will be aged 65 years and over.

Geographic features and migration patterns influence the lives of older rural adults in regards to the accessibility of formal and informal support services. Location affects social support in the following ways: a smaller population size may reduce volunteer capacity; population density influences access to neighbours, friends, and family; and proximity to urban centres affects access to health and social services (Duncan & Retter, 2006). Migration patterns influence the aging experience in rural communities as well. In recent decades, outmigration of rural youth in search of employment opportunities in urban areas has consistently exceeded in-migration among young adults (Niemeyer, Bruin, Cook, Laux, Memken, White, Crull, & Yust, 2007). Clark and Leipert (2007) found that this outmigration of the youth, along with decreased incomes and greater geographic distance between networks, has eroded avenues of social support for rural seniors. Additionally, the number of urban older adults migrating to rural areas after retirement has increased (Keating, Swindle, & Fletcher, 2011; Niemeyer et al., 2007). Since many rural older adults choose to AIP, the combination of youth outmigration and retired urban older adult in-migration has resulted in a relatively large proportion of older adults residing in rural communities (Niemeyer et al., 2007).

Commonly held myths and assumptions associated with aging in rural communities emerge within the literature. These should be considered when addressing the needs and abilities of older rural seniors. Firstly, the term "rural" often has the effect of homogenizing the members of such communities. While there are certain similarities among aging rural residents, there is also great diversity in the experience of living in rural Canada. Research indicates that rural older adults tend to demonstrate poorer socioeconomic conditions: lower educational levels; less-healthy behaviors; reduced utilization of formal services; increased sense of community belonging; and higher overall mortality rates in comparison with their urban counterparts (Forbes and Edge, 2009). Secondly, there is a tendency to portray rural communities as relaxing and idyllic; however, the economic hardship rural older adults face due to a lifetime of lower incomes can result in lower standards of housing in later life. Thirdly, these older adults

are assumed to possess strong social networks and therefore high levels of informal social support. Recent research on social support and social isolation has found that older rural adults belong to more community organizations, spend more hours volunteering, and provide more personal care than their urban counterparts (Keating et al, 2011). However, geographic barriers may increase the risk of social isolation. Living far from relatives and living for a short duration within the community increases risk of social isolation; therefore, urban retirees relocating to rural areas may be more likely to experience social isolation (Keating et al., 2011).

These findings indicate that rural communities require a greater need for health and social services in order for older adults to successfully AIP; however, support services and health resources are already overstretched due to in-migration of urban retirees and outmigration of young adults (Duncan & Retter, 2006). Policy makers should consider the circumstances of aging in rural communities when selecting technologies that would be most beneficial for rural older adults. They should examine the unique histories of these communities within each province in relation to the current experiences of their aging residents.

Aging Canadians: A Heterogeneous Population

Old age is commonly associated with negative connotations, such as illness, disability, weakness, and burden (Sixsmith & Gutman, 2013). These ageist assumptions present aging as a homogeneous experience; however, the older population represents a highly heterogeneous group of people with varying abilities and needs (Sixsmith & Gutman, 2013). Policies should reflect this heterogeneity in relation to opportunities that technological advancements present for aging individuals and societies (Sixsmith and Gutman (2013) address this issue arguing that research and development should appreciate the diverse marketplace and customer base within the older population. They differentiate between four groups of older adults based on needs and abilities: healthy and active seniors; people with chronic diseases; people with dementia; and people with mild cognitive impairment.

Expanding upon Sixsmith and Gutman's (2013) categorization of older adults, this literature review incorporates eight subpopulations. These include older adults who are: healthy and active; care dependent and isolated; care-dependent and supported; living with one or more chronic diseases; frail; cognitively impairment, and economically marginalized. Each group experiences aging differently, and each individual within a group experiences aging uniquely. By recognizing the diverse abilities and needs of older Canadians in relation to ICT's potential as an innovative component of home and community care, policy makers will be better equipped to design initiatives that ensure the accessibility and relevance of such technologies to a broader spectrum of older adults.

Healthy and Active Older Adults

Contrary to common ageist misconceptions, the majority of older adults remain physically fit, active, and healthy well into later life (WHO, 1999; CIHIb, 2011). In a 2008–2009 survey, the majority of Canadians younger than age 85 did not report any limitations in functional capacity; however, by age 85, the majority reported mild limitations. The youngest group of older adults reported limitations similar to those reported by adults age 45 to 64 (CIHIb, 2011). They continue to perform activities of daily living, play an active role within the community, and maintain a relatively high functional capacity (WHO, 1999). Even when physical health issues are present, many older adults report feeling healthy and taking actions to improve their health (Public Health Agency of Canada, 2010). According to the *2009 Canadian Community Health Survey* (CCHS), 44% percent of older adults perceived their health to be excellent or very good, and 37% reported taking some action to improve their health, such as increasing their level of physical activity (71%), losing weight (21%) or changing their eating habits (13%) (Public Health Agency of Canada, 2010). In a 2010 survey, 41% of older Canadians reported very good or excellent health based on their perceptions of general and mental health, functional abilities, and independence in activities of daily living (CIHIb, 2011). Therefore, when addressing the needs and abilities of this independent and proactive group of older adults, policy makers should focus on technologies that support health promotion and preventative interventions with the intention of enabling these seniors to maintain their physical, mental, and social states.

Older Adults Coping with Chronic Diseases

The number of older adults coping with chronic conditions is increasing with 89% of older Canadians reporting at least one chronic condition as of 2009 (Public Health Agency of Canada, 2010). The most common chronic diseases include conditions such as arthritis, rheumatism, hypertension, strokes, cancers, cardiovascular disease, diabetes, osteoporosis, and Parkinson's disease. Many older adults experience multiple chronic conditions with 25% of Canadians aged 65 to 79 years and 37% of those aged 80 years and older reporting four or more chronic conditions in the 2009 CCHS survey (Public Health Agency of Canada, 2010). Research indicates that older adults with multiple chronic conditions, referred to as comorbidity, report poorer quality of life and an increased need of health care resources (Public Health Agency of Canada, 2010).

Technology has the potential to address specific health issues associated with specific chronic conditions as well as overarching needs such as, early and proactive interventions, home care, rehabilitation, disease management, and self-management. For example, older adults who live with one or more chronic conditions require multiple prescription medications. Older Canadians with three or more chronic conditions report routinely taking an average of six prescription medications, which is twice as many medications as those with only one chronic condition (Public Health Agency of Canada, 2010). Medication management is crucial to managing chronic conditions with non-adherence negatively affecting older adults' health and leading to increased hospitalization (Hayes, Larimer, Adami, & Kaye, 2009). Since medication management is an instrumental activity of daily living that enables independent living, ICTs enabling older adults to safely manage their prescription medication regime within the home environment is crucial to AIP (Hayes et al., 2009). Automatic medication dispenser technology automatically dispenses the prescribed quantity of tablets at certain time intervals (Center for Technology and Aging, 2009). Audio and visual reminders prompt older adults to take their medications. If the tablet is not removed, the device uses ICT to connect with central call centres and follows up with the individual or their caregiver if necessary (Center for Technology and Aging, 2009). By making ICT, such as the automatic medication dispenser, accessible to this group of older adults through policy, older adults will be better equipped to remain in the home for as long as possible.

Frail Older Adults

Frail older adults tend to be more susceptible to adverse health outcomes, such as disability, falls, dependency, long-term care, hospitalization, institutionalization, and mortality (Daniels et al., 2011; Piau, et al., 2014). Frailty refers to deficiencies in multiple physiologic systems that result in a decline in homeostatic reserve and resiliency (Daniels et al., 2011; Piau et al., 2011). Frail older adults often "require continuing support because of accumulated disabilities with increasing age, sometimes to a loss of disability, and sometimes to a loss of adaptability leading to age-related mortality and disability, and sometimes to concurrent impairments" (Chappell et al., 2008). Frailty causes disability, defined as "experiencing difficulty in performing activities in any domain of life" (Daniels et al, 2011, p.965). Frailty is reversible, and consequently responsive to technological interventions. As a result, ICTs applied within home and community care services can prevent adverse health outcomes by identifying early indicators of frailty (Piau et al., 2014). Unobtrusive sensors collect physiologic and behavioural data within the living environment, and ICTs transmit this data to medical professionals who evaluate the information in relation to early detection of frailty. ICTs may also be used to detect falls, gait abnormalities, and lack of movement (Piau et al., 2014).

While the majority of older adults are healthy and active, a significant number require some form of care due to the presence of one or more health issues. Separating these care-dependent seniors by their living arrangements creates two groups: seniors who live alone and those who live with family or friends. This distinction is relevant to technological interventions because each group experiences dependency differently.

Care Dependent and Isolated Older Adults

Due to decreasing fertility rates, more childless marriages, increasing divorce rates, declining remarriage rates, and more never married women, there are greater numbers of older persons living alone than in previous generations (McPherson & Wister, 2008; CIHIb, 2011). According to the 2006 Canadian Census, 93% of Canadian and 94% of older British Columbians live at home, and the proportion living alone within the household dwelling increases with age (CIHIb, 2011). Of Canadians 75 years and

older, 37% reported living alone; however, of those 85 years or older, this number rises to 49% (CIHIb, 2011). Women aged 85 years or older are twice as likely as their male counterparts to live alone due to higher rates of widowhood and longer life expectancy as well as an age differential at marriage (CIHIb, 2011). While living alone does not necessarily result in social isolation, it is a characteristic that may predispose older adults to become socially isolated and/or lonely, along with widowhood, low income, poor health, and caregiving (Newall and Menec, 2013; Cloutier-Fisher and Kobayashi, 2009). Social isolation refers to an objective self-perception of a lack or absence of meaningful social contact and the opportunities associated with these interactions (Chappell et al., 2008; WHO, 2002). According to a recent British Columbia study using a scale measuring relationships with relatives and friends, 17% of older adults are socially isolated (Kobayashi, Cloutier-Fisher, & Roth, 2009).

Care dependent older adults who are also isolated face complex needs. They may require assistance with various activities of daily living (ADL) and IADL (instrumental activities of daily living); however, they lack the presence of social networks and to assist them. Socially isolated older adults are at greater risk to be disconnected from informal and formal support as social and health resources (WHO, 2002). ADLs include personal hygiene, toileting, eating, and moving, while IADLs include meal preparation, housework, medication management, shopping, and transportation (CIHIb, 2011; Turcotte & Schellenberg, 2007). ADLs are considered vital to independent living and the ability to AIP (Institute for Perspective Technological Studies, 2006). Since informal caregivers tend to be spouses, daughters, and daughter-in-laws, socially isolated older adults who live alone lack traditional informal support resources (WHO, 2002). Inadequate social support relates to an increase in mortality, morbidity, and psychological distress (WHO, 2002). Therefore, advances in ICT that connect older adults with health care professionals through videoconferencing may compensate for the lack of social support in relation to health care needs. Policy supporting ICT interventions could potentially provide these older adults with more resources to AIP.

These older adults may also experience loneliness, which is ""a subjective feeling that the quantity/quality of one's social relationships is insufficient" (Newall & Menec, 2013, p.3); however, not all socially isolated people are lonely (Chappell et al., 2008).

14

Research indicates that social isolation and loneliness have detrimental affects on the health and well being of older adults (Newall & Menec, 2013). Approximately 20% to 40% of older adults report experiencing severe loneliness (Newall & Menec, 2013). ICT interventions that provide social connectedness and participation may also be of importance in providing social support resources for these older adults.

Care Dependent and Supported Older Adults

While the number of seniors living alone and isolated is on the rise, most seniors receive support and care from family members, friends, and neighbours (WHO, 2002). This informal support often outweighs the support they receive from the formal caretakers. Nearly 97% of home care recipients have an informal caregiver (CIHIb, 2011). They provide assistance with ADLs, such as personal hygiene, toileting, eating, and moving, as well as IADLs, such as meal preparation, housework, medication management, shopping, and transportation (CIHIb, 2011; Turcotte & Schellenberg, 2007). These responsibilities can be especially stressful for informal caregivers, especially because they occur around the clock (CIHIb, 2011).

Studies find that the rate of caregiver distress increases with the total hours of care provided (CIHIb, 2011). Negative consequences associated with caregiver burden include: worse personal health, injury, depression, fatigue, financial problems, and employment losses (Lilly, Robinson, Holtzman, & Bottorff, 2012). Those providing informal care to older adults with dementia are more vulnerable for social isolation and psychological distress (CIHIb, 2011; Lilly et al., 2012). This increases the risk for caregiver burnout, which refers to the point at which caregivers are no longer able to provide care due to physical, mental, and emotional depletion (Lilly et al., 2012). Caregiver burnout also increases the risk of institutionalization among the older adults under their care (Lilly et al., 2012). Since informal caregivers play a vital role in home care, policies should attempt to reduce burden and burnout by providing avenues of support themselves (WHO, 2002). Policy may aid the informal care process in terms of communication, scheduling, and monitoring, which may in turn reduce the physical and psychological burden of caregiving.

Older Adults with Cognitive Impairment

Another group of people with unique needs are those older adults with dementia or mild cognitive impairment. According to the Canadian Study of Health and Aging (CSHA, 8% of Canadian seniors have dementia, and this number rises to 35% for those over 85 years of age (Dubois & Hebert, 2006). These conditions can be extremely difficult for the older person as well as family members and caregivers; therefore, ICTs should focus on assisting both parties' needs. Specific needs include: help with memory, wandering, recognition, ideation, activity sequences, activities of daily living, and security issues. Technologies such as location tracking devices allow caretakers to keep track of older adults with dementia who are prone to wondering (Center for Technology and Aging, 2011). These devices use GPS, Wi-Fi Positioning Service WPS), cell towers and networks, Bluetooth, and radio frequency in order to track the wonderer (Center for Technology and Aging, 2011). These technologies may involve continuous tracking, require activation by a third party, or provide alerts to the caregiver when the older adult leaves certain areas (Center for Technology and Aging, 2011). Mild cognitive impairment presents an opportunity for ICT in terms of prevention, because this diagnosis does not necessarily lead to dementia (Sixsmith & Gutman, 2013). ICTs may help people maintain cognitive status through cognitive stimulation exercises, such as brain training and digital gaming (Sixsmith & Gutman, 2013).

Economically Marginalized Older Adults

Despite the image of the affluent "baby boomer", many older adults have limited incomes and education levels. Poverty among older adults is most common among those living alone, women over the age of 80, visible minorities, and immigrants (B.C. Ministry of Health 2005). According to the B.C. Ministry of Health (2005), the percentage of older adults living in poverty varies depending on the province, ranging from 2% in Saskatchewan to 10.3% in British Columbia.

As of 2003, 7% of older adults lived under the after tax low income cut off. Of these 258,000 older persons, 154,000 were women (B.C. Ministry of Health, 2005). Older women are at a higher risk of economic marginalization during old age, because they tend to have spent less time in the work force due to child rearing and/or home

making, which decreases the size of their pensions (Chappell, McDonald, & Stones, 2008; B.C. Ministry of Health, 2005). Additionally, older women are more likely to be widowed and to live alone due to their longer life expectancy. Older immigrants are also more likely to experience poverty due to a lack of private pension income, ineligibility for old age security, and Guaranteed Income Supplement (Turcotte & Schellenberg, 2007). When faced with such financial hardship, the aging process can be difficult to adapt to as health, social, and mental issues may be exacerbated. Since many older adults experience economic hardship, policies should strive to make ICT for AIP financially affordable as well as accessible.

Older adults and their caregivers are the end-users of ICTs for AIP; therefore, a comprehensive understanding of their diverse needs, abilities, and preferences is necessary to the success of ICTs' relevance to their everyday lives. Diversity in health status, care needs, and cognitive and functional abilities is a consequence of the interaction of multiple factors. Health inequalities are often attributed to disparities in access to health and social services; however, differences in education, income, stress and the ability to cope with stress, control or autonomy over one's life, environmental conditions in homes, workplaces and communities, and opportunities for social participation also create these inequalities (Wong, MacDonald, Valaitis, Maczorowski, Munroe, & Blatherwick, 2010). These factors contributing to health inequalities represent opportunities for technology to mediate their effects and thus improve the health of older adults as well as their ability to AIP.

What are Canadians' preferences for care arrangements in later life?

Aging in Place

AIP refers to "the ability to live in one's own home and community safely, independently and comfortably, regardless of age, income or ability level (Farber & Shinkle, 2011, p.1). In other words, older adults should not be forced to relocate from their current residences in order to ensure access to support services appropriate to evolving needs. A more comprehensive definition of AIP is "a diverse range of programs

and housing options needed to ensure older adults maintain personal dignity and functional independence in their homes, neighborhoods, or communities for as long as possible" (Strategy for Positive Aging in Nova Scotia, 2005, p. 17). In this context, the definition of home is not limited to the older adults' personal residence; it also includes the larger community. Wiles and collogues' (2011) qualitative study exploring the meaning of AIP for older adults residing in two New Zealand communities supports the idea that AIP is more than merely aging within the home residence. According to this study, AIP relates to an older adult's sense of community, familiarity, and choice concerning where to age.

The majority of older adults possess a strong desire to live in in their own homes and communities as they age (Sixsmith & Sixsmith, 2008; Farber & Shinkle, 2011). According to a 2008 study, 85% of Canadians over 55 express the preference to AIP and the majority of older Canadians do reside in private households (Canada Mortgage and Housing Corporation, 2008). As of 2011, 92% of older Canadians lived in private households and 8% lived in collective dwellings, such as chronic care and long-term care hospitals and nursing homes (CIHIb, 2011b). Based on these statistics, older adults are AIP; they are living out their lives in homes, neighborhoods, and communities. In spite of this fact, AIP continues to dominate academic literature, health care debates, and interpersonal conversations as something yet achieved. Since the majority of older adults are already AIP in the sense that they are not residing in institutionalized long term care facilities, the underlying principle is not to ensure that older adults remain in their own homes and communities, but to enable them to do so with support systems that will maximize their quality of life.

Home Adaptation and Universal Design

Traditionally, homes were not designed to meet changing needs over the life course; consequently, many older adults must modify their homes or use home adaptions in order to AIP. The CMHC's Home Adaptations for Seniors' Independence Program financially assists homeowners and landlords' home adaptations to enable low-income older adults to AIP (Public Health Agency of Canada, 2010). The Residential Rehabilitation Assistance Program for Persons with Disabilities also benefits older adults by offering financial assistance to homeowners and landlords for the modification of

homes for disabled low-income Canadians (Public Health Agency of Canada, 2010). While these programs are useful for retroactively addressing design issues related to AIP for low-income Canadians, they do not tackle address design issues for future generations of older adults.

In order to create housing that avoids the necessity of retrospectively modifying the home for age-related needs, policies should embrace universal design. Universal design refers to a lifespan design that creates housing suitable for those of all ages, abilities, and mobility levels, without adaptation or specialized design (Carr, Weir, Azar, & Azar, 2013). This design concept encourages access and inclusion within safe environments (Carr et al., 2013). In addition, universal design removes stigmatization by using seamless or invisible design features as opposed to hospital-like adaptations. Seven principles of universal design that create accessibility without stigmatization include: equitable use, flexibility of use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and appropriate size and space for use (Carr et al., 2013). This design approach aligns with the goals of AIP, because it creates supportive environments for older adults to continue to live independently and engage in society.

Overarching federal and provincial policies pertaining to disability also influence the implementation of universal design. For example, the Accessibility of Ontarians with Disabilities Act [1]requires full accessibility of public and private buildings by the year 2025 (Carr et al., 2013). However, universal design is not merely about accessibility; it is concerned with equality and inclusion aspects of design that accommodate people of all abilities and ages (Carr et al., 2013). Therefore, policies supporting universal design should involve financial incentives for builders and consumers as well as legislation regulating building codes and zoning for the implementation of its seven principles (Carr et al., 2013).

Age-friendly Communities

The application of universal design within the context of neighbourhoods and communal environments creates age-friendly communities that support AIP. The World Health Organization (WHO) defines age-friendly communities as those in which

"policies, services, settings and structures support and enable people to age actively" (WHO, 2007, p. 5). WHO (2007) outlines eight areas of significance, including: outdoor spaces and buildings; transportation; housing, social participation; respect and social inclusion; civic participation and employment; communication and information; community support; and health services. Urban planning for age-friendly communities encourages AIP by optimizing "opportunities for health, participation, and security in order to enhance quality of life as people age" (Buffel, Phillipson, & Scharf, 2012, p.598). Underlying the notion of age-friendly communities is the linkage of various urban systems, including housing, street design, transportation, and accessibility to services (Buffel et al., 2012). Studies concerning neighborhood environments have found that pedestrian-oriented designs, such as continuous, barrier-free sidewalks, four-way stop signals, and pedestrian amenities, increase accessibility to recreational facilities and is positively associated with mobility in seniors (Clarke & Gallagher, 2013). Outdoor mobility enables older adults to participate in the community and maintain social networks important to health

The Public Health Agency of Canada demonstrated support for the WHO's c age-friendly community model with the endorsements of the *Age-friendly Community Initiative* and the *Age-Friendly Rural/Remote Community Initiative* sponsored by the Federal/Provincial/Territorial Ministers Responsible for Seniors. As of 2011, over 560 Canadian communities have committed to becoming age-friendly. Eight provinces (British Columbia, Alberta, Manitoba, Ontario, Quebec, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island) are actively promoting age-friendly initiatives that support older adults ability to live active, socially engaged, and independent lives.

Innovative Housing Options

Affordable, accessible and suitable housing options, especially those in close proximity to community resources, can enable older adults to live independently well into advanced old age (Singelenberg, Stolarz, & McCall, 2014). Innovative housing models have emerged from the desire to meet older adults' preference to AIP, including: cohousing, naturally occurring retirement communities, villages, and retirement-villages. These housing options are alternative avenues to AIP for policy makers to consider when examining how ICTs can promote AIP.

Cohousing is a "form of autonomous and designed neighbourhoods - carefully and deliberately designed spaces in which better relationships with neighbours are facilitated through participatory process, nonhierarchical structures, and a mixture of private home and shared facilities." (Sargisson, 2012, p. 35). Nationally occurring retirement communities, originally recognized as unintentional communities for older adults, have evolved into intentional communities for older adults that provide a full range of support services for older adults within the communities where they live (Guo & Castillo, 2011). This model involves "grassroots organizations that provide community-dwelling older adults with a combination of nonprofessional services, such as transportation, housekeeping, and companionship, as well as referrals to existing community services, sometimes at a reduced rate" (Scharlach, Graham, and Lehning, 2012, p.419). Consumers initiate and govern villages, while annual membership dues fund them (Scharlach et al., 2012). These housing models align with the principles of AIP and age-friendly communities in relation to social and civic participation, social inclusion, and community support and health services, all of which are opportunities for ICTs.

While most Canadians prefer to age in their own homes and communities, they may be forced or encouraged to relocate due to changing circumstances, such as the death of a spouse, declining health, inaccessible services, and the loss of income (CHBA, 2011). The emergence of a continuum of care within one retirement-village provides an innovative option for older adults. This model is transforming the concept of AIP. Older adults within these communities have the ability to transition in place. As the degree of care required increases older adults transition to corresponding levels of support within the retirement-village. They transition from independent living facilities to assisted living facilities to long-term care facilities within the same setting. Since moving between facilities is often disorienting, disturbing, and undesirable, the option to minimize movement to the village is appealing to older adults. At the independent living level, the older adult is functionally independent (Retirement Concepts, 2014). The choice to relocate may be for the convenience of hospitality or IADL services, freedom from home management, access to a social environment, or the promised security associated with these facilities (Retirement Concepts, 2014). When the required level of care increases, the older adult moves within the community to the assisted living level

for supportive, semi-independent living. At this level, they receive hospitality services as well as some combination of personal assistance with ADLs (Retirement Concepts, 2014). The next level includes extended care for the aging individual by a nursing staff (Retirement Concepts, 2014). This continuum of care creates a sense of familiarity with the physical and social environment that remains consistent with each transition within the community. This new concept of retirement-villages may prove to be especially relevant to future generations of the oldest-old, or those aged 85 years and older. The literature implies that the oldest-old are at greater risk of living in long term care facilities due to decreasing functional status and increasing need for assistance with ADLs (Richards & Rankaduwa, 2008). This model offers the choice of moving out of the home at an earlier age, before relocation is a necessity, to communities that accommodate possible future changes in care needs. Therefore, they may provide older adults with a sense of autonomy over the continuum of care.

Theoretical Background: the Relationship between Health and Aging in Place

Since older adults spend a significant amount of time at home, thisenvironment emerges as potentially influencing the health and well-being of these individuals (Sixsmith & Sixsmith, 2008). The World Health Organization's (1999) holistic definition of health provides a comprehensive basis for understanding the relationship between health and AIP. The WHO (1999) defines health as a state of complete physical, mental, and social wellbeing and not merely the absence of disease and infirmity. This definition's emphasis on not only physical health, but also personal identity, social participation, autonomy, and general well-being is of great significance to AIP, because the benefits associated with this preference are not limited to physical health (Sixsmith & Sixsmith, 2008; Peace, Holland, & Kellaher, 2011).

The physical environment may be either supportive or restrictive to older adults. Hazardous conditions can impede a person's ability to maintain a healthy and active lifestyle in old age. For example, if the home lacks handrails or has uneven floors, the possibility of an older adult falling and suffering from a fall related injury is greater. While the physical environment's potential to impose constraints in later life is well documented, it may also enhance opportunities for older adults by supporting their ability

to maintain physical, mental, and social health (Black, 2011: Sixsmith & Sixsmith, 2008; Peace et al., 2011; Wahl, Iwarsson, & Oswald, 2012). Environmental gerontology acknowledges the interactive relationship between the older adult and the environment.

Over the past 50 years, environmental gerontology has shaped the environmental context of aging through theory, research, and practice with Lawton and Nahemow's (1973) ecological person-environment fit/ competence-press model leading the development of this theoretical perspective. According to this perspective, the ability to AIP is dependent on the existence of an appropriate match or balance between a person and the environment (Wahl, et al., 2012).

Lawton and Nahemow's (1973) model originates from Lawton and Simon's (1968) docility hypothesis, which argues that the individual achieves a balance between the individual's competence and environmental press by changing one's competence, the environment, or both. Even if the individual's functional competence deteriorates, lowering the demands, or press, created by the environment will improve the capacity for activity (Wahl, et al. 2012 p.64). This model addresses the environmental stimuli or press (neutral forces interacting with the individual) that an individual experiences within the home environment. It also incorporates the individual's capacity (degree of cognitive ability, physiological adjustment, and physical health) to respond to this press through the processes of adaptive behavior (behavioural response resulting from interaction), affective response (emotional response to environment), and adaptation level (individual's affective, cognitive, and perceptual experience of the environment) (Wahl, et. al, 2012).

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Opportunities for AIP arise when the individual experiences an optimal level of functioning, which is the result of the interaction of biological, social, and psychological resources and the environment. In addition, the environment may provide an optimal level of stimulation that can help the older adult stay mentally agile while also reducing the risk of boredom in old age. In later years, Lawton broadened the concept of environment to include interactions with technology. ICT may be used to increase the efficiency of individual resources when faced with increasing environmental press. Consequently, the older adult is better able to safely navigate the home environment and thus better equipped to AIP (Wahl et al., 2012).

The cognitive-affective dimension of the physical environment, or place attachment, is another aspect of environmental gerontology significant to AIP. According to Rubinstein and Parmelee (1992), place attachment is a meaning-oriented approach that is concerned with "the phenomenology of person's experiences of physical space as a real and personally meaningful place" (p.140). They envision place attachment as "a life course phenomenon that involves place as lived and in memory" (Walker & Hennessy, 2004). Therefore, place attachment in later life is dependent on time and space. There are three main concepts: geographic behaviour, identity, and interdependence. These concepts interact on a collective level (the meanings shared by the members of an established culture) and the individual level (the meanings inspired from personal experiences, beliefs, and attitudes) (Rubinstein & Parmelee, 1992).

The geographic behaviour represents the geographic life world of the person. Space is an undifferentiated territory in the realm of the collective, and place is a space to which a person has assigned meaning in the individual realm (Rubinstein & Parmelee, 1992). Identity arises from a lifetime of experiences in the collective realm (cultural and socially normative life course status and transitions) and individual realm (personalized version of the life course based on specific life experiences) (Rubinstein & Parmelee, 1992). Inter-dependence refers to the avenues in which the individual interacts within the social life space through the collective roles and individual relationships. Place attachment is strong or weak, positive or negative, depending upon the relationships between these dimensions. Place attachment is especially significant to older adults because it enables a person to maintain a sense of continuity and identity; it strengthens sense of self in that it can help the person retain a positive self-image in spite of negative social evaluation of the aging process; and it represents independence and continued competence (Rubinstein & Parmelee, 1992). These aspects of place attachment influence an older adult's preference to AIP.

Advantages of Aging in Place

Research indicates that enabling older adults to AIP is beneficial on both a micro level for the aging individual and on a macro level for the aging society (Hwang, 2008; Sixsmith & Sixsmith, 2008; Wiles, Leibing, Guberman, Reeve, & Allen, 2011).

Benefits to an Aging Individual

When the preference to AIP is met, older adults are more like to express a sense of well-being (Wahl et. al, 2012). The ability to live safely in their own homes as opposed to institutional settings is associated with "improved quality of life, social connectedness to friends and family, and fewer health care complaints" (Mahmood, Yamamoto, Lee, & Steggell, 2008). Quality of life is more than general well-being, it involves specific domains including emotional well-being, interpersonal relationships, material well-being, personal development, physical well-being, self-determination, social inclusion, and rights (Lancioni & Siggh, 2014; Schalock et al,2002; Wang et al., 2010). In addition, AIP is associated with increased social capital, the maintenance of social networks, and increased quality of life. In terms of social health, AIP provides older adults with the

ability to maintain personal connections with friends and family and the social interactions that accompany these relationships.

Research indicates that social inclusion is an important factor in promoting health and well-being for older adults, partially because by being socially included they come in contact with a greater range of social support resources to assist them with issues associated with aging (Moody and Phinney, 2012). Social inclusion refers to equal opportunity for full participation in society; it centers on notions of belonging, acceptance, and recognition (Moody and Phinney, 2012). While the home encompasses a physical environment, it "operates on social and symbolic levels in interconnected ways" (Wiles et al, 2011, p.2). It is within this realm that AIP has potential positive implications on older adults' mental, emotional, and social health.

Over time, people become attached to the home and assign meanings to the space (Rubinstein & Parmelee, 1992; Sixsmith & Sixsmith, 2008). Being able to remain in one's own home can provide the conditions necessary to retain a sense of belonging and security in later life (Hammarstrom and Torres, 2012). Additionally, the older adult may experience a sense of continuity in terms of self-identity, because the home is a place of self-expression, individuality, and autonomy over one's life (Hammarstrom and Torres, 2012; Sixsmith and Sixsmith, 2008; Wiles et al, 2011). Canadians highly value autonomy and independence in old age, as it represents the ability to age with dignity. The term autonomy refers to "the perceived ability to control, cope with and make personal decisions about how one lives on a day-to-day basis, according to one's own rules and preferences" (WHO, 2002, p.13). Independence, on the other hand, refers to the ability to perform ADLs (WHO, 2002).

To summarize, AIP is beneficial to the individual in numerous ways. These benefits include: meeting the preference to remain at home; improving quality of life and well-being in relation to physical, mental, and social health; maintaining a sense of autonomy; and allowing a continuum of connection with one's self and the community (Ballard, et. al, 2011; Hwang, 2008; Sixsmith and Sixsmith, 2008). However, there is no guarantee that older adults will experience the benefits associated with AIP. Many factors influence whether or not AIP has a positive impact on aging adults.

Benefits to an Aging Society: Aging in a Community

AIP is also beneficial to an aging society in relation to health care costs and social capital. Studies indicate that AIP, along with necessary home and community care services, reduces health care costs when compared to institutional care (Chappell, Havens, Hollander, Miller, and McWilliam, 2004; Cheek, Nikpour, & Nowlin, 2005; Wiles et al, 2011). However, most research does not directly address the cost-effectiveness of AIP. Instead, these studies focus on the cost-effectiveness of home and community care services as a means of delaying institutionalization, which indirectly supports aging in place (Chappell & Hollander, 2013). Chappell and colleagues (2004) examined the cost-effectiveness of home care for seniors as opposed to long-term institutional care between two Canadian cities: Victoria British Columbia, and Winnipeg, Manitoba. This study found that when informal caregiver time is valued at replacement wage, home care is notably less costly than institutional care (Chappell et al, 2004).

AIP increases and/or maintains social capital. Since many older adults are active members of society, AIP enhances community well-being by delaying or preventing institutionalization. According to Alley and colleagues (2007), "If communities support AIP through appropriate infrastructure, older adults can be empowered to continue as active citizens and volunteers for many years, enriching communities through their time and experience" (p.2). For example, healthy older adults often help care for their grandchildren or other children within the community (Alley, Liebig, Pynoos, Banerjee, & Choi, 2007; Cloutier-Fisher et al., 2009). Not only does this assist working parents, but it also creates opportunities for intergenerational relationships that may break down stereotypes and create more positive views of aging (Cloutier-Fisher et al., 2009).

Disadvantages of Aging in Place

While the literature has established the benefits associated with AIP, the concept of AIP operates as a complex process that some older adults may not experience as beneficial or advantageous (Wiles et al., 2011). The older adult may have undesirable memories associated with the home; therefore, AIP not be appealing. Wiles and colleagues (2011) draw on place attachment theories stating, "Long-term emotional attachments to environmental surroundings have also been shown to contribute to well-being in old age although residential stability may not always be emotionally beneficial,

such as when older people are unable to move away" (p.2). For example, an older woman whose husband was abusive may wish to leave the family home after his death in order to escape the reminders of abuse).

Another disadvantage relates to the house itself. Frolik (2006) states, "many older adults are over-housed" (p.44). This refers to the fact that the house, originally purchased for purposes that are no longer relevant, may become overwhelming in old age. For example, its initial appeal of being near a respected school is no longer of value since the children have grown and moved away. This location may be isolated from necessary services for the older adult. The house may also become lonely or depressing if one loses his/her spouse after investing in AIP (Frolik, 2006). Older adults may also experience "over-housing" due to the increasing costs of maintaining a house. If the older adult has resided in the same home for a substantial amount of time, the house has been aging along with owner (Frolik, 2006). Upkeep of the home may create physical and financial hardships in later life. In addition, the initial cost of modifying the home in order to enable successful AIP may be high if the person-environment fit is unsatisfactory, calling for complex modifications. The reality of home maintenance and/or the association of home with negative memories may discourage some older adults from choosing to AIP.

Barriers to AIP

Policies should [2]decrease the impact of geographic and financial barriers to AIP. Geography creates numerous challenges to AIP, especially for older adults residing in rural and remote communities. Older adults residing in underserved areas may not have access to necessary health and social resources to meet their nee[3]ds (Clark & Leipert, 2007). In addition, geographic location influences the availability and accessibility of appropriate community support and transportation services that enable older adults to AIP.

Financial barriers to AIP include cost of implementing home modifications. Those with low incomes, such as older women and immigrants, may be at greater risk of experiencing financial hardships due to a history of lower wages, part-time employment, and inadequate pensions. In addition, the cost of routine maintenance may become too

burdensome for those in aging homes (Frolik, 2006). Failing health and functional limitations may inhibit seniors to preform the work themselves, thus requiring the employment of builders and maintenance workers.

The Relocation of Care from the Hospital to the Home

AIP requires a shift in location of care from institutional facilities to the home and community. Over the past two decades, home care has demonstrated significant growth due to an aging population, an increasing demand for cost effective alternatives to institutional care, and substantial technological and medical advancements (CHCA, 2007). According to the Canadian Institute for Health Information (2011), almost 1 million Canadians are receiving home care at any given time, and the majority of these recipients (82%) are older adults (2011). Consequently, the home is becoming more dominant in terms of location of care within Canada.

Despite this growth, home care remains under resourced within the Canadian health care system (CHCA, 2007). This is at least partially due to the fact that home care is considered an extended health care service under the Canada Health Act, meaning that the services are neither insured nor subject to restrictions on user fees or extra-billing (Clark, 2007). Each province and territory has developed its own model of home care service delivery, which has created provincial inconsistencies in relation to not only the standards and scope of services offered but also eligibility and residency requirements; public coverage, and access to services (CHA, 2009). Consequential service inequalities based on geographic location and user charges run counter to the principles of universality, accessibility, comprehensiveness, portability, and public administration (Clark, 2007). In order to understand the current landscape, the subsequent sections will discuss the evolution of Canada's public health care system.

The Evolution of Canada's Health Care System

Canada's health care system represents "an interlocking set of ten provincial and three territorial health insurance schemes" (Stephenson & Sawyer, 2002, p.163). The system reflects the decentralized nature of Canada's government (Boyd, 1995; WHO, 1996). The Constitution Act of 1867, originally the British North American Act, outlines

the distribution of powers between the federal and provincial legislatures, assigning the majority of power over health care to the provinces (Boyd, 1995). Until the 1940s, health care delivery and financing was predominately private (Boyd, 1995). Canada's present national health insurance program, often referred to as 'Medicare', has evolved over the past 50 years from hospital to medical care insurance.

Canada Health Act

In April of 1984, the Canada Health Act received Royal Assent as Canada's federal legislation for publically funded health care insurance (Madore, 2005). The Act outlines the primary object of Canadian health care policy, which is "to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers". The Act defines federal and provincial health care responsibilities, establishes criteria for insured health services, and outlines the national standards that provinces and territories must maintain in order to receive federal funding under from the Canada Health and Social Transfer (CHST). The CHST terminated the targeted funding programs of EPF and EHCS by combining funding for health welfare and postsecondary education into one block-funding program with no stipulation of how the funds were to be used (Stephenson & Sawyer, 2002). Under this act, the federal government's responsibility is restricted to: establishing and administrating national principles; financially assisting provincial health care services, and providing direct healthcare service delivery to specific groups, including veterans, native Canadians residing on reserves, military personnel, inmates, and the Royal Canadian Mounted Police (Madore, 2005).

While the Act provides a broad legislative framework at a national level, specific legislative mandates for the delivery of services takes place at the provincial level (Duncan & Reutter, 2006). Provincial governments decide the location of hospitals, the number of physicians needed, and how much money to spend on healthcare services (Canadian Healthcare Association (CHA), 2009). This enables provincial governments to address needs and conditions specific to their jurisdictions. It has also resulted in differences "in access to and provision of healthcare services not only among provinces but also within them" (CHA, 2009, p.10). Despite this variation, each province must still

meet certain funding and health service requirements established by the Canada Health Act (Madore, 2005). The five national principles include:

- Accessibility: reasonable access by insured persons to medically necessary hospital and physician services must not be impeded by financial or other barriers

- Universality: all eligible residents are entitled to public health insurance coverage on uniform terms and conditions

- Comprehensiveness: all medically necessary services provided by hospitals and doctors must be insured

- Portability: coverage for insured services must be maintained when an insured person moves or travels within Canada or travels outside the country

- Public Administration: the health insurance plan of a province or territory must be administered on a non-profit basis by a public authority (Madore, 2005).

These requirements, or "national principles", form the cornerstone of the health care system. They reflect two overarching objectives for federal health care policy: to ensure that every Canadian has timely access to all medically necessary health services regardless of his or her ability to pay for those services; and to ensure that no Canadian suffers undue financial hardship as a result of having to pay health care bills (Madore, 2005).

The Romanow Commission and the 2004 Health Accord: Home Care Moves from the Margins to the Mainstream of Canada's Health Care System

By the late 1980s and early 1990s, Canada's health care system had matured to include universal medicare for physician and hospital services (Chappell et al., 2008; Romanow, 2002). Despite this progression, public dissatisfaction with medicare was becoming more vocal (Chappell et al., 2008: Romanow, 2002). Reductions in federal funding and increases in regionalization characterized Canada's health care system (Chappell & Hollander, 2013). Fiscal challenges and regionalization resulted in hospital downsizing by way of bed closures, shortened stays, and more day surgeries (Romanow, 2002). Reliance on home and community care services increased in order to

offset insufficient hospital care (Romanow, 2002). Consequently, more and more Canadians were directly experiencing the financial effects of excluding home and community care from the Canada Health Act as medically necessary services.

In response to the public's waning confidence, numerous commissions and inquiries were established to evaluate the health care system (Chappell & Hollander, 2013). Among these, the Romanow Commission on health care and the federal-provincial Health Accords emerged as major initiatives (Chappell & Hollander, 2013). In 2001, the federal government established the Commission on the Future of Health Care in Canada (Romanow, 2002). Headed by Commissioner Romanow, its mandate was "to review medicare, engage Canadians in a national dialogue on its future, and make recommendations to enhance the system's quality and sustainability" (Romanow, 2002, p. xv). The final report called for "increased federal funding, greater accountability by all governments, and strategic reforms to health services that would improve access to and quality of care and restore public confidence in the system" (Health Council of Canada, 2008, p.9).

In regards to home care, the Romanow Commission suggested that it should be recognized and developed as an essential service for the future of Canada's health care system (Shapiro, 2003). It dedicated an entire chapter, appropriately titled, "Home Care: The Next Essential Service", to the significance of home care (Shapiro, 2003). The report included "Directions for Change" as recommendations in regards to home care (Shapiro, 2003). Specific recommendations include: building the foundation for a national home care strategy that ensures access to common home care services; revising the Canada Health Act to include certain areas of home care as necessary medical services; and providing benefits to informal caregivers (CHA, 2009).

The Romanow Commission's recommendations started a dialogue about health care reform that resulted in the 2004 First Ministers' Accord on Health Care Renewal (Chappell & Hollander, 2013). This 10-year plan to strengthen health care included an agreement between federal, provincial, and territorial governments to focus on relevant issues emerging within health care. These included: wait times and access; strategic health human resources action plans; home care; primary care reform; access to care in

32

the north; a national pharmaceutical strategy; prevention, promotion, and public health; health innovation; accountability and reporting to citizens; and dispute avoidance and resolution (Chappell & Hollander, 2013, p.81-82).

One of the most significant contributions of the 2004 10-year plan is its formal recognition of home care as a vital aspect of health care. It states, "All governments have recognized the value of home care as a cost-effective means of delivering services and are developing home care services to prevent or follow hospitalization" (Health Council of Canada, 2005, p.14). Under the 2004 Health Accord, First Ministers agreed to establish first-dollar coverage for specific home care services based on assessed need (CHA, 2009: Health Council of Canada, 2005). Firstly, they agreed to publically fund short-term acute home care for case management, intravenous medications, nursing, and personal care for two weeks after being discharged from the hospital (CHA, 2009; Health Council of Canada, 2005). Secondly, two weeks of short-term community mental health home care for the provision of case management and crisis response services were to be included in public funding (CHA, 2009; Health Council of Canada, 2005). Thirdly, this accord includes end-of-life care for case management, nursing, palliative-specific pharmaceuticals and personal care at the end of life (CHA, 2009; Health Council of Canada, 2005). The 2004 Health Accord not only acknowledged but also responded to the shift in location of care from the hospital to the home. Consequently, this accord is often recognized as a significant step towards moving home care from the margins to the mainstream of Canada's health care system (CHA, 2009). However, it should be noted that the 2004 Health Accord only includes short-term, post-acute home care with no mention of long-term home care (Cloutier-Fisher et al., 2009).

Home Care

Home care's definition continues to evolve in order to accommodate changing and individualized needs (CIHI, 2011). Health Canada (2005) defines home care as "an array of services which enables clients, incapacitated in whole or in part, to live at home, often with the effect of preventing, delaying, or [in] substitution for long term care or acute care alternatives" (p.4). This definition reflects three functions of home care that have dominated home care research. They include: (1) substitution for more costly acute care services, (2) substitution for long-term care in institutional settings, and (3)

supporting Canadians with health and functional deficits in maintaining their independence and preventing functional decline for as long as possible (CHA, 2009; Chappell & Hollander, 2013; Clark, 2007). The emphasis on home care as a substitution service diminishes the fact that home care is also valuable in its own right, and that this value increases with the inclusion of community-based services (Chappell & Hollander, 2013).

In 2004, the Canadian Home Care Association (CHCA) developed a more inclusive definition of home care that has recently gained acceptance across Canada. The CHCA defines home care as "an array of services, provided in the home and community setting, that encompass health promotion and teaching, curative intervention, end-of-life care, rehabilitation, support and maintenance, social adaptation and integration, and support for the informal (family) caregiver" (CHA, 2009, p. 22). Home care is increasingly being replaced with "home and community care" because it has evolved to include services offered at home and in the community that support not only those who need assistance to remain in the home, but also those who care for them (CHA, 2009).

Home and Community Care

Home and community care includes home health care services, home support services, and community-based services (CIHI, 2011). It encompasses health care, community, and social support programs that enable individuals to receive care at home and to live as independently as possible in the community. Licensed health personnel, such as nurses, physiotherapists, occupational therapists, case managers, and nutritionists, provide home health care services (CIHI, 2011). Home health care services cover pain management, wound care, palliative care, mobility, endurance and strength training, and assessment for home support (Stephenson & Sawyer, 2002. Home support services consist of a range of non-professional services designed to meet the assessed needs of older adults for personal care, housekeeping, and meal preparation (Keefe et al., 2011; Stephenson & Sawyer, 2002). Personal care includes: grooming and hygiene, bath assistance, assistance with mobility lifts and transfers, and medication assistance, to name a few (Stephenson & Sawyer, 2002). These are supplemented by community-based services, such as adult day programs, meal services, home maintenance and

repair, transportation, and respite services (CIHI, 2011). CIHI's Home Care Reporting System found that of assessed home care clients, 68% received home health care services while 38 % received home support services (CIHI, 2011).

Home and Community Care and Aging in Place

The expansion of home care to include supportive community-based services recognizes the holistic conceptualization of health put forward by the World Health Organization WHO). The WHO (2002) describes health as a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity. While home health care services address physical and mental health issues, home support and community services address the social aspects of health. According to Health Canada (2011), home and community care seeks to: help people maintain or improve their health status and quality of life; assist people in remaining as independent as possible; support informal caregivers; and enable people to stay at or return to the home through prevention, rehabilitation, and/or palliative care. These aspirations align with the goals of AIP; therefore, appropriate and effective home and community care services should enable present and future generations of older adults to AIP (Stephenson & Sawyer, 2002).

Home and Community Care Delivery and Service Providers

Provincial and territorial governments are not obligated to provide home and community care services beyond the 2004 Health Accord's specifications; however, each province has attempted to move care options away from institutional services and towards home and community care services (CIHI, 2011; Williams et al., 2000). Through the Canada Health and Social Transfer (CHST), provinces are able to independently determine the amount of funding offered to home care programs (Stephenson & Sawyer, 2002). As a result, the availability of home and community care services varies across the nation.

Four categories of home and community care providers include: traditional formal caregivers, independent formal caregivers and personal assistants, volunteer caregivers, and informal caregivers (Stephenson & Sawyer, 2002). Traditional formal caregivers include service delivery personnel usually employed by government-funded, for profit or

not-for-profit agencies. Independent formal caregivers and personal assistants include service delivery personal. Volunteer caregivers provide unwaged services independently or through a non-profit agency. Informal caregivers include family and friends of the recipient of care (Stephenson & Sawyer, 2002).

Home and Community Care Recipients

A better understanding of home care recipients provides insight as to which areas of home and community care may benefit from technological innovations. The Health Council of Canada (2012) used the Resident Assessment Instrument-Home Care (RAI-HCI) analysis of older adults receiving at least 60 days of publically funded home care in British Columbia, Manitoba, Ontario, Nova Scotia, and the Yukon. RAI-HC is employed by home care professionals to evaluate home care clients' strengths, preferences, and needs for the purposes of developing care plans and allocating services (Health Council of Canada, 2012). This analysis found that most home care recipients were women, over the age of 75, and married (Health Council of Canada, 2012). Half of the men were married compared to less than one-quarter of the women (Health Council of Canada, 2012).

The majority received home care in addition to receiving support from an informal family caregiver and many had one or more chronic conditions, including diabetes, Alzheimer's or other dementia, stroke, heart failure, emphysema or chronic obstructive pulmonary disease (COPD), cancer, or a psychiatric condition (Health Council of Canada, 2012). Nearly one-third possessed high care needs due to complex health problems, such as cognitive impairment in addition to having challenging behavior and/or physical disability (Health Council of Canada, 2012). In addition, 95-98% reported some level of difficulty with IADLs, such as cleaning, grocery shopping, home maintenance; 23-41% required assistance with ADLs, such as bathing, eating, and toileting; and pain, depression, and falls were the most common problems reported (Health Council of Canada, 2012). These findings suggest areas within home and community care that may benefit from ICT, including chronic disease maintenance, assistance with ADLs and IADLs, fall prevention, and caregiver support.

Cost-Effectiveness of Home and Community Care Services and Aging Society

Due to increased concern about the sustainability of Canada's health care system, there is a growing body of literature examining home and community services from an economic analysis approach. Economic analysis compares alternative courses of action in relation to both their costs and consequences (Chappell & Hollander, 2013). Cost-effectiveness analysis "measures the costs and consequences of programs in comparable units"; however, this analysis "does not place a monetary value on the quality of outcomes" (Chappell & Hollander, 2013, p.96). It compares different interventions for different groups of people in order to determine which has the greatest impact (Chappell & Hollander, 2013).

The majority of studies evaluating home and community care services tend to focus on its cost-effectiveness in relation to its function as a substitute for acute-care services or residential care (Chappell & Hollander, 2013). Early discharge from acute-care and the use of home care services have been found to reduce cost in relation to various health issues often associated with aging, such as hip fractures and strokes (Chappell & Hollander, 2013). Studies evaluating the cost-effectiveness of home care as a substitute for residential care have found that home care recipients usually cost less than residential care recipients. Hollander and Chappell (2002) compared the costs for home care and nursing homes for the same level of care, from 1987 to 1997. They concluded that home care costs were 40% to 75% of the costs for facility care (Chappell, 2011; Cloutier-Fisher et al., 2009). In fact, the only time the costs of home care exceeded that of nursing care was when individuals passed away while receiving home care (Chappell, 2011; Cloutier-Fisher et al., 2009). Chappell (2011) points out that the higher costs were actually a result of hospitalization at the end of life. These findings support the OECD study, which found that proximity to death, not aging, is correlated with increased health expenditure (Palangkaraya & Yong, 2009).

Only recently have inquiries evaluating home and community care's cost-effectiveness in terms of its maintenance and prevention function gained prominence within the literature. Hollander (2006) conducted a study that compared four health regions within British Columbia. Two regions implemented provincial directed cuts to home-making only services and the other two did not (Cloutier-Fisher et al., 2009). The

people cut from care demonstrated the lowest level of care need and only received housekeeping home support services (Cloutier-Fisher et. al, 2009: Hollander, 2006). Hollander examined the overall costs to the health care system of those cut from the service to those who continued to receive the service in the two regions that did not implement these cuts (Cloutier-Fisher et al., 2009;). On average, people cut from the home support service cost $3,500 more than those who remained in the program (Cloutier-Fisher et al., 2009). Those cut were more expensive after 3 years because they demonstrated greater use of hospital beds, increased use of home care services, and increased admission to nursing homes (Cloutier-Fisher et al., 2009). Thus, those who were cut utilized acute care and long term residential care more than those who were not cut from the program.

Chapter 4.   Emerging Challenges in Home and Community Care

This literature review on home and community care emphasizes the significance of these services for AIP; however, three issues challenge the future of these services. These emerging issues include: the medicalization of home and community care, the availability of human resources, and the provision of care for rural and remote older adults.

Medicalization of Home and Community Care

Home and community care has recently gained momentum as a cost-effective alternative or substitution to acute hospital services and residential care. This emphasis on the substitution model of home care overshadows the significance of its preventative-maintenance function within policy, academic, and public discourse (Stephenson & Sawyer, 2002).

The Health Council of Canada (2005) explains that while the 2004 Health Accord brought attention to the importance of home care, it also motivated its medicalization due to "the separation of acute from chronic home care, the emphasis on hospital diversion, and the marginalization of its prevention and maintenance functions of home care" (p.47-48). Medicalization refers to the process by which various life course situations and events, formally nonmedical, become medical in one of three ways: conceptually, institutionally, and/or through doctor-patient interaction (Benny, Estes, & Ingman, 1990). This is reflected in CIHI's (2007) examination of public-sector home care expenditure, which determined that provinces are spending more of their reallocated budget on acute care substitution costs and removing preventative-maintenance services such as home support from subsidized programs.

Penning and colleagues (2001) suggest that long-term home care and home support services, which were slowly growing during the 1970s and 1980s, are gradually being dismantled. This is partially because post-acute care is more expensive than long-term home care, and therefore consumes a large portion of provincial home care budgets (Cloutier-Fisher et al., 2009). Consequently, home care is becoming more of a medical support system than one that is providing social care (Cloutier-Fisher et al., 2009). While reducing or eliminating home care and home support services that sustain prevention and maintenance may reduce costs in the short term, this will most likely result in increased utilization of more expensive health services in the long term.

Availability of Human Resources

Greater demand for and complexity of home and community care services has led to increased pressure on human resources within this segment of the health care system (Health Canada, 2005). The providers of home and community care services include paid formal caregivers and unpaid informal caregivers. Stephenson and Sawyer (2002) argue that the supply of informal caregivers will decline in the future due to changing family structures, such as lower marriage rates, higher divorce rates, lower birth rates, and increased mobility of the population (Keefe, Knight, Martin-Mathews, Legare, 2011). Since informal caregivers provide the majority of support to community-dwelling older adults, this decline could potentially create significant gaps in the care of older adults. Numerous studies have assessed the economic value of informal caregiver contributions as minimum wage or at replacement value (Chappell, 2011; Chappell et al., 2004). One American study estimated that informal caregivers provided $350 billion worth of services in 2006 (Gibson, 2007). Chappell and colleagues (2004) examined the costs of Canadian informal home care and formal residential care, concluding that there was a sharp increase in average annual costs when informal caregiver time was valued at minimum or replacement wage. Another Canadian study estimated that informal caregivers provide $25 billion of care annually to older adults (Hollander et. al, 2009).

The availability of paid formal providers of home and community services is also emerging as a future concern. Five factors contributing to the increased demand of home and community care workers are: the aging of the baby boom generation; a home

care policy that emphasizes AIP; increased pressure to contain health costs; difficulty recruiting and retaining trained workers; and the high percentage of current formal caregivers nearing retirement (Keefe et al., 2011). The Canadian Home Care Human Resources Study (2003) was the first pan-Canadian study to analyze short and long-term human resource challenges in the home care sector. This study found that home care has more difficulty attracting and retaining workers compared to the institutional sector, partially due to a lack of public and government recognition of the importance of these workers, which has consequently decreased the attractiveness of the work. In addition, funding of home care has not kept up with the demand, which affects the stability of employment. This has also resulted in lower wages and fewer benefits than the acute care sectors. The supply will continue to decline without proper training opportunities and educational programs (Keefe et al., 2011). In addition, a shortage of professional providers within institutional sectors has further reduced the supply of home care workers, because of increased use of home support workers within these institutional settings (Health Canada, 2005). Growing provincial support of home health care services over home support services will potentially increase the complexity of the work, which will require more specific training (Health Canada, 2005).

Provision of Care for Rural and Remote Seniors

While many provinces face recruitment and retention challenges in terms of home care workers, this issue is compounded in rural and remote areas (Keefe et al, 2011). Disincentives to attracting workers to these regions include: limited amenities, social isolation, and long distances between clients (Keefe et al., 2011). Forbes and Edge (2009), identify the shortage of home care providers, and especially registered nurses, as one of the most significant challenges of aging in rural settings. These researchers suggest several successful rural and remote recruitment strategies. These include: targeting home care nurses and providers who grew up in rural communities; maximizing the fit between their attributes and the needs and expectations of the rural community; improving access to education; improving working conditions and organizational supports; policies that better support home care providers' practice; and working with employed home care providers and community residents to assist new

recruits to develop a sense of belonging and attachment to their community (Forbes & Edge, 2009, p.122).

The Potential of Technology

Currently, Canadian policy initiatives concerning AT and ICT within the home care sector may not sufficiently be able to address these emerging issues; however, ICTs may help to mediate these issues. Technology has the potential to address these issues and enhance opportunities for AIP by fostering connectedness. ICTs can connect older adults with each other, family, friends, service providers, and the outside world; however, in order to realize the full potential of ICTs, policy support in relation to research and development, economics, and technological infrastructure is necessary. The following section will discuss the evolution of ICTs for AIP in order to provide a basic understanding of the Canadian landscape.

Chapter 5. What is the Current Landscape of Information and Communication Technology in Canada?

The Evolution of Assistive Technology to Information and Communication Technologies for Aging in Place

In order to enhance older adults' ability to AIP, gerontechnological research and development have utilized an interdisciplinary collaboration between experts within gerontology, health sciences, rehabilitation, and social sciences as well as technical experts within engineering, computing science, and robotics (Sixsmith et al, 2010; Lesnoff-Caravaglia, 2007). These collaborations have driven the expansion of AT from simple standalone devices to complex environmental systems that incorporate ICTs.

Basic Assistive Technology

Throughout history, humankind has strived to adapt to a diverse range of needs by augmenting abilities through innovative interventions. Basic AT, defined as simple low technology devices that aid in the performance of everyday activities, emerged from this determination to improve quality of life through technological advancements (Posse & Mann, 2005). According to Sixsmith and colleagues (2007), three generations of ICT have evolved from basic ATs in order to support independent living.

First Generation Technologies

First generation technologies involve personal alarm systems. They are entirely reliant on the older adult activating the system, as they are of simple design with no embedded intelligence (Brownsell, Blackburn, & Hawley, 2008). These involve the older adult wearing an alarm, such as a pendant trigger wore around the neck (Brownsell et al., 2008; Beech & Roberts, 2008). When an emergency occurs, the older adult presses the pendant in order to notify the appropriate response team (Sixsmith et al, 2007). Once alerted, a staff person at a 24-hour call center contacts the older adult and determines

whether informal caregivers or emergency services are necessary (Sixsmith, 2000). A well-known example of first generation technologies is LifeCall, recently renamed LifeAlert. Its trademark "Help, I've fallen and I can't get up!" commercial from 1992 brought public awareness to these devices. This media attention contributed to the market success of these technologies

First generation alarms have several benefits related to the security and safety of community-dwelling older adults. These benefits include: reduced stress levels among older adults, families, and caregivers; reduced hospital admissions; earlier hospital discharge; and delayed entry into long term care facilities (Sixsmith, 2000). While beneficial in certain situations, a weakness of first generation ICTs is the reliance on the user for activation. If the older adult is incapacitated, either physically or mentally, or forgets to wear the device, he or she may not be able to trigger the alarm in a emergency. For example, an older person may remove the alarm when going to bed and then forget to put it back on when using the washroom in the middle of the night. Consequently, the personal alarm may be ineffective within lived experiences of high-risk situations. In terms of adoption, older adults may be reluctant to use these personal alarms because they are associated with old age and frailty. Innovation in AT and ICTs has been greatly motivated by the goal to create supportive technologies that do not carry with them the stigma of old age.

Second Generation Technologies

In order to address limitations of the first generation, researchers developed a second generation of technologies that utilized advances in ICT. Unlike the first generation, activation of second generation technologies is not dependent upon the older adult. These technologies are more complex in terms of design, but less complicated in terms of usability. They include all of the first generation features within a passive monitoring system that integrates a basic level of intelligence and automatic detection (Brownsell et al., 2008; Sixsmith, 2000). Older adults are monitored within the home using detective and responsive sensors (Sixsmith, 2000). Detection of a dangerous or unusual situation prompts an automatic message to relevant parties. For example, in the case of a carbon monoxide leak, the older adult may be unaware of the

situation or incapacitated because of it. In this scenario, the passive monitoring system automatically raises the alarm (Brownsell et al., 2008; Sixsmith, 2006).

Only recently have these second generation technologies become available within the marketplace and utilized by older Canadians; however, their benefits are becoming increasingly apparent and documented within gerontechnological research. For example, many older adults demonstrate difficulty using household appliances. They are more likely to forget to turn off appliances, such as the stove, after completing a task. Second generation technologies sense that the stove element has remained on for too long and alert the individual before it becomes dangerous. Despite the potential benefits, a weakness associated with this generation is the fact that some users feel it is intrusive.

Third Generation Technologies

Third generation of ICTs for AIP detect and report problems as well as prevent them by incorporating the concept of ambient assistive living system (AAL). AAL combines stand-alone assistive devices with smart home technologies and telehealth innovations. This progression from an individual device assisting with one task or ADL to an ambient environment in which the assistance or support completely encompasses the living area and the person is an extremely significant development in the evolution of technology and aging. The definition of the adjective "ambient" reflects this development. The technology is "of the surrounding area or environment; completely surrounding or encompassing; relating to the immediate surroundings; or creating a relaxing atmosphere" (Merriam-Webster, 2010). A potential benefit of this technology is the reduction of stigma associated with monitoring and assistance devices by embedding the technology invisibly within everyday objects. AAL systems "render their service in a sensitive and responsive way and are unobtrusively integrated into our daily environment are referred to as being ambient intelligent" (Kleinberger et al., 2007, p.105).

An example of third generation technologies is home monitoring systems that utilize non-intrusive methods while negating the need of manual activation for alarms and reducing reliance upon active supervision. These systems integrate computing systems and assistive devices into everyday living contexts in order to monitor the home

environment and the older person. Environmental and wearable sensors monitor vital signs as well as changes in mobility and activity patterns, which are indicative of changes in health status. Actuators, which are mechanical devices that are used for controlling a mechanism or system, provide the older person with assistance while smart interfaces provide information, support, and encouragement. In this context, AAL systems can be interventions for secondary or tertiary prevention of chronic conditions and diseases. An example of this is Cognitive Orthosis for Assisting aCtivities in the Home (COACH), which is a computerized device that uses artificial intelligence to autonomously guide an older adult with dementia through ADLs, such as hand washing (Piau et al., 2014). It uses video tracking to monitor the hand washing in terms of proper positioning around faucets, soap, and towels (Piau et al., 2014). It determines whether the task was completed successfully and initiates visual and audio prompts to encourage completion if need (Piau et al., 2014). This concept applies to other areas, such as cooking and exercising (Piau et al., 2014). Barriers to the uptake of this technology include cost, instillation, and complexity. Presently, more advanced third generation systems, such as AAL systems, are in development; however, certain intelligent systems and remote services are increasingly being adopted to improve quality of life, support self-independence, and reduce health care costs (Kleinberger et al., 2007).

Theoretical Discourses on Technology and Aging

These definitions are rooted in an underlying assumption arising from the medicalization of old age and the social construction of later life as a time of increased disability and dependency. According to Greenhalgh and colleagues (2012), a bio-medical discourse dominates literature pertaining to technology and aging. The aging body is objectified and quantified as an accumulation of impairments. By medicalizing aging as a disease, this discourse legitimizes existing power relations, such as the doctor-patient relationship (Greenhalgh et al., 2012). It also legitimizes the increase in use of pharmaceuticals to treat disease and the emphasis on acute rather than preventative health care (Greenhalgh et al., 2012).

The bio-medical discourse on technology and aging interacts with a neo-liberalism discourse on health and aging that evaluates the usefulness of older adults

according to economic rationalism (Martinez & García, 2000). The bio-medical discourse presents older adults as non-productive members of society who create a burden on the productive members by using a disproportionate amount of resources. On the other hand, the aging population represents a market opportunity, as there is an increased demand for specialized goods and services that target older adults and the problem of aging. The development of ICTs as solutions to the problems associated with the aging population represent a market opportunity according to these discourses. In particular, technologies are supposed to reduce the use of scare healthcare and social resources.

The World Health Organization (WHO)'s social model of health and active aging emerged in the 1990s as an alternative framework in which to address the challenges associated with population aging. According to the WHO, active aging is "the process of optimizing opportunities for health, participation, and security in order to enhance quality of life as people age" (WHO, 2002, p.12). This definition stresses that activity is not merely the ability to remain physically active or participate in the workforce. Instead, activity refers to the continuing participation of seniors in social, economic, cultural, spiritual, and civic affairs (WHO, 2002). The WHO active aging agenda, presented at the United Nation's World Assembly on Ageing, recognizes the human rights of older people and the U.N.'s principles of independence, participation, dignity, care, and self-fulfillment (Christensen et al, 2003). By focusing on a "rights-based" approach, which recognizes the rights to equality of opportunity and treatment as people age, the WHO agenda distances itself from the "needs-based" approach, which assumes that older people are passive (WHO, 1999). The active aging agenda focuses on the following: maintaining activity, health, and social participation; discussing the rights of older adults as active participants within society; and recognizing the processes of marginalization that often objectify, stigmatize, exclude, and impoverish older adults (WHO, 2002). Therefore, ICTs should focus on the abilities, rights, and desires of older adults in addition to issues pertaining to safety, security, avoidance of harm, reduction of risk, and management of chronic diseases.

The Emergence of eHealth

According to Health Canada (2010) eHealth is an umbrella term used to describe the application of ICT in the health sector ranging from administrative to health care delivery purposes. EHealth includes electronic health records (HER), telehealth, laboratory and radiology information systems, electronic messaging systems, and remote vital sign monitoring, just to name a few applications. Canadian initiatives focus on two specific applications: an electronic health record system and telehealth.

Canada Health Infoway and the Electronic Health Record

Since 1997, the federal government has invested over $1.5 billion to further the use of information and communication technologies in the provision of health information, services, and expertise across the country; however, development of a pan-Canadian policy has yet to exist (Assadi, 2003). Assadi (2003) reviewed the distribution of federal funds throughout the nation and identified over 15 federal initiatives and programs that funded over 153 ICT related projects. The creation of Canada Health Infoway (Infoway) was the largest federal investment (Assadi, 2003). The First Ministers created this independent, federally funded, not-for-profit corporation in 2001 (Assadi, 2003). Infoway seeks to transform health care through health information and communication technology. Its mandate includes: accelerating the development and adoption of modern systems of health ICTs and; defining and promoting health infrastructure standards and thus interoperability (Assadi, 2003). Since 2001, Infoway has received $2.1 billion through five separate federal grants, which has been allocated into 12 programs that have co-invested in 390 projects with provinces and territories (Canada Health Infoway website, 2013). These projects focus on the development of ehealth projects, such as electronic medical records, EHR, telehealth, and public health surveillance systems.

Since its inception, Infoway has predominately focused on the development and adoption of EHR. Health Canada defines an electronic health record as a longitudinal collection of personal health information of a single individual that is entered or accepted by health providers electronically (Assadi, 2003). EHRs involve digital imaging systems, drug information systems, and laboratory information systems (CHCA, 2008). Currently,

most information imputed into EHRs is based on periodic episodic hospital visits (CHCA, 2008). The Canadian Home Care Association (2008) argues that a comprehensive and effective EHR has yet to be developed because the key elements of the home and community care sector are excluded. These components of home care include: initial assessment of client needs within the home environment; ongoing visits for the purposes of treatment and intervention; care specific tools; diagnostic information; therapeutics; and health outcomes and future needs based on discharge (CHCA, 2008). Most EHR programs only include the assessment conducted by a case manager, overlooking the diagnosis, intervention, and outcomes (CHCA, 2008). Policy should seek to incorporate these elements in to EHRs..

Telehealth in the Canadian Context

Defining Telehealth

Telehealth is quickly becoming a key component of Canada's health care system. Telehealth refers to the use of ICTs to deliver health care services, expertise, and information over a distance (Canada Health Infoway, 2011). Telehealth programs support the integration of care by coordinating the technology with appropriate providers at the right time to provide the necessary services to the intended patient (Canada Health Infoway, 2011). The concept encompasses three types of technologies; however, a unifying aspect is that it uses ICTs for mediating distance in health care delivery (Candia Health Infoway, 2011; Peddle, 2007). The three types of telehealth technologies include: live videoconferencing; store-forward-solutions; and telemonitoring solutions (Canadian Health Infoway, 2011).

Telemonitoring is a common application of telehealth within the community. Home telemonitoring or telehomecare refers to remote care delivery or monitoring that occurs between the health care provider and patients in their place of residence, and in which patient outcome data transmit to a health care provider from a remote location (Tran et. al, 2008). An example of telehealth is the use of telemonitoring to record physiological data, such as blood pressure, blood glucose, and weight, and activity levels and patterns (AALIANCE, 2009). There are two categories of telemonitoring. Synchronous technologies enable real-time interaction and communication (Tran et al, 2008). Examples include audio and video conferencing. Asynchronous telemonitoring,

which is also referred to as "store-and-forward telemedicine", is characterized by storing the data and then sending it to a health care professional at a distant location by email or through the Internet to be assessed at a later time (Tran et al, 2008).

Benefits of Telehealth

The Canada Health Infoway (2011) organizes benefits derived from telehealth into three categories: access, quality, and productivity.

- Access: Improves equitable access to specialized clinical services for rural and Aboriginal Canadians; Enhances patient-centred care through provision of convenient services closer to home; Saves patients time and avoids personal travel cost; Improves timeliness of care; Enables provincial and territorial responses to emergency management situations;

- Quality-Supports better chronic disease management; Supports application of best practices; Improves knowledge and skill development in local care providers; Improves care coordination

- Productivity- Improves provider efficiency by reducing provider travel time; Avoids health system costs through avoided subsidized travel; Reduces avoidable health system utilization; Reduces unnecessary transfers; Increases productivity by allowing providers to perform a higher volume of consultations (p.21).

The promise of telehealth to improve the health care system in terms of access, quality, and productivity has motivated the development of provincial telehealth programs (Canada Health Infoway, 2011). Over the past five years, telehealth usage in terms of clinical consults has grown at a rate of over 35% annually (Canada Health Infoway, 2011). As of 2011 there were at least 5,710 Telehealth systems implemented in at least 1,175 communities across Canada (Canada Health Infoway, 2011). However, the creation of telehealth programs does not guarantee that older adults will adopt these technologies..

Barriers to the Adoption of Information and Communication Technologies

In the mid-1990s the concept of the digital divide emerged as an umbrella term referring to a gap between people with effective access to digital, assistive, and ICTs and those with very limited or no access to these technologies (Sciadas, 2002). The

Organization for Economic Cooperation and Development (Montagnier and Wirthmann, 2011) conceptualizes the digital divide as "the gap or divide between individuals, households economic and geographic areas with different socio-economic levels with regard both to their opportunities to access information and communication technology, and the use of the Internet for a wide variety of activities" (p.5). Recent studies suggest that Canada, once a world leader in telecommunications, is experiencing a growing digital divide when compared to other developed countries (Theckedath & Thomas, 2011). The percentage of households with broadband Internet subscriptions, or the penetration rate, has decreased due to higher prices and lower quality services (Theckedath & Thomas, 2011). According to Sciadas (2002), many divides exist based on age, income, and geography.

Age influences personal and household penetration of ICT. Older adutls use the Internet the least but make up the fastest growing group of users (Veenhof & Timusk). Growth rates of Internet use have remained the highest among older adults since 2000 (Veenhof & Timusk, 2009). Despite the fact that an increasing number of older adults are using the Internet, the ageist stereotype that older persons are technophobic continues to influence public perceptions on aging and technology (Saunders, 2004). Household penetration of ICT increases as income increases; however, this effect is more pronounced on new technologies, such as smart phones and the Internet, than on more established technologies, such as televisions and cable (Sciadas, 2002). Since older adults often experience economic restrictions, this divide may be of particular interest for policy makers.

Geographic factors also influence the digital divide, as discrepancies exist between rural and urban Canadians. This may be a result of the market failing to recognize and support these more expensive rural areas (Ramirez & Richardson, 2005). Since the proportion of older adults within rural communities is increasing, the lack of technological infrastructure may have an accumulating affect on these seniors' interaction with ICT. In addition, the digital divide depends "on the specific technology, its timing of introduction, as well as the variable of interest" (Sciadas, 2002). Ramirez & Richardson (2005) argue that, "the digital divide is not only about physical access to phone lines and computers, it is also about becoming aware of the values of

telecommunication services, having access to training on a range of computer and information-related skills, and to having an occupation where the relevant uses for the technology yield added value or savings" (p,500). In the case of rural older adults every variable, income, education, age, and geographical location, significantly influences this segment of the population's access to such technologies. Immigrant older adults residing in rural areas might experience language barriers and a lack of familiarity with the community that can increase the digital divide. Barriers associated with the digital divide influence the accessibility of ICT and the adoption of these technologies by older adults. These include: the challenge of paying for the technologies; a lack of awareness about the benefits associated with these technologies; the stigma associated with their use; and a disconnect between the older adult's abilities and the design of the technologies (Center for Technology and Aging, 2009). Policy has the potential to diminish these barriers to older adults' adoption of ICTs; however, policy can also strengthen or multiple these barriers. In order to gain a more comprehensive understanding of the opportunities to AIP in Canada, the following policy analysis will examine facilitating and impeding factors within relevant areas of interest.

Chapter 6.   Policy Analysis

Policy analysis refers to "a problem-solving discipline that draws on theories, methods, and substantive findings of behavioural and social sciences, social professions, and social and political philosophy" (Dunn, 2004, p.1). Through multidisciplinary inquiry, policy analysis is a process designed to create, critically assess, and communicate useful information in order to improve policies (Dunn, 2004).

Statement of the Problem

As the population ages, projections of increased care demands and expectations for Canada's health care system are gaining attention within policy discourse (Duncan & Reutter, 2006). Within a health care climate of limited resources and restructuring, innovative and strategic policy approaches are necessary in order to address the changing needs, abilities, and expectations associated with aging. Policymakers face the difficult task of augmenting the quality of life of older adults who are living longer and more active lives without adding to the growing strain on financial and health resources (Sixsmith & Gutman, 2013; Ombudsperson, 2012). A review of the literature points to the potential of ICTs to meet the preference to AIP; however, current policy and funding arrangements may be impeding the delivery of home and community care and ICTs. This analysis examines issues within the following areas: research and development, the economic environment, the technological infrastructure, legislative foundation and health care, and ethics and cultural issues. The goal is to create a better understanding of how ICT innovation is fostered to support home and community care and AIP.

The Stakeholders

In order to foster the use of ICTs for AIP, stakeholders must engage in active collaboration and communication throughout the process. A stakeholder is "a person, group, or organization that has an investment, share, or interest in something, such as a business or industry" (Merriam-Webster, 2014). For the purposes of this capstone project stakeholders include:

- The end users: older adults and their caregivers

- Research Organizations: universities, community organizations

- Industrial Partners: technology companies

- Health and social care providers: the organizations offering services to the end-users (health and home care-service organizations, shopping, delivery, and social services)

- Health and Social Care Policy Makers: the organizations analyzing the economical and legal context

These stakeholders should engage in a collaborative partnership in order to foster ICTs for older adults and AIP. To do so, they must collaborate and communicate with each other throughout the process. Policies should create open pathways for collaboration and communication. Researchers should have access to the end-users in order to gain a better understanding of their needs and preferences. Industrial partners should have access to researchers in order to develop technologies that are marketable and relevant to the end-users. They should also inform researchers and policy makers as to the feasibility of developing technologies. The health and social care providers should collaborate with researchers in order to assist with assessing future projects and to educate themselves about available technologies. Policy makers should involve these stakeholders in the decision-making process relating to ICTs and AIP. In addition, established policies and regulations within research and development, the economic environment, and the technological infrastructure influence the ability of stakeholders to engage in collaborative partnerships. Subsequent sections will discuss the impact of

policies within these domains on the delivery of ICTs and home and community care services to older adults.

Research and Development

According to the Conference Board of Canada (2008), Canada ranks 13 out of 17 in terms of adoption of innovation. Similarly, a 2006 study found that in Canada only 23% of physicians have electronic medical record systems, compared to 98% in the Netherlands, 92% in New Zealand, and 89% in the United Kingdom (CHA, 2009). While policy and funding arrangements may be impeding the adoption of ICTs for AIP, certain aspects of the research and development process may also be stifling innovation. An overview of key design, research, and development aspects of ICTs for AIP creates a comprehensive understanding of the ICT landscape in Canada for the purposes of informing policy. These include: adopting a collaborative and user-driven approach; re-evaluating the role of evidence-based research in policy decision making; and applying standardization for research purposes.

A Collaborative and User-driven Approach to Technological Design and Development

Recent research stresses the importance of collaborative, user-driven approaches to technological design and development as opposed to a technology-driven approach (van Gemert-Pijnen et al., 2011). Collaboration between all stakeholders is necessary in order to design and develop appropriate technologies supporting older adults preference to AIP. According to this approach, end-users must play a central role in every aspect of the innovation process from research and development to implementation (Comyn, Olsson, Guenzler, Ozcivelek, Zinnbauer, & Cabrera, 2006). Wallach and Scholz (2012) define user-center design as a design and evaluation process that listens to the intended user, concentrating on how the product will be used, where it will be used, and what features the user identifies as essential in terms of relevance and usability. Usability refers to "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Wallach & Scholz, 2012, p.15). Older adults and their

caregivers are the end-users of ICTs for AIP; therefore, a comprehensive understanding of their diverse needs, abilities, and preferences is necessary to the success of ICTs' relevance to their everyday lives. Incorporating user-centered design principles in the beginning phase of a project not only increases the technology's usability; it also saves time and cost by decreasing the need for modifications late in the development process (Wallach & Scholz, 2012).

> Technology that monitors people's health, keeps their homes secure and helps them stay fit and connected with family and friends will benefit older people more than perhaps any other group - but only if they are able and willing to use it. EU-funded researchers are overcoming barriers to the acceptance and usability of ambient assisted living systems through innovative user-centred design (European Commission, 2011, para. 1).

Involving end-users (older adults) in every stage of research and development reduces the risk of homogenization. The user-driven approach increases the potential that technological development is usable, useful, and acceptable in the everyday life context of older users (Sixsmith et. al, 2010, p.2). It directly involves older people and their caregivers during the first stages of developing conceptual designs and prototypes, as opposed to restricting their involvement to end phases of product testing (Sixsmith et al., 2010).

The Service-Oriented Programmable Smart Environments for Older Europeans Project, also referred to as SOPRANO, provides a recent example of a randomized controlled trial (RCT) that applies a user-driven approach to the process of technological innovation. SOPRANO is an Integrated Project in the European Commission's 6th Framework Programme for Research and Technological Development that began in January 2007 (Sixsmith et. al, 2010). With over 20 partners in Canada, Germany, Greece, Ireland, the Netherlands, Slovenia, and Spain, this European Union funded project is an association of corporations, service providers, and university research institutes. The goal of this consortium is "to design the next generation of systems for ambient assisted living in Europe" (SOPRANO, 2010). In order to enhance the lives of older people, SOPRANO examines the use of pervasive ICTs, such as smart home technologies, sensors within the home, and intuitive interfaces (SOPRANO, 2010). In the four-stage research and development process of SOPRANO, the experts listened to the

older people and respond to their needs, concerns, and goals as opposed to beginning with problems predefined by the researchers. The SOPRANO project's findings challenged researchers' preconceived notions about the user-technology relationship. For example,

> Developers initially thought that displaying a series of coloured icons on the TV or a touch screen to control different applications - such as to see who is at the door or check if the windows are closed - would be an intuitive interface. End-users, however, actually responded better when the icons were replaced with numbers as the interface more closely resembled the buttons on a TV remote control, which they were more accustomed to using (European Commission, 2011, para. 9).

This design enabled the SOPRANO project to develop AAL technologies that are responsive to the wide range of needs, circumstances and aspirations of older adults. According to Sixsmith and colleagues (2010), a variety of themes emerged from the SOPRANO project including: social isolation, safety and security, forgetfulness, adherence to health and activity routines, community participation, accessing information, access to shops and services, quality management of care, and mobility (Sixsmith et al., 2010).

Industrial stakeholders have also begun to acknowledge the necessity of understanding end-users' (older adults) needs and preferences in order to develop ICTs for AIP. The Health Research and Innovation group within Intel's Digital Health Group conducted a multi-year project called "The Intel Global Aging Experience" (Plowman, Prendergast, & Roberts, 2009). This study used ethnographic research techniques, such as open-ended interviews, observations, and multi-day visits to households, in order to "gain an understanding of the social and cultural differences in people's experiences of aging and health and to identify the types of technologies and services that could empower people to be more proactive in managing their health and wellness." (Plowman et al., 2009, p.1).

This study's ethnographic research resides within the context of industry as opposed to an academia. The authors explain that this context demands immediate relevance and actionable research (Plowman et al, 2009). By actionable, it is meant that the research be problem-directed and produce results that are easily consumed and

understood in order for stakeholders to quickly act upon them (Plowman, et al, 2009). While this type of research may appear to produce more hands on and practical results, it should be noted that it "was conducted as much to shape the activities of a business division as it was to meet a pre-defined set of research needs" (Plowman et al, 2009, p.35). Therefore, when examining this study it is important to understand that this study's driving force is to understand users in terms of their needs and wants in order to better market products and services for increasing profit. Nevertheless, the ethnographic study does highlight key themes pertaining to ICT and the aging experience. These include: people want to focus on what they can do not what they can't do; healthy aging and independent living are more than just health; health is defined collaboratively and culturally and is not just an objective quality; people mark the progression of aging by a series of threshold events; healthy aging is linked to social participation; the lived in space is crucial to the experience of aging; and healthcare networks are large and increasingly complex (Plowman et al, 2009). While this project did not utilize user-driven research in that it did not involve older adults from the first stages of design, it does indicate a shift in thinking among industrial stakeholders as well as academics. The study's ethnographic approach demonstrates a "commitment to affecting a paradigm shift within the independent living market" (Plowman et al., 2009, p.25).

User-driven research acknowledges older adults as active participants in the design and development process of ICTs for AIP. The transferring of authority from researchers to users directs research and development towards more appropriate and valuable AIP applications for older adults. The emergence of user-driven research has two major implications for policy in the ICT and AIP area. Firstly, policies should support research endeavors that employ this approach as opposed to technology-driven research in order to avoid the homogenization of older adults and their needs based on preconceived notions of aging. Secondly, policy makers should utilize the findings of user-driven research when selecting ICTs to fund in order to ensure the relevance of these technologies for older adults. Involving older adults in the research and development process from inception will also increase the likelihood of older adults' uptake and acceptance of the technologies.

58

Evidence Supporting the Benefits of Information and Communication Technologies for Aging in Place

Policy makers require evidence-based research in order to justify the allocation of limited financial and human resources for technological interventions supporting AIP. While numerous studies stress the usefulness of ICT for AIP, the literature lacks evidence-based research confirming these claims. RCTs test the efficacy and effectiveness of an intervention and are considered the gold standard in experimental design; however, pilot, observational, and case studies dominate technology and aging research. RCTs evaluating ICTs for AIP tend to focus on three aspects of the aging process: the health and wellness; safety and security; and social connectedness of older adults (Pearce, Adair, Miller, Ozanne, Said, Santamaria, & Morris, 2012).

Health and Well-Being

In order for adults to live independently and contribute to their communities as they enter advanced old age, ICTs should support health and well-being in relation to the prevention and management of chronic diseases as well as the maintenance of functional capacity. Gellis and colleagues (2012) executed a RCT in order to examine the influence of a multifaceted telehealth intervention on health, mental health, and service utilization outcomes among homebound medically ill older adults suffering from heart or chronic respiratory failure. This study examines the efficacy of telehealth in relation to self-care disease management among older adults. The researchers defined telehealth as "the use of electronic information and telecommunications technologies to support long distance clinical health care, patient and professional health-related education, public health and health administration" (Gellis et al, 2012, p. 542). The tele-HEART intervention included the following features:

> in home assessment; in home setup and education on telehealth monitoring device; ongoing care management provided by a telehealth home care nurse specialist; use of home care protocols for evaluation and management of heart failure and related chronic respiratory failure and comorbid depression; utilization of an integrated electronic medical record; use of a computerized care management tracking tool; and prior research on integrated mental health service delivery by home health care teams" (Gellis et al., 2012, p. 542).

The tele-Health program demonstrated positive effects on the older adults in the experimental/intervention group. Compared to the control group, the intervention group experienced reduced depression symptoms, increased quality of life, increased general health, and increased social functioning (Gellis et al., 2012). Strength of this study resides in its use of a randomized control design in a real world setting with a home health care control group. However, for this reason, the researchers caution about generalizing the results to non-Medicare-certified home care agencies or different diagnostic patient groups (Geillis et al., 2012).

Woodend and colleagues (2008) conducted a RCT that evaluated the impact of three-month home telemonitoring on hospital readmission, quality of life, and functional status in adults with heart failure and angina recently discharged from hospitals. Heart failure is a common condition among older adults, with approximately one in ten suffering from it (Woodend, Sherrard, Fraser, Stuewe, Cheung, & Struthers, 2008). This coupled with the fact that readmission rates can be as high as 47% within three months and 54% within six months indicates that effective telehealth programs for heart failure management may reduce the use of limited health care resources (Woodend et al., 2008). This study randomly allocated 121 patients to home telemonitoring after discharge or usual post-discharge care. The mean age for patients was 66 years. The home telemonitoring intervention involved three months of video conferencing with a nurse in addition, daily transmission of body weight and blood pressure, and periodic transmission of 12-lead electrocardiogram.

This study found that home telemonitoring reduced hospital readmissions, visits to the emergency department, and days spent in hospital among those with angina; however, those with heart failure did not exhibit reduced hospital readmissions. The quality of life and functional status of all participants improved over time; however, the home telemonitoring group demonstrated greater improvements than the control group in both areas. By the one-year follow-up, the differences between groups had lessoned, indicating the need to investigate the sustainability of the benefits associated with home telemonitoring. The study also found that telehealth users expressed high levels of satisfaction with the care they received. While this study supports the application of telehealth for chronic disease management and reduction of health care resources

usage, it is not without its limitations including, the use of patient recall for health care resource data and the lack of inquiry as to what aspects of the home telemonitoring influenced the outcomes.

Scherr and colleagues' (2009) MOBIle TELemonitoring in Heart Failure Patients Study (MOBITEL) conducted an RCT to evaluate the impact of home-based telemonitoring on the frequency and duration of hospitalizations among chronic health failure patients recently discharged from the hospital. Both control and experimental (tele-group) groups received the pharmaceutical treatment. The tele-group also received the telemonitoring intervention, which involved three commercially available components: a mobile phone; a weight scale; and a sphygmomanometer for fully automated measurement of blood pressure and heart rate (Scherr et al, 2009). The study found that telemonitoring among chronic heart failure has the potential to reduce frequency and duration of heart failure hospitalizations (Scherr et al, 2009). After 6 months, there was a reduction of relative risk in tele group patients (re-admission or death) by 54% (Scherr et al., 2009). Among those hospitalized for worsening heart failure during the study, tele-group patients demonstrated shorter stays (Scherr et al, 2009). However, limitations include the small sample size and the premature termination of randomization because of relevant technological issues with the patient terminal.

Inglis and colleagues (2011) performed a Cochrane review of RCTs of structured telephone support or telemonitoring compared to standard cardiologist and general practitioner care among people with chronic heart failure. The researchers concluded that structured telephone support and telemonitoring reduce the risk of all-cause mortality and chronic heart failure-related hospitalizations while also increasing quality of life and reducing healthcare costs. This indicates that these telehealth interventions can provide specialized heart failure care to older adults who may face geographic or financial barriers to tradition care services. This Cochrane review also found that "switching resources from crisis management (by hospitalizing patients) to health maintenance (through structured telephone support or home telemonitoring) may be an affordable method to maintain and improve the quality of care for chronic heart failure" (Inglis et al, 2011, p.2).

Safety and Security

Safety and security emerges from the literature as an area in which ICTs may enable older adults to live independently. Since hazards in the home environment can lead to falls, fires, or accidents, which result in debilitating and painful injuries, high treatment costs, and death (WHO, 2002). ICTs should minimize such hazards and accident-related injuries by supporting personal and home safety and security for older adults living within the community. The scope of ICTs potential to enhance safety and security is quite broad. ICTs may target may the mental, physical, and functional capability of the older adult in terms of falls or disorientation; the physical environment of the home in terms of control of household equipment; the virtual space of the Internet, email, and gaming; or the issue of receiving assistance in the case of emergency (Sixsmith et al., 2010).

Hoof, Kort, Rutten, and Duijstee (2011) conducted a qualitative study comprised of interviews and observations of technology and environmental interventions in the home environment in order to evaluate older adults' motivation to use ambient intelligence technologies for AIP. A prototypes of the Unattended Autonomous Surveillance system was installed in eighteen older adults' homes. This system offers mobility monitoring, voice response, fire detection, as well as wandering detection and prevention. Hoof and colleagues (2011) found that improved sense of safety and security was the motivating factor for utilizing this technology, with the avoidance of falls being the main concern. The appearance of 24 hour-care emerged as major perceived benefit. While the qualitative design provides insight as too the motives of technology acceptance and importance of safety and security, RCTs evaluating the effectiveness of these technologies are necessary for future research projects.

Social Connectedness Social Interaction, Participation, and Inclusion

Aging is a social phenomenon that takes place within the context of others; therefore, ICTs should also foster social interaction, communication, and social participation (WHO, 2002). Aging and social support literatures stress the importance of the social environment in terms of their influence on perceived quality of life and physical as well as mental health (Mair & Thivierge-Rikard, 2010; AALIANCE, 2009).

White et al. (2002) investigated the impact of the Internet (electronic mail and the World Wide Web) engagement on older adults in the late 1990s. This RCT assessed the psychosocial impact of providing Internet access to older adults over a five-month period in order to develop new opportunities for communication and to avoid social isolation. The researchers found older adults were eager to use the Internet, with 74% of the intervention group using it on a weekly basis after five months. The participants perceived the Internet as an avenue to new social activities.

Over the past decade, Internet usage among older adults increased drastically. Research indicates that older adults are using the Internet, with over half of older adults online (Zickuhr & Madden, 2012). One third (34%) of Internet users age 65 and older use social networking sites such, as Facebook, and 18% do so almost daily (Zickuhr & Madden, 2012). While ICTs for social connectedness are readably available through affordable commercial video communication technologies and software, there is a shortage of RCTs assessing the impact of these technologies on older adults (Cutler, 2005). Possible reasons include the recent availability of these ICTs and ageist perceptions of older adults as non-users of these technologies (Cutler, 2005).

Economic Evaluations of Information and Communication Technologies in Health Care

While preliminary studies promised monetary savings, researchers have only recently begun to conduct RCTs investigating the economic impact of technologies such as telehealth and EHRs. This delay in empirical evidence may be the result of the relatively recent integration of these technologies in traditional health care systems.

Evidence supporting the cost-effectiveness of telehealth is growing. The Ontario Telemedicine Network (2014) conducted a systematic review of 23 articles and found that home telecare was cost-effective in 91% of the studies reviewed. In a Taiwanese study, Chen and colleagues (2013) found that telehealth is cost-effective. This quasi-experimental study evaluated the clinical outcome and cost-effectiveness of a synchronous telehealth service on older patients with cardiovascular diseases. The telehealth services evaluated included: instant transmission of physiologic data (blood pressure, pulse rate, electrocardiography, oximetry, and glucometry) for analysis; a

combination of telephone communication and health promotion; and continuous analytical and decision-making support. They concluded that a synchronous telehealth intervention may reduce costs, decrease all-cause admission rates, and decrease durations of all-cause hospital stays in cardiovascular disease patients, regardless of age.

Effectiveness of Ambient Assisted Living Systems

Evidence of AAL systems' effectiveness is limited compared to that of telehealth technologies. Martin and collogues (2008) conducted a Cochrane review in order to explore the effectiveness of smart home technologies (social alarms, electronic assistive devices, telecare social alert platforms, environmental control systems, automated home environments and 'ubiquitous homes') as an intervention for people with a physical disability, cognitive impairment, or learning disability, who are residing at home. The researchers examined the impact these technologies have on the individual's health status and on the health care system's financial resources. Outcome measures included any objective measure that records an impact on: a participant's quality of life, healthcare professional workload, economic outcomes, costs to health care provider or costs to participant were considered outcome measures. In addition, the researchers included measures of service satisfaction, device satisfaction, and healthcare professional attitudes or satisfaction. This review investigates "electronic assistive technology" (ETA), which encompasses a broad range of assistive devices, varying in complexity from social alarms to environmental control systems. Martin and collogues (2008) concluded that "current available published studies lack the application of robust empirical methodologies to validate smart home technologies as effective intervention to support health and social care" (p.6).The researchers did not find a single study evaluating the effectiveness of smart home technology use within health care found no studies evaluating their effectiveness despite the fact that some of these technologies are already on the market.

The lack of RCTs evaluating AAL systems reveals the dominance of reactionary second generation ICT interventions among RCTs. AAL interventions may prove to have secondary and tertiary preventative applications, but more research is need. Assessment of ICT interventions' effectiveness in relation to post-acute care needs

dominate studies using a RCT design. Assessments of ICT interventions for the health maintenance function of home and community care tend to focus on telemonitoring those with a chronic condition in order to avoid readmission or initial admission to hospitals, as indicated by the use of outcome measures such as hospital readmission and duration of hospital stay to demonstrate effectiveness. Secondly, the absence of RCTs assessing third generation technologies indicates that evaluation research has not kept pace with technological development. Traditionally, policy decision-making requires evidence-based research as to the benefits of one intervention compared to another in order to justify the allocation of limited funds. Since the preventive applications of AAL systems may promote a lifespan model of AIP; however, if policies must wait for RCTs to prove effectiveness the technology may be obsolete or out of date by the time evaluation research catches up to technological development. The Whole System Demonstrator (WSD) program also demonstrates this disconnect between technological development and evidence-based research.

The Whole System Demonstrator (WSD) program

In the United Kingdom, the Department of Health established the Whole System Demonstrator (WSD) program to demonstrate the effectiveness of telehealth and telecare (UK Department of Health, 2011). Since 2008, the WSD program has gathered information in order to provide a strong evidence base to support financial investment decisions and show how telehealth and telecare support people to live independently by supplying them with the tools to take responsibility for their own health and care (UK Department of Health, 2011). With 6,191 patients and 238 general practitioners across three sites (Newham, Kent, and Cornwall), the WSD program is the largest randomized controlled trial (RCT) on telehealth and telecare in the world (UK Department of Health, 2011). Five themes were evaluated: service utilization, participant reported outcomes such as quality of life; cost effectiveness; user and professionals experience; and influence of organizational factors to adoption (UK Department of Health, 2011). Preliminary findings demonstrate that when delivered appropriately and properly, telehealth reduces mortality, reduces the need for hospital admissions, lowers the number of days spent in hospital beds, and reduces time spent in accident and emergency departments (UK Department of Health, 2011; Steventon et al., 2012).

A recent nested economic evaluation of the WSD program examined the costs and cost-effectiveness of telehealth in addition to support and treatment, compared with the usual support and treatment regimine (Henderson & colleagues, 2013). The incremental cost per quality adjusted life year (QALY) gain by patients using telehealth in addition to usual care was similar to that by patients receiving usual care only. Since the total costs associated with the telehealth intervention were higher, the researchers concluded that telehealth does not seem to be a cost effective addition to usual care (Henderson et al., 2013).

Sanders and colleagues (2012) conducted qualitative semi-structured interviews with the 22 people who declined to participate or withdrew from the intervention in order to explore barriers to participation and adoption of telehealth and telecare from their perspective. The researchers found that these non-participants were concerned with potential threats to identity and that telehealth interventions could undermine self-care and coping. In addition, they did not participate in order to avoid the risk of potentially disruptive changes to existing services (Sanders et al, 2012).

Cartwright and colleagues (2013) assessed the effect of second generation, home based telehealth on health related quality of life, anxiety, and depressive symptoms by reviewing 12 months of patient reported outcomes. The study was nested in the WSD telehealth trial. The researchers found telehealth to be ineffective when compared to usual care only. It did not improve quality of life or psychological outcomes for patients with chronic obstructive pulmonary disease, diabetes, or heart failure.

The WSD program applies a RCT study design to telehealth and telecare interventions on a large-scale level; however, findings from this study have only just begun to emerge within the literature almost three years after data collection ended. The delay in evidence-based research of ICTs for AIP creates the risk of policies becoming obsolete or irrelevant due to the rapidly changing technology landscape. Therefore, traditional avenues to policy decisions that require empirical research may not be appropriate. Presently, policy makers may need to base their decisions on available pilot, observational, and case studies in order to incorporate ICTs in health and support systems for older adults in a timely matter..

The Need for Standardization in Technology Research and Development

A review of the literature indicates that RCTs evaluating the effectiveness of ICTs and telehealth interventions for AIP have only recently become available in the past decade (Krupinski & Bernard, 2014). The lack of evidence-based research evaluating health outcomes and cost-effectiveness of telehealth interventions relates to the lack of standardization within this field of aging and technology (Bashshur, Krupinski, and Grigsby, 2011; Canada Health Infoway, 2011).

Clarification of Terms

Bashshur and colleagues (2011) stress the need for need for clarity and structure arguing that the confusion arouse as a result of "the expansion of the initial concept of telemedicine to include a wide spectrum of applications and contexts. In turn, the phenomenon has resulted in a parallel increase in concepts, labels, and definitions, some intersecting and others distinct." (p. 484). Consequently, the content and boundaries between concepts such as telehealth, telecare, telemedicine, ehealth, and mhealth has been blurred (Bashshur et al., 2011). Bashshur and colleagues (2011) use telemedicine as the umbrella term to base their conceptualization of corresponding technologies and services. Health Canada (2005) considers telehealth to be the umbrella term referring to "the use of communications and information technologies to overcome boundaries between health care practitioners or between practitioners and service users for the purposes of diagnosis, treatment, consultation, education and information transfer" (para. 31).

Research utilizes various definitions of telehealth, often using the term interchangeably with telemedicine and telecare. Inconsistency also describes tele-enabled services and their measurable benefits (Canada Health Infoway, 2011). Many telehealth programs may possess similar names yet produce different types of benefits, while programs possessing different names may deliver the same or corresponding benefits (Canada Health Infoway, 2011). Consequently, comparing telehealth programs and services becomes a challenging endeavor. To complicate matters, telehealth benefits may result from an interaction between the telehealth intervention and other variables (Canada Health Infoway, 2011). Recent reviews of telehealth indicate research

designs, measurements, methods, and outcomes would benefit from a taxonomy of telehealth (Krupinski & Bernard, 2013).   This inconsistency creates challenges in research as well as policy, reimbursement decisions, and provider acceptance (Bashshur et al., 2011; Krupinski & Bernard, 2013).

The Canadian National Telehealth Outcome Indicators Project (NTOIP)

In 2007, after two decades of evaluation activities in the telehealth field, the Canadian National Telehealth Outcome Indicators Project (NTOIP) was established to address issues concerning research in terms of quality, scope, and technical nature (Scott et al., 2007). The lack of guidance regarding outcome indicators for telehealth evaluation motivated this endeavour. By lack of guidance, the authors are referring to the

> lack of comparable data, as a basis for ongoing monitoring and review and formal evaluation, (that) had been identified as a major impediment to the development of telehealth….This simple strategy will help ensure that telehealth data is collected uniformly from all services and jurisdictions, facilitating informed policy debate and community discussion in the contemporary healthcare environment (Scott et al., 2007, S.2.2).

The NTOIP examined outcome indicators of telehealth within four categories: quality, access, acceptability, and cost (Scott et al., 2007). After conducting a systematic literature review, a workshop with experts, and a consensus process, the NTOIP identified 34 outcome indicators (Scott et al., 2007).

Health Technology Strategy 1.0 (HTS 1.0)

The 2003 Accord on Health Care Renewal called for "a comprehensive strategy for a technology assessment that assesses the impact of new technology and provides advice on how to maximize its effective utilization in the future" (HTS 1.0, 2004, p.2). This strategy proposed creating a pan-Canadian approach to policy formulation for the purpose of assisting jurisdictions with health technology investment decisions (HTS 1.0, 2004). Health technology assessments are valuable in that they

> Health technology assessment (HTA) is a form of multidisciplinary research that typically consists of the systematic examination of the safety, clinical efficacy and effectiveness, and cost-effectiveness of a technology, but that may also include

the organizational implications, social consequences, and legal and ethical implications of its adoption and implementation (Bond and Oremus, 2014, p.131).

Assessment should include the management of technologies across the entire spectrum of the technology lifecycle, or from innovation through to obsolescence (HTS 1.0, p.2). The Health Technology Strategy also recognized deficiencies in traditional health technology assessment (HTA), which refers to "the secondary research activity of collecting primary research data about a given health technology and normalizing it for policy input" (HTS 1.0, 2004, p. 3). The Strategy recommends creating a national health technology agency, a health technology policy forum, a health technology analysis exchange, and a field evaluation system. Currently, the Canadian Agency for Drugs and Technologies in Health (CADT), which is an independent non-for-profit agency that assesses the cost and health effectiveness of drugs and health technologies and identifies and promotes best practices, plans to implement this national Health Technology Strategy 1.0

Economic Environment and Funding Arrangements

The Significance of Economic Evaluations

In order for policy makers to justify their decisions regarding which ICT or ICT-enabled technology to fund, they must demonstrate an understanding of the economic impact of their decision. Economic evaluations "identify, measure, value, and compare the costs and consequences of alternatives being considered to inform value for money judgments about an intervention or program" (CADT, 2006, p.1). In relation to technological innovation, economic evaluations assist policy decision-making in relation to the uptake of ICTs in the following areas

- The funding of ICTs and ICT-enabled home care programs and services,;

- The pricing regulations concerning ICTs and ICT-enabled services manufacturers;

- The establishment of priorities for research and development funding;

- The evaluation of ICTs and ICT-enabled home care programs and services post-marketing or after they have been utilized in the real world (CADT, 2006).

Economic evaluations also assist policy makers in that they can demonstrate the potential market for technological innovations as well as the effectiveness of innovative approaches to health care services. As previously discussed, the lack of RCTs supporting the cost-effectiveness of these technologies has impeded the decision-making process because policy makers lack evidence-based research to justify the redistribution of funds away from traditional care models.

The Sustainability of Canada's Health Care System

With the financial crisis of 2008 and the first wave of baby boomers turning 65 years old in 2011, concern about the sustainability of Canada's health care system has markedly increased (Chappell & Hollander, 2013). To recap, the concern is that Canada's aging population will inevitably lead to greater demands for health care services and accelerated growth in health spending (CIHI, 2011b). While the effects of population aging vary across Canada, overall, this demographic shift has been a very modest cost driver, contributing an annual average growth of only 0.8% (CIHI, 2011b). Canada's health care system is financed through a combination of the public sector, which involves the governments, and the private sector, which involves primarily private insurance and out-of-pocket payments (CIHI, 2011b). Since 2007, the public sector's share of total health expenditure has remained relatively constant at approximately 70%, with 65% coming from provincial/territorial governments and 5% from federal/municipal governments (CIHI, 2011b; CIHI, 2013). In 2013, it is estimated that the public sector spent $148.2 billion on health care (CIHI, 2014). The Conference Board of Canada (2012) estimates that in 2010 total spending on home and community care, including informal support, ranged from $8.9 billion to $10.5 billion, which is roughly 4.6 and 5.5% of total health spending (Hermus, Stonebridge, Theriault, & Bounajm, 2012).

According to the Canadian Institution for Health Information (2013), recent data suggest three main trends in Canada's health spending, including: slower growth in total

health expenditure; an unchanging division of health spending between public and private sectors for over a decade, and slower growth in hospitals, drugs, and physician services (CIHI, 2013). Total spending on health care in Canada reached approximately $211 billion in 2013, or $5,988 per person. After adjusting for inflation and population growth, total health spending actually decreased by an average of 0.2% in the past three years (CIHI, 2013).

This emerging downward trend can be attributed to Canada's modest economic growth and government efforts to balance budgets since the economic crisis of 2008 (CIHI, 2013). Within this economic climate, innovative prospects for economic growth, such as telehealth, are of great value. Recent economic inquiries have focused on the market for telehealth within the Canadian context.

Telehealth: An Opportunity for the Canadian Economy

As Canada's population ages, there is growing concern that this demographic shift will lead to increasing demands for health care services and thus substantial growth of health spending; however, contrary to apocalyptic projections, population aging was a moderate contributor to Canada's health care expenditure, adding only 1% to the annual growth (CIHI, 2011b). Aging contributed to an annual average rate of growth of only 0.6% to physician spending; however, in terms of long-term institutional care it contributed 2.3% (CIHI, 2011b). A neo-liberalism perspective presents the socio-demographic composition of Canada as an opportunity for economic growth in relation to the telehealth industry. There is an increased demand for specialized goods and services that target older adults and their needs. The development of ICTs as solutions to the problems associated with the aging presents market opportunities. Telehealth' has emerged as a solution to the challenges associated with population aging. By funding telehealth programs, economic growth will occur in other sectors as well. For example, as the demand for telehealth increases, new telehealth companies will emerge in order meet this demand and/or existing companies will be forced to hire new employees. While the telehealth industry may see profits, the Canadian government expects to see savings with the implementation of ICT-enabled services such as telehealth.

In recent decades, the Canadian government has begun to recognize the potential of ICTs not only for meeting the preference of AIP, but also for cutting health care related costs. To date, it has invested $2.10 billion dollars in the Canada Health Infoway implementation program for telehealth and EHRs based on potential health-related benefits as well as economic-related benefits. The rational being, ICTs will reduce costs associated with health care delivery while increasing the efficiency of services.

Provincial Telehealth Programs

Telehealth is beginning to gain momentum within provincial home care programs. This growth is at least partially due to a surge in the number of initiatives in this area. In 2001, the National Institute for Telehealth Guidelines (NIFTE) developed a national framework that established standards for health professionals, providers, and accrediting agencies (Jarvis-Selinger et al., 2010). The 2003 First Ministers' Accord on Health Care Renewal asserted that the further development of telehealth should be prioritized given its critical importance to delivering of health care services across geographical, cultural, and socio-economic barriers (CHI, 2013; Health Council of Canada, 2012). As a result, in the *2004 10 Year Plan to Strengthen Health Care,* the federal government committed to working with Canada Health Infoway to accelerate the implementation of telehealth (Health Council of Canada, 2012).

A 2012 progress report indicated that since 2004, every province and territory had developed and implemented various levels of telehealth initiatives, except for Prince Edward Island. For example, while the Ontario Telemedicine Network encompasses a broad strategy that focuses on telemedicine in health care delivery and care education, Nova Scotia integrates telehealth in relation to primary health care and emergency care as a part of the Better Care Sooner Plan. Other jurisdictions use telehealth for non-emergency services through phone and web applications (COACH, 2013). British Columbia's BC NurseLIne is an example of a non-emergency telehealth program. This tele-triage nurse call program offers support to residents in relation to palliative care and pharmaceutical services during off hours in 130 different languages (CHCA, 2008). Over the telehealth study period, British Columbia, New Brunswick, Ontario, and Quebec

reported an estimated hospital savings of $915,000 in emergency department visit and $20 million in in-patient costs (Health Council of Canada, 2012).

Currently, telehealth services are increasingly being applied in the home care sector. Examples of home telehealth applications include: consultations between health professionals and patients; lifestyle change support; and patient vital signs monitoring (Jarvis-Sellinger et al. 2010). These applications indicate a shift towards utilizing this technology to support home and community care's prevention-maintenance function. The 2013 CIHI report identified five jurisdictions that had implemented home telehealth programs, British Columbia, Ontario, Quebec, New Brunswick, and Yukon Territory. According to this report, home telehealth includes the use of home-based equipment, such as fixed equipment, tablets, or smart phones, to monitor a patient's medical condition. Two chronic conditions, congestive heart failure (CHF) and chronic obstructive disease (COPD) dominated home monitoring telehealth programs. The rate of growth in home telehealth monitoring was below the growth of telehealth services, despite the fact that the number of people with one or more chronic disease is increasing while the number of home and community support workers is decreasing (CHI, 2013). Future policy initiatives should address this disjointedness between the needs of older adults, the lack of human resources, and the advancement of advantageous technologies.

The variation in telehealth programs across the country is the result of two underlying factors. Firstly, it is the result the British North American Act's distribution of health care power in favour of provincial governments, whereby each province determines how health care is delivered. Secondly, this variation reflects diversity within telehealth. As mobile technology advances, telehealth is expanding to various settings, including hospitals, clinics, ambulances, prisons, and the home (Jarvis-Selinger et al., 2010). The potential of telehealth is limited only by the technology. It encompasses a broad definition of technology-enabled health care services, and these services will expand with the advancements of technology.

Funding Arrangements

According to Branham Group's "eHealth in Canadian Hospitals Study" health care organizations spend approximately 17% of their budgets on new initiatives, which means that 80% of healthcare ICT budgets are used to maintain existing infrastructures (2006). While the provincial and territorial governments have the majority of power over health care delivery and services in Canada, the federal government provides funding support through transfer payments. In addition numerous federal programs have been established to promote research within the home and community care and the ICT sector; however, more funding is necessary.

The federal government uses contribution programs as a lever for health care discussions. The Health Care Policy Contribution Program (HCPCP) is a national program designed to address current and emerging health care priorities through policy research and analysis, evidence-based pilot projects, and evaluations (Health Canada, 2010). Contributions fund non-profit, non-governmental organizations, professional associations, educational institutions, and provincial, territorial and local governments, in order to develop, implement and disseminate knowledge, best practices and strategies for innovative health care delivery. Key areas the HCPCP support include:: health human resources, the integration of internationally educated health professionals, access to health care and reduction in wait times, primary health care and chronic disease management, home and community care, quality care and patient safety, and palliative and end-of-life care (Health Canada, 2011).

Technological Infrastructure and Innovation

In order to advance the innovation and uptake of ICTs for AIP, a sound technological infrastructure is required. The 2001 National Broadband Task Force (NBTF) and Telecommunications Policy Review Panel (2006) proposed the implementation of direct investments or subsidies for private operators that are focused on mitigating the urban-rural digital divide. As of 2013, the federal government has done neither. Recently, the Canadian government committed to expanding the technological infrastructure with Canada's Economic Action Plan providing $225 million to expanding

broadband. Through the Broadband Canada: Connecting Rural Canadians initiative, millions of dollars have been invested into Canada's ICT infrastructure and programs. In addition, the Digital Canada 150 strategy is a comprehensive approach to ensuring Canada is well situated in the new digital age by providing connectivity to its citizens (Government of Canada, 2014).

The goal is to encourage ICT growth, adoption, application and innovation; ICT integration and innovation lacks in Canada at least partially due to inadequate investment in ICT (Government of Canada, 2014). Several federal funding programs to support ICT growth and innovation have emerged. The Canadian Innovation Commercialization Program is part of the Economic Plan of 2012. Under this program, the Canadian government is the first user of technologies before they are marketed to consumers. It should be noted that concerns about privacy and security tend to dominate legal discussions concerning ICTs. The Government of Canada is currently applying a new legal framework to protect the online marketplace (2014)

Legal, Ethical, and Cultural Issues

The use of ICT for health care delivery raises unique legal, ethical, and cultural issues. The transmission of sensitive information and data over the Internet causes concern over confidential communication and privacy. The EHR's storage and communication of health, contact, and identification data create issues of security. The use of telemonitoring also creates issues concerning privacy.

Canada is a diverse country, and this diversity has cultural implications for ICTs in health care. Officially, Canada is bilingual; unofficially, it is a nation of immigrant and many different languages. Technologies such as telehealth should seek to accommodate different languages. British Columbia's NurseLine offers services in over a hundred languages. In addition research and develop should consider the nuances and differences in culture during the design process. Involving older adults in the user-centered design process will help to insure this.

Legislative Foundations of the Health Care System

In order to gain a better understanding of policies on ICT and AIP this project examines the legislative foundation of Canada's health care system in relation to home and community care. The Act outlines the primary object of Canadian health care policy, which is "to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers".

While the Canada Health Act is inclusive in theory, in application it is increasingly restrictive. The use of the term "medically necessary" as the defining criteria for publically funded health services has limited the scope of coverage within an evolving health care landscape. The Act defines "medically necessary" as health care services medically required and rendered by physicians or health care practitioners within the hospital setting (Parliament of Canada, 2002). Provinces are not required to insure health promotion and/or prevention services or non-hospital based health care services performed by non-physician health care practitioners, such as psychologists or physiotherapists (Emery & Kneebone, 2013; Madore, 2005). Non-physician medical services, which are covered in the hospital setting, are no longer insured once the location of care moves out of the hospital, despite the fact that they may still be "medically necessary" (CHA, 2009). Consequently, the five national principles do not apply to extended health care services, such as home and community care (Madore, 2005).

The Canada Health Act has also become more restrictive because it applies to a shrinking number of services as fewer services are performed in hospitals (Ceci & Purkis, 2011; Madore, 2005). The preferred location of care has shifted from the hospital to the home (Ceci & Purkis, 2011). Recent fiscal pressures to provide cost-effective care as well as medical and technological advances enabling the delivery of care services within the home has influenced this shift in preferred location of care from hospital to home (Ceci & Purkis, 2011). While the home has always been an important site of informal care, it is becoming an increasingly important location for formal health care services (Ceci & Purkis, 2011). In response to this shift, reliance on extended

health care services has increased across the nation; however, these services do not qualify as medically necessary under the Canada Health Act (Ceci & Purkis, 2011). Consequently, these services do not have to abide by the national principles of accessibility, comprehensiveness, and universality, and are therefore not necessarily available to all Canadians in a timely and financially feasible manner (Madore, 2005). Since the early 1990s, commissions and reforms have influenced the development of the health care system.

Currently, the health care system supports episodic conditions by providing public funding to short-term interventions in a hospital setting or by a physician (Duncan & Reutter, 2006). Not only is this reactive system failing to meet the complex needs older adults, it is also straining health and financial resources (Duncan & Reutter, 2006). The present state of the Canadian health care system is the result of a decade long restructuring of public health services (Duncan & Reutter, 2006). Regionalization involved developing regional structures for the governance and administration of health care services and organizations so that regional health care systems could be more responsive to local priorities (Born, Sullivan, & Bear, 2013).. The health regions interact with the Ministry of Health as opposed to hundreds of hospitals and health care providers (Born et al., 2013). Policy agendas associated with this restructuring have included "shifts to regional governance, institutional downsizing, and an insidious erosion of community care and public health systems" (Duncan & Reutter, 2006, p.242). The following section will review the policies influencing the opportunity to AIP in Alberta and British Columbia.

Policy Review of British Columbia and Alberta

In order for older adults to AIP, governments need to create a policy ecosystem that provides the appropriate support and care, while also enabling connectivity to ICT-enabled services, such as telehealth. Since

> there is no guarantee that innovations will appear when and where they are most needed, or at a price that reflects all environmental and social externalities associated with their deployment. Governments need to create a policy environment that provides the right signals to innovators and users of technology

processes, both domestically and internationally; to fund basic research; and to support private initiatives in an appropriate manner" (OECD, p.25).

British Columbia and Alberta have both sought to create AIP supportive environments; however, they have taken different avenues.

Alberta

Alberta was one of the first provinces to apply the regionalization to their health care system during the 1990s. The province saw increased rivalry between regions, increased waiting times, poor communication between organizations, and a lack of information sharing (Born et al., 2013). In response to these issues, the Alberta Health Services "experiment" consolidated the regions into a single origin of care that functions like a corporation even though government funded.

Alberta's Continuing Care Strategy for AIP dedicated funding to a broader application of the technologies that will connect older adults with and their health professionals, caregivers, and family members. The Alberta government successfully used a collaborative partnership between stakeholders in order to build the capacity for HTA in Alberta. The Advisory Committee on Health Technology (the Committee) includes: persons from the health ministry, health authorities, medical association, universities, and the provincial HTA agency. By

> bridging the realms of research, scientific evidence, and public policy analysis, allows the Government to make evidence informed decisions about the funding of health services. This process includes defined, close links between relevant policy areas, organizations undertaking HTA, and advisory groups (Borowski, Brehaut, & Hailey, 200, p.156).

It advises on: criteria for selecting technologies for review, procedures for conducting reviews, linkages with related activities and processes, recommends technologies for provincial review, and comments on findings from the reviews.

Alberta is at the forefront with its commitment to providing broadband connectivity. The government invested $190 million in its SuperNet program, which is a high capacity fibre and fixed wireless backbone network that connects public facilities

(Rajabium & Middleton, 2013). The provincial government supplied the program with an additional $10 million in 2009 to assist with deploying wireless broadband networks (Rajabium & Middleton, 2013). Adding another $15 million, the Final Mile Rural Connectivity Initiative committed implemented a multistage program. Local governments and network providers are funded under this program to extend connectivity to households that still lacking broadband services (Rajabium & Middleton, 2013). The established ICT infrastructure has created a base for ehealth development. Alberta's provincial EHR has almost been completed. In addition, Alberta Telehealth is of the largest integrated telehealth networks in North America. It uses videoconference technology to connect Albertans with the best possible health care. It is funded through donor contributions, Alberta Health and Wellness, Alberta Health Services and Health Canada First Nations and Inuit Health Branch, and Canada Health Infoway strategic investments.

British Columbia

Alberta has created a policy environment that is supportive of AIP and the use of ICTs. British Columbia has attempted to improve quality of care with the Integrated Primary and Community Care Initiative. This initiative integrates hospitals, primary care, home and community care, and mental health services in the health care planning process. It targets those with high needs, such as older adults with chronic conditions. Barriers to increasing collaboration include: structural barriers of funding and location of providers, and the lack of streamlined information sharing processes.

The regionalization of British Columbia's health care system has resulted in many rural hospitals either reducing or eliminating their services (Duncan & Retter, 2006). This downsizing has led to limited access to emergency services, physicians, and pharmacies (Duncan & Retter, 2006). Consequently, dependency on informal support networks, such as family members, friends, neighbours, and community groups, has increased; however, reliance on younger generations for support is a short term solution since many are migrating to urban centres (Duncan & Retter, 2006: Hanlon & Halseth, 2005). The lack of acceptable, accessible, and reliable formal services has resulted in

rural caregivers reporting a lower use of such services as compared to urban caregivers (Duncan & Retter, 2006).

British Columbia's government has recognized the importance of broadband Internet for connectivity for connecting rural older adults and has invested in establishing an ICT infrastructure. The government entered into 2006 Connecting Communities Agreement and the 2011 Connecting British Columbia Agreement with Teleus (Rajabium & Middleton, 2013). Under this contractual solution to connectivity, Teleus provides wholesale access services in 120 communities and the provincial government (Rajabium & Middleton, 2013). Unlike Alberta, British Columbia did not make direct investments. Under B.C.'s contractual solution to promoting connectivity, TELUS agreed to maintain points-of-presence in approximately 120 communities, offer affordable wholesale access services to third party Internet service providers, upgrade network facilities, and improve rural broadband speeds. In return, the B.C. government entered into a 10 year procurement contract with TELUS covering a wide range of telecommunications and information technology services (e.g. long distance, data, cellular, strategic services) for core ministries, health authorities, and various other public entities. Under the Community Network Infrastructure Grants Program and the Connecting Citizens Grant Program, local infrastructures were enhanced. The BC government's arrangement with TELUS represented "an innovative contractual instrument for enabling connectivity;" however, procurement lock-ins prevent bidding among the public sector, which can result in increased costs (Rajabium & Middleton, 2013, p.15). The ICT infrastructure has provided the base for telehealth service in British Columbia. There are currently 20 clinical telehealth program areas, including oncology, mental health/psychiatry, thoracic surgery, homecare, renal, rheumatology and wound care, as well as special services for children

Canada's Health Infostructure

Both Alberta and British Columbia have created policy environments that support the uptake of ICTs, such as telehealth, to better enable older adults to AIP; however, the availability of home and community care varies across provinces. In order to meet the

challenges of aging of population aging, the individual provinces and Canada as a nation must establish comprehensive health infrastructures. Health infostructure refers to

the development and adoption of modern systems of information and communications technologies (ICTs) in the Canadian health care system. Such an infostructure will allow the people of Canada (the general public, patients and caregivers, as well as health care providers, health managers, health policymakers and health researchers) to communicate with each other and assist them to make informed decisions about their own health, the health of others, and Canada's health system" (Health Canada, 2007, para.2)

While the policy environment is becoming more encouraging for AIP with federal funding of the Canada Health Infoway and contributory funding programs in innovation, greater support for home and community care services are necessary. Policy should address the challenges facing home and community care services and providers, such as its medicalization, diminishing supply of human resources, and difficulty providing care to rural and remote communities.

Chapter 7.   Discussion

In order to address the needs of a rapidly aging population, practitioners and policy analysts increasingly acknowledge the need of more comprehensive and coordinated strategies. new and innovative approaches to making aging in place a more realistic option for many people. According to the Canadian Home Care Association (2008) home and community care's greatest challenge is that it must deliver the best home health care services possible while maintaining operational efficiency. The CHCA (2008) supports innovative technologies, such as ICTs, as providing vital solutions to this challenge. This growing support of technology's ability to expand and support home and community care emerges in recent gerontechnological research. Kitchener and colleagues (2008) reviewed [4]previous research on AT in relation to medicare programs in the United States. Five main themes were identified from this study. These themes include the documentation of: increased AT use generally and examination of specific device efficiency; importance of appropriate training and reduction stigma associated with device use for the adoption of AT in the community; outcome reports of AT and improved functioning, reduced isolation, and improved quality of life, lower costs for paid home care, and reduced caregiver burden; and findings suggesting that simple AT may substitute for informal care and more complex AT may supplement formal care (Kitchener et al., 2008). The desire to create better opportunities for AIP resonates among these themes as the underlying goal.

According to Mahmood and colleagues (2008), gerontechnological development is fuelled by the desire of older adults to AIP combined with their increasing need for assistance in daily activities. As previously discussed, home and community care is a crucial component of the health care system in regards to AIP. When properly utilized, these services prevent, delay, or substitute institutional long term services by addressing needs specifically associated with a medical diagnosis, compensating for functional deficits, and providing social and supportive services (Stephenson & Sawyer, 2002).

Increasingly, technology is being described as the "missing link" between home care, other health care sectors, and the public (CHCA, 2008). Recent research stresses the potential of ICT within home and community care. Information and communication technologies include electronic health records, telehealth, home telemonitoring devices, and electronic reminders (CHA, 2009). The CHCA (2008) argues that ICT can stimulate electronic connectivity through the use of telehealth and other eHealth initiatives such as the Electronic Health Record. By providing opportunities to increase efficiency of information exchanges, improve the quality and coordination of care, and improve capacity to support individuals to remain independent at home and within the community. In addition, ICTs can increase the potential of optimal AIP by enabling older adults to continue performing daily activities through the Internet. They can shop, pay bills, play cards or other games, obtain health information and education, and even fill prescriptions online.

ICT's potential lies in its ability to assist both the aging individual and the home care provider. Using ICTs, the aging individual is able to remain at home with greater peace of mind, through increased ability to self-monitor and manage conditions, which decreases hospital visits (CHA, 2009). In regards to home care providers, ICT assists with monitoring and managing patients' health conditions; improving productivity by increasing the number of patients they can monitor; accessing and exchanging information more efficiently; decreasing time spent on paperwork; collecting and evaluating data; reducing errors, duplication, and administrative cots; obtaining diagnostic results in a more timely manner; and improving the quality and coordination of care (CHA, 2009). Improved integration of knowledge through the establishment of electronic connectivity may also result in a higher level of confidence among home care providers (CHCA, 2009). By establishing connectedness, ICT creates opportunities to address critical issues emerging within the home and community care sector. As previously discussed, these issues include: the medicalization of home care; the availability of human resources; and the provision of care to rural and remote seniors.

Technological advancements are often presented as a contributing to the medicalization of home care; however, this is a very limited view of the dynamic relationship between technology and home care. To a certain extent, technology does

contribute to the medicalization of home care since it is essential for many home health care services, such as nursing and rehabilitation. ICTs, such as medication reminders, support independence and self-care; however, the accumulation of these technologies can potentially transform the experience of the space from a home to an institutional environment. The desire to minimize this effect has influenced the evolution of AT to include more discreet devices and systems such as ambient assisted living systems. Provincial favouritism of home care services, which are more technological than home support services, has also been associated with the medicalization of home care. These aspects of technology in home care support a bio-medical approach that emphasizes the impairments of older adults and medicalizes aging as a disease (Greenhalgh et al., 2012).

Technology's potential to minimalize the medicalization of home care by supporting the prevention-maintenance function is often overlooked. Recent research emphasizes the potential of ICT in relation to the prevention-maintenance function of home and community care.(ref) ICTs benefit home support services by connecting care providers and older adults and by increasing awareness of programs and services within the community. These technologies also increase access to health information, which is a vital component of health promotion.

In addition, technological advancements may alleviate concerns related to the availability of human resources and the difficulty of providing care to rural seniors. ICTs create and environment of electronic connectivity, which can increase the number of clients each home care provider monitors and manages. The implementation of telehealth within home care programs enables older adults to see and talk to health care providers through video conferencing over a secure network (COACH, 2013). Telehealth has the potential to create more efficient health services by eliminating or reducing the time home care providers spent traveling under traditional delivery program (COACH, 2013). This increases the ability of providers and seniors to make appropriate and timely health care decisions. Providers can utilize saved time productively by attending to other clients or attending educational and training seminars. Telehealth increases the accessibility, timeliness, productivity, quality, and convenience of home and community care services (COACH, 2013). Consequently, its inclusion as a core component of

home care may address many of the grievances expressed by home care and support providers by creating a more favourable work environment. With time this may result in more people entering the home and community care sector.

While the declining availability of human resources affects all aspects of the home and community care sector, it is especially detrimental to older adults residing in rural communities. Research indicates that service delivery to rural communities has always been a difficult task for home and community care programs (Mitchell et al., 2006). Geographic distance, weather, limited transportation, increased costs of travel, and inadequate technological infrastructure hinder the ability of home care providers to reach rural older adults (Forbes & Edge, 2009). Without innovative innovations, such as information and communication technologies, that connect rural seniors with home and community care services, aging in place may seem unattainable or undesirable. Telehealth is proving to bridge these gaps in the health care system. Telehealth may alleviate the effects of a shrinking labour force. In addition, telehealth eliminates distance barriers and thus improves equity of access to services that would otherwise not be available in rural and remote communities (COACH, 2013).

While telehealth is crucial for the delivery of home and community care services to rural areas, it is dependent on the existence of technological infrastructures that support information and communication technologies. Despite the fact that Canada has one of the most advanced ICT infrastructures in the world, much of its rural and remote communities do not have reliable and sustainable access broadband Internet (Ramirez, 2001). However, the Canadian government has recently implemented a plan to provide broadband Internet to rural and remote communities.

Technological advancements have the potential to create a more accessible and efficient home and community care system that supports prevention and health maintenance. The Canadian government recognizes the importance of assistive and information technologies in the success of home and community care programs. It also recognizes the importance of home and community services in meeting the long-term needs of older adults, thus increasing their ability to age in place. Despite this knowledge, Canadian decision makers have been slow to directly and strategically

invest in the integration of technology within home and community care on a policy level. However, policies that support access to ICT infrastructure and improve research and developing will foster innovative strategies to AIP.

Chapter 8.   Implications for the Future

This review suggests that Canadian initiatives incorporating ICT within home and community care programs in support of its prevention-maintenance function are sparse in terms of detailed policies. [5]Traditionally, initiatives support technology in terms of acute care services and the development of administrative applications such as electronic health records (CHCA, 2008). In order to create better opportunities for older adults to AIP, policy makers should address the underlying factors preventing the integration of technology into long-term home and community care.

A strategic shift in thinking and funding decisions must occur in order to adequately support home and community care through recent technological advancements. McAdam (2000) explains, "to ensure that the needs of seniors over the next decade will be met by the right programs and services at the right time, a paradigm shift from a system that prioritizes episodic, short-term interventions to one that supports long- term, comprehensive care" (p.4). This implies a shift in discourse from that of a bio-medical model that associates older adults with disease and medicalizes aging to a more inclusive and holistic discourse on aging and technology, such as WHO's social model of health and active aging (Greenhalgh et. al, 2012).

The active aging approach emphasizes the rights of older adults as active participants within society. It places value on technologies that support the rights and desires of older adults as well as health and safety issues. A user-driven research design that involves older adults at every stage of the research and development process recognizes older adults as active participants. By concentrating on initiatives that focus on treating health conditions, policy makers run the risk of perpetuating the medicalization of aging by presenting policies as solutions to the problem of aging. Future initiatives should apply the active aging approach and focus on supporting the abilities and desires of older adults. The integration of ICT and home and community

care should be strategically incorporated into policy initiatives a. In doing so, policies have the potential to reshape the ageist perception of aging from a period of decline to one of possibilities.

Evidence of a shift in strategic thinking is gradually occurring on a provincial level as use of telehealth within the home increases; however, this is a recent development. Long term home and community care is still considered an extended service. The inclusion of telehealth and ICT has followed a similar path. VONC (2008) explains, "although there are currently pockets of innovation in the sector, they are very much the result of ad hoc investments of pilot funding from governments, technology vendors, and home care organizations" (p.17). For instance, Canada Health Infoway did not include the home environment in their implementation plan of Canada's electronic health records (CHCA, 2008; VONC, 2008).

Another area of concern for policy makers is the readiness of communities, health care organizations, older adults, and service providers to accept and adopt AT and ICT applications of home and communication care. Just because the technology exists does not guarantee its success. Literature addressing the readiness of these stakeholders is limited and often focuses on the ageist assumption that older adults will resist new technologies (VONC, 2008). The circumstances surround the readiness of older adults, as well as communities, health care organizations, and service providers should be investigated further. In addition, policy makers should acknowledge that gerontechnologies are increasingly reliant upon the existence of technological infrastructure such as broadband Internet. This is especially true for rural and remote communities where older adults may be ready for telehealth services but the technological infrastructure is not. As technologies continue to advance, readiness becomes an issue of digital divide. Innovative technology may become available before the infrastructure is in place. In addition, service providers may require additional training before the new technology can be applied to the home setting. Consequently, the issue of digital divide should be readdressed continuously as well as the policies implementing the technological infrastructures.

Throughout the literature, the lack of standardization in the field of technology and aging emerges as an important issue for policy makers to consider when examining research. An example is Canada's Health Informatics Association (COACH)'s 2013 *Canadian Telehealth Report* examines the data obtained from the CTF surveys. This report allows for comparisons between jurisdictions; however, it cautions that the structuring of the telehealth programs and the taxonomy and scope of data varies depending on the province. As a result, in some cases jurisdictions' regional and hospital based data were combined. These factors made collecting and comparing data across provinces difficult. Policy makers should keep these data collection and reporting issues in mind when creating new initiatives that integrate technology and home and community care. They should be cautious when evaluating the efficacy of programs, services, and technologies in relation to possible initiatives. In addition, they should consider the need for national standards that incorporate technology into the home care sector. These issues, while not exhaustive, are of vital importance to policy makers if they choose to create initiatives that integrate ICT within the home and community care sector.

Future initiatives should implement a technology strategy specifically designed for the home and community care sector with emphasis on its prevention-maintenance function. Recommendations based on this analysis include: broadening Canada Health Infoway's to include the key components of home and community care; direct funding towards preventative and maintenance aspect of the sector through home telehealth programs; invest in the education and training of home care providers; and support research on the outcomes and effectiveness of new technology applications and its impacts on health human resource utilization and empowerment.

Chapter 9.   Conclusion

Despite its exclusion from the Canada Health Act, research emphases that home and community care plays a crucial role in Canada's health care system. Not only do these services help to maintain and enhance the health of Canadians, they also create supportive environments that increase opportunities for AIP. In addition, gerontechnological research increasingly stresses the potential of ICT to enhance these services. The accessibility of home and community care and technological support creates an environment in which older adults are better able to live within their preferred surroundings by: increasing autonomy, self-confidence, and mobility; increasing or maintaining health and functional capacity; promoting active and healthy lifestyles, thus reducing the risk of disability and institutionalization; enhancing security; preventing social isolation; and maintaining support networks (AAL Joint Programme, 2009; Beech & Roberts, 2008).

Technological advancements, especially ICT, are gaining recognition as benefiting home and community care by improving the quality, accessibility, productivity, and convenience of these services. By improving access to resources and facilitating the sharing of information and care management, ICT supports aging Canadians with mobility issues and those residing in rural or remote areas. In addition, the use of technology to automate certain tasks enables care providers to be more efficient and effective thus addressing the issue of declining human resources within this sector. ICT is also beneficial in that it contributes to the overall integration of the health care system through the adoption of electronic health records. Lastly, ICT can facilitate data collection to support planning and evaluation of home and health care programs. This list of benefits is by no means exhaustive, and it will continue to grow with advancements in technology.

Throughout this analysis, the underlying factors contributing to the lack of strategic investment integrating ICTs with home and community care emerge as hindering older adults from AIP. Strategic thinking must evolve from a bio-medical approach to a more inclusive and holistic active aging approach in regards to this issue. More emphasis should be placed on the role technology can play in supporting the prevention-maintenance function of home and community care as opposed to its substitution functions. In addition, future initiatives should implement a technology strategy specifically intended for the home and community care sector. By supporting home and community care services that enable older adults to purposefully age in place, proactive policies encouraging the use of preventative interventions, such as ICTs, can enhance older adults' quality of life while also improving the cost-effectiveness of the Canadian health care system.

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