



Mortality and Longevity



Aging and Retirement

# Health and Social Care Analysis Regarding the State of Canadian Women Living in the Alone Stage of Retirement



# Health and Social Care Analysis Regarding the State of Canadian Women Living in the Alone Stage of Retirement

**AUTHOR**

Douglas Andrews, FSA, FCIA, Ph.D.  
University of Waterloo

Lori Curtis, Ph.D.  
University of Waterloo

**SPONSOR**

Society of Actuaries:  
Aging and Retirement Research  
Committee on Life Insurance Research  
Financial Reporting Section  
Mortality and Longevity Research  
Product Development Section  
Reinsurance Section

**Caveat and Disclaimer**

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the Society of Actuaries or its members. The Society of Actuaries makes no representation or warranty to the accuracy of the information.

Copyright © 2020 by the Society of Actuaries. All rights reserved.

# CONTENTS

<b>Abstract</b> .....	<b>3</b>
<b>Section 1: Introduction</b> .....	<b>3</b>
<b>Section 2: Health, Social and Other Challenges</b> .....	<b>4</b>
<b>Section 3: Three Promising Developments</b> .....	<b>6</b>
3.1 Integrated Services .....	6
3.1.1 Aging in Place – Canada .....	6
3.1.2 The Netherlands - stichtings.....	7
3.1.3 The Eden Alternative.....	8
3.1.4 In Summary.....	8
3.2 Social Prescribing .....	8
3.2.1 Is it effective? .....	10
3.2.2 Potential benefits for the ASR .....	11
3.3 Robotics.....	12
3.3.1 Communication and Memory Aides .....	12
3.3.2 Mobility.....	13
3.3.3 Strength .....	13
3.3.4 Safety .....	13
3.3.5 Service.....	14
3.3.6 Healing and Health Development .....	14
3.3.7 Assessment.....	14
<b>Section 4: Areas for Future Research</b> .....	<b>15</b>
<b>Section 5: Conclusions</b> .....	<b>16</b>
<b>Section 6: Acknowledgements</b> .....	<b>17</b>
<b>Section 7: References</b> .....	<b>18</b>
<b>About The Society of Actuaries</b> .....	<b>19</b>

# Health and Social Care Analysis Regarding the State of Canadian Women Living in the Alone Stage of Retirement

## Abstract

Canadians are living substantially longer without increasing years of work; a longer retirement must be resourced within a stable working life. This paper provides results from a larger research` project studying the financial and social implications of providing health care, long-term care, and other support to an aging population. This paper examines the type of health, long-term care, and social supports older women living alone are likely to require and assesses the adequacy and availability of such support. A companion paper examines the financial requirements. This paper attempts to answer for this group of women such questions as: what mix of health care, long-term care and other supports might this group require; what are the likely gaps in care need and availability; will families and friends be expected to fill any gaps or is government action recommended; can robotics play a role while maintaining dignity? Although this research focuses on Canada many of its observations have global applications.

## Section 1: Introduction

Canadians are living substantially longer without increasing years of work; a longer retirement must be resourced within a stable working life. The literature recognizes 3 stages of retirement, early (ages 65 - 74 years), middle (ages 75 - 84 years), and late (ages 85 plus). Resource needs follow a U-shaped pattern. High while seniors are active; fall in the middle stage as retirees enjoy home routines; and higher again in the later stage, as health declines and daily living activities become more difficult. On average women expect to live longer than men, and those that marry tend to marry men who are older than themselves. Female baby boomers, more than previous cohorts, either divorced or are not married. Thus, a growing proportion of baby-boomer women will end up living alone at older ages with limited incomes as health and daily activity issues exacerbate. Towards the end of the middle and into the late stage of retirement, many women find themselves having to cope alone - 'the alone stage of retirement' (ASR).

A comprehensive literature review indicates that there were approximately 8,100 centenarians living in Canada in 2015, projected to double by 2031. The fastest growing age group in Canada is 90 years and over. Women gradually outnumber men in the older age groups (over 88% of centenarians are women). Senior poverty rates are increasing in Canada, particularly for women, after a long period of stability but the statistics are more dismal for those living alone (poverty rates grew by 3.2% for women living in families but 18.9% for those living alone). Despite these statistics, there has been little focus on ASR in general or the late stage of retirement specifically.

This paper identifies the types of non-financial issues that many Canadian women in the ASR are likely to face<sup>1</sup>. In a companion paper, entitled How Amending Old Age Security Would Improve the State of Canadian Women Living in the Alone Stage of Retirement, we discuss the financial issues that many Canadian women in the ASR will likely face

---

<sup>1</sup> More precisely, this paper identifies the types of non-financial issues that many Canadians living in the ASR are likely to face; however, the vast majority of Canadians living in the ASR are women. Consequently, the issues described are much more likely to be faced by women than by men. Section 2 of the companion paper provides a statistical overview of the portions of men and women living in various marital statuses and income levels.

and propose solutions. Taken together these two papers provide an outline of the challenges the “average Canadian woman living in the ASR” may experience both financially and otherwise. A wide range of non-financial issues that Canadian women in the ASR may confront, fall into broad categories such as accommodation, physical and mental health decline, personal care, transportation, long-term care, emotional support, and personal dignity. In this paper, we provide a brief description of such issues. Next, we provide a more in-depth analysis of three developments that provide promise in addressing some of the issues identified.

The paper is organized as follows. In Section 2, we provide information to describe the situation from a non-financial perspective in which women in the ASR may find themselves. In Section 3 we describe briefly significant challenges that many women in the ASR may face and then identify 3 of these issues for further discussion. This analysis draws on international practices and proposals. It discusses how adaptations might be required for the Canadian context and the limitations of the proposals. In Section 4 we discuss areas for further research. Section 5 concludes. Section 6 acknowledges the support that facilitated this research. Section 7 provides references.

## Section 2: Health, Social and Other Challenges

Those in the ASR may face a range of challenges. Some are similar to those faced by seniors in other stages of retirement, but others are unique to those in the ASR. Few individuals will face all of the challenges discussed herein and some may not experience any; but many individuals in the ASR will face several difficulties throughout the ASR. Sometimes the challenges may arise simultaneously, which can create additional stress and burden, e.g., as a result of a fall an individual has new medical requirements, is no longer mobile resulting in loss of independence, is then isolated from friends, and faces a requirement to move into a different and unfamiliar accommodation.

Throughout the period of the ASR there will be requirements for housing and accommodation. Most individuals prefer to age-in-place for as long as possible, remaining in their own home. However, at some point the home may prove unsuitable, perhaps being too large to be maintained, or inconveniently located for access to family and caregivers, or because a higher level of in-accommodation care is required. The decisions surrounding a change of accommodation will likely generate stress, as changes, even positive ones, are accompanied by stress<sup>2</sup>. Necessary changes may create conflict within the family unit as family members may hold differing opinions on what is necessary or may be asked to increase their support for the individual. When downsizing is required, it may bring a sense of loss as one is forced to part with familiar belongings that carry memories, or the prospect of age and eventual death becomes more prominent. At some point individuals may have to be institutionalized and this can be especially jarring, for multiple reasons, including removal from familiar circumstances, adjustment to new (and imposed) routines, and recognition that age is taking its toll.

One expects that throughout the ASR there may be changes in physical health that prove challenging. Many studies show that mobility is often a strong determinant of the quality of one’s life among the elderly, e.g., Davis et al. (2015). Researchers colloquially refer to three stages of retirement: go-go, slow-go, and no-go; each of which will have its own lifestyle options and/or requirements. On average, frailty increases as we age and for the frail a bad fall may dramatically change lifestyle and increase mortality (Fried et al., 2001). Moreover, the elderly tends to have multiple prescribed medications (Ouslander, 1981) and sometimes, this could lead to undesirable side effects and/or interactions.

---

<sup>2</sup> Some surveys suggest moving is one of life’s more stressful events, viz., <https://www.bustle.com/p/moving-is-one-of-the-most-stressful-life-events-a-new-study-says-but-here-are-7-ways-to-make-it-suck-less-11832166>

Individuals may also observe a change in mental health as they age. While mild cognitive impairment may not inhibit one's ability to live independently in the ASR or any stage of life, severe cognitive impairment such as dementia or Alzheimer's disease will and these conditions tend to increase with age at an increasing rate (Guerreiro and Bras, 2015). Even mild memory loss may alienate friends and family, create problems regarding medications (e.g., needing additional medications or forgetting to take as prescribed), or lead to safety concerns (e.g., leaving the stove on).

Emotional health may also change. Those living in the ASR who have lost spouses may experience bereavement and grief issues. Moreover, their loss may result in isolation by former companions who were used to experiencing the companionship in a "couple's setting", resulting in loss of social connection and feelings of loneliness or diminished self-worth or loss of social position and dignity.

Although discussed herein as three separate issues, changes in physical, mental and emotional health often occur simultaneously. Events arising within one category, e.g., having to use a wheelchair, may have significant implications for other forms of health, e.g., being seen in a wheelchair may create a feeling of loss of dignity and respect. The experience of the individual and those perceiving an individual with multiple issues may take on greater significance than what would be suggested by a linear sum of the significance of the issues.

Although Canada has a system of universal health care and has many agencies available to provide assistance with social, emotional and other challenges, it can be difficult for individuals to access the available services which might be supportive in their later life. A number of reasons for this include lack of knowledge of available services and how to access them; difficulty in obtaining necessary referrals from an appropriately certified professional; long waiting lists for some services; and transportation constraints due to geographic placement. Canada is a vast country and many parts are sparsely populated. There are special challenges for those living in remote and northern locations, where the nearest hospital or ambulance may be hours away.

This is particularly challenging for Indigenous people. As well as the consideration regarding remote locations, they often face greater challenges when separated from community, such as higher suicide rates. They may also face prejudice that may reduce the extent to which service is received or sought.

Finally, those who reach the ASR will have lived a long life and experienced significant changes over that life, which in itself may be stressful and difficult to cope with. Individuals who reach the ASR may live in the stage for a considerable period time, e.g., 20 years, and during this time change will continue. Throughout the 20<sup>th</sup> and 21<sup>st</sup> centuries there has been significant change, some of which has been disruptive, and there is general agreement that change will continue; although, there is debate about whether the pace of change is accelerating<sup>3</sup>, or follows a series of S-curves<sup>4</sup>, is exponential, or some other shape<sup>5</sup>. It can be difficult to remain flexible and open to change, particularly as it comes in so many different forms, such as changing medical and long-term health-care services, family relationships, and technology

---

<sup>3</sup> [https://www.nature.com/polopoly\\_fs/1.194311/menu/main/topColumns/topLeftColumn/pdf/530398a.pdf?origin=ppub](https://www.nature.com/polopoly_fs/1.194311/menu/main/topColumns/topLeftColumn/pdf/530398a.pdf?origin=ppub)

<sup>4</sup> <https://www.weforum.org/agenda/2018/08/change-is-not-accelerating-and-why-boring-companies-will-win/>

<sup>5</sup> [https://www.accelerationwatch.com/history\\_brief.html](https://www.accelerationwatch.com/history_brief.html)

## Section 3: Three Promising Developments

### 3.1 INTEGRATED SERVICES

An ongoing criticism of the Canadian health care system is that it is somewhat of a patchwork that is difficult for patients to access. Acute care, chronic care, nursing care, mental health care all tend to reside in separate siloes controlled by different professionals and it can be difficult to transition between siloes as conditions change; furthermore, if one needs to move between provinces the care is even more disjointed as, realistically, each province has its own health-care system<sup>6</sup>. Ontario, Canada’s most populous province and largest healthcare funder, announced early in 2019 that it would reform the health-care system by creating a new superagency and discontinuing six other agencies. One of the stated objectives of the reform was to reduce siloes and make access to care more patient-centric<sup>7</sup>. Even the outgoing government had announced changes to make the system more patient centric. In the Minister Christine Elliott’s own words:

“Yet we rank poorly - on critical factors such as wait times, quality of care, and system integration - compared to our provincial counterparts.

Right now, care is fragmented, particularly at transition points, for example, from hospital to home care.

Patients, families and caregivers experience frequent gaps in care, and have to reiterate their health concerns over and over again, because of a lack of digital tools and care continuity.

And for health care providers, they are each paid out of different funding envelopes and are discouraged from working together in teams.

The fact is that the value of our health care system is locked in siloes.”<sup>8</sup>

For those living in the ASR this can be particularly difficult. With the exception of some extreme acute care events, much of the care for those in the ASR relates to chronic conditions and a gradual deterioration of health, strength, mental capacity, and independence<sup>9</sup>.

#### 3.1.1 AGING IN PLACE – CANADA

For those in the ASR, it would be ideal to be able to remain in a familiar facility as one’s needs for assistance with the activities of daily living increase, or mild cognitive impairment progresses to severer dementia, or general health deteriorates; i.e., a facility to call home as one moves from little need for assistance to moderate care, to long-term care, and finally end-of-life care. As part of this research we contacted several providers and did site visits. The Village of Winston Park in Kitchener, Ontario, which is part of the Schlegel Villages chain<sup>10</sup>, provides a continuum of care from independent living through to institutionalized long-term care, within one complex divided into separate neighbourhoods. This appears to be the care model for those in the ASR to be emulated. Some other providers are delivering similar approaches or have plans to be able to deliver comparable services in the future.

<sup>6</sup> <http://www.cfp.ca/news/2017/08/09/808-1>

<sup>7</sup> Patient-centric health care has been under discussion in the U.S. for some years, see, for example, <https://www.practicefusion.com/blog/patient-centricity-as-a-healthcare-value/>

<sup>8</sup> From the announcement of the People’s Health Care Act 2019 <https://news.ontario.ca/mohltc/en/2019/02/minister-christine-elliotts-remarks-for-the-announcement-of-the-peoples-health-care-act-2019.html>

<sup>9</sup> [https://www.cma.ca/sites/default/files/2018-11/CMA\\_Policy\\_Health\\_and\\_Health\\_Care\\_for\\_an\\_Aging-Population\\_PD14-03-e\\_0.pdf](https://www.cma.ca/sites/default/files/2018-11/CMA_Policy_Health_and_Health_Care_for_an_Aging-Population_PD14-03-e_0.pdf)

<sup>10</sup> founded by Ron Schlegel who has made significant contributions to aging research at the University of Waterloo,

However, in investigating the cost of such care, we think it is likely to be affordable for only those living at the upper end of the wealth distribution. We estimated that for a stay in Winston Park of about 20 years starting with an independent lifestyle with some need for assistance with certain activities of daily living and a continuing deterioration to long-term care and death would require a net worth on entry of at least one-million Canadian dollars.

### 3.1.2 THE NETHERLANDS - STICHTINGS

On further investigation, we found that there is a continuum of care in the Netherlands that is more affordable at the patient level, from which Canada might learn. “Patient level” is important to note as we found that the Netherlands has one of the higher tax rates within the OECD, considerably higher than Canada. Certainly, the question of what services should be provided by government is one for the people of each country to make. Our view is that the timing and extent of health and long-term care requirements are not readily foreseeable; with an aging population the ability of the majority of individuals to be able to save sufficiently for their own requirements is precarious; and the Canada Health Act provides for necessary health care for all. So we would support greater government involvement to ensure that care with dignity is provided throughout life for all individuals.

The following anecdotal evidence regarding the Netherlands provides a description of a continuum of care desirable for those in the ASR. “Soon after my father’s passing in late 2005, my mother started showing early signs of memory loss. They lived in the small village where I was born which had some elder care options, but my brother and his wife decided it would be better for her to move to their (somewhat bigger) town where she could enter an assisted living facility within walking distance of their home. That was the start of the journey<sup>11</sup>. The housing units are designed for independent living with full kitchens, but there is daily follow up to ensure medications are being taken and general monitoring for any obvious changes in health status. She was very happy at this facility, but after a few years and some further cognitive assessments it was clear that a higher level of care was required.

This prompted a move to another similar elder-care facility<sup>12</sup> but this one offered a separate dementia ward, which is normally the end of the line. In this small town all the health care facilities are conveniently located in the same general area, so the move was very easy.

Both facilities are non-profit “stichtings”<sup>13</sup> a Dutch legal entity akin to a foundation, which appear to be overseen by government at the municipal or city level. Individuals desiring government support are required to undergo an evaluation, which is physical, mental, and financial. The required level of care is delivered, but individuals pay for care in accordance with an assessment of their ability to pay. On this model the required level of care is available throughout life but there may not be much of an estate on death, if any. However, there are private care options available at much higher costs for those who want an alternative option, usually housed in gorgeous old mansions in spectacular settings.”<sup>14</sup>

---

<sup>11</sup> <http://www.deulenpas.nl/>

<sup>12</sup> <https://www.innoforte-zorg.nl/ik-zoek-een-woning/lorentzhuis.aspx>

<sup>13</sup> <https://en.wikipedia.org/wiki/Stichting>

<sup>14</sup> Personal experience related by Peter VanderPlaat



### 3.1.3 THE EDEN ALTERNATIVE

Another form of integrated approach is the Eden Alternative, which describes itself as a non-profit 501(c)3 organization<sup>15</sup>. It originated in the U.S. about 20 years ago and has spread to 10 other countries including Canada and the United Kingdom. Its brochure<sup>16</sup> describes it as a principles-based philosophy that changes culture to create elder-centred communities. It attempts to address the loneliness, helplessness and boredom experienced by elders living in traditional settings by engaging the elders in the decision-making and care activities, as well as engaging other family members, children, and other caregivers in sharing caring with the elders. It can be applied to home or community-based care, as well as to long-term care settings.

Research that it<sup>17</sup> cites found successes in long-term care settings such as decreasing behavioural incidents, decreasing pressure sores, and decreasing staff absenteeism. Regarding its use in extended care the successes cited appear to relate to the operation of the facility and include reduced turnover among staff, decreased overtime, and fewer employee injuries. Regarding its use in home settings, the research found improved outlooks and positive changes in relationships among participants.

Part of the philosophy is the ongoing journey to establish a Human Habitat. Education plays an important role. In this regard there are training programs, newsletters, conferences and interested individuals may join a registry.

### 3.1.4 IN SUMMARY

In conclusion, it seems some will go without necessary, respectful care (as is currently the case<sup>18</sup>) unless we can put in place a system of continuous care throughout the ASR; a system delivering services from assistance with activities of daily living, through deteriorating physical and mental conditions (including cognitive impairment and dementia), through long-term care, to end of life palliative care. Such a support system needs to be available for those in need including those with limited or no wealth, To be affordable, the care will most likely have to run on a non profit or similar basis which means it will have to be government provided or heavily regulated. Otherwise, the system will likely be fragmented, siloed, and not patient-centric; as it is now.

## 3.2 SOCIAL PRESCRIBING

Social prescribing is being widely promoted and adopted by the UK National Health Service. In this section we provide a description of social prescribing, review the literature with respect to its use and effectiveness, and describe why it holds promise for addressing some of the challenges faced in dealing with people in the ASR.

Defining social prescribing is difficult. According to Bickerdike et al. (2016) “there is no widely agreed definition of social prescribing but the Social Prescribing Network defines it as ‘enabling healthcare professionals to refer patients to a link worker, to co-design a non-clinical social prescription to improve their health and wellbeing.’”<sup>19</sup> Key aspects of this definition appear to be the referral by a healthcare worker, such as a doctor, to another party – the link worker, who might be a volunteer or a paid individual, to provide connection to a non-clinical program that could improve health and well-being.

---

<sup>15</sup> <https://www.edenalt.org/about-the-eden-alternative/>

<sup>16</sup> Eden Alternative [www.edenalt.org](http://www.edenalt.org)

<sup>17</sup> ibid

<sup>18</sup> <http://www.ohrc.on.ca/en/time-action-advancing-human-rights-older-ontarians/elder-care>

<sup>19</sup> P1 citing a 2016 Report of the annual Social prescribing Network conference by the University of Westminster.

There are a wide-ranging set of non-clinical programs<sup>20</sup> that could provide information or services that might improve health or well-being, such as organizations that provide information about budgeting or that assist in accessing services that assist with activities of daily living. It might be referral to a support group or drop-in centre or a call line that could help reduce stress, trauma or loneliness. It might be to provide free passes to visit museums or galleries with a group to provide an activity or sense of connectedness. These are only examples and there are many possibilities.

Kimberlee (2013) presents information from a study of social prescribing in Bristol and defines three models of social prescribing: social prescribing light, social prescribing medium, and social prescribing holistic. His analysis indicates that social prescribing holistic is the preferred model, so the following information has been limited to a description of that model.

According to Kimberlee (2013), “for a project to be defined as *Social Prescribing Holistic* it must:

- have a clear GP/Primary Care referral process;
- have a local remit and have developed local knowledge of supportive organizations and events;
- be a jointly developed intervention which has been sustained over time;
- have a method to address beneficiary needs in a *holistic* way;
- not limit the amount of time a health facilitator/worker/officer spends with a referred beneficiary;
- address beneficiary well-being but anticipate that mental health needs may also be discovered. “

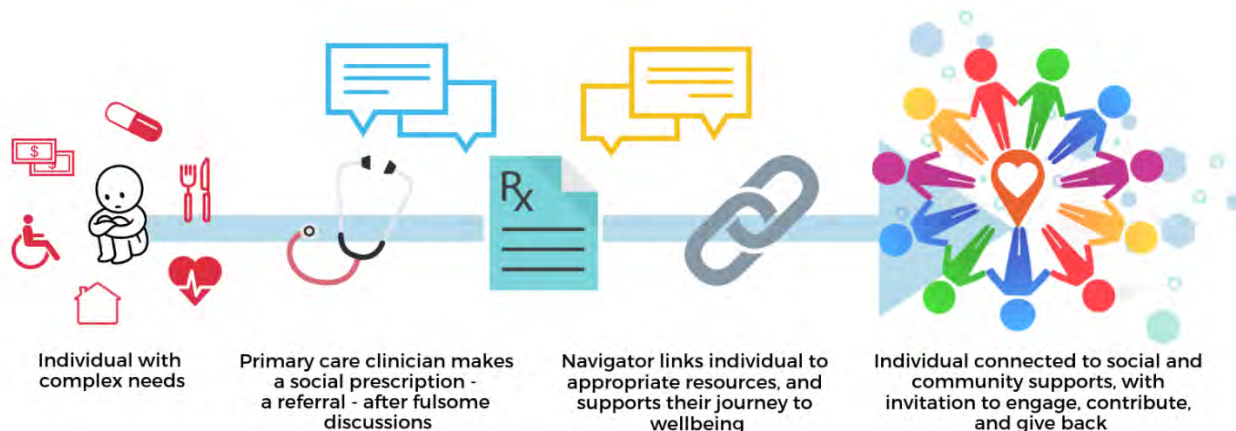
This definition includes the healthcare professional referral process and link to non-clinical programs noted above. But it adds that the programs must be local, that needs must be addressed holistically, and there be no limits on the referred workers time. In the further description Kimberlee notes that “no limits” is not necessary as long as the amount of support is extensive, e.g., for at least 12 months or some other appropriate time parameter. It also introduces the idea that mental health needs may be discovered.

Alliance for Healthier Communities<sup>21</sup> provides the following model. It notes that the overall model is similar but there may be slight differences in delivery and design depending on each local community’s needs and capacity

---

<sup>20</sup> See for example <https://www.allianceon.org/Rx-Community-Social-Prescribing>

<sup>21</sup> <https://www.allianceon.org/Rx-Community-Social-Prescribing>



Social prescribing’s usefulness with mental health, emotional and psychotherapy is stressed. In this regard it is suggested that it can be beneficial for the vulnerable and marginalized who may not be able to afford to access private mental health counselling and services for extended periods.

### 3.2.1 IS IT EFFECTIVE?

In his evaluation of social prescribing holistic programs in Bristol, Kimberlee (2013) reports that the qualitative evidence from interviews with participants is positive with large percentages of beneficiaries meeting personal ultimate goals, expressing satisfaction with self-development aims and self-management, and other reported positives such as less feeling of isolation, reduced suicide attempts or thoughts. Moreover, reports from GPs are generally positive in terms of the benefits from patients having achieved improved positive emotional and social states from non-clinical programs, leading to some reduction in visits to doctors’ offices (referred to as surgeries).

However, it is important to be cautious when interpreting these results, for a number of reasons. The information tends to come from interviews and reports. There is little use of randomized control groups. The time periods measured are quite short. The calculation of cost-effectiveness information is imprecise and difficult to interpret categorically.

Experiments with social prescribing have taken place in the UK for several decades. The best-known example of social prescribing holistic is Bromley by Bow in London that evolved out of the development of a local Healthy Living Centre built in 1999 (Kimberlee, 2013) but has a history dating back to 1984 (Stocks-Rankin et al., 2018). At Bromley by Bow Centre and Bromley by Bow Health Partnership the organizational character challenges conventional wisdom, tries to keep the approach simple and practical, and focused on creating a place that encourages human interaction and elevates the things that enable people to have a purpose to life over the simple acts of delivering a series of services (Stocks-Rankin et al., 2018).

Stocks-Rankin et al. (2018) studied the Bromley by Bow model, interviewed participants and staff, and provided recommendations on how such approaches could be evaluated robustly. The researchers acknowledge that it is perhaps the most complex community health model in the UK and that it firstly centres around addressing the social determinants of health but then has the additional focus of delivering high quality clinical services (Stocks-Rankin et al., 2018). Based on information gathered from participants and staff, the researchers find that it is successful in addressing social determinants of health; however, there is still work to be done to be able to provide robust qualitative and quantitative assessments of such approaches.

Similarly, Dayson and Bashir (2014) report very positive results from their evaluation of Rotherham Social Prescribing Pilot such as reductions in patients' use of hospital resources after they had been referred to Social Prescribing, a high percentage of patients reporting experiencing at least one positive change (e.g., feeling positive, looking after yourself, money), and positive reports on four broad themes of increased well-being, reduced social isolation and loneliness, increased independence, and access to wider welfare benefits. Moreover, Dayson and Bashir (2014) estimate sizable cost benefits and substantial returns on investment. Nonetheless they warn that the results should be viewed with caution because there are currently too few patients in the sample analyzed and too little time elapsed to produce findings that are statistically significant; nor is there a control group against which to compare Social Prescribing patients (Dayson and Bashir, 2014).

In this regard Bickerdike et al. (2016) conducted a systematic review of 9 databases from 2000 to January 2016 and include 15 evaluations of social prescribing programs that met their standards for inclusion. They observe that most evaluations were small scale and limited by poor design and reporting. All had a high risk of bias. Common design issues included a lack of comparative controls, short follow-up durations, a lack of standard and validated measuring tools, missing data and a failure to consider confounding factors. Despite clear methodological shortcomings, they observed (ibid) that most evaluations presented positive conclusions. They provide suggestions for researchers evaluating social prescribing programs in order to obtain robust evaluations. They do not establish that there is clear evidence that social prescribing is ineffective. They do report that the use of a link worker is a key feature of social prescribing. (Bickerdike et al., 2016).

There has been recent interest in Canada in social prescribing. A pilot project launched in Ontario, Canada's most populous province, in 2018 aims to connect patients to programs and services that address some of the broader determinants of health such as exercise, community involvement, and diet, but fall beyond the scope of medical practice. It is far too early to draw any conclusions regarding its effectiveness.

### 3.2.2 POTENTIAL BENEFITS FOR THE ASR

If well-designed social prescribing programs provide positive outcomes and are hypothesized to be cost effective, and there is not conclusive evidence that they do; then they could play an important role in addressing the situation of people in the ASR. The benefits for the participants include:

- getting links to available non-clinical programs and services;
- receiving support for emotional, mental, and social well-being issues associated with grief, isolation, lack of meaning, etc.;
- raising satisfaction with life through concrete changes in circumstances, enhanced confidence, and greater connection (Stocks-Rankin, 2018); and
- enhancing the sense of well-being through activity and interaction with others.

There are also potential benefits for the health care system, which include:

- reducing the burden on healthcare professionals by referrals for non-clinical programs and services;
- increasing the well-being of participants may reduce the costs associated with attempted suicides, self-harm, and depression; and
- balancing the care burden between healthcare professionals and other carers, creating greater efficiency and less stress.

A major obstacle to implementing social prescribing is that it is an innovative approach that must be delivered within a fragmented system with siloes. Questions arise such as: how will suitable link workers be identified; how will they connect with doctors; from where will funding for social prescribing come; will social prescribing initiatives be set up so that proper assessment of their effectiveness can be performed; will they be given sufficient time to determine where they may be most effective?

### 3.3 ROBOTICS

An increasingly common idea to address some of the needs of those in the ASR such as affordability, independence but support as necessary, and companionship is the purchase of a very large home or even neighbourhood by multiple individuals to share together<sup>22</sup>. While this may address some of the needs, there are others that remain such as mobility, requiring far more or a different type of support than others are able or willing to provide. One possible way of addressing some of these needs is through the use of robots. Japan, which has aged more rapidly than other countries, sees great potential in robotics. It also sees robotics as a critical step in filling the expected future labour shortages of caregivers and healthcare workers.

The University of Waterloo has many researchers involved in robotics and aging research<sup>23</sup>. We interviewed a number who are developing robotics to be used in aging and examined other sources to learn the extent that robotics is being developed. The following presents a synopsis of this information.

As the focus of this paper is on those living in the ASR, we have tried to categorize the robotics broadly by the types of assistance and problems being addressed for those in the ASR. Developments are described under six broad categories that we have created. We are unaware of any other categorization that is used in studying this research.

#### 3.3.1 COMMUNICATION AND MEMORY AIDES

These are robots that converse with individuals. They can be helpful in ensuring that prescribed medications are taken on time, in some forms of therapy, and in dealing with loneliness. They are touted as having a role in dealing with individuals with dementia and mental health issues. Individuals report feeling comfortable and able to open up in conversations with robots, without worrying that the party to which they are speaking may be judging them.

The field of social robots or sociable robots<sup>24</sup>, focuses on the development and design of robots which interact socially with humans. Social robots show ‘human social’ characteristics such as expressing emotions, conducting high level dialogue, learning, developing a personality, using natural cues, and developing social competencies. Pepper<sup>25</sup> by SoftBank Robotics is billed as the world’s first social humanoid robot able to recognize faces and basic human emotions. Pepper was optimized for human interaction and is able to engage with people through conversation and a touch screen.

There are other examples. Paro<sup>26</sup> is an interactive baby seal robot that offers emotional support, it responds to touch, light and speech; moves its head, blinks its eyes, plays recordings of seal cries. ElliQ<sup>27</sup> offers trivia, plays

<sup>22</sup> See for example <https://www.theglobeandmail.com/globe-investor/retirement/retire-housing/for-retiring-boomers-co-housing-is-a-livelier-way-of-growing-old/article27212717/>

<sup>23</sup> For an indication of the range of projects see <https://uwaterloo.ca/intelligent-technologies-wellness-independent-living/projects>

<sup>24</sup> An expression first coined by Aude Billard, Kerstin Dautenhahn and Cynthia Breazeal

<sup>25</sup> <https://www.softbankrobotics.com/emea/en/pepper>

<sup>26</sup> <https://www.independent.co.uk/arts-entertainment/photography/japan-robot-elderly-care-ageing-population-exercises-movement-a8295706.html>

<sup>27</sup> <https://elliq.com/>

music, suggests educational video lectures and encourages outside walks; it connects users with others through video or text and photo messaging. Mabu<sup>28</sup> is a 15-inch yellow robot that is focused on helping patients with congestive heart failure by tracking medications and activity level; it asks persons how they feel (verbal and text), inquires about their weight, and/or screens for anxiety and depression.

### 3.3.2 MOBILITY

One of the important limiting factors for an aging population is lack of mobility. Apparently, Toyota is investing heavily in the research and development of robotics to assist individual mobility. It has noted that with an aging population in Japan its sales of vehicles in the domestic market is declining but it sees an expanding market for individual mobility devices, in addition to the self-driving vehicle. SmartCane<sup>29</sup> and SmartWalker<sup>30</sup> are two examples of personal aid for mobility and monitoring (PAMM) systems and a number of designs of rollators are under development. SmartCane and the SmartWalker and such aids are designed to extend the stay of elderly in assisted living facilities. Both have been tested experimentally in eldercare facilities and have been shown to have high user acceptance.

### 3.3.3 STRENGTH

Many of the activities of daily living require a degree of strength, and lack thereof would limit an individual's ability to live independently. An individual's strength can also reduce the burden for those providing care and support (may also increase the burden if the client is not cooperative). Examples of robotics in this area include strap-on steel back supports or machines that help with the transfer from bed to ground or wheelchair.

Hug<sup>31</sup> developed by Fuji Machine Manufacturing relieves care workers of repetitive tasks such as helping patients on their feet or moving from bed to wheelchair. Robohelper Sasuke<sup>32</sup> developed by Muscle Corporation helps to lift a person from bed to wheelchair; it is described as a motor with a brain and is designed for more infirm patients; it lifts them through a sheet that it manoeuvres beneath the patient. Muscle Suit<sup>33</sup> developed by Innophys is a wearable exoskeleton that helps a person lift people or objects, which could be worn by caregivers or the individual who would likely require help to get in and out of it. Personalized wearable exoskeletons are in development that have assistive controllers to improve robot adaptation. Many of these types of technologies have been available for decades in care institutions but wider-scale demand and cheaper technology is extending availability to some individuals.

### 3.3.4 SAFETY

Robotic safety devices might be helpful in preventing falls, for example, by providing support or moving furniture out of the way of a person's fall path. The PAMM systems, mentioned above, use a camera for localization and a sonar array to detect obstacles and are capable of maneuvering the user away from obstacles. AvatarMind's iPal<sup>34</sup> is being designed to monitor for falls. In a related development, Andrew Laing, professor of Kinesiology within the Schlegel - UW Research Institute for Aging and a leading expert in safety flooring, is studying how special floors can maximize impact-force reduction during falls while having minimal effects on balance and mobility. CARE-RATE<sup>35</sup> is

<sup>28</sup> <https://robots.ieee.org/robots/mabu/>

<sup>29</sup> [https://www.researchgate.net/publication/220489558\\_Smart\\_Cane\\_Assistive\\_Cane\\_for\\_Visually-impaired\\_People](https://www.researchgate.net/publication/220489558_Smart_Cane_Assistive_Cane_for_Visually-impaired_People)

<sup>30</sup> <http://www.eecs.ucf.edu/~turgut/Research/Publications/Download/Feltner-2019-ICC.pdf>

<sup>31</sup> <https://www.ft.com/content/6802f840-caf8-11e7-8536-d321d0d897a3>

<sup>32</sup> <https://www.ft.com/content/6802f840-caf8-11e7-8536-d321d0d897a3>

<sup>33</sup> <https://www.ft.com/content/6802f840-caf8-11e7-8536-d321d0d897a3>

<sup>34</sup> <https://www.canadianinsider.com/avatar-mind-s-ipal-r-robot-unveils-new-robot-development-platform>

<sup>35</sup> <https://uwaterloo.ca/intelligent-technologies-wellness-independent-living/projects/care-rate-cognitive-computing-connect-family-caregivers-0>

an online resource to support family caregivers of people with dementia. It uses natural language processing and artificial intelligence to create a dialogue-based interface that allows caregivers to describe the problem (verbally or using a keyboard) to CARE-RATE which then returns tailored information about assistive technology, local, regional and global resources, online forums and strategies. Caregivers rate the usefulness of the information and CARE-RATE uses machine learning to make better recommendations over time.

### 3.3.5 SERVICE

Robotic devices can provide assistance with some of the routine chores such as vacuuming, bringing trays of food or goods, etc. For example, My Spoon – Secom Medical System<sup>36</sup> is a robot arm with a spoon and fork that allows patients to eat a meal without another person. Or Chapit<sup>37</sup> developed by Raytron, hands-free communication robot, recognizes human voice in noisy environments, understands more than 500 words, and can operate 200 kinds of remote controllers for various home electric appliances.

### 3.3.6 HEALING AND HEALTH DEVELOPMENT

The devices described above tend to be designed to compliment the patient's condition or environment and to improve the living conditions within those circumstances. In the interviews<sup>38</sup>, we heard of other robotics under development that seek to improve upon the patient's underlying condition.

Dr. Jen Boger and colleagues have developed a virtual reality (VR) exergame<sup>39</sup>. The head-mounted VR is for people to use when exercising and for exercise therapists as well. It encourages people to exercise by having them repeat familiar motions such as head rotation, reaching straight ahead, cross-body reaching, lifting both arms, rowing with both hands, in a familiar but neutral environment such as a farm setting.

Dr. Niang Jiang and colleagues are working on a device<sup>40</sup>, based on Hebbian plasticity<sup>41</sup> research. It uses electrodes placed on the scalp. When the brain activates, a signature is created, which the electrodes detect non-invasively the muscle or nerve that responds, e.g., it might be used in therapy for patients recovering from a stroke involving (partial) paralysis. An instruction to lift a finger or toe creates a brain signature that is detected in real time. Over time and with repetition it is expected that the brain will build new connections; hence, overcoming or working around the paralysis.

Dr. Arash Arami and colleagues are working with robots to assist patients that have suffered from conditions affecting the central nervous system. For example, they are doing modeling of those with Parkinson's disease with the goal to build models for sensorimotor deficits like balance deficiency, rigidity, and tremor. By understanding these conditions, they plan to develop robotics to better help patients manage with their condition, e.g., strap-ons to help with gait-freezing or smart endoprostheses.

### 3.3.7 ASSESSMENT

Many of these robots are still at the design and testing stage. It is hard to assess how low the price may be once they have been tested and are available to a mass market. Our sense is that at this time most are too expensive to have wide take-up by seniors. Moreover, many have limited or singular application so someone in the ASR might

<sup>36</sup> <https://www.ft.com/content/6802f840-caf8-11e7-8536-d321d0d897a3>

<sup>37</sup> <https://www.ft.com/content/6802f840-caf8-11e7-8536-d321d0d897a3>

<sup>38</sup> With University of Waterloo researchers Arash Arami, Jennifer Boger, and Niang Jiang.

<sup>39</sup> <https://uwaterloo.ca/games-institute/news/using-virtual-reality-help-older-adults>

<sup>40</sup> <https://uwaterloo.ca/intelligent-technologies-wellness-independent-living/projects/brain-computer-interface-older-adults>

<sup>41</sup> To learn more about this subject see, for example, <https://www.frontiersin.org/articles/10.3389/fnins.2015.00527/full>

need multiple robots to remain living independently. However, there are many major companies involved in the research and development and the demand for robotics is expected to increase exponentially in the coming years. It is quite possible that prices will drop significantly in the future, as they have with the implementation of other types of technology.

A further development challenge is that even though most activities of daily living can be easily described, and a robot might be designed to perform a single activity, the combination of activities involving different types of operations, e.g., turning, lifting, communicating, and such a combination can be difficult to incorporate in a single affordable robot.

Although such activities of daily living seem relatively straightforward, activities that require the robot to work with the brain or the central nervous system are extremely complex. Our knowledge of how the brain works continues to increase but is still limited. Moreover, robotics for those with health conditions may be working with partially damaged brains making the design of the robotics more challenging. The testing requires trials involving humans which adds a further level of regulation and complexity. Although such robotics hold great promise, it is likely that their development will take longer and that they will be used primarily in institutional settings, rather than in a personal (owned) context.

Another important issue is the ethics of robotics. It is hard to believe that society would find a picture of a line of seniors sitting at a long table being fed by robotic arms an appealing sight. Nonetheless, we do see a role in the future for robotics in facilitating life for those in the ASR.

## Section 4: Areas for Future Research

It is well acknowledged that the health and social care system is fragmented, which provides obstacles to individuals in obtaining the care they need and should be entitled to, as well as obstacles for care providers in delivering the care required. As long as such obstacles exist, there will be inconsistent delivery and receipt of care, which will produce other problems. Moreover, there are additional obstacles encountered by and in delivering support to those living in northern and remote areas and to Indigenous people. More research is required regarding these obstacles and how they may be overcome.

The demographic projections indicate that not only is the population in the ASR likely to increase and continue to age, but also the population of caregivers is also aging and will be less able to meet the care demands. A substantial part of the responsibility for providing care is born by family members, typically female family members, who themselves will be less able to provide support as they age. An important area for future research is how we can address the expected shortage of care givers.

This paper has suggested several avenues for research that may help reduce the burden of the expected shortage. Robotics for assistance with the aged are still at a very early stage. There is a need to develop multi-purpose robots that would be affordable for individuals to own and have in their homes. Social prescribing offers promise as a way to reduce the burden of care, but it too is only in a development stage. Rigorous studies are required to determine whether social prescribing is cost-effective; if so, in what settings; proper cost-benefit analyses are required.

There will be both men and women in the ASR, but women predominate. Although, we have not discussed it here, it will be important that solutions that are proposed are gender appropriate. There are tales of technology designed by men being suited for male dimensions and not being able to be used by women, e.g., space suits. It is important



than women's views and needs are incorporated in research and development. In this regard, it is important that we engage and promote more women in STEM<sup>42</sup> research.

Gratton and Scott (2016) make an important point that with the prospects of very long life, perhaps of 100 years, that we must change our paradigm of a 3-stage life, divided into education, followed by work, and then retirement, to a multi-stage life. Throughout the multi-stage, education, work and leisure would be intermingled and overlap. This would enable us to be active mentally and physically longer, develop supportive relationships that would persist. But the multi-stage life requires governments and employers to be more flexible in the rules surrounding work, partial retirement, job-sharing, etc. Much more research is required to identify the barriers to change and how they may be removed. There remains considerable ageist bias and until it is overcome the multi-stage life will remain an idea rather than becoming a reality.

## Section 5: Conclusions

With the number of centenarians in Canada exceeding 8,000 and expected to double within 10 years, those living in the ASR are a significant group. This group and its significance will continue to grow. Although the experiences of each individual in the ASR will be unique, there are some challenges that people in this population segment are likely to face. It is likely that there will be some physical and mental deterioration as we creep toward death. We will lose contact with some who have been our friends, for a variety of reasons, and that will have emotional consequences. We will also face change in many areas that will also have an impact.

For those in the ASR to have a life of dignity, our health- and social-care system must be able to deal with physical, mental and emotional health issues seamlessly in a caring way throughout the life cycle. It needs to recognize that deterioration in any area may have consequences for other areas. It requires a holistic view. However, the current system is fragmented in many ways, such as separation of facilities for caring for those with physical needs and those with mental impairment, or access to care that varies by geography, or by relying on family and especially female family members to provide for a large portion of the care burden on a "voluntary" basis.

But there are models of care being developed that are more holistic. In this regard we have pointed to the example of The Village of Winston Park that provides a continuum of care from independent living through to long-term care in a single community. Although as we noted the cost to the individual associated with living in such a community for many years makes it unaffordable for most of the population. However, the Netherlands has found a way to deliver such a continuum of care based on need and ability to pay, so there are examples worth studying.

Our concern is that governments are slow to act on such matters, probably hoping that individuals and the private sector will find manageable approaches. Providing adequate care for an aging population will require greater government funding, which will likely entail some combination of higher taxation, reallocation of funds from other services, cost and service-shifting to individuals, their families and friends, and the private sector. In democratic countries such as Canada, debate must take place on the range and level of services to be provided and the way in which these services are to be delivered and funded.

While most of those living in the ASR will wish to maintain a degree of independence for as long as it is feasible, it is likely that a residence in which an individual can acquire care from robots or support from workers, friends or family, as required, will help to satisfy individuals' need for a degree of independence. Social prescribing may be a

---

<sup>42</sup> STEM stands for science, technology, engineering, and mathematics.

way for individuals to receive support but also retain independence. Gratton and Scott (2016) suggest that another component may be rethinking the western approach to family. In Asia it is not uncommon for multiple generations to live together, with each generation contributing to the overall household care responsibilities as they are able. But this will take time and cultural change. Although some are starting to live together in non-familial groups.

In that regard, our most important conclusion is that our past ways of thinking about the elderly require change. The number of elderlies is increasing, the average length of life of the elderly is also increasing, but unless we consider the challenges to be faced by the elderly their quality of life will decline. Such a decline will impact the quality of life of all in society, even if we do not have to deal with any of the elderly directly, we ourselves will likely become elderly at some point, and our government budgets will be stress tested.

It is important that we as a society talk about the challenges that an aging population brings. We must decide what our goals for the elderly are, what resources are to be expended, what changes are required, and what is the balance between government, the private sector, the individual, and the family. Such conversations and decisions can be difficult and filled with conflict, especially if they require significant change and redirection of resources. Each society must decide what is the right balance of services for its population, and that balance may change over time or as the population ages.

But significant change is possible. In Canada, since 2015 individuals in certain circumstances are entitled to medical assistance in dying (MAID). This remains controversial, some not wanting to be involved in carrying out MAID, and others advocating that the law is too restrictive. But the point is not what should Canada's law be, but rather that we must continue to communicate about the quality of life for all individuals and how we can deliver that. Also, we must be open to change.

## Section 6: Acknowledgements

This research has been prepared as part of a larger project entitled *Population Aging, Implications for Asset Values, and Impact for Pension Plans: An International Study*, which has been funded by the following partners: the Canadian Institute of Actuaries, the Institute and Faculty of Actuaries, the Society of Actuaries, the Social Sciences and Humanities Research Council, the University of Kent, and the University of Waterloo. In addition to the authors, the project team for the larger project includes researchers Stephen Bonnar and Kathleen Rybczynski, both University of Waterloo, Miguel Leon Ledesma, Jaideep Oberoi, Aniketh Pittea and Pradip Tapadar, all University of Kent, Mark Zhou, Canada Mortgage and Housing Corporation; and contributor Tony Wirjanto, University of Waterloo.

For this research, University of Waterloo co-operative education students, Sean Ruby and Asha Abraham, made valuable contributions, as well we received an additional grant from the Canadian Institute of Actuaries.

We also received helpful advice from: Gillian Alexander who arranged a tour of The Village of Winston Park part of Schlegel Villages; Peter VanderPlaat who provided information regarding the system of care in the Netherlands; researchers in robotics at the University of Waterloo who provided interviews and demonstrated their developments, Arash Arami, Jennifer Boger, Ning Jiang and James Tung.

The authors thank all that contributed.

## Section 7: References

Bickerdike L, Booth A, Wilson PM, Farley, K., and Wright. K. 2016. Social prescribing: less rhetoric and more reality. A systematic review of the evidence. *BMJ Open* 2017;7:e013384. doi:10.1136/bmjopen-2016- 013384

Davis, JC, Bryan, S, Li, LC, Best, JR, Hsu, CL, Gomez, C, Vertes, KA, and Liu-Ambrose, T. 2015. *Mobility and cognition are associated with wellbeing and health related quality of life among older adults: a cross-sectional analysis of the Vancouver Falls Prevention Cohort*. *BMC Geriatrics* 2015 15:75

Dayson, Chris and Nadia Bashir. 2014. Summary Evaluation Report. CRESR Sheffield Hallam University

Fried, LP, Tangen, CM, Walston, J, Newman, AB, Hirsch, C, Gottdiener, J, Seeman, T, Tracy, R, Kop, WJ, Burke, G, and McBurnie, MA. 2001. *Frailty in older adults: evidence for a phenotype*. *J Gerontol A Biol Sci Med Sci* 2001 Mar: 56(3): M146-56..

Guerreiro, R, and Bras, J. 2015. *The age factor in Alzheimer’s disease*. *Genome Med*. 2015; 7: 106.

Gratton, Lynda and Andrew Scott. 2016. *The 100-Year Life*. Bloomsbury Information

Kimberlee, Richard H. 2013. Developing a Social Prescribing approach for Bristol. University of the West of England

OECD. 2019. Risks that Matter: Main Findings from the 2018 OECD Risks that Matter Survey. [www.oecd.org/social/risks-that-matter.htm](http://www.oecd.org/social/risks-that-matter.htm)

Ouslander, JG. 1981. *Drug Prescribing for the Elderly*. *West J Med*. 1981 Dec: 135(6):455-462.

Stocks-Rankin, C-R., Seale, B. and Mead, N. 2018. Unleashing Healthy Communities Summary Report Researching the Bromley by Bow model. Bromley by Bow Insights

The Economist. Robots that look after grandma. Volume 430 Number 9130, pp. 50-51.

The King’s Fund. What is social prescribing? <https://www.kingsfund.org.uk/publications/social-prescribing>

## About The Society of Actuaries

With roots dating back to 1889, the [Society of Actuaries](#) (SOA) is the world's largest actuarial professional organizations with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

**Objectivity:** The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

**Quality:** The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and nonactuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

**Relevance:** The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

**Quantification:** The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

Society of Actuaries  
475 N. Martingale Road, Suite 600  
Schaumburg, Illinois 60173  
[www.SOA.org](http://www.SOA.org)