FEDERAL/PROVINCIAL/TERRITORIAL MINISTERS RESPONSIBLE FOR SENIORS

THE IMPACT OF INTERNET CONNECTIVITY AND TECHNOLOGICAL TOOLS ON REDUCING SENIORS' SOCIAL ISOLATION AND LONLINESS DURING THE PANDEMIC AND BEYOND

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Prepared by Dr. John Puxty MB, ChB, MRCP (UK), FRCP (C) (Queen's University and Centre for Studies in Aging and Health, Providence Hospital), Sarah Webster MHS (Centre for Studies in Aging and Health, Providence Hospital) and Alexandra Puxty BSN, BPE (Centre for Studies in Aging and Health, Providence Hospital) for the Federal, Provincial and Territorial (FPT) Forum of Ministers Responsible for Seniors. The views expressed in this report may not reflect the official position of a particular jurisdiction.

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1. EXECUTIVE SUMMARY

The objective of this report is to explore the impact of internet connectivity and technological tools on reducing seniors' social isolation and loneliness during the pandemic and beyond and thereby propose policies and approaches to adapting service delivery to seniors using the internet and other technological tools.

1.1 Social isolation and loneliness in seniors prior to and during the pandemic

Social isolation and loneliness in seniors have gained increasing attention as significant public health concerns, exacerbated by the COVID-19 pandemic. Pre-pandemic rates of social isolation and loneliness in seniors vary, with studies indicating that 12-20% of Canadian seniors report feelings of loneliness and 12-30% report feeling socially isolated; however, during the pandemic, these rates escalated due to a variety of factors (see Appendix A), with initial surveys indicating that 29-40% of Canadians aged 65 and older felt socially isolated and 33-51% felt lonely. Longitudinal studies from both Canada and the United States echoed this trend.

Data drawn from the Canadian Longitudinal Study on Aging (CLSA)[1], suggested that during the first year of the pandemic, there was a 67% increase in the rate of loneliness for women aged 65 to 74, and a 37% increase for those aged 75 to 84. In addition to gender differences, feelings of loneliness appear to be more prevalent amongst seniors with lower household incomes, poor health, and those living alone. Other vulnerable groups include those seniors in remote areas, LGBTQ2S+ seniors, ethnic minority and immigrant seniors, Indigenous seniors, caregivers who are seniors, and those living with chronic conditions (see Appendix B).

Some seniors with positive self-perceptions of aging coped better and exhibited more resilience against loneliness and psychological distress. Generally, levels of loneliness tended to level off or decrease as the pandemic progressed; however, for some, loneliness levels persisted or worsened. It was noted that seniors experiencing persistent or worsening loneliness often report a lack of social support, difficulties accessing or using social technology, and challenges coping emotionally.

1.2 Internet connectivity and technology strategies to reduce isolation and loneliness

Prior to the pandemic, communities across Canada had begun implementing a variety of interventions to reduce and mitigate the risk of social isolation and loneliness for seniors. Several new interventions emerged during the pandemic, with a particular focus on technology. Appendix C offers an extensive inventory (excel spreadsheet) of technology-based strategies that have been implemented to reduce isolation and loneliness in seniors.

Recent literature appears to validate earlier studies concerning the positive impacts of a range of both Social and Physical Information Communication Technology (ICT) interventions on reducing reported feelings of loneliness and social isolation by seniors. Artificial Intelligence

[1] The CLSA's Data Collection Sites are in Calgary, Halifax, Hamilton, Montréal, Ottawa, Sherbrooke, St. John's, Surrey, Vancouver, Victoria and Winnipeg. The provinces included were AB, BC, MB, NL, NS, ON and QC. It is the author's understanding that older adults from the Territories were not included. It does not mean that the findings don't apply to the territories. However, we cannot say with certainty that they do or do not and associated percentages and rates may be different in those jurisdictions for multiple reasons.

(AI) complements and enhances the efficacy of ICT in combatting social isolation and loneliness by bridging the gap between technology and human-centric care. The benefits of ICT may be linked to sustaining and/or strengthening pre-existing and new social connections, promoting leisure, and the fostering of intergenerational connections. It is important to note that engaging seniors themselves in co-design, building upon existing social support systems and provision of training and ongoing support, were identified as facilitators of effective use of ICT.

The existing literature however has some limitations due to its varied methodologies, differing statistical reports such as effect sizes, and the inconsistency in sample sizes across studies. Additionally, the range of ICT devices studied adds to this diversity. There's a clear need for more research using validated metrics, long-term study formats, and Randomized Control Trials (RCTs) that can pinpoint causality. Moreover, we need a deeper understanding of how current seniors are adopting and utilizing available communication tools to combat loneliness and isolation before we can plan for the needs of upcoming generations.

1.3 Use of the internet and technology by seniors prior to and during the pandemic

In today's digital age, participation in online communities is becoming essential for socio-economic involvement. Pre-pandemic, seniors' use of the internet increased from 32% to 68% over 2007-2016; however, there was a significant age gradient as less than half of those aged 80 and older used the internet. Despite these notable increases, seniors still lagged behind younger age groups; for example, internet use among Canadians aged 15 to 64 years was at near-saturation levels (97.2%) in 2016. In addition to having lower levels of internet use pre-pandemic, Canadian seniors were less likely to report that technology made their life better and less likely to use technology to communicate with people, make informed decisions or save time.

A poll of Canadian seniors in July 2020 found that during the pandemic, 88% were using the internet daily, 65% owned a smartphone, 58% used their smartphone daily; and 72% reported feeling confident using technology. Increases in the use of video calls, social media, online activities, and food delivery services were also reported during the pandemic.

1.4 The digital divide and barriers to internet and technology use

Despite increases prior to and during the pandemic, a digital divide remains between those seniors' using technology and those who had limited digital accessibility due to factors such as education, geography, income, culture, and gender. Lower usage rates are still seen in low-income seniors, those living in remote rural, northern, and Indigenous communities, older immigrants and seniors with physical disabilities or cognitive impairments.

Barriers to technology adoption include uncertainty regarding benefits, access and affordability issues, lack of knowledge and confidence, suitability for people with physical and cognitive declines, availability of support, privacy concerns, and risk of identity theft. Challenges also exist with the use of internet and other technology in long-term care and retirement home facilities, often due to residents' lack of understanding or physical capability and poor infrastructure. The design of technology often excludes the input of seniors and caregivers, resulting in usability issues.

The COVID-19 pandemic has starkly highlighted the digital divide affecting seniors, with consequences ranging from social isolation to unequal healthcare access and information

asymmetry. As we move towards a more digital society, the importance of digital literacy cannot be overstated. Immediate action is necessary to bridge this gap, ensuring that technological progress is inclusive and accessible to all, regardless of age.

1.5 Advancing age-friendly community initiatives by leveraging internet connectivity and other technology

Age-friendly communities (AFC) encourage active aging by optimizing opportunities for health, participation, and security to enhance quality of life as people age. The AFC movement provides an opportunity to leverage internet connectivity and other technological strategies to address the risk factors for social isolation and loneliness by supporting those experiencing life transitions, enabling mobility and aging-in-place, increasing transportation options, promoting social participation, increasing access to services and amenities, and creating opportunities for meaningful connection.

1.6 Recommendations

Internet connectivity and other technological strategies, in combination with other interventions, has potential to reduce the occurrence and impact of isolation and loneliness. We suggest that a comprehensive and balanced approach that leverages technology to address social isolation and loneliness with federal, provincial, and territorial leadership and support, is required**.**

Establishment of a **Digital Inclusion Strategy for Seniors** is strongly recommended to overcome the digital divide. This should focus on improved digital literacy, access to affordable devices and internet connectivity, and education, support and resources to help seniors navigate and utilize the internet and other technological tools effectively **(*See Recommendations #1 a-h*)**.

The Digital Inclusion Strategy should be guided by ethical frameworks which consider digital literacy, affordability, privacy and security, inclusivity & accessibility, social connection, and well-being, and have a unique socio-cultural context **(*See Recommendations #1 i*).**

Lessons learned during the COVID-19 pandemic should be applied to the post-pandemic era. This includes adapting and continuing to fund successful and promising interventions that leverage technology and integrate other best practices, addressing root causes of marginalization and supporting vulnerable populations, encouraging intergenerational connections, and fostering partnerships **(*See Recommendations #2-3*)**.

At this time, the success of many pandemic interventions is primarily being judged based on a wide range of often incomplete evidence (e.g., anecdotal information, subjective feedback from participants, initial pilot study results) or based on evaluations of pre-pandemic programs. Further research should be conducted utilizing standardized tools to examine the impacts of transitioning programs to remote delivery. An ongoing inventory of resources and validated interventions should be maintained and linked to a knowledge mobilization strategy. **(*See Recommendation #4*)**

Finally, it is essential to enhance the digital capabilities of retirement homes and long-term care facilities to meet the social and well-being needs of residents, while also promoting the widespread adoption of internet connectivity and other technological strategies. **(*See Recommendations #5-6*)**.

2. OBJECTIVE OF THE REPORT

The objective of this report is to explore the impact of internet connectivity and technological tools on reducing seniors' social isolation and loneliness during the pandemic and beyond and thereby propose policies and approaches to adapting service delivery to seniors using the internet and other technological tools.

3. SOCIAL ISOLATION AND LONELINESS IN SENIORS

Social isolation is "a lack in quantity and quality of social contacts" and "involves few social contacts and few social roles, as well as the absence of mutually rewarding relationships." (Keefe et al., 2006, p.1). Loneliness is more subjective and defined as a "distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or especially the quality of one's social relationships" (Hawkley & Cacioppo, 2010, p.1).

Social isolation and loneliness can be experienced at any age, although some age-related circumstances may make seniors more vulnerable. These include transitions to retirement and accompanying social role loss, ill health, loss of a spouse or friends, mobility problems, vision and hearing loss, lower income, residential changes, and changes in access to transportation (Bryant et al., 2004). At a broader social level, ageism may contribute to social isolation (Shiovitz-Ezra, et al., 2018).

For the purpose of this paper, "senior" is defined as someone 65 years of age or older. If a referenced study instead used the term "older adults" and/or included individuals 55 years of age or older, it has been noted for transparency.

3.1 Prevalence of social isolation and loneliness among seniors pre and during the pandemic

In recent years, the issue of social isolation and loneliness among seniors has garnered increasing attention as a significant public health concern. The transition from unrestricted social circles to more solitary circumstances in later years has long been recognized, but the problem has been further exacerbated by the COVID-19 pandemic. It is important to note that reporting exact rates of isolation and loneliness among seniors can be difficult, as many studies rely on self-reporting of subjective feelings of loneliness, belonging and connection. However, the data described below suggests that the prevalence of social isolation and loneliness among seniors continues to rise and that the contributing factors and impact of isolation and loneliness are complex and multi-faceted.

3.1.1 Pre-pandemic rates

Estimates vary from 12-30% for self-reported rates of social isolation and from 12-20% for loneliness prior to the pandemic. For example, according to a Statistics Canada population-based survey in 2008/2009, about 12% of individuals aged 65 or older felt isolated and reported feelings of loneliness and a weak or somewhat weak sense of community belonging (Gilmour & Ramage-Morin, 2020). A decade later, the National Seniors Council (2017) found that 16% of Canadians aged 65 years and older felt a lack of companionship, left out, or isolated from others; 30% of older Canadians were found to be at risk of social isolation. Finally, Wister et al. (2018) estimated that pre-pandemic, approximately 20% of seniors experienced loneliness at least some

of the time, and that about 10% experienced chronic or intense levels of loneliness that were associated with negative health and well-being outcomes.

3.1.2 Patterns and rates during the pandemic

The net effect of several factors during the COVID-19 pandemic appears to have been an intensification in the levels of social isolation and loneliness among older Canadians. Appendix A summarizes a variety of factors that likely contributed to increased rates of loneliness and social isolation for seniors during the pandemic.

3.1.2.1 Social isolation

In 2023, Ooi et al. published the results of a secondary analysis of the 2020 and 2021 cycles of the *Survey on COVID-19 and Mental Health* and used rates of living alone as a surrogate for estimating social isolation levels. They reported that 29.0% of seniors were living alone (Ooi et al., 2023). Females (vs. males), those aged 75 years and older (vs. 65–74 years), and those with high school education or below (vs. postsecondary education) were more likely to be living alone. Seniors living alone tended to report poorer mental health, community belonging, and lower life satisfaction than those living with others.

A survey conducted by the National Institute on Ageing (2020)[2] reported that 40% of Canadians aged 55 and older had experienced a lack of social connections and companionship early in the pandemic. In the first year of the pandemic, Gutman et al. (2021) also found that 57% of Canadians aged 55 and older felt isolated some or most of the time (60% of women and 46% of men). These Canadian studies did not isolate information specifically for those over the age of 65 but are worth mentioning to understand the landscape of this older population in Canada.

Towards the end of the pandemic, another online survey found that 40% of community-dwelling seniors 65-74-years-old and 30% of those 80 years and older had symptoms of social isolation (National Institute on Ageing and Environics Institute, 2022). They noted low income and poor health as factors that increased the risk of social isolation.

3.1.2.2 Loneliness

Multiple studies conducted during the COVID-19 pandemic in Canada have highlighted the escalating prevalence of loneliness among seniors.

Ooi (2023) reported that over one-third (34.1%) of seniors reported feeling lonely due to the pandemic, with a greater proportion of females (42.4%) reporting feelings of loneliness than males (24.5%). Similarly, a survey of retired teachers in Ontario (Savage et al., 2021) reported that 43% of respondents felt lonely at least some of the time, with gender (female), living alone, caregiving responsibilities, and fair or poor health status contributing to increased odds of feeling lonely. Data from the recent *Canadian Social Survey–Well-being, Activities and Perception of Time (2021)* likewise noted higher rates of reported loneliness in women and those over 75 years of age (14% of 75 years and over vs. 9% for those 65-74 years old).

Another study by Gutman et al. (2021) discovered that over half (51%) of respondents aged 65-74 years of age and 46% of those older than 75 years of age felt lonely either some or most of the

[2] It is the author's understanding that the National Institute on Ageing survey did not include individual from the territories.

time, with higher rates among women (55% versus 37% of men) due to factors like adhering to social distancing guidelines, changes in social support, and experience of negative emotions.

The variability in reported rates of loneliness (33-51%) is not surprising given the subjective nature of reporting; however, the findings do suggest an increase from pre-pandemic rates of loneliness (10-20%).

Longitudinal studies from both Canada and the United States echoed this trend. Utilizing data drawn from the Canadian Longitudinal Study on Aging (CLSA), Wister and Kadowaki (2021) estimated that during the first year of the pandemic, there was a 67% increase in the rate of loneliness for women aged 65 to 74 and 37% for those aged 75 to 84. Smaller increases were observed for men, where there was a 45% relative rise for men aged 65 to 74 and 33% for the oldest group (Wister & Kadowaki, 2021). This is consistent with gender differences noted in previous studies (Gutman et al., 2021; Savage et al., 2021; Ooi 2023; Tian et al., 2022).

Several longitudinal studies from the United States (Kotwal et al., 2020; Krendl & Perry, 2021; Luchetti et al., 2020) noted fluctuations in loneliness as the pandemic evolved; generally, levels of loneliness tended to level off or decrease as the pandemic progressed; however, for some, loneliness levels persisted or worsened (Kotwal et al., 2020; Luchetti et al., 2020). Kotwal et al. (2020) also noted that seniors experiencing persisting or worsening loneliness during the pandemic often reported a lack of social support, difficulties accessing or using social technology, and challenges coping emotionally.

Encouragingly, some studies suggested that seniors' utilization of technology and strategies to support social connectedness mitigated the loneliness-inducing effects of pandemic-related isolation (Compernolle et al., 2022). Pre-existing positive self-perceptions of aging, as measured using the Attitudes Toward Own Aging subscale, also appeared to enhance resilience against loneliness and psychological distress during the pandemic (Losada-Baltar et al., 2021).

Some studies in Canada and the USA suggested that rurality was protective against increases in rates of loneliness during at least the first year of the pandemic (Fuller & Huseth-Zosel, 2021; Kirkland et al., 2023). However, this should be interpreted with caution. In the case of the Fuller paper, most of the rurally classified participants did not live in remote rural areas, but rather in small towns located within 60 minutes of an urban area. In this context, they may benefit from the close-knit community of a small, rural town but also from accessibility to urban resources such as health care or social services. This may also be the case in the Kirkland et al. (2023) paper based on CLSA use of postal code conversions, where *rural* population includes all people living in rural areas of census metropolitan areas and census agglomerations (CAs), as well as populations living in rural areas outside of these areas.

3.2 Vulnerable subpopulations

The COVID-19 pandemic potentially exacerbated social isolation and loneliness among those living alone; vulnerable older people in remote and northern communities; LGBTQ2S+ seniors; ethnic minority and immigrant seniors; Indigenous seniors; people living with dementia; caregivers; low-income seniors; those living with chronic conditions; and those experiencing life transitions, such as loss of spouse (Kirkland et al., 2023; Lin, 2023; Ooi et al., 2023). Researchers from the United States suggested that the social networks of minority groups were more likely to be disrupted by the pandemic (Gauthier et al., 2020). Appendix B summarizes the contributing factors and prevalence of isolation and loneliness for vulnerable sub-populations.

3.3 Impact of social isolation and loneliness in seniors

Social isolation and loneliness are associated with adverse health behaviours (Leigh-Hunt et al., 2017) and poor health outcomes such as cardiovascular disease, psychiatric disorders (e.g., major depressive disorder), and an increased use of psychoactive (or mood-altering) medications (National Institute on Ageing, 2022). Social isolation during the COVID-19 pandemic has been linked to negative outcomes for seniors, such as depression (Krendl & Perry, 2021; Robb et al., 2020), sleep problems (Grossman et al., 2021), and anxiety (Robb et al., 2020).

Social isolation is not only harmful to the seniors involved but also has negative consequences for the health care system (MacCourt, 2022). Seniors who are socially isolated make more unplanned visits to their doctor and to emergency rooms, use more medication, fall more often, and enter long-term care sooner (Government of Canada, 2022). Seniors who are socially isolated may also be more susceptible to elder abuse (Pillemer et al., 2016). They share many common risk factors, including stress related to caregiving, limited cognitive ability, mental illness, poverty, ageism, and the overuse or abuse of illicit drugs and/or alcohol (Peterson et al., 2014).

There is therefore a need to both identify and reduce social isolation and loneliness in seniors utilizing both technological and non-technological approaches (Poscia, 2018).

4. INTERNET CONNECTIVITY AND TECHNOLOGY STRATEGIES TO REDUCE ISOLATION AND LONELINESS

A variety of technological tools have been developed or proposed to enhance social engagement and combat isolation and loneliness among seniors. These are commonly grouped under the umbrella of Information and Communication Technologies (ICT), which the United Nations Educational, Scientific and Cultural Organization (UNESCO) defined in 2009 as "a diverse set of technological tools and resources used to transmit, store, create, share, or exchange information."

Many studies have focused on tools that facilitate and enhance social interactions and connections among individuals, often referred to as Social ICT (e.g., internet connectivity, social media, online platforms, virtual programs and online support groups, virtual reality, telehealth and telecare). Latikka and colleagues (2021) have also introduced the concept of Physical ICT for technologies reliant on technological communication of data but without the primary purpose of connections between people (e.g. social robots, wearables, and smart technologies).

Artificial intelligence (AI) significantly augments both Social and Physical ICT strategies against loneliness and social isolation by bringing a personalized, adaptive, and proactive approach. Its ability to analyze data, learn from user interactions, and provide tailored recommendations and interventions positions AI as a crucial tool in addressing these challenges among seniors. By bridging the gap between technology and human-centric care, AI not only complements but also enhances the efficacy of ICT in combating social isolation and loneliness.

This section of the paper explores the evidence supporting its use and the potential benefits, challenges, and ethical considerations associated with Social ICT, Physical ICT, and AI. Where applicable, evidence specific to seniors living in the community (i.e., in their own homes or with family or friends) or those living in congregate settings (i.e., facilities where people live or stay

overnight and use shared spaces, such as assisted living, retirement homes, and long-term care homes) is identified. Furthermore, the need for tailored interventions, user-centered design, training, and support systems to maximize the positive impact of technology in reducing social isolation and loneliness among seniors is highlighted.

4.1 Evidence suggesting Social and Physical ICT can help reduce seniors' social isolation and loneliness

In the rapid review for this paper (Appendix D for methodology), the authors identified 30 relevant reviews since 2017 of interventions with seniors in the community and congregate living. All included reviews were critically appraised using the Health Evidence Quality Assessment Tool. For this report, the findings of six high-quality reviews that study both Social and Physical ICT and have been published since 2020 are included below. Only one focussed specifically on Physical ICT interventions (Latikka, 2021), although two other reviews included some Physical ICT interventions, primarily social robots (Döring et al., 2022; Thangavel et al., 2022).

In the first scoping review, Petersen et al. (2023) selected 54 original articles focussing on Social ICT published before July 2020 for analysis. They excluded studies that solely included health-related interventions, grey literature, or literature reviews. The authors identified three major themes within the literature:

1. Social ICTs were associated with a reduction in loneliness and an increase in well-being.
2. Social ICTs promote social connectedness by facilitating conversations.
3. Factors such as training, self-efficacy, self-esteem, autonomy, and the design, features, or affordability of Social ICTs contribute toward the associations between their use and well-being.

Interventions involving video conferencing, web-based computer training, social-networking websites, gaming, and prototypes such as the Personal Reminder Information and Social Management (PRISM) were associated with decreased loneliness. Video conferencing provided older LTC home residents with emotional and social support, and users experienced reduced depressive symptoms. Similarly, users of video chat had approximately half the probability of developing loneliness and depressive symptoms. The authors suggested that the benefits of Social ICTs may be tied to strengthening pre-existing and new social connections, promoting leisure, and fostering intergenerational connections.

In a systematic review, Todd et al. (2022) identified fifteen articles from 2000 to September 2020 that used Social ICT as an intervention for targeting social isolation. The studies include a range of methods, including randomized controlled trials, a controlled quasi-experimental study, qualitative studies, and mixed methods. Ten of the fifteen studies used standardized instruments (e.g., the University of California, Los Angeles (UCLA) Loneliness Scale, the DeJong Gierveld Loneliness Scale, and the Quality of Life Scale) to measure changes in isolation and loneliness.

Studies took place in eight countries: the USA, the UK, Canada, Brazil, Australia, Italy, the Netherlands, and Taiwan. The types of Social ICT used included videoconferencing, internet-based applications, and telephone-based applications. The results of these studies varied; most studies reported positive impacts on social isolation, but this was identified more in self-reporting compared to changes in baseline measures. Their recommendations included

recognizing the importance of including older people in purposeful design, engaging families and support networks, and providing ongoing training and support so that systems and skills are in place for future periods of mandated isolation.

Döring et al. (2022) took a different approach and conducted a scoping review of published reviews before November 2021. They identified 28 reviews over the previous 50 years that met their criteria and found that the positive effects of Social ICT and social robots (Physical ICT) use were evident in 55% of the outcome measures for loneliness and 44% of the outcome measures for social isolation; however, the authors noted there was limited causal evidence in terms of the relationship. Internet and computer were the most researched communication technologies (23 reviews), followed by videoconference systems such as Zoom or Skype (16 reviews), email (13 reviews), telephone (12 reviews), and social robots (10 reviews).

The fourth review to note was by Shah et al. (2021); the authors conducted a systematic review and meta-analysis of the use of Social ICT digital technology interventions to reduce loneliness with a minimum intervention period of three months and follow-up measurements of at least three months post-intervention. They extracted data from six studies published between January 2010 and July 2019 that met their criteria, including five clinical trials and one pre-post study. The UCLA Loneliness Scale was used in four studies and the De Jong Gierveld Loneliness Scale in the remaining two studies. Their narrative summary indicated a reduction in loneliness in the intervention groups at follow-up compared with baseline; however, their meta-analysis of the five clinical trials with follow-up measurements at three, four, and six months with pooling of results showed no statistically significant effect. Of possible relevance to the lack of a significant effect is the range of technologies utilized (videoconferencing, CareTV, social media, apps, and personal computers with internet) and populations studied (LTC, community-dwelling, and supported living).

In a recent scoping review, Thangavel et al. (2022) summarized current empirical research on customized Social and Physical ICT (social robots) solutions. From the review of 39 studies, most (20/39, 51%) addressed the problem of social isolation, whereas 9 (23%) focused on loneliness, and 10 (26%) focused on both social isolation and loneliness. The interventions included social networks, messaging services, video chat, virtual spaces or classrooms with messaging capabilities, robotics, games, and content creation and management. Loneliness was mainly measured using the ULCA Loneliness Scale in 63% of the studies, and 18% used the De Jong Gierveld Loneliness Scale.

The authors identified five different purposes of customized Social ICT and social robotic solutions focusing on reducing social isolation and loneliness: 1) social communication; 2) social participation; 3) a sense of belonging; 4) companionship; and 5) feelings of being seen. They concluded that strategies for increasing social communication and social participation (social networks, video chat, messaging services, and games) can help reduce social isolation, whereas those fulfilling emotional relationships and feeling valued (virtual coaching, robotics, and virtual companions) can offer support in tackling loneliness.

In a systematic literature review of loneliness, social isolation, and Physical ICT, Latikka (2021) identified 23 empirical studies conducted from January 2006 to May 2021. The Physical ICT included were smart homes, social robots, VR, and wearable sensors. Most studies (n=13) were from the USA, two each from Germany and Singapore, and one each from Australia, Canada, Ireland, Mexico, the Netherlands, New Zealand, and Taiwan. Most of the included studies

focussed on seniors' loneliness (n=17), whereas the rest examined social isolation or both phenomena (n=6).

The two main areas of the reviewed research comprised "detection and prediction" (n=7) and "alleviation" of seniors' loneliness and social isolation (n=16) using Physical ICT. Seniors' out-of-home habits were measured (time spent outside the house, number of outings, and number of places visited) in five of the studies as unobtrusive models to detect loneliness or social isolation.

None of the studies reported complete elimination of seniors' loneliness experiences with the help of Physical ICT, but they did report success in detecting and alleviating them. Studies that reported statistically significant results for a decrease in perceived loneliness of seniors included interventions using social robots and an ambient activity system such as an activity sensor. Moreover, two studies reported qualitative evidence that using social robots helped alleviate loneliness; in addition, one study reported the positive impacts of an intervention using a smart home solution on loneliness. No statistically significant results were demonstrated for a decrease in social isolation, but two studies did suggest that social robots with the capacity to facilitate video calls could help combat social isolation.

In summary, the reviews described above do appear to validate the positive impacts of a range of Social and Physical ICT interventions in reducing reported feelings of loneliness (Petersen et al., 2023; Döring et al., 2022; Shah et al., 2021; Thangavel et al., 2022; Latikka, 2021) and social isolation among seniors (Todd et al., 2022; Döring et al., 2022, Thangavel et al., 2022, Latikka, 2021). However, there is less evidence of significant changes in objective measures using standardized tools of social isolation or loneliness, such as the UCLA Loneliness Scale and the De Jong Gierveld Loneliness Scale.

4.2 Evidence suggesting AI can help reduce seniors' social isolation and loneliness

Although not prominently featured in ICT reviews, artificial intelligence (AI) plays a significant and evolving role in supporting both Social and Physical ICT strategies. For example, AI-powered algorithms can analyze user data to suggest relevant groups, activities, and social connections that align with their preferences. This helps users find like-minded individuals and fosters social interactions.

AI can also detect and respond to changes at the individual level. In mental health applications, AI-powered natural language processing (NLP) techniques can analyze and understand users' sentiments, emotions, and mental well-being through text or voice interactions. It can detect signs of distress, loneliness, or depression, offering appropriate interventions or referrals to support services. NLP approaches are proving to be a promising means to help assess, monitor, and detect loneliness and depression in older individuals based on speech (DeSouza et al., 2021).

AI techniques like sentiment analysis can analyze social media posts and other online content to gauge individuals' emotional states, identifying those experiencing loneliness or isolation. Yamada and colleagues (2021) were able to identify distinct speech patterns for loneliness that correlated with self-rated scores on the UCLA Loneliness Scale. This information could be used to provide targeted interventions or support, connect individuals with appropriate resources, or reach out to help.

AI presents a unique opportunity to address social isolation and loneliness through its multifaceted applications. AI has the potential to significantly alter the landscape of elderly care and social interaction, from offering conversation and companionship through virtual companions to sophisticated health and well-being monitoring systems that keep caregivers informed and engaged.

Particularly for individuals with limited social interactions, AI-driven chatbots and virtual companions can provide company and support. An example of this is a study by Jones et al. (2021), where they exposed seniors over 75 years of age over 8 weeks to personal voice assistants (PVAs), such as Amazon's Echo, which offer ease-of-use voice control with a friendly, helpful AI. They noted a significant improvement in the UCLA Loneliness Scale measure at 4 weeks. A similar study by Park and Kim (2022) using Amazon's AI-based speaker, Alexa, demonstrated a significant reduction in loneliness measures (UCLA) by two months in frequent users.

AI technology, through wearable devices and virtual assistants, can provide continuous health monitoring and personalized care for seniors, while AI-integrated smart home systems and voice-activated assistants like Amazon's Alexa or Google Assistant can assist seniors in daily tasks and ensure their safety.

Finally, at a more macro level, AI algorithms can analyze vast amounts of data collected from various sources, including social media, wearable devices, and online platforms. By identifying patterns and correlations, AI can offer insights into social behaviour, community dynamics, and factors contributing to isolation or loneliness. This information can inform the development of targeted interventions and policies.

While AI holds immense potential for reducing isolation and loneliness, it is essential to consider ethical and privacy concerns. Safeguards should be in place to protect privacy, ensure inclusivity, and prevent overreliance on AI, always prioritizing human connections and well-being.

4.3 Limitations of the literature review

Only English language reviews were considered during the screening process, possibly causing the exclusion of relevant reviews and reports published in other languages.

Part of the challenge in interpreting the available literature to date was the heterogeneity of methodologies, statistical reporting (i.e., effect sizes), range in sample sizes across studies, and diversity in ICT devices. For example, the reviews included a mix of randomized control trials (RCTs), cross-sectional designs, quasi-experiments, case series, and cohort studies.

There remains a need for further study, including the provision and use of validated measures, longitudinal study designs, and RCTs establishing causality. In addition, more insight is needed to better understand how current and future generations of seniors will adopt and use off-the-shelf communication technologies in self-directed ways to overcome loneliness and social isolation.

4.4 Environmental scan of Social ICT, Physical ICT and AI strategies

In response to growing concerns about loneliness and social isolation among seniors during the pandemic, the Ontario Age-Friendly Communities Outreach Program (2021) conducted a rapid literature review and environmental scan to create an inventory of Canadian programs seeking to

address social isolation among seniors. As part of the current review, the authors updated the inventory to April 2023. Appendix C provides an updated inventory of technological strategies to reduce social isolation and loneliness in the format of a Microsoft Excel file. The resource is filterable by:

- Status of the program (active or inactive)
- Region (local, provincial, national, international)
- Target subpopulation (if applicable)
- Type(s) of program (i.e., Internet connectivity, access to devices, technology training, telephone check-ins, telephone-based group programming, virtual group programming, innovative new technology, or policy/funding).

Illustrative examples from both the literature and environmental scans are included below. Examples of AI evolving role in supporting both Social and Physical ICT strategies are included in relevant sections. Although not all of these examples have been formally evaluated for their efficacy in reducing social isolation and loneliness, many have reported encouraging data regarding their use. Therefore, their impact warrants consideration as a promising practice.

Where available, evidence specific to community-dwelling seniors (i.e., those living in private homes or with friends or family), and seniors living in congregate settings (i.e., long-term care, assisted living, and retirement homes) is identified.

4.4.1. Social information and communication technology

Social ICT can be utilized as a socialization tool to facilitate and enhance social interactions and connections among and between individuals. Some of the main types include.

- Internet connectivity and use
- Social media and online platforms
- Online support groups and virtual programs
- Enhanced engagement and cognitive stimulation
- Telephone-based programs
- Virtual reality
- Telehealth

4.4.1.1 Internet connectivity and use

Evidence for community-dwelling seniors

Access to quality internet enables seniors to access information, news, and resources that can contribute to their well-being and decrease feelings of loneliness.

Several studies reported that greater use of the internet was associated with lower levels of loneliness in seniors (Erickson & Johnson, 2011; Cotten et al., 2013; Heo et al., 2015; Chopik, 2016). A study by Stockwell et al. (2021) also noted that seniors using the internet/email either once a week or once a month were significantly less likely to be socially isolated than those using the internet/email less than once every three months.

Evidence for seniors living in congregate settings

During the pandemic, the internet became a window to the outside world for residents, enabled LTC homes to better connect with the community, and helped reduce the segregation often

inherent in such institutions (Seifert & Cotton, 2020). Mello et al. (2008) equipped residential aged care facilities with communal computers with access to the internet, email, and chat rooms. Seniors found adopting the new technology frustrating at times; however, the study found an overall improvement in social connectedness through internet access, which peaked at 3 months and reduced at the 6 and 12-month marks, although it remained above previous preintervention levels (Mellor et al., 2008).

Examples of internet connectivity and use programs

Program	Lead	Location	Setting	Description
Tablets for Loan for Seniors Project	Vaughan Community Health Centre Human Endeavour (Technology partner)	Vaughan, Ontario	Community	During the pandemic Vaughan Community Health Centre loaned 23 tablets to low-income isolated seniors and provided them with data plans to stay connected and participate in virtual programming. Training was provided on how to use the tablets and a technology helpline was available to remotely access the tablets and troubleshoot any issues. Vaughan Community Health Centre partnered with the non-profit Human Endeavour who managed the helpline and data.
Connecting Families 2.0	Government of Canada	Canada	Community	Connecting Families 2.0 introduced significantly faster speeds and increased the data usage amount. At 50/10 megabits per second (Mbps) for $20 a month, the download and upload speeds are five and ten times faster, respectively, than in the first phase of Connecting Families. The data allotment also doubled, from 100 GB to 200 GB of usage per month. This new phase also broadened eligibility from families receiving the maximum Canada Child Benefit (CCB) to include low-income seniors receiving the maximum Guaranteed Income Supplement (GIS). The existing $10 internet plan offering under Connecting Families 1.0 will also remain available.

Contactivity Café	The Contactivity Centre	Westmount, Quebec	Community	The Contactivity Centre hosts virtual and in-person courses and interest groups for autonomous seniors 60+.
GetSetUp	GetSetUp	International	Community	GetSetUp is an international online learning platform for seniors. They offer live classes taught by peers, social hours hosted by community members, and special events with guest speakers. Classes are taught in English, Spanish, Hindi and Mandarin with core teams in the U.S., Australia, and India.
Project Joy	Project Joy	Edmonton, Lethbridge, Red Deer, Calgary, Alberta	LTC	Project Joy was initiated during the pandemic and collected old tablets and smartphones to donate to seniors living in long-term care facilities. RJ Systems, a local technology company, assisted with the setup, refurbishment, and management of the devices. Each device could be used by about 5-8 seniors.
Tablet Provision Program	Government of New Brunswick	New Brunswick	LTC	During the COVID-19 pandemic, the Government of New Brunswick provided iPads to long-term care facilities. Each facility was provided one tablet for every 10 residents. The iPads were intended to address the social isolation as a result of the pandemic and to allow physicians to do their rounds and hold virtual medical appointments with residents as needed.

4.4.1.2 Social media and online platforms

Social media platforms, video chats, and messaging apps provide seniors with opportunities to connect with family, friends, and peers. Online platforms provide a wealth of information about health, hobbies, and interests, which can empower individuals, foster a sense of engagement with the wider world, and reduce social isolation. Opportunities for seniors to engage in lifelong learning through online courses, webinars, and educational platforms promote mental stimulation, personal growth, and social interaction with fellow learners, combating social isolation and loneliness.

Evidence for community-dwelling seniors

With the growing use of digital technology by older Canadians, video calls and social media have been incorporated into interventions to reduce social isolation. Community-dwelling seniors who can use video chats (e.g., Skype) or online social media sites (e.g., Facebook) to stay in contact with family and friends often appreciate such technical solutions to overcome feelings of isolation and loneliness (Hajek & König, 2021; AGE-WELL NCE., 2020; Conroy et al., 2020).

Social media sites can be used to maintain and build social networks (Conroy et al., 2020). Zhang et al. (2020) explored the association between social media communication with close social ties and loneliness among community-dwelling seniors. They found that more frequent usage of social media communication was associated with lower levels of loneliness, and this association was mediated by increased social support and social contact. A pre-pandemic study in Israel demonstrated that internet and social media use in adults aged 50 and older could decrease loneliness and enhance quality of life (QoL) (Khalaila & Vitman-Schorr, 2017). The combination of internet use and pre-existing good social networks had a synergistic effect on QoL. With respect to the impact of social media on social isolation, Hajek and König (2021) suggest that though social media has positive impacts in terms of increasing contact with family and other intergenerational relationships, the associations between social media and social isolation specifically remain unclear.

However, evidence of the impacts of social media on loneliness is not consistent (Chen & Schulz, 2016; Ibarra et al., 2020). Chen and Schultz identified 25 articles published between 2002 and 2015 and consistently reported positive effects in terms of social support, social connectedness, and social isolation. Fifteen of the 18 studies that looked at loneliness showed a positive impact, especially with the use of communication programs and high-technology apps. However, the general use of the internet and computers had no significant impact. Ibarra and colleagues reviewed 25 studies published before January 2020, of which 13 considered loneliness as the primary outcome and 12 had loneliness and/or social connectedness as secondary outcomes. Nine studies reported decreased loneliness and two increased social networks. Seven studies reported no significant impact.

Evidence for seniors living in congregate settings

Within congregate settings, there is little data exploring the use of social media; the focus instead is on leveraging communication technology, such as videoconferencing, to maintain social connections with peers, family, and friends.

For example, Barbosa Neves et al. (2017) looked at the feasibility of an accessible communication app to enhance perceived social connectedness among frail seniors living in a retirement home. They found it feasible if five crucial elements were considered: the active involvement of a relational tie; perceived usefulness and functionality; appropriate adjustment periods to learn the app; management of different intergenerational preferences, norms, and expectations; and having geographically distant relatives.

Zaine et al. (2019) used media parcels (a novel human-facilitated social networking system) to facilitate and guide photo and video sharing between friends and family members. They found participants reported increased frequency of interaction and improved depth of discussions, along with strengthened social connectedness.

Finally, Tsai et al. (2010, 2011, 2020) used videoconferencing capabilities to link long-term care home residents with family and friends. All these studies reported ongoing positive effects at 3 months on loneliness using the UCLA Loneliness Scale. In one study, the follow-up period was extended to 12 months and found that while the frequency of videoconference calls decreased over time, the length of calls increased. The authors also continued to see positive effects on loneliness compared to the control group (Tsai et al., 2011).

Tsai et al. (2020) found no difference in changes in mean scores for loneliness or depressive symptoms at either the 1 or 3-months' time-point compared with baseline between smartphone and laptop videoconferencing; however, the type of social support (informational, appraisal, emotional) and source of social support (friends, other sources) were significantly greater for smartphone-based communication compared with the laptop-based platform.

However, the evidence is not always clear. A systematic review of pre-pandemic literature by Noone et al. (2020) found that video calls had little to no effect on loneliness or quality of life for residents. There was, however, a small reduction in depression at one-year follow-up.

Feedback from staff and volunteers suggests that residents enjoy connecting with volunteers remotely (Fearn et al., 2021; van Dyck et al., 2020). However, facilitating resident-family connections (whether they be in-person or virtual) required a significant amount of time and effort from already overburdened staff in congregate settings. For example, Ickert et al. (2020) estimate that a LTC home with 100 residents would require a minimum of 2 full-time and 1 part-time staff to provide most residents with a once-a-week visit (virtual or in-person at window or outdoor visit) with family for 30 minutes.

Examples of social media and online platforms

Program	Lead	Location	Setting	Description
Amintro	Amintro	Ontario	Community	Amintro is an online social platform and information hub exclusively for those 50+ interested in expanding their circles of friends and staying involved, informed and connected.
Jarlette Health Services Facebook Page	Jarlette Health Services	Ontario	Retirement and Assisted Living	Jarlette Health Services is a Retirement and Assisted Living Facility that created a Facebook page where it shares information with residents, their families, and their community about recreational activities and events in the facility.
Confinés, ensemble!	School of Public Health of the University of Montreal and Center for Public	Quebec	Community and seniors residence	Confinés, ensemble! was a project that invited seniors to take photos of their confinement during COVID-19 and then participate in weekly online meetings with other seniors to discuss their experiences. The project targeted seniors who were

	Health Research			living alone, living in a seniors residence, or a member of the LGBTQ community. The photos were developed into a virtual exhibition.
Komp	No Isolation	Norway	Retirement homes and LTC	Komp is an AI-driven platform with a simple one-button interface, making it easier for seniors to video call their loved ones. It's tailored for older adults who may have limited experience with technology.
Oscar Senior	Oscar Senior	North America	Community, Retirement homes and LTC	Oscar Senior is an AI-powered app that not only facilitates video calls and messaging but also provides personalized content like news articles and games. It also helps seniors manage daily tasks and medication reminders.

4.4.1.3 Online support groups and virtual programs

Online support groups and virtual programs that are tailored to specific interests or needs offer seniors the chance to connect with like-minded individuals, share experiences, and receive emotional support. These communities can be particularly valuable for individuals who face physical limitations or live in remote areas.

Evidence for community-dwelling seniors

The pandemic disrupted the operations of community and recreation organizations, and many switched to remote delivery of programs. Examples of activities that can be offered remotely include book clubs, discussion groups, social games, creative arts, group health promotion initiatives, lectures, virtual tours, and cultural opportunities (Day et al., 2020; Hebblethwaite et al., 2020; INSPQ, 2020; Son et al., 2020). While there are various exercise videos available online, recreation staff can also offer online classes to provide opportunities for social connections (Son et al., 2020). Older women particularly benefit from online group classes, since past research suggests they prefer to exercise in social settings (Gutman et al., 2021).

Evaluations of such virtual programs for seniors conducted prior to the pandemic suggest that they can reduce social isolation (Botner, 2018; Gorenko et al., 2021); however, securing adequate funding to support their operations has been a challenge for some non-profit and community organizations (Coordinated Pandemic Response Steering Committee, 2020).

Evidence for seniors living in congregate settings

The evidence for how virtual programming and online support groups address loneliness and social isolation among seniors living in congregate settings is limited. However, there are some specific programmatic examples that demonstrated promising results. Murphy et al. (2021)

evaluated the feasibility and efficacy of delivering a virtual visual arts intervention to seniors living in LTC and reported a positive response to the intervention and significant improvement in well-being. D'Cunha et al. (2020) observed that a virtual group cycling experience for seniors living with dementia in LTC was immersive, engaging, and challenging physical activity, which allowed them to reminisce about cycling earlier in life.

Examples of online support groups and virtual programs

Program	Lead	Location	Setting	Description
Rainbow Circle	Sunshine Centres for Seniors	Toronto, Ontario	Community	The Rainbow Tea & Talk program offers LGBTQ+ seniors an opportunity to stay social, keep connected with each other, and have fun while staying at home. The program is delivered over Zoom.
Sustaining Strength of Seniors	Grade 12 student at St. John's-Ravenscourt School.	Winnipeg, Manitoba	Community	The Sustaining Strength of Seniors program is an online weekly social group for local seniors, initiated and hosted by a local teen. The teen organized speakers, led craft activities and gave space to chat.
Creative Connection	Creative Connection	16 institutions across Canada	LTC	Creative Connection was initiated by students from Western University during the pandemic. It paired student performers with residents in long-term care homes, retirement homes and hospitals for virtual live musical/art performances and conversation.

4.4.1.4 Enhanced engagement and cognitive stimulation activities

Using ICT to engage in cognitive activities (e.g., playing online games, solving puzzles, using brain-training applications, etc.) has been associated with improved cognitive function and mental well-being. These activities can serve as enjoyable and stimulating pastimes, reducing feelings of loneliness and promoting positive psychological health.

Evidence for community-dwelling seniors

A USA pre-pandemic study evaluated the impact of a specially designed computer system for seniors, the Personal Reminder Information and Social Management (PRISM) system (Czaja et al., 2018). PRISM provided participants with access to a broad array of features beyond the internet, such as e-mail, games, and a dynamic classroom feature that provided additional opportunities for social interaction and engagement. Overall, their results suggested potential

value with respect to reducing problems with social isolation, fostering connectivity, and decreasing feelings of loneliness among seniors who live alone and have limited engagement in work and social activities (Czaja et al., 2018).

Evidence for seniors living in congregate settings

Again, the evidence linking this strategy directly to social isolation and loneliness among seniors living in congregate settings is limited. However, there seem to be some broader effects that have emerged. For example, Swinnen et al. (2021) reported that seniors with cognitive disorders living in LTC participating in stepping exergame training for 15 minutes, three times per week, can improve their physical functions, improve Activities of Daily Living (ADLs), significantly reduce depression, and improve quality of life.

Examples of enhanced engagement and cognitive stimulation activities

Program	Lead	Location	Setting	Description
Companion Calls	Nucleus Independent Living	Ontario	Community	Companion Calls connects seniors with trained volunteers via weekly video calls. Interactions are a mixture of structured activities and unstructured social engagement. Tablets and activity kit are provided to interested participants.
Diamond House Personal Care Home	Diamond House Personal Care Home	Saskatchewan	Retirement Home	Diamond House Personal Care Home in Saskatchewan, adopted cutting-edge interactive tech inside their personal care house. Obie For Seniors helped combat some of the loneliness and enhanced their quality of life.

4.4.1.5 Telephone-based programs

Evidence for community-dwelling seniors

For some seniors, low-tech telephone-based helplines and programming may be the most practical and appropriate options for social connection (e.g., if the senior prefers not to use computers, lacks access to high-speed internet, etc.) (Conroy et al., 2020). A review of the pre-pandemic literature found social activities, educational sessions, and befriending programs can be successfully conducted over the telephone (Gorenko et al., 2021). Telephone lines and telephone outreach programs can provide friendly conversation and play an essential role in connecting seniors to organizations offering services to reduce social isolation.

Pre-pandemic, interviews with staff and users of a senior's helpline in the UK revealed that seniors often called the helpline to seek friendly conversation and alleviate loneliness (Preston &

Moore, 2019). During the pandemic, reported benefits of telephone outreach programs in the US have included positive emotions and connecting seniors to needed services (Office et al., 2020; Rorai & Perry, 2020). Telephone outreach programs also provide volunteer opportunities for seniors, as they can be trained virtually to become telephone volunteers (Lee et al., 2021).

Preston and Moore (2019) found that telephone services enabled the linking of geographically dispersed individuals using non-visual communication; this may be particularly attractive for seniors who do not thrive in face-to-face situations (e.g., those who are shy or poor at interpreting visual social cues). People using the phone services spoke about the value they found in not being judged on appearances, in having relative anonymity, and in feeling freer to say what they wanted.

Evidence for seniors living in congregate settings

A study by Sacco et al. (2020) found that seniors confined to health care settings (i.e., a geriatric acute care unit or long-term care home) were more often independently able to perform telephone calls than video calls, and they tended to use the telephone more often to communicate with their relatives. Their levels of satisfaction were similar with both communication supports, and satisfaction was even greater with video calls among residents of the long-term care home when they received assistance to establish communication. The study exhibited that the use of technological communication methods, such as telephone calls and video calls, could help prevent social isolation and loneliness in frail seniors during confinement. (Sacco et al., 2020).

One practical solution to reduce social isolation was a program where health profession graduate student volunteers placed calls to seniors living in long-term care facilities and the community that were at risk of social isolation during the COVID-19 pandemic (Office et al., 2020). Conversation topics were related to coping, including fears or insecurities, isolation, and sources of support; health; and personal topics such as family and friends, hobbies, and life experiences. Results showed that seniors appreciated and enjoyed receiving calls and that students felt empowered, able to make a difference in the lives of socially isolated seniors, and learned how to be patient and to slow down in conversations with hearing-impaired seniors, specifically learning important geriatrics tenets in the process. (Office et al., 2020).

The Telephone Outreach in the COVID-19 Outbreak (TOCO) program by van Dyck at al. (2020) also achieved initial success in promoting the social well-being of long-term care home residents through the pairing of residents with student volunteers to participate meaningfully in a telephone program. Initial reports of the study were positive, and residents indicated that they looked forward to weekly phone calls and expressed gratitude for social connectedness (van Dyck et al., 2020).

To enable the success of remote befriending programs, Fearn et al. (2021) recommend that organizations assign a staff member to assist with coordination and scheduling, ensure access to technology and provide set-up assistance, provide volunteers with training on how to communicate with people with hearing or cognitive impairments, provide headphones for residents with hearing impairments, arrange a face-to-face visit or video call for the first visit (if possible), and exchange short bios between the residents and volunteers.

Examples of telephone based programs

Program	Lead	Location	Setting	Description

Phone Pal Program	Strathcona Place Society	Edmonton, Alberta	Community (1-1)	The Phone Pal Program matches volunteers and seniors based on shared interests, cultural background, and language. Matches are also accommodated based on other preferences, such as age. Regular phone calls are made to the senior. Should something stand out in a conversation with a senior, the volunteer notes this in their weekly report, and the case referred to the Strathcona Place Outreach Team (SPOT) for follow-up.
Studio Without Walls	University of Regina	Saskatchewan	Community (1-1)	Studio Without Walls was a telephone-based arts program that paired seniors with professional artists. The artists provided seniors with advice over the phone on various creative arts (e.g., painting, writing). The program targeted seniors living in rural areas, though all seniors were welcome to participate.
Friendly Calls Program	Canadian Red Cross	Canada	Community (1-1)	The Friendly Calls Program matches volunteers with seniors (55+) for a weekly phone call.
Seniors' Centre Without Walls	Edmonton Southside Primary Care Network	Alberta	Community (group)	Seniors' Centre Without Walls is a free, phone-based program that offers seniors 55 years+ in Alberta a variety of interactive health and well-being information sessions, recreational activities, and friendly conversation. A pre and post-intervention evaluation of the program found statistically significant decreases in loneliness scores (for high users of the program) and anxiety and depression scores. Over half of participants also reported making new friends from the program. During the past year, the number of participants actively using the SCWW program has increased by

				about three-fold, and in response the SCWW has tripled their programming to accommodate the new participants.
Companion Calls	Student Association for Geriatric Empowerment (SAGE), University of Toronto	Toronto, Ontario	LTC (1-1)	Student volunteers made telephone or video Companion Calls to residents in long-term care (LTC). SAGE had also provided other supports to LTC homes including letters, cards, and gardening supplies.

4.4.1.6 Virtual reality

Evidence for community-dwelling seniors

Emerging technologies like virtual reality (VR) and augmented reality (AR) hold immense potential to combat loneliness by providing immersive and interactive experiences. VR applications can simulate social environments, allowing individuals to engage in virtual gatherings, events, or even attend virtual classrooms. AR can enhance real-world experiences by overlaying digital content and fostering social interaction and connectedness. By blurring the lines between the physical and virtual realms, these technologies offer novel avenues for social engagement and companionship.

Evidence for seniors living in congregate settings

Over the last five years, evidence has emerged about the positive effect of VR on the social, emotional, and physical health of seniors living in congregate settings. In 2018, Lin et al. focused on understanding the potential effects of using VR on the social and emotional well-being of seniors, especially those living in assisted living communities with limited social activities. Compared to the control group, those that interacted with the VR system were more likely to feel good about their own health, more likely to feel positive emotions, less likely to be depressed, and less likely to feel socially isolated. Participants in the VR group also reported being more satisfied with and accepting of the technology and its contents compared to the control group.

In an exploratory study with residents of LTC homes, Baker and colleagues (2020) found that, by providing topics of conversation for residents to engage in with their families and friends, interactive and stimulating features of the Oculus Rift VR technology increased engagement among individuals who frequently self-isolate. Chaze and colleagues (2022) also found positive effects in a pilot study within four Canadian LTC homes; they demonstrated the tolerability and potential of VR experiences to contribute to the physical, emotional, cognitive, and social well-being and socialization of seniors. In one study, participants were more talkative and provided more details regarding their dementia in a VR-simulated meeting than in the real-world scenario, suggesting that VR may facilitate more verbal interactions and improve social-emotional

behaviour (Mendez, 2015). Finally, a study by Huang (2022) using immersive VR reminiscence found it can improve mood and preserve cognitive function in elderly patients with dementia in LTC during the period of the intervention.

Examples of VR

Program	Lead	Location	Setting	Description
Virtual Reality Project	Parry Sound Family Health Team	Parry Sound, Ontario	Community	The VR Project, is a virtual reality project to lift seniors/senior's spirits and contribute to their mental health/well-being, with arts, music, travel, animals, and more through the powerfully immersive virtual reality technology and content. Target population is focused on hundreds of seniors/seniors living in long-term care homes, retirement homes, congregate homes, and/or those with mobility, functional, and/or cognitive conditions.

4.4.1.7 Telehealth

Evidence for community-dwelling seniors

Telehealth consultations and remote monitoring systems not only provide medical support but also offer an avenue for education and social interaction with healthcare professionals and peers, thereby contributing to reduced social isolation and loneliness. For example, utilizing data from the 2020–2021 National Health and Aging Trends Study, Howe and colleagues were able to demonstrate lower social isolation rates in seniors who were telehealth users (Howe et al., 2020). Similarly, Zubatsky et al. (2020) utilized a telehealth program within circle of care groups to help alleviate loneliness in seniors early in the pandemic.

A novel and scalable Telehealth Intervention Program for older adults (TIP-OA) was introduced in March 2020 by the GeriPARTy research group (Sekhon et al., 2022). TIP-OA is a friendly phone call service (providing social interaction for isolated older adults) that serves seniors utilizing trained volunteers in the province of Quebec, Canada. The aim of this multilingual (>15 languages) program was for volunteers to provide social interactions, connect seniors with existing community resources/networks, and help them navigate and access online resources (e.g., grocery delivery, pharmacy refills and delivery). In a prospective cohort study, they were able to demonstrate significant improvements in depression scores and improvements in anxiety and stress measures.

Examples of telehealth services

Program	Lead	Location	Setting	Description

CanConnect	CanAssist	British Columbia	Community	The CanConnect Device (CanConnect and the Custom Case) – is a user-friendly software app for an iPad allowing people with a wide range of barriers (conditions associated with aging, such as dementia and frailty, cognitive and physical disabilities) to communicate easily and securely with family, friends, caregivers and clinicians in real-time video over the internet.
Telehealth Intervention Program for Seniors (TIP-OA)	Jewish General Hospital and McGill University	Montreal, Quebec	Community	TIP-OA is a free service serving isolated and vulnerable seniors with mental health/cognitive issues and their caregivers. Volunteers call weekly to inquire about the general well-being, give out information about COVID-19, ask if the seniors need any help or support (e.g., food delivery, medication from their pharmacy), connect seniors with community organizations offering services, and give friendly company on the phone to increase a sense of connection.

4.4.2 Physical information and communication technology

By facilitating communication between individuals, Social ICT plays a pivotal role in bridging the gap and connecting seniors with the outside world. While these technologies have undoubtedly made significant strides in reducing loneliness, it is important to recognize that they are not the only solution. Innovation extends beyond the realm of Social ICT and there exists a wide array of other technologies that can enhance the social lives of seniors, foster meaningful connections, and monitor and alleviate social isolation and feelings of loneliness. These technologies embrace diverse approaches, ranging from robotic companions to monitoring health and activity, and aiding mobility and functional independence.

4.4.2.1 Smart homes and wearables

Evidence for community-dwelling seniors

Smart home devices and wearable technologies enable seniors to maintain independence in their daily lives; these technologies offer a sense of autonomy and control over the environment and can positively impact well-being and reduce social isolation. Smart wearable technologies in the home have also been used to facilitate social connections (Gustafson et al., 2015), relationships with healthcare providers, and tele-rehabilitation. In a recent literature review, Latikka et al.

(2021) suggested that physical information technologies such as smart home solutions can help detect and predict loneliness and social isolation by tracking behaviour patterns within the home.

As individuals strive to maintain their independence, there may be a need for technology that can identify health or mobility changes (e.g., changes in broader health markers that might suggest the risk of adverse events). Smart home technologies can support aging in place and the preservation of existing social networks by assisting seniors with functional impairments, communication challenges, or the need for monitoring of chronic diseases (Peek et al., 2014). Smart home technologies have been demonstrated to help identify abnormalities in gait (Lockhart et al., 2014), the onset of infection (Rantz et al., 2015), and changes in cognitive functioning (Seelye et al., 2018). Motion sensors can detect falls and connect the senior to a caregiver or emergency services. Wearable health technologies can also empower seniors to play an active role in their own health management. Technology-based solutions offer a way to track, monitor, and improve health while empowering seniors to take control of their own well-being (Hirani et al., 2014).

Technology holds the promise to help monitor changes in cognition, provide cognitive stimulation and training to reduce the impact of these changes, and create systems that assist individuals and families to monitor safety and maintain financial security (Chouvarda et al., 2015). Wander detection systems can provide caregivers with the peace of mind that comes from knowing that seniors living with cognitive impairment are safe at home. In a systematic literature review, Pinto-Bruno et al. (2017) suggest that people living with dementia can benefit from information and communication technology interventions to help them maintain, facilitate, and create social networks.

Examples of smart home technology

Program	Lead	Location	Setting	Description
The Assured Living System	Carleton University, Bruyère Research Institute, and Best Buy Health	Ottawa, Ontario	Community	Carleton University, Bruyère Research Institute, and Best Buy Health are developing practical at-home wellness monitoring systems that allow Canadian seniors to age in place with independence and help seniors improve their outcomes. The Assured Living systems and other smart home technologies are intended to support Canadians aging in place - delaying institutionalization for as long as possible, giving seniors independence and dignity, while also providing their caregivers and family members peace of mind, and taking pressure off the health care system by enabling at home triaging and recovery.

Night-time Wandering Detection and Diversion system	The University of Ottawa Brain and Mind	Ottawa, Ontario	Community	In collaboration with the Dementia Society of Ottawa and the Champlain Local Health Integration Network, the Bruyère Research Institute in Primary Health Care Dementia Research designed supportive smart homes for people living with dementia. These homes use sensors and cloud-computing systems to assist individuals with dementia in navigating their homes and performing daily activities, significantly reducing the burden on caregivers.
Immersive Smart Home System for Elderlies	SEER	Alberta	Community	An immersive smart home system project is being developed to support aging in place for seniors with neurocognitive disorders. This system utilizes Internet of Things (IoT) devices and Mixed Reality (MR) head-mounted devices to create an environment that blends virtual interactive objects with the physical world. The system supports two user modes: senior and caregiver, providing tailored memory prompts and other assistance to seniors while ensuring caregiver involvement in configuring the system to meet the seniors' specific needs.

4.4.2.2 Social robots

Evidence for community-dwelling seniors

Advancements in social robotics have led to robots designed to interact and engage with humans in social settings. These robots can provide companionship, assist with daily tasks, and facilitate social interactions. AI-powered social robots have shown promise in addressing loneliness and social isolation among the elderly population. These robots can engage in conversations, remind users of medication or appointments, and provide companionship. They can also serve as a bridge between seniors and their families by facilitating video calls or sharing updates, thus reducing feelings of isolation and improving overall well-being. Latikka et al. (2021) found that technologies such as robotic pets and some other social robots can help alleviate loneliness.

It is noteworthy that the pandemic and associated changes in lifestyle may have led to a change in the perception of the benefits of social robots. A Canadian survey by Ghafurian et al. (2020) found that, in the absence of human contact, people viewed a socially assistive robot (SAR) as a potential companion to reduce social isolation. The University of Waterloo has various social robots being used to facilitate social connectedness, intergenerational relationships, and meaningful engagement (Rasouli et al., 2022).

In Spain, Misty, a 36-cm-tall mobile robot, is being used to augment the abilities of human care providers visiting seniors in their own homes by allowing them to remotely check in more frequently than is possible with home visits, even with pandemic quarantining regulations (Getson & Nejat, 2021). Misty helps address loneliness among the elderly by providing companionship through dancing, telling jokes, and playing music.

Evidence for seniors living in congregate settings

Fan et al. (2022) presented a novel human-robot interaction (HRI) framework and a realized platform called socially assistive robotic (*SAR)-Connect* to foster robot-mediated social interaction among seniors living in LTC through carefully designed tasks that also incorporate physical and cognitive stimuli. The study results showed this platform could involve one or multiple seniors to perform multi-domain activities and foster human-human interactions.

Social Robots is a social enterprise specializing in using companion robots to improve the quality of life for seniors. Their robot, Mindy, is a social robot who provides engaging and entertaining group events (e.g., music and movement) as well as 1:1 visits (e.g., brain games, video calling, etc.) in retirement and LTC homes. In a 2021 pilot study, researchers found that 96% of residents wanted to see Mindy again after their first visit. Though there was no significant effect on loneliness, the authors note that many contextual variables made this measurement difficult (Social Robots, 2022).

Examples of social robots

Program	Lead	Location	Setting	Description
Social Robots	Social Robots	N/A	Retirement homes and LTC	Social Robots is a social enterprise specializing in using companion robots to improve the quality of life for seniors. The goal is to help recreation leaders in retirement homes and LTC facilities to leverage technology to better engage and entertain residents and reduce the impact of social isolation, loneliness and boredom.
Misty	Misty Robotics	Spain	Community	In Spain, Misty is being used to augment the abilities of human care providers whose job it was to visit those aging-in-place in their own homes, by allowing them to remotely check in more frequently than what

				is possible with home visits, even with pandemic quarantining regulations. Misty keeps track of the health of the elderly through asking them questions about daily habits such as sleep quality, medication taking, and diet. Another of its strengths is that Misty also helps address loneliness in the elderly by providing companionship through dancing, telling jokes, and playing music.
Pepper	SoftBank Robotics	BC	LTC	A humanoid robot that uses AI algorithms to recognize and respond to human emotions. It can converse, dance, and lead exercise routines, offering interactive experiences for seniors.
Lovot	University of British Columbia	Canada	LTC	The University of British Columbia is conducting a study with social robots Kiwi and Mango, which are equipped with AI to learn, speak, recognize faces and voices, move around, and offer physical interaction like hugs. This study, led by Dr. Lillian Hung, aims to explore how these robots interact with seniors, including those with cognitive challenges, and assess their impact on elder care. Preliminary visits to care homes in the Vancouver region with these robots have shown positive responses from residents. The study plans to collaborate with Amica Residences to further observe and record interactions between residents, care staff, and the robots, aiming to inform future directions in elder care.

4.4.2.3 Physical and ambient assistive devices

Physical assistive technologies are tangible tools or equipment designed to help individuals perform specific tasks, improve their physical abilities, or replace a lost function. Advanced technological features can further enhance the capabilities of traditional assistive devices, thus

enabling seniors to engage more deeply and frequently with their surroundings and communities. By integrating advanced technology into physical assistive devices, the potential to combat loneliness and social isolation among seniors is significantly amplified. These tools not only address the immediate physical needs but also cater to the emotional and social well-being of seniors, ensuring a holistic approach to their quality of life.

Some physical assistive technologies can increase seniors' ability to independently navigate within their environment. For example, advanced wheelchairs and scooters with GPS functionalities and assistive robotics allow seniors to navigate unfamiliar places, encouraging them to explore new areas and engage in community events. Advanced glasses with camera technology can describe surroundings or read texts for visually impaired seniors, allowing them to engage more actively in social settings. In addition, augmented reality overlays can highlight obstacles or provide navigation cues in real-time.

Other physical assistive technologies enable seniors to foster more frequent and deeper connections within their community. Wearable devices with social reminder functions can notify seniors of upcoming community events, family gatherings, or social meetups. Advanced hearing aids equipped with Bluetooth technology can connect directly to phones, TVs, and radios, enabling seniors to engage in phone conversations, enjoy shows, or listen to the radio without feeling disconnected. Speech-generating devices with AI capabilities can also predict and suggest words, helping those with speech impairments communicate more efficiently and effectively. For those seniors looking for new ways to connect with others, interactive gaming platforms, tailored for this population, encourage physical activity and can be played with family members, bridging the generational gap and facilitating shared fun experiences.

Ambient assistive devices, also known as ambient assisted living tools, incorporate a blend of sensors, artificial intelligence (AI), and communication interfaces to monitor, assist, and adapt to an individual's needs, often without requiring direct interaction.

These devices help detect loneliness by monitoring behavioural patterns and noting deviations, such as diminished physical activity or changes in sleep cycles. By analyzing this data, the devices can deduce feelings of isolation or depressive episodes, prompting interventions. When signs of loneliness are discerned, some devices can initiate communication. This could range from a simple nudge to call a family member or friend to connecting with helplines or community groups. Advanced devices might even employ conversational AI to engage seniors in meaningful dialogues. Finally, beyond immediate interventions, ambient assistive device features, such as reminders for social events or facilitating video-calling interfaces, can help seniors remain tethered to their communities and loved ones.

Evidence for community-dwelling seniors

Both types of technologies can play a crucial role in reducing isolation and loneliness in seniors by promoting independence, social engagement, and enhancing their overall well-being (Jutai & Tuazon, 2022).

Evidence for seniors living in congregate settings

In their scoping review, Macdonald et al. (2021) reported assistive technologies used in LTC could be engaging and beneficial in support of social interactions. Budak et al. (2021), in their scoping review, identified that assistive technologies used to apply psychological interventions

have the potential to improve loneliness and quality of life in seniors living with dementia in LTC.

Examples of assistive devices

Program	Lead	Location	Setting	Description
Tenera Care wearable devices project	Atlantic Canada Opportunities Agency	Nova Scotia	LTC	Atlantic Canada Opportunities Agency in Nova Scotia with Federal support started Tenera Care wearable devices project that will enable the company to install this technology in selected LTC facilities
AI Monitoring System	University of Waterloo	Ontario	Community, Retirement homes and LTC	Researchers at the University of Waterloo have developed a new AI monitoring system to unobtrusively monitor the health of seniors. This system, which does not require wearable devices, uses low-power, millimeter-wave radio systems combined with AI to track an individual's activities in their living space, such as long-term care facilities or homes. It can alert healthcare workers to sudden falls and detect general declines in mobility, increased likelihood of falls, and the onset of medical conditions

5. USE OF INTERNET CONNECTIVITY AND OTHER TECHNOLOGIES BY SENIORS PRE AND DURING THE PANDEMIC

A Statistics Canada report noted that internet use by seniors had increased from 32% to 68% between 2007 and 2016, although still less than half of those aged 80 and older were using the internet (Davidson & Schimmele, 2019). Despite this increased use by seniors, it still lagged behind younger age groups. For example, internet use among Canadians aged 15 to 64 was at near-saturation levels (97.2%) in 2016. Moreover, Canadian seniors were less likely to report technology's positive impact on their lives and were less likely to use it to communicate with people, make informed decisions, or save time.

Although the proportion of seniors accessing home broadband increased to 83% in 2020 during the first year of the pandemic, it remained below the national average (94%) (Statistics Canada 2020). Another recent poll found that a significant portion of Canadian seniors use the internet

daily (88%), own a smartphone (65%), use their smartphone daily (58%), and feel confident using technology (72%) (AGE-WELL NCE, 2020).

The pandemic prompted increased technology use among seniors, particularly in terms of video calls, social media, online activities, and food delivery services (AGE-WELL NCE, 2020). According to CLSA (2021) data, 83% of seniors isolating at home used the telephone to stay in contact during the pandemic, 48% used video calls, and 44% used social media. Significant age gradients, however, still existed for the use of video calls and social media, with those aged 85 and older the least likely to use them (e.g., 64% of people 65 to 74 used video calls compared to 31% of those 85 and up). Despite the increased use of smart phone, there continues to be a need to adapt smartphone interfaces and functionality to meet the needs of seniors with limited digital literacy (Marston et al., 2022).

A number of seniors, like many Canadians, transitioned to virtual programming during the pandemic for social, practical, and informational purposes. For example, the Older Adult Centres' Association of Ontario (2020) conducted a province-wide survey of participants at senior centres and found 35% were participating in virtual programming.

Despite the pandemic acting as a potential 'digital push', the increase in ICT use among LTC residents was marginal. Only a small percentage (9.2%) reported using the internet to stay in contact with relatives, and most (99.3%) preferred the telephone. The pandemic's lockdowns did not significantly change this pattern, indicating the persistence of barriers to digital engagement (Gallisti et al., 2021).

Sixsmith et al. (2022) compared the results of a survey of seniors regarding their use and attitudes toward technology before and during the pandemic. While seniors felt more isolated in 2020, many felt positive about the benefits of technology and had increased technology use during the pandemic to support their health, wellness, and communication needs.

5.1 Barriers to technology use: The digital divide

The term "digital divide" refers to the gap between those who have ready access to computers and the internet and those who do not. As described above, Canadian seniors have lagged behind other groups both before and during the pandemic. The digital divide among Canadian seniors during the COVID-19 pandemic was influenced by a variety of factors that are both systemic and individual. Several studies, including those by Benoit-Dubé et al. (2020), Gorenko et al. (2021), Savage et al. (2022), and Harris et al. (2022), identified barriers to seniors' tech adoption during the pandemic, including uncertainty about tech benefits, cost, tech literacy, physical and cognitive challenges, social supports, privacy concerns, and potential fraud risks. These factors created disparities in access to and utilization of digital technology, thereby exacerbating existing vulnerabilities among this demographic. Below are some of the contributing factors:

5.1.1. Socio-economic barriers

Some seniors face limited digital accessibility due to factors like education, income, and gender, as emphasized by Hebblethwaite et al. (2020). The affordability of technology and internet services is a significant issue for many seniors, particularly those who rely on fixed incomes or pensions.

High-speed internet, essential for video conferencing and telehealth services, as well as keeping up to date with the latest technological devices (e.g., smartphones and computers), can be costly

and financially challenging for seniors. Unreliable internet and smartphone access also play a role in determining usage.

Gender discrepancies also still exist. Traditionally, men have been more involved online than women (Helsper, 2010; Joiner et al., 2015; Seifert & Cotton, 2021). More recent research indicates that women have started to close this gap, especially for social interactions, and even surpass men in some areas (Bünning et al., 2023). However, some disparities remain, though they are diminishing. For example, men continue to be more likely to use online banking, (Bünning et al., 2023); a variety of explanations are possible for this persisting gender gap for online banking, including female preference for personal service, financial literacy levels, and stereotypical role factors.

5.1.2 Geographic disparities

In Canada, urban-rural divides are particularly pronounced when it comes to internet access. Other factors that may contribute to difficulty in embracing technology include living in remote or Indigenous areas or living with disabilities or cognitive challenges. While urban areas often have several high-speed options, rural regions may lack this infrastructure, limiting access for seniors residing in these areas. This geographical divide further exacerbated the digital gap during the pandemic, especially when lockdowns and physical distancing measures made online services more critical than ever.

5.1.3 Digital literacy

Digital literacy refers to an individual's knowledge, skills, and confidence to keep up with changes in technology; this is less prevalent among older Canadians compared to younger generations who grew up in a digital age.

Data from Statistics Canada (2022) showcased a growing disparity between novice and intermediate internet users. The pandemic further distanced less experienced users from digital advancements. Over one-quarter of seniors (25.4%) are considered basic users, compared to 12.2% of those aged 50-64 and 9.8% of those aged 49 years and younger (Statistics Canada 2022). During the pandemic, a higher proportion of basic users fell further behind in their use of the internet. This skill gap made it challenging for many seniors to navigate online platforms, use apps, or even perform basic tasks like connecting to Wi-Fi, which became especially problematic when services like healthcare and social interaction moved online. Furthermore, the psychological barriers to adopting new technologies, often termed 'technophobia,' can prevent seniors from even attempting to bridge the digital divide.

The 2021 Canadian Digital Health Survey explored seniors' preference for virtual care. The results revealed seniors mostly preferred telephone consultations, then video, followed by secure messaging (Yu & Hagens, 2021). The study highlighted that while health conditions drive some of this demand, digital health literacy plays a significant role, with lower-income and less-educated seniors expressing less desire for virtual consultations. The report by the Task Team on Equitable Access to Virtual Care (2021) underlined the absence of a unified Canadian strategy for equitable online healthcare services. They emphasized exploring both digital and social determinants of health in understanding the equity challenges in accessing online care.

Finally, the Older Adults Centres' Association of Ontario (2020) researched reasons seniors might resist virtual programs. Many cited a lack of interest (52%) or discomfort with technology

(32%). The challenge lies in replicating real-life interactions in virtual spaces, ensuring they cater to the underserved and are marketed effectively (Cohen-Mansfield et al., 2021).

5.1.4 Accessibility issues

Usability and accessibility are significant concerns with respect to the use of the internet and technology, particularly for seniors who may have visual, auditory, or cognitive impairments. Many digital platforms and services are not designed with these accessibility needs in mind, making it difficult for seniors to engage with them effectively. This may become particularly challenging if you are also living with physical or cognitive challenges (Conroy et al., 2020; Davidson & Schimmele, 2019; Ryerson Leadership Lab, 2021; Lam et al., 2020; Lee & Miller, 2020).

In addition to barriers specific to access and ability to use technology, Haase et al. (2021) found that physiological barriers, such as hearing and vision loss or issues with dexterity and poor coordination, may impede seniors' willingness or ability to engage with technology. Physical or cognitive limitations related to injuries or age-related decline also inhibited seniors' use of technological applications (Haase et al., 2021). Technology-based interventions must be developed with those with significant sensory impairments, limited internet access, and financial limitations in mind (National Institute on Ageing, 2022).

5.1.5 Language and cultural barriers

For seniors belonging to linguistic and cultural minorities, the task of navigating digital landscapes can pose particularly significant challenges. Seniors from different cultural backgrounds may have had different levels of exposure to technology throughout their lives, affecting their current digital literacy and readiness to utilize technology. Language barriers may impede their access to online services, understanding of instructions, or ability to utilize available resources, thereby exacerbating their isolation and restricted access. Many immigrant seniors also lack internet connectivity; public libraries frequently act as an essential resource for these individuals to access the internet and computers (Haight et al., 2014). However, the pandemic's enforcement of closures on public internet access points, including libraries, exacerbated this digital divide (Ryerson Leadership Lab, 2021).

5.1.6 Lack of tailored services

A lack of services specifically designed to meet the needs of seniors can exacerbate the digital divide. While there are some efforts to create senior-friendly platforms, apps, and services, these are not universally available or adequately publicized. A person's experience, ability, and preferences play a part in their use of technology. This is important to consider, as the design and operation of technologies are not typically friendly for seniors (Science and Technology for Aging Research Institute, 2019), and in fact, seniors and caregivers are often excluded from the design and development process (Mannheim et al., 2022).

5.1.7 Setting (community and LTC)

The introduction of technology into the home environments of seniors has raised specific concerns, such as cost, usability, false alarms, and the potential for misplacing or losing portable devices (Peek et al., 2014). Although many seniors express the desire to age in place, only a small percentage (33%) would consider installing smart home technologies in their residences (HomeStars, 2017). A more recent study focusing on community-dwelling seniors in the US

revealed that while 94% used a smartphone, just 40% utilized a digital home assistant (e.g., Amazon Echo or Google Home), and a mere 23% had adopted smart home technology (Harris et al., 2022). Privacy concerns were the most commonly cited issue among those who had not adopted smart technologies. Other prevalent concerns included a lack of awareness of technological features, cost, and the perceived complexity of setup.

In long-term care (LTC) facilities, challenges persist. A survey from British Columbia reported that only 41% of LTC residents possessed a personal telephone (mobile or landline), and more than 85% required assistance to use it (Office of the Seniors Advocate British Columbia, 2020). Access to technology was hampered by the availability of digital devices, older buildings with limited or no WiFi/internet infrastructure, and a lack of knowledge and ability among residents, family, and staff members to manage the technology (Ickert et al., 2020). A study by Chu et al. (2022) examining caregiver experiences with technology in LTC settings in Ontario and British Columbia during the COVID-19 pandemic identified multiple issues, including insufficient technology and infrastructure, barriers to coordinating visitations, inappropriate technology implementation, and the failure of technology to meet the needs of residents. Many residents were unable to make calls themselves due to a lack of understanding of the technology, sensory impairments, or the manual dexterity required to operate touchscreens. Facilitating connections between residents and family, whether in-person or virtual, demands a significant investment of time and effort from staff who are already facing heavy burdens (Ickert et al., 2020).

5.1.8 Limited support for technology use

Peek et al. (2021) flag the importance of social influence, particularly family, friends, and peers, in influencing the acceptance and adoption of technology. Seniors who live alone or do not have family members to assist them in learning how to use new technology often find themselves isolated and unable to access essential services. In LTC, facilitating resident-family connections (whether they be in-person or virtual) requires a significant amount of time and effort from already overburdened staff (Ickert et al., 2020). This lack of support in teaching, operating, and navigating digital technology can contribute to the divide.

5.1.9 Systemic barriers

It is important to note that public policies and institutional practices can also contribute to the digital divide. For example, a limited allocation of resources for digital literacy programs or a scarcity of infrastructure development in rural areas create systemic obstacles that are hard for individuals to overcome on their own.

In summary, the digital divide among Canadian seniors during the COVID-19 pandemic was not the result of a single, isolated factor but rather a complex interplay of economic, social, geographical, and systemic issues. Addressing this divide requires a multi-pronged approach that considers the intricacies and intersections of these various factors.

5.2 Strategies to overcoming the digital divide

The digital divide represents a stark disparity in access to and proficiency in using digital tools, affecting individuals and communities worldwide. Bridging this gap is not merely a matter of technological advancement but a critical pursuit of equity and inclusivity. There is a need for digital technology education and training programs for seniors, as well as access to low-cost

technology and high-speed internet services (Conroy et al., 2020; Day et al., 2020; Science and Technology for Aging Research, 2019; Sixsmith, 2020; Son et al., 2020).

In Canada, various programs have been initiated or expanded to address the digital divide among seniors, with a focus on providing training and access to digital technologies. These initiatives often involve one-to-one tech training sessions covering common devices such as smartphones and tablets, as well as common applications such as web browsers, social media, and video chat tools.

Many programs engage students as volunteer trainers. Breck et al. (2018) found that social isolation among seniors may be alleviated by using reverse mentoring programs to cultivate intergenerational connections and develop the digital competence of seniors so they can connect socially through digital platforms. Their research highlighted the positive impact of reverse mentoring programs, increasing both generations' knowledge and confidence in using technology for social benefit.

Prior to the pandemic, the Government of Nova Scotia provided funding for internet and digital literacy pilots for community-dwelling seniors, including programs targeting Indigenous and African Nova Scotian communities. An evaluation of a pre-pandemic tablet training program in Ontario showed improved attitudes and usage of technology among seniors, although no changes for loneliness or social isolation were observed, possibly due to a limited sample size (Neil-Sztramko et al., 2020).

A study by Rolandi et al. (2020) examined the impact of a short training course for seniors aged 80 years and over on the use of social networking sites (i.e., Facebook and WhatsApp). The results demonstrated that one year after training, participants experienced reduced feelings of loneliness and less reduction in social engagement with family and friends during the period of forced self-isolation to counteract the COVID-19 spread (Rolandi et al., 2020).

Finally, in British Columbia, a study by Haase et al. (2021) emphasized the value of web-based socialization as a strategy to mitigate potential mental health effects related to virus containment strategies during a pandemic. These strategies include telephone training, creating task lists, using facilitated socialization activities, forming partnerships with community groups to address barriers, and potentially bolstering socialization support for seniors.

These findings underscore the importance of digital literacy initiatives for seniors, not only in improving their technological skills but also in enhancing their social connections and overall well-being, particularly in times of isolation and pandemic-related restrictions.

5.2.1 Examples of digital literacy training

Program	Lead	Location	Setting	Description
Student-Senior Isolation Prevention Project	SSIP	Toronto, Ottawa, Mississauga, London, and Peterborough, Ontario	Community	SSIPP pairs student volunteers with seniors for technology training, social connection and comfort, health literacy, connection to community resources and grocery services. Isolated seniors are referred to the program by health care providers

		Winnipeg, Manitoba Calgary, Alberta Saskatoon, Saskatchewan		or coordinators. The program at the University of Toronto has over 270 volunteers and has now expanded to 12 university campuses.
SeniorNet	Saint Vincent de Paul Carbonear Foodbank	Carbonear, Newfoundland & Labrador	Community	Summer Students offered help for seniors who were facing issues with digital technology such as setting up new devices, scheduling appointments, or renewing driver's licences.
Cyber Seniors	Cyber Seniors	Canada and USA	Community	Cyber Seniors provides seniors with tech-training using an intergenerational, volunteer model. High school and university/college students are trained to act as digital mentors and seniors gain access to effective technology training and intergenerational communities that keep them socially connected and engaged.
Connected Canadians	Connected Canadians	Canada	Community	Connected Canadians is a non-profit organization that promotes digital literacy skills amongst seniors by providing free technology training and support.

To increase access to devices, many groups and organizations developed lending programs and/or secured time-limited funding to enable the gifting of devices to seniors. Some lending programs included an opportunity to purchase the device at the end of the program. Many of the programs included device set-up support and ongoing training.

5.2.2 Examples of access to device programs

Program	Lead	Location	Setting	Description
Seniors and Technology	The Saskatoon Council on Aging	Saskatoon, Saskatchewan	Community	Seniors and Technology program assists seniors to stay connected to friends and family and access information by learning how to use technology to enhance their lives. The program offers one-on-one

				lessons, advanced tech workshops, and an iPad lending library.
Digital Learning Pilot Project	United Way of the Lower Mainland (Funder)	British Columbia	Community	Between April 2021 and March 2022, community agencies could apply to receive ITECH Packages (up to 5 devices, 12 months of data, technical support, and access to a curated resource library) to distribute devices to isolated seniors. Agencies were able to decide whether to loan or gift the tablets. The tablets came pre-loaded with relevant apps and were set up by Best Buy's Geek Squad, who provided ongoing technical support.

5.3 Privacy and security concerns

In today's interconnected world, privacy has emerged as a critical concern. Protecting privacy becomes increasingly crucial as we navigate the online world, where vast amounts of personal information are collected, stored, and transmitted through various technological tools. For Canadian seniors, who may be less familiar with the intricacies of digital technologies, safeguarding their privacy becomes even more critical.

Canadian seniors are particularly vulnerable to privacy breaches due to various factors, including limited digital literacy, trust in technology, and potential cognitive or physical impairments. They may inadvertently share sensitive information, fall victim to phishing scams, or unknowingly grant excessive permissions to applications. Additionally, there is an increased risk of identity theft, financial fraud, and online exploitation for this demographic.

With the rising use of digital technology, it is vital to educate seniors about technology-related frauds and scams, as they are increasingly being targeted with tech support, text messaging, and internet service scams. In 2021, $84 million dollars was lost to fraud by individuals over the age of 60, more than double the previous year (CAFC, 2021). It is also important to educate seniors about the importance of examining the quality and accuracy of online information since Statistics Canada data shows people aged 55 and up were the most likely to share COVID-19 misinformation online (Garneau & Zossou, 2021).

5.4 Ethical guidelines

Several existing ethical guidelines and frameworks can provide a foundation for promoting responsible and ethical use of internet connectivity and other technological tools among individuals, including seniors. These guidelines offer principles and recommendations that can be applied to address the unique needs and challenges faced by seniors in the digital realm. Some notable guidelines and frameworks include:

a) UNESCO's "Rethinking Education: Towards a Global Common Good?" (2015) - This framework emphasizes the importance of inclusive education and digital literacy, aiming to ensure that all individuals, including seniors, have access to quality education and can participate in a knowledge-based society.

b) The European Commission's "Ethical Guidelines for Trustworthy AI" (Hickman & Petrin, 2021) - Although not specifically focused on seniors, these guidelines provide valuable insights into the ethical considerations related to emerging technologies, including artificial intelligence (AI). Ethical principles such as transparency, fairness, and accountability can be applied to the use of internet connectivity and other technological tools used by seniors to promote responsible and trustworthy digital practices.

While existing ethical guidelines provide a broad framework, their application to the Canadian senior population requires contextual adaptation. Canadian seniors face unique challenges, including socio-economic factors, cultural diversity, and accessibility concerns. To ensure the relevance and effectiveness of ethical guidelines, it is important to consider these specific factors and tailor the recommendations accordingly:

- Digital Literacy: Promote digital literacy initiatives tailored to seniors, ensuring they have the necessary skills to navigate digital technologies, critically evaluate information, and protect themselves from online risks.
- Privacy and Security: Emphasize the importance of privacy protection and cybersecurity practices, encouraging seniors to safeguard their personal information, use secure online platforms, and be cautious of scams and fraudulent activities.
- Inclusivity and Accessibility: Advocate for inclusive design principles to ensure that internet connectivity and other technological solutions and services are accessible to seniors with varying abilities, accommodating different levels of digital skills, and considering factors such as font size, color contrast, and assistive technologies.
- Social Connection and Well-Being: Encourage the use of technological tools to promote social connection, combat social isolation, and enhance seniors' overall well-being. Emphasize the importance of responsible and ethical online interactions while fostering a sense of community and support.
- Considering the unique socio-cultural context of Canadian seniors, it is crucial to develop context-specific ethical guidelines. This involves collaboration between government bodies, regulatory agencies, technology developers, community organizations, and seniors themselves. By involving seniors in the process, their voices, experiences, and concerns can be incorporated, ensuring that the guidelines effectively reflect their needs and values.

By developing and implementing ethical guidelines and frameworks tailored to the Canadian senior population, policymakers, service providers, and individuals can create an environment that promotes responsible, inclusive, and ethical use of internet connectivity and other technological tools. Regular updates and revisions of ethical guidelines are necessary to address evolving technologies, new risks, and the changing needs of the senior population. These guidelines should empower seniors to navigate the digital landscape confidently, protect their rights, and fully benefit from the advantages offered by internet connectivity and other technological tools while mitigating potential risks.

6. INTEGRATING INTERNET CONNECTIVITY AND OTHER TECHNOLOGIES INTO AGE-FRIENDLY COMMUNITY INITIATIVES

The previous sections explored how internet connectivity and other technologies could target seniors who are socially isolated or lonely. It is important to acknowledge, however, that there are ways in which we can also leverage internet connectivity and other technologies within more upstream strategies, addressing risk factors for social isolation and loneliness and thereby aiming to prevent the negative impacts of these challenges.

The age-friendly communities (AFC) model provides a framework for us to consider these upstream strategies. The AFC model seeks to create environments and processes that support and enhance the well-being and quality of life of seniors. The World Health Organization (2007) defines an age-friendly community as one that "encourages active aging by optimizing opportunities for health, participation, and security in order to enhance quality of life as people age." In practical terms, an age-friendly community adapts its structures and services across eight domains of community life to be accessible to and inclusive of older people with varying needs and capacities. These domains cross the physical environment, social environment, and personal well-being; they are not necessarily distinct, but rather overlap. For example, the use of social programs or health services is dependent on the way information about the program is shared, the accessibility of the program space, and transportation options.

Image from the World Health Organization.

The following sections (6.1-6.8) explore and provide examples of how internet connectivity and other technologies can address the risk factors for social isolation and loneliness by supporting those experiencing life transitions, enabling mobility and aging-in-place, increasing transportation options, promoting social participation, and creating opportunities for meaningful connection.

6.1 Outdoor spaces and buildings

Outdoor spaces and buildings that are safe and accessible offer opportunities for physical activity, social interaction, and engagement with nature. Internet connectivity and other technologies play a crucial role in enhancing the accessibility, safety, and usability of these

spaces for seniors. For example, mobile applications can provide accessible mapping and navigation, helping seniors locate accessible pathways, seating areas, and amenities. The GoHere Washroom Access Program is a Canadian app that helps people map out washrooms along a route and locate the closest available washroom, anywhere in Canada. Though developed by Crohn's & Colitis Canada, the impact of this technology has additional benefits for seniors, as well who may be reluctant to engage in community activities without knowing where there is washroom access.

6.2 Transportation

An age-friendly community offers a wide range of accessible and affordable transportation options to ensure that seniors can access essential services, participate in social activities, and maintain their independence. Changes in access to transportation is a risk factor for social isolation (Bryant et al., 2004), but internet connectivity and other technologies can revolutionize transportation options and accessibility. For example, mobile applications and online platforms provide real-time information on public transportation schedules, routes, and accessibility features. Temiskaming Shores in Ontario created a telephone-based strategy and established 1-800 number seniors can call to determine their transportation needs and be connected with a local provider.

Ride-sharing services with senior-friendly options offer convenient transportation for seniors who may face mobility challenges or are no longer able to drive. However, downloading an app or registering online can be a barrier for some seniors. For a small fee, businesses like GoGoGrandparent offer a concierge service that can arrange rides for seniors over the phone with popular services like Uber and Lyft.

These technologies enable seniors to maintain independence and be able to choose from a range of transportation options so that they can continue to access essential services and participate in social activities.

6.3 Housing

The availability of appropriate, affordable housing with a choice of styles and locations that incorporate flexibility through adaptive features is essential for age-friendly communities. Internet connectivity and other technologies transform housing to meet the diverse needs of seniors and enable them to age in their homes and/or communities. The internet connectivity and other technologies described in the previous section on Smart Homes not only have the potential to directly target seniors who are socially isolated or lonely, but by enabling aging-in-place, these technologies also directly affect risk factors for social isolation and loneliness by delaying residential changes and enabling a continuation of established social connections.

6.4 Respect and social inclusion

Shiovitz-Ezra et al. (2018) identified that ageism may contribute to the social isolation of seniors. Age-friendly communities can play a crucial role in breaking systemic issues of ageism by promoting respect, dignity, and social inclusion for seniors. The World Health Organization (2021a) identified three strategies for combatting ageism: 1) policy and law; 2) educational interventions; 3) intergenerational contact interventions. Virtually-based education interventions and intergenerational interventions have emerged as age-friendly strategies in communities. What is of particular interest are those such as TechServe that use technology to connect older

and younger generations for digital literacy and skills training, helping to bridge the digital divide and foster mutual learning and understanding between different age groups.

6.5 Social participation

Social participation is crucial for the well-being and quality of life of seniors. Maintaining social connections can enable additional support through life changes, role loss, and the loss of family and friends. Internet connectivity and other technologies provide seniors with opportunities for digital connectivity, enabling them to maintain and expand their social networks. Social media platforms, online communities, and digital communication tools facilitate connections with family, friends, and peers, regardless of geographic distance. Online platforms dedicated to specific interests, hobbies, or health conditions allow seniors to connect with like-minded individuals, share knowledge and experiences, and provide mutual support. For example, the LIFE Institute at Toronto Metropolitan University offers a series of online interest 'clubs' for those 50 years and older, including a book club, climate action club, philosopher's club, photography club, triple-E investment club, and writers circle.

6.6 Civic participation and engagement

Civic participation and employment opportunities enable seniors to maintain their sense of purpose and actively contribute to their communities. Internet connectivity and other technologies can not only enable seniors to search through online databases for volunteer opportunities but also participate in volunteerism remotely. For example, through the Volunteer Ottawa database, seniors can search for virtual opportunities suitable for them that match their interests and availability.

6.7 Communication and information

Access to reliable communication and information is essential for seniors to stay connected and informed. Internet connectivity and other technology play a vital role in ensuring that seniors can access relevant information; this is particularly important during periods of transition. Online information and resource portals provide a wealth of knowledge on various topics relevant to seniors, including health, finance, and leisure activities. Accessible websites and mobile applications ensure that information is both easily available and usable. For example, funding from the Federal Government has expanded 211 telephone information and referral services to all jurisdictions in Canada. Users can search for senior-specific government and community-based, non-clinical health and social services. The free and confidential service can be accessed 24 hours a day, in more than 150 languages, by phone, chat, text, and web.

6.8 Community support and health services

A range of services that help promote, protect, and maintain independence and mental and physical health should be available and accessible to people of all ages and health statuses. Technology provides access to more services as well as support in care navigation and health information. This can address social isolation risk factors such as ill health and mobility issues. As outlined in a previous section, internet connectivity and other technologies enable remote healthcare services, known as telehealth or telecare, which benefit seniors in numerous ways. Telehealth platforms allow seniors to consult healthcare professionals from the comfort of their homes, reducing the need for travel and enabling timely medical advice. Remote monitoring

technologies, such as wearable devices and home sensors, facilitate continuous health monitoring, early detection of health issues, and remote caregiver support.

Internet connectivity and other technologies provide seniors with access to health information and resources, promoting health literacy and empowering them to actively manage their health. Online health portals, mobile applications, and health-related websites such as the Centre for Studies in Aging and Health offer reliable information and self-care resources. This access to health information enhances seniors' ability to make informed decisions and engage in preventive healthcare practices.

Finally, internet connectivity and other technologies facilitate communication and coordination among caregivers, seniors, and healthcare professionals. Digital platforms enable real-time sharing of information, care coordination, and remote monitoring of seniors' well-being. Caregivers can access resources, support networks, and training materials online, reducing their burden and enhancing the quality of care provided to seniors.

7. CONCLUSIONS

While there is limited rigorous evaluative evidence on the impacts of specific types of technological interventions to reduce the social isolation of seniors during the pandemic, a spectrum of peer-reviewed research findings and grey literature evidence exists. Through an examination of this evidence, several promising practices have emerged that provide internet connectivity, access to devices, technology training, and/or programming in a variety of formats. Innovative new technology solutions are also emerging, supported by AI and advances in robotics.

Moving forward, it is important to build upon the progress made to date in utilizing internet connectivity and other technological tools to support isolated and lonely seniors. The lessons learned during the COVID-19 pandemic should be applied to the post-pandemic circumstances, including adapting and continuing to fund successful and promising interventions; building digital literacy; ensuring access to technology and high-speed internet; addressing causes of marginalization and supporting vulnerable populations; encouraging intergenerational connections; supporting partnership building; ensuring reform to LTC and retirement homes to support the social and well-being needs of residents; and supporting the scale and spread of comprehensive interventions.

Research on using Physical and Social ICT to reduce isolation and loneliness among seniors during the COVID-19 pandemic, however, has several notable gaps. Many studies reference standardized definitions of loneliness and social isolation but do not distinguish between subjective feelings of loneliness and objective measures of both conditions. The research also often fails to account for the diversity among seniors, including factors like cultural background, economic status, and varying levels of tech-savvy. Longitudinal studies examining long-term effects are also lacking, as are comparative studies that evaluate the benefits of Physical and Social ICT versus traditional physical interactions. Additionally, research is sparse on best practices for training seniors in the use of technology, the impact of virtual interactions on broader mental health parameters, and economic aspects affecting access to technology. Overall, there is a need for more nuanced, targeted, and longitudinal research to fully understand the role and efficacy of ICT in mitigating loneliness and social isolation among seniors.

It is important, however, to appreciate that internet connectivity and other technological tools are just one way to reduce social isolation and loneliness for seniors in Canada, and that technological interventions are often dependent on human support to set up devices, troubleshoot issues, and foster digital connections. In 2017, Canada's National Seniors Council noted the need for policies that address issues of social inclusion, such as housing, income, and transportation, as well as targeted interventions to prevent or reduce isolation and loneliness. In a previous review, the authors identified five different features of programs that were effective in mitigating social isolation: Arts, Social Interaction, Technology, Education, and Physical Activity (Ontario Age-Friendly Communities Outreach Program, 2021). Programs that incorporated multiple features were more effective in mitigating social isolation.

Given the evidence to date, a comprehensive and balanced approach that incorporates internet connectivity and other technological strategies to address social isolation and loneliness with federal, provincial, and territorial leadership and support is required.

8. RECOMMENDATIONS FOR REDUCING SENIORS' SOCIAL ISOLATION AND LONELINESS - LESSONS LEARNED DURING THE PANDEMIC

To improve awareness, access, and utilization of internet connectivity and other technological tools by seniors in Canada, the following policy changes and strategies are recommended for government, in partnership with other stakeholders:

1. **Establishing a Digital Inclusion Strategy for seniors** is highly desirable to overcome the digital divide. This strategy should focus on improving digital literacy, access to affordable devices and internet connectivity, and providing education, support, and resources to help seniors navigate and utilize internet connectivity and other technological tools effectively (Conroy et al., 2020; Day et al., 2020; DeLange Martinez et al., 2020; Science and Technology for Aging Research, 2019; Sixsmith, 2020; Son et al., 2020). A Digital Inclusion Strategy should be guided by ethical frameworks that consider digital literacy, privacy and security, inclusivity and accessibility, social connection and well-being, unique socio-cultural context, and the specific needs of retirement and long-term care homes. Regular updates and revisions of ethical guidelines are necessary to address evolving technologies, new risks, and the changing needs of the senior population.
    a. **Implement comprehensive digital literacy programs tailored to seniors.** These programs should cover basic digital skills such as using computers, smartphones, and tablets, navigating the internet, using email and social media, and engaging in online transactions.
        i. Continue to invest in the Federal Digital Literacy Exchange Program and create provincial funding opportunities to encourage community organizations, libraries, and educational institutions (high school, college, and university) to deliver these programs.
        ii. Prioritize intergenerational digital literacy programs within funding opportunities, such as the Federal Digital Literacy Exchange Program.
        iii. Ensure volunteers are appropriately trained and supported to utilize technology in their work with seniors.

b. **Establish accessible technology standards**: These standards should cover internet connectivity and other technological tools, devices, software, training materials, and websites to ensure they are inclusive and usable for seniors with diverse abilities. The standards should address features like adjustable text size, clear navigation, voice control options, and compatibility with assistive technologies to enhance accessibility and usability.
c. **Enable access to affordable internet and devices**: Work with internet service providers and technology manufacturers to create affordable internet packages and devices specifically targeted at seniors. Offer subsidies or discounted pricing to ensure access to affordable and reliable internet connectivity and user-friendly devices.
d. **Additional investment in internet connectivity and other technological infrastructure**: This includes access to affordable, high-speed internet connectivity and reliable networks in both urban and rural areas to ensure that seniors across Canada have equitable access to digital resources and services. The "High-Speed Access for All: Canada's Connectivity Strategy" identifies that 93.5% of households have access to high-speed internet as of December 31, 2022. To exceed the target of 95% of Canadians by 2026, more ambitious investments are needed.
e. **Promote universal design**: Encourage technology developers and companies to adopt universal design principles when creating technological products and services. Involve seniors (inclusive of cultural and ethnic groups) in the design and testing process to ensure that their needs, preferences, and limitations are considered, resulting in intuitive and age-friendly technologies.
f. **Promote strategies to help seniors find and access the recommended technologies**:
    i. Launch public awareness campaigns to promote the benefits of seniors using internet connectivity and other technological tools to combat age-related digital stereotypes or biases. These campaigns should emphasize the positive impact of technology on reducing isolation, fostering social connections, and improving overall well-being.
    ii. Maintain a current inventory of resources and promising technological interventions for use by the government and other stakeholders.
    iii. Provide resources for local community centers, libraries, or senior facilities to establish tech hubs where seniors can access devices and internet connections. These spaces can also serve as physical hubs for training sessions and peer-to-peer support.
    iv. Implement policies in schools or universities that encourage students to devote some time to helping seniors learn technology. This could be part of their community service or internship requirements.
    v. Create guidelines for public broadcasters or other media platforms to produce senior-focused content that can be accessed digitally, promoting usage.
g. **Target isolated seniors within vulnerable populations:** Ensure programs are tailored to the linguistic and cultural needs of different population groups and provide safe and inclusive spaces for participation.

h. **Collaboratively develop guidelines, resources, and training materials**: Collaboration between the government, industry, advocacy, and senior groups is essential to facilitate the creation of comprehensive guidelines, resources, and training programs specifically tailored to seniors, promoting safe and responsible use of internet connectivity and other technological tools.
i. **Address privacy and security concerns:** Canadian seniors are particularly vulnerable to privacy breaches due to various factors, including limited digital literacy, trust in technology, and potential cognitive or physical impairments.
    i. Promote Safeguarding of Personal Information**:** Launch education and awareness campaigns tailored to seniors that emphasize the importance of protecting personal information online. Promoting secure practices, such as using strong passwords, enabling two-factor authentication, and regularly updating software, can enhance their privacy and security.
    ii. Strengthen privacy protections: Regulatory frameworks play a crucial role in protecting the privacy of individuals. These laws govern how organizations collect, use, and disclose personal data and provide individuals with the right to access and correct their information. Policymakers should consider enhanced transparency requirements, stricter consent mechanisms, and stronger enforcement measures. Moreover, organizations handling seniors' data must prioritize privacy and security by implementing robust data protection measures. This includes employing encryption, regularly auditing and monitoring data access, and adopting privacy-by-design principles in the development of technological solutions.

2. **Foster communication, collaboration, and partnerships**: Foster communication and collaboration between government agencies, technology companies, non-profit organizations, care partners, community groups, and seniors to share knowledge, resources, and best practices in promoting the use of internet connectivity and other technological tools among seniors. Partnerships among academics, non-profit and community organizations, the government and the private sector have the potential to build capacity to evaluate the effects of promising interventions.

3. **Continue to invest in social isolation and loneliness interventions that leverage technology and integrate other best practices (i.e., education, physical activity, arts, and social interaction).** Many of the intervention examples in this report have been supported by funding from the Federal, Provincial, or Territorial governments, particularly during the pandemic, and highlight that government can influence the development and sustainability of social isolation initiatives through their funding powers. An illustrative example is *A Friendly Voice* program which is a free confidential "warm line" for seniors in Ontario and Maritimes that has funding from Government of Canada, Government of Ontario, United Way, Trillium, and Ottawa Community Foundation. However, short-term pilot projects and the abrupt stoppage of pandemic programs may exacerbate feelings of loneliness and isolation. Providing non-profit and community organizations with long-term grants or ongoing operational funding to support successful programs and related reporting requirements will contribute to more sustainability of these initiatives.

4. **Support research and evaluation**: Ensure research efforts continue to focus on understanding the impact of social isolation and loneliness in Canada, as well as evaluating

the effectiveness of interventions inclusive of internet connectivity and other technological tools to address it at the local, regional, and national levels. At this time, the success of interventions is primarily being judged based on a wide range of often incomplete evidence or based on evaluations of pre-pandemic programs. Further research should be conducted to examine the impact of internet connectivity and other technological tools on the well-being and quality of life of seniors using standardized tools (e.g., UCLA Loneliness Scale, the DeJong Gierveld Loneliness Scale and the Quality of Life Scale). In addition, there is a need to evaluate the effectiveness of digital inclusion programs and policies, gather data on usage patterns, and measure outcomes to inform evidence-based decision-making and continuous improvement. An ongoing repository or inventory of validated interventions should be created and maintained, linked to a robust knowledge mobilization strategy.

5. **Enable retirement homes to leverage internet connectivity and other technological tools for resident comfort, independence, and engagement.** Retirement homes are designed for seniors who are relatively independent and require minimal assistance with their daily activities. These facilities offer a more socially engaging environment with various amenities, social activities, and recreational opportunities. Specific technological recommendations for retirement homes should be represented within a broad Digital Inclusion Strategy for seniors and include:
    a. **Promote and provide funding support to retirement homes to have reliable and robust internet connectivity and other technological infrastructure:** This includes high-speed internet connectivity, Wi-Fi coverage throughout the facility, and adequate data storage capabilities. A stable and secure network is essential for supporting various digital initiatives.
    b. **Promote and support retirement homes to invest in specific technological tools such as:**
        i. Mobile health apps: Introduce mobile health apps that residents and their families can use to access health-related information, monitor wellness, and receive alerts about upcoming medical appointments or wellness activities.
        ii. Emergency communication systems: Implement emergency communication systems that can quickly notify residents, staff, and families about critical events or updates during emergencies or lockdown situations.
        iii. Social engagement platforms: Utilize digital platforms or social networking tools to foster social connections among residents and between residents and their families. These platforms can facilitate group discussions, virtual events, and the sharing of photos and memories.
        iv. Virtual Reality (VR) and cognitive training: Introduce VR experiences and cognitive training applications to support mental stimulation and cognitive health among residents. VR can offer virtual tours, cognitive exercises, and interactive experiences to engage and entertain residents.
        v. Real-time communication tools: Use instant messaging or collaboration tools to enable real-time communication among staff members, promoting efficient and effective team coordination.
    c. **Implement smart home solutions**: Implement smart home technologies that allow residents to control lighting, temperature, and other aspects of their living

space through voice commands or mobile apps. These technologies enhance resident comfort and independence.

d. **Training and support**: Provide comprehensive training to staff and residents on using various technological tools and systems effectively. Regular support and assistance should be available to address any technical issues or questions.

6. **Increase the capacity of LTC homes to support resident social connections:** Moving forward, there is a need to prioritize updating the technological capabilities of new and existing LTC to support residents' opportunities to pursue life-enhancing relationships with family and friends and participate in activities. Activities to enable the use of technology in long-term care homes should be represented within a Digital Inclusion Strategy for seniors and include:
    a. **Provide adequate staff support and training** to effectively enable resident social connections: Regardless of what form visits take, some staff support is required to facilitate the visits (e.g., screening visitors, setting up technology). Staff are required to provide social activities for residents and to coordinate with external organizations offering programs (e.g., befriending programs).
    b. **Ensure access to internet connectivity and other technological tools**: Use legislation and targeted funding investments to ensure LTC residents have access to simple technology appropriately modified to their needs that enables them to independently make connections. For example, a wall-mounted tablet screen that has loudspeakers or audio that connects directly to hearing aids, where residents could simply press an image of their family member to make a video call.
    c. **Invest in internet connectivity and other technological infrastructure**: Through legislation and targeted funding investments ensure LTC homes have robust technological infrastructure to support and maintain ongoing virtual connections. In older buildings, this may include things like wall-mounted Wi-Fi extenders.
    d. **Maintain the option of remote family engagement** even after the pandemic. Virtual visits and communication platforms should continue to be available for residents and families who are unable to visit in person due to distance, health concerns, or other limitations.
    e. **Prioritize regular evaluation and feedback**: Continuously assess the effectiveness and impact of internet connectivity and other technological initiatives in retirement and LTC homes. Solicit feedback from residents, families, and staff to identify areas for improvement, address any challenges, and refine the use of technology to enhance resident engagement, socialization, and quality of life.

APPENDIX A: FACTORS THAT CONTRIBUTED TO ISOLATION AND LONELINESS AMONG SENIORS DURING THE PANDEMIC

Factor	Impact
Stay-at-home orders, social and physical distancing measures, lockdowns of businesses, schools, and overall social life. Seniors living alone and in social housing were identified as at-risk groups during the pandemic (Emerson, 2020; Pirrie & Agarwal, 2021).	Barriers to accessing family, friends, social, and community programing.
Informal caregivers, many of whom are seniors, provided more hours of care, experienced decreased social support, and had difficulties accessing health care services.	Increased pressures, stress, and feelings of isolation felt by seniors acting as informal caregivers in Canada (Anderson & Parmar, 2020; Ontario Caregiver Organization, 2020).
The assumption that <u>all</u> seniors were vulnerable drove protective measures and restrictions based solely on age.	Ageist views and associated intergenerational tensions further isolate seniors and add to aging-related social problems such as elder abuse. (Ayalon, 2020; Makaroun et al., 2021; Shiovitz-Ezra et al., 2018).
No-visitor policies were enacted at long-term care (LTC) and retirement homes, as well as hospitals, during at least the first six months of the pandemic and at other times as deemed necessary.	Residents and patients were forced to self-isolate in their rooms for prolonged periods of time, leading some to experience what was dubbed "confinement syndrome." (Tupper et al., 2020). Seniors living in non-institutional congregate living settings were required to adhere to strict lockdown and isolation measures with little autonomy or choice.
Workplace closures and growing unemployment rates during the pandemic (CLSA, 2021; Statistics Canada, 2021a).	Reduced source of social connection for employed seniors.
Declining participation of older volunteers, with COVID-related health concerns a contributing factor (Volunteer Canada, 2023; CLSA, 2021).	Reduced source of social connection and reduced capacity for organizations to provide programs.

APPENDIX B: CONTRIBUTING FACTORS, PREVALENCE, AND STRATEGIES TO ADDRESS ISOLATION AND LONELINESS AMONG VULNERABLE SUB-POPULATIONS

Contributing Factors	Prevalence	Example of a Strategy
80 years and older and those living alone		
• Significantly less contact with others during lockdowns and stay-at-home orders. • Living alone and being a female are important risk factors for loneliness, both pre-COVID-19 and during the pandemic, as many older females living alone, reported feeling lonely during the first wave of COVID-19 (Savage et al., 2021). • Those over 90 are vulnerable to a number of intrinsic factors and extrinsic factors influencing the likelihood of isolation/loneliness. Intrinsic factors include physical factors (reduced vision or hearing, reduced mobility and physical strength, illness) or psychological conditions (loss of vital impulse). Extrinsic factors include children restricting their parents' activities due to concern for their safety, death of contemporaries, the modification of the couple's balance when their spouse died, or their own health deterioration (Escourrou et al., 2022). • Senior women and older seniors (age 80 and older), for example, are vulnerable to social isolation if they have low support with routine activities such as meal preparation, shopping, and transportation, have reduced physical and leisure activities, and live alone. Senior men are vulnerable to social isolation if they have low emotional support. (Keefe et al., 2006). • Increased risk for lower levels of well-being, as seniors living alone experienced more negative emotions (loneliness, sadness, and stress) when they talked to someone on the phone compared to people who lived alone but did not talk with others on the phone or who live with others regardless of phone contact (Fingerman et al., 2021).	• Some variation in studies -some studies found that more advanced age was associated with greater rates of loneliness, whereas other studies reported the opposite pattern (Kadowaki & Wister, 2022).	Confinés, ensemble! (Quebec): Confinés, ensemble! was a project that invited seniors to take photos of their confinement during COVID-19 and then participate in weekly online meetings with other seniors to discuss their experiences. The project targeted seniors who are living alone, living in a senior's residence, or a member of the LGBTQ community. The photos were developed into a virtual exhibition.
Rural, remote & northern communities		
• Rural and remote communities face unique circumstances: limited access to health care services; older or poor-quality housing that is overcrowded; communities that are facing economic insecurity; less access to technology and high-speed internet services; and limited infrastructure to assist with daily tasks (e.g., grocery shopping, transportation) (Henning-Smith, 2020). • Additional factors for Northern communities: lack of health care infrastructure, food insecurity, fragile supply chains, access to water for handwashing and cleaning, housing shortages and overcrowding, and high rates of tuberculosis (Arctic Council, 2020; Fryer & Collier, 2020; Inuit Tapiriit Kanatami, 2020).	• As many as 17% of seniors, living primarily in small-town and small-city environments in British Columbia, were socially isolated (Kobayashi et al., 2009).	SmART Aging (Newfoundland and Labrador) - SmART Aging is a community-based virtual arts program delivered by local professional artists (based on their availability) in the western region of the island portion of the province.

• Activities and services for seniors in rural areas are often offered by small senior's clubs and groups with limited funds and resources. • The more tight-knit nature of rural communities is a strength, and older Canadians living in rural communities report higher levels of social support than urban residents (Frank, 2020).		The program connects socially or geographically isolated seniors with artists and other participants through online sessions that feature a variety of expressive arts disciplines.
LGBTQ2S+ seniors		
• Lack of social support and isolation, past traumas and experiences of discrimination, and disparities in health and access to health services contribute to an increased level of vulnerability for LGBTQ2S+ seniors during the pandemic (Jen et al., 2020). • LGBTQ2S+ seniors were more likely to have no one to turn to if they needed help, suggesting an increased need for practical help during the pandemic (Gutman et al., 2021). • COVID-19 may exacerbate social isolation among this at-risk population (Lee & Miller, 2020). • Past experiences living through the HIV/AIDS pandemic may act as a potential source of resilience, with LGBTQ2S+ seniors reporting feeling prepared and more ready to act during the COVID-19 pandemic (Gutman et al., 2021).	• Based on survey data collected during the pandemic, lesbian, gay, and bisexual Canadians reported worse mental health (i.e., depression, anxiety, and sadness) than the general population (Gutman et al., 2021). • Nearly 40% of LGBTQ2S+ seniors report being susceptible to loneliness as they were rejected by family or close friends because of gender identity or sexual orientation (Lee & Miller, 2020).	Rainbow Circle (Toronto, ON) - The Rainbow Tea & Talk program offers LGBTQ+ seniors an opportunity to stay social, keep connected with each other, and have fun while staying at home. The program is delivered over Zoom.
Ethnic minority and immigrant seniors		
• Five main themes were identified as contributing to social isolation and loneliness that were leading to poor physical and mental health among Canadian immigrants and refugee seniors, including a sense of loss, living arrangements, dependence, challenges and barriers (cultural and language barriers, and poverty), and family conflicts (Johnson et al., 2019).	• De Jong Gierveld et al. (2015) study found that immigrants from other European countries (non-British or French) and non-European	Immigrant Seniors Go Digital (Vancouver, BC) - Immigrant Seniors go Digital offers classes to help immigrants and refugees 55 years+

• New immigrant and refugee seniors are at a greater risk of social isolation because of the following factors: a higher level of poverty, limited access to transportation, being a caregiver, a lack of awareness of services, and language barriers (Employment and Social Development of Canada, 2018). • Social isolation and loneliness are themselves important social risk factors for poor mental health outcomes among older Black adults (Chatters et al., 2020). • Survey data from Statistics Canada also suggests minority group members were experiencing higher unemployment rates and greater financial challenges due to COVID-19 compared to the general population (Statistics Canada, 2021a). • The social networks of minority groups were more likely to be disrupted by the pandemic (e.g., higher COVID-19 mortality rates, disruptions to religious and cultural activities, and being less likely to use technology) (Gauthier et al., 2020). • People of Asian visible minority groups have reported experiencing increased harassment and discrimination (Statistics Canada, 2020). • The pandemic has worsened the existing disparities in health and access to services for ethnic minority and immigrant groups in Canada (Wang et al., 2019).	immigrants continued to be significantly lonelier (15.8%) than Canadian-born seniors. • Visible minorities who are new immigrants and refugee seniors have higher rates of social isolation than non-minority groups (Employment and Social Development of Canada, 2018a).	enhance their digital literacy skills to use computers, tablets and smartphones, as well as build their confidence to access the internet safely. Classes are offered in English with support in Cantonese, Mandarin, Korean, or Farsi.
Indigenous people		
• Pre-existing vulnerabilities such as geographic isolation, lack of access to medical and community care, and high rates of chronic conditions make COVID-19 a disease of particular concern for Indigenous communities in Canada (Statistics Canada, 2021c). • Low education and health literacy, low income or poverty, geographic location and isolation, poor health status, cultural separation, a higher likelihood of experiencing traumatic events, and fragmented informal and formal support systems may create a cascading of risk for social isolation among Indigenous seniors (National Seniors Council, 2017). • The pandemic has had a significant impact on cultural activities, with limits on large cultural gatherings and elders not being able to participate in regular intergenerational and cultural activities (Assembly of First Nations, 2022). It is important to acknowledge that past bans on Indigenous cultural and spiritual ceremonies were a source of trauma for Indigenous peoples (First Nations Health Authority, 2022f). • Rules on community entry, self-isolation trailers, and family groups returning to the land are examples of ways Indigenous peoples have responded to the pandemic (Banning, 2020; NCCMT & NCCIH, 2020). • For some Indigenous peoples, isolation of the community or family groups is a traditional practice that has been used in the past to safeguard the well-being of the community (Banning, 2020; NCCMT & NCCIH, 2020). • Large proportion Indigenous older individuals in Canada are at increased risk of digital divide (Ali-Hassan, 2020).	• Although the extent of social isolation among Indigenous seniors has not accurately determined, it is estimated that between 19% and 24% are socially isolated (Employment and Social Development Canada, 2018b).	Virtual Community Gatherings (Ottawa, ON) - The Inuuqatigiit Centre for Children, Youth and Families provided laptops and training on their use to Inuit elders during the pandemic. They also hosted weekly community gatherings on Zoom where elders could sing, pray, share stories, and check up on each other in Inuktitut.

People living with dementia		
• Sources of care and social support have been reduced during the pandemic due to lockdown measures (e.g., closure of health and community services, diversion of resources and efforts towards the pandemic, restrictions on contact with family and friends) (Alonso-Lana et al., 2020; Roach et al., 2020). • Increases in neuropsychiatric symptoms (e.g., agitation, anxiety, and depression) have been observed, as people living with dementia may find it difficult to understand and comply with physical distancing and lockdown measures (Manca et al., 2020; Rainero et al., 2021; Roach et al., 2020). • 69% of residents in LTC have dementia and were subjected to the lockdown and restriction of visitors (CIHI, 2023). • Low social participation and less frequent social contact were associated with a 41% and 57% risk of dementia over a 7-year follow-up period (Huang et al., 2023).	• In a UK study, approximately 30% of seniors living with dementia reported being moderately lonely, and 5% were severely lonely. Around 19% of the seniors living with dementia lived alone, with the proportion living alone increasing with the severity of loneliness (Victor et al., 2020).	Resident to resident Virtual Connection Program (Toronto, ON) - A resident-to-resident virtual connection program used video conferencing software on tablets to reduce the decline of residents' mental health and improve their quality of life while also decreasing feelings of isolation. Three groups of residents were targeted: those living with dementia, residents who are friends, and residents who do not know each other.
Caregivers		
• During the pandemic, caregivers provided more hours of care, experienced decreased social support, and had difficulties accessing health care services (Anderson & Parmar, 2020; Ontario Caregiver Organization, 2020). • Caregivers living with seniors with dementia were understanding of COVID-19 prevention measures but at the same time expressed concern for their own ability to continue to cope on a long-term basis, indicating the possibility of burnout without supports, and an increased feeling of isolation, stress, and anxiety (Roach et al., 2020). • Caregivers of seniors are experiencing increased elder abuse risk factors since the beginning of the COVID-19 pandemic, including stress, alcohol use, social isolation, and negative impacts on their own health (Makaroun et al., 2021). • Compared to before COVID-19, over 40% of caregivers reported doing worse financially, 16% were experiencing new financial hardship, 19.4% were a lot more worried about their financial situation, and 15% reported drinking more alcohol (Makaroun et al., 2021).	• Ontario caregivers found 43% often feel isolated and lonely, while a survey in Alberta found 86% of caregivers have experienced loneliness since the pandemic began (Anderson & Parmar, 2020; Ontario Caregiver Organization, 2020). • Analysis of data from a large study in the UK found that higher levels of loneliness during	Telehealth Intervention Program for Seniors (TIP-OA) (Montreal, QC) - The Telehealth Intervention Program for Seniors is a free service serving isolated and vulnerable seniors with mental health/cognitive issues and their caregivers. Volunteers call weekly to inquire about the general well-being, give out information about COVID-19, ask if the seniors

	the pandemic resulted in a four times higher risk of depression for caregivers (Gallagher & Wetherell, 2020). • Compared to before COVID-19, 64% of caregivers had somewhat or greatly increased feelings of social isolation and loneliness (Makaroun et al., 2021).	need any help or support (e.g., food delivery, medication from their pharmacy), connect seniors with community organizations offering services, and give friendly company on the phone to increase a sense of connection.
Low-income seniors		
• Low-income seniors report having less social support available than other seniors (Frank, 2020). • Data from Statistics Canada shows only a little over half of low-income Canadians use the internet, creating a 'digital divide' (a term referring to the divide in uptake and access to digital technology) (Davidson & Schimmele, 2019). • As many services and programs transition to virtual modes of delivery during the pandemic, low-income seniors are particularly at risk of isolation as they may not be able to afford access to digital technology and high-speed internet (Conroy et al., 2020). • For women, income may be more helpful with regard to improving or creating higher-quality connections; for men, income is potentially more likely to enable the maintenance or rise in quantity of connections and social isolation, due to less access to resources that bolster their mental health during crises (Kung et al., 2022; Gauthier et al., 2020).	• Both men and women with lower economic status have a higher probability of reporting loneliness, social isolation, and a lack of social support (Kung et al., 2022). • Agarwal et al. (2021) showed that for Ontario low-income seniors, the rate of social isolation was nearly twice that observed in the same age group of the general population (36.1% vs. 19.6%). Results show that 1 in 5 low-income seniors living in social housing had subjective social isolation or loneliness.	Notebook Project (Winnipeg, MB)- Manitoba Association of Senior Centres partnered with Fort Garry Rotary Villa, a low-income housing building for seniors, to provide digital devices and training to residents. The Villa had on-site staff who were able to provide the training to small socially distanced groups of residents. The availability of WiFi within the building was a key enabler for the project.
Seniors living in assisted living and long-term care		

• Residents who do not speak English and/or French are particularly vulnerable to experiencing social isolation, as they rely heavily on family, visitors, and other residents who speak their language for companionship and to communicate with staff (Shippee et al., 2020). • The discriminatory accuracy of inequalities, particularly among nursing home residents, was consistently low to moderate throughout the analyses but increased marginally during the pandemic in 2020 (Gustafsson et al., 2022). • In an Alberta survey of LTC residents, 75% reported experiencing stress, anxiety, or depression due to being unable to visit with loved ones (Health Quality Council of Alberta, 2021).	• A large BC survey found that 57% of assisted living residents were confined to their rooms at some point during the pandemic (Office of the Seniors Advocate British Columbia, 2020). • One study provided insights into the perspective of relatives who were concerned that residents of LTC had increased loneliness (76%), sadness (66%), and decreased quality of life (62%), since implementing the nursing home visiting restrictions during the pandemic (Wammes et al., 2020).	Creative Connection (Canada): Creative Connection was initiated by students from Western University during the pandemic and was operating at 16 institutions across Canada. It paired student performers with residents in long-term care homes, retirement homes and hospitals for virtual live musical/art performances and conversation. Sessions were delivered 1-on-1 or as small group concerts.
Francophone seniors living outside Quebec		
• Lima & Bouchard (2022) highlighted the inequality between social determinants of health, including financial insecurity, low levels of education, isolation, and loneliness, among French-speaking seniors in a linguistic minority situation in relation to English-speaking seniors in Ontario, Canada.	• Francophone seniors represent 13% of the population in Manitoba. Study noted that more Francophone home care clients were left alone for long periods (45.8% vs 41.2%) or reported feeling lonely (17.6% vs 12.1%) than clients of the non-Francophone	FARFO Virtual Programs (Ontario) - Fédération des aînés et des retraités francophones de l'Ontario offers virtual programming for Francophone seniors.

	cohort (De Moissac, 2022).	
Seniors living with chronic conditions and disability		
• These individuals were identified as being at high risk of severe illness from COVID, and so they may have self-isolated to a greater extent than people without chronic conditions (Campbell, 2020). • Higher anxiety symptoms, more worry about the COVID-19 infection, and more financial strain because of the pandemic were linked to greater loneliness. • Older people with chronic conditions may be especially vulnerable to loneliness during the pandemic (Luchetti et al., 2020).	• A survey of individuals over the age of 50 with chronic diseases from Michigan noted that two-thirds of respondents reported moderate to severe loneliness (Polenick et al., 2021). • A national survey of individuals with disabilities and chronic health conditions noted increased anxiety, stress, and despair were associated with negative financial effects of COVID-19, greater concerns about contracting COVID-19, increased loneliness, and decreased feelings of belonging (Pettinicchio et al., 2021).	The Assured Living System (Canada) - The Assured Living systems and other smart home technologies are intended to support Canadians aging in place - delaying institutionalization for as long as possible, giving seniors independence and dignity, while also providing their caregivers and family members peace of mind, and taking pressure off the health care system by enabling at home triaging and recovery.
Seniors experiencing life transitions (e.g., widowhood, losing drivers licenses etc.)		
• Older German women felt lonely more severely and frequently in comparison with men, even if there was no difference in the quantity or quality of their social network. The increased loneliness was predicted by older age and being divorced or widowed (Boehlen et al., 2022). • Seniors who were widowed had higher levels of emotional loneliness compared to seniors who were married and partnered (Teater et al., 2021). • Temel Elginli et al. (2022) showed that due to COVID-19, emotional loneliness arising out of social isolation was evident in seniors who are unmarried (widowed, divorced, bachelor), as they experienced a range of problems accommodating	• A Turkish study found that the mean for emotional loneliness was higher (6.68) in the unmarried (widowed, divorced, bachelor) seniors	Griefshare - GriefShare is a 13-week support group where people can explore the difficult emotions of grief. In-person and virtual groups are offered.

themselves to the changes in their daily lives and routines. A lack of or limited communication via telephone with their close circle, such as children and relatives, led many seniors to experience fears, anxieties, and feelings of being unvalued (Temel Elginliet al., 2022). • During the pandemic, some seniors experienced an irretrievable loss of family members or friends, the closure of social groups, or withdrawal from groups as priorities changed. As a consequence, participants expressed increased loneliness, anxiety, social isolation, frustration and, feelings of depression (Derrer-Merk et al., 2022).	(Temel Elginli et al., 2022).	

APPENDIX C: INVENTORY OF PROGRAMS IN VARIOUS JURISDICTIONS THAT LEVERAGE TECHNOLOGY AND SOFTWARE TO REDUCE ISOLATION AND LONELINESS

Name of program	Active/ Inactive	Community	Region	Lead Organization	Targetted Subpopulation	Description	Type of Program	Reference	Date Validated
A Friendly Voice	Active	Ontario	Provincial	A Friendly Voice		A Friendly Voice is a free, confidential "warm line" for older Ontarians, 55+ who just want to chat with a friendly person who cares, without expectations or judgment.	Telephone Check-ins	https://afriendlyvoice.ca	28/02/2023
Algoma Senior Telephone Outreach Program	Active	Sault Ste. Marie, Ontario	Local	Algoma Geriatric Clinic		Algoma Geriatric Clinic and Seniors Mental Health connect socially-isolated seniors in their programs with a volunteer who will call them to provide a friendly telephone chat and a social connection.	Telephone Check-ins		10/01/2023
Amintro	Active	Parts of Ontario	Provincial	Private- Amintro		Amintro is an online social platform and information hub exclusively for those 50+ interested in expanding their circles of friends and staying involved, informed and connected.	Innovative New Technology	https://www.cbc.ca/news/canada/sudbury/social-network-older-adults-1.6592195	12/01/2023
Au bout du fil	Inactive	Quebec	Provincial	Les Petits Frères		Au bout du fil (On the Line) is a program for Quebec older adults aged 75 and up who are experiencing isolation. The program offers participants two phone calls by volunteers per week.	Telephone Check-ins	Les Petits Frères. (2020). Au bout du fil. https://www.petitsfreres.ca/programmes/au-bout-du-fil/	10/01/2023
CanConnect	Active	British Columbia	Provincial	CanAssist	People living with dementia, Caregivers	CanAssist is piloting the CanConnect Device (CanConnect and the Custom Case) – allowing people with a wide range of barriers (conditions associated with aging, such as dementia and frailty, cognitive and physical disabilities) to communicate easily and securely with family, friends, caregivers and clinicians in real-time video over the Internet.	Innovative New Technology	CanAssist. (2020). CanConnect device pilot. Healthy Aging CORE British Columbia. https://healthyagingcore.ca/resources/canassist-programs-canconnect-and-canstayhome-assistive-devices-older-adults	11/01/2023
Community Connects	Active	Sackville, NB	Local	Mount Allison University and Nursing Homes Without Walls		Community Connects matches university students with a senior. The pair checks in on a weekly basis, usually sharing or delivering a meal donated and prepared by a partner organization.	Telephone Check-ins, Intergenerational	Lyall, L. (2021, February 9). University students pair with N.B. seniors to ease loneliness of pandemic. CTV News. https://atlantic.ctvnews.ca/university-students-pair-with-n-b-seniors-to-ease-loneliness-of-pandemic-1.5302517 Weldon, T. (2020, September 20). Struck by loneliness of seniors in pandemic, N.B. student pairs them with peers. CBC News. https://www.cbc.ca/news/canada/new-brunswick/seniors-students-port-elgin-rural-hannah-crouse-brenda-trafford-1.5729334	10/01/2023
Companion Calls	Inactive	Toronto, ON	Local	Student Association for Geriatric Empowerment (SAGE)	Seniors in assisted living/ LTC	In the Companion Calls program University of Toronto student volunteers made telephone or video calls to residents in Long Term Care (LTC). SAGE had also provided other supports to LTC homes including letters, cards, and gardening supplies	Telephone Check-ins, Intergenerational	McNeely, S. (2020, August 20). COVID-19: After studying elder care, U of T students form group to support seniors and front-line staff. U of T News. https://www.utoronto.ca/news/covid-19-after-studying-elder-care-u-t-students-form-group-support-seniors-and-front-line-staff	12/01/2023

Companion Calls	Active	Ontario	Provincial	Nucleus Independent Living		Companion Calls connect clients with trained volunteers via weekly calls. Interactions are a mixture of structured activities and unstructured social engagement. Tablets and activity kits are provided to interested participants.	Telephone Check-ins, Access to Devices	https://www.nucleusonline.ca/companion-call-program	28/02/2023
Confinés, ensemble!	Inactive	Quebec	Provincial	School of Public Health of the University of Montreal and Center for Public Health Research	Very old and living alone, LGBTQ2S+ seniors, Seniors in assisted living/ LTC	Confinés, ensemble! was a project that invited seniors to take photos of their confinement during COVID-19 and then participate in weekly online meetings with other older adults to discuss their experiences. The project targeted older adults who are living alone, living in a seniors residence, or a member of the LGBTQ community. The photos were developed into a virtual exhibition.	Virtual Programs (Group)	Confinés, ensemble!. (2021). Le projet. https://confinesensemble.ca/	11/01/2023 project completed, results are posted on the website
Connected Canadians	Active	Ottawa, Canada	National	Connected Canadians		Connected Canadians promotes digital literacy skills amongst seniors by providing free technology training and support. The organization offers free one-on-one support, instructor-led workshops, and web-based resources.	Technology Training		10/01/2023
Connecting Families 2.0	Active	Canada	National	Government of Canada	Low income seniors	Connecting Families 2.0 introduced significantly faster speeds and increased the data usage amount. At 50/10 megabits per second (Mbps) for $20 a month, the download and upload speeds are five and ten times faster, respectively, than in the first phase of Connecting Families. The data allotment also doubled, from 100 GB to 200 GB of usage per month. This new phase also broadened eligibility from families receiving the maximum Canada Child Benefit (CCB) to include low-income seniors receiving the maximum Guaranteed Income Supplement (GIS). The existing $10 Internet plan offering under Connecting Families 1.0 will also remain available.	Internet Connectivity	https://globalnews.ca/news/8116593/subsidized-sasktel-internet-low-income-seniors-families/	11/01/2023
Connection in Action	Active	Halton Hills, Burlington, Milton, Oakville, ON	Local/Regional	Connection in Action, Halton's Community Safety & Well-Being plan		A Connection Specialist supports older adults (55+) one-on-one by providing information on opportunities to increase social connections based on individual needs, strengths, and interests.	Telephone Check-ins	https://connectioninaction.ca/	28/02/2023
Contactivity and Outreach and Courses	Active	Westmount, QC	Local/Regional	The Contactivity Centre		The Contactivity Centre hosts virtual and in-person courses and interest groups for autonomous seniors 60+.	Virtual Education / Info	https://contactivitycentre.org/online-courses-and-activities-winter-2023.php	28/02/2023
Conversation Circle	Active	British Columbia	Provincial	Immigrant Services Society of BC	Ethnic, minority and immigrant seniors	Immigrant older adults (55+) are able to meet virtually or in-person to improve their English conversation skills, learn more about Canadian culture, build their speaking confidence and make new connections.	Virtual Programs (Group)	https://issbc.org/our-services/connecting-seniors	28/02/2023
Creative Connection	Inactive	Canada	National	Creative Connection	Seniors in assisted living/ LTC	Creative Connection was initiated by students from Western University during the pandemic and was operating at 16 institutions across Canada. It paired student performers with residents in Long Term Care homes, retirement homes and hospitals for virtual live musical/art performances and conversation. Sessions were delivered 1-on-1 or as small group concerts.	Virtual Programs (Group), Intergenerational	Mackay, C. (2020, December 7). Music sparks virtual connections with the community's most vulnerable. Western News. https://news.westernu.ca/2020/12/music-sparks-virtual-connections-with-the-communitys-most-vulnerable/	12/01/2023
Cyber Seniors	Active	Canada and USA	National, International	Cyber Seniors		Cyber Seniors provides seniors with tech-training using an intergenerational, volunteer model. High school and university/college students are trained to act as digital mentors and seniors gain access to effective technology training and intergenerational communities that keep them socially connected and engaged.	Technology Training, Virtual Programs (Group), Intergenerational	Cyber-Seniors. (2021). About Cyber-Seniors. https://cyberseniors.org/about/ Singh, S. (2021, February 26). Online webinars and programming connect Niagara seniors to digital world. Niagara This Week. https://www.niagarathisweek.com/community-story/10338070-online-webinars-and-programming-connect-niagara-seniors-to-digital-world/	10/01/2023

Dig-IT	Active	Canada	National	HelpAge Canada	Low income seniors	Dig-IT offers devices, data, education and technical support for low-income Canadian seniors. Participants receive a tablet on loan for the duration of the program, limited data plan, access to online course material, support of volunteers coaches.	Internet Connectivity, Access to Devices, Technology Training		10/01/2023
Digital Coaching	Active	Manitoba	Provincial	A&O Support Services for Older Adiults		Digital Coaches work one-on-one with older adults to help them increase their digital literacy. Both clients and volunteers are provided with the same device (tablet computer) for the digital coaching sessions. The Digital Coach helps to answer basic digital skills questions in simple terms and provides encouragement to older adults through regular, one-on-one telephone check-ins.	Access to Devices, Technology Training, Telephone Check-ins	https://www.aosupportservices.ca/2021/09/23/volunteer-digital-coaching/	28/02/2023
Digital Learning Pilot Programs: Active Aging Plus (AA+) Grants[i]	Inactive	British Columbia	Provincial	United Way of the Lower Mainland (Funder)	Rural, remote and northern, Indigenous people	Active Aging Plus (AA+) Grants provided funding to community agencies to develop and/or adapt Active Aging programs to be delivered virtually. The grants prioritized agencies serving Indigenous persons, rural and remote communities, and other underserved groups.	Policy / Funding	Healthy Aging CORE British Columbia. (2020). Active Aging + & Digital Learning Pilot info session recording & slides. https://bc.healthyagingcore.ca/resources/active-aging-digital-learning-pilot-info-session-recording-slides	11/01/2023
Digital Learning Pilot Project (Active Aging Plus and ITECH)	Active	British Columbia	Provincial	United Way of the Lower Mainland (Funding Partner)		Community agencies can apply to receive ITECH Packages (up to 5 devices, 12 months of data, technical support, and access to a curated resource library) to distribute devices to isolated older adults. Agencies will be able to decide whether to loan or gift the tablets. The tablets will come pre-loaded with relevant apps and be set up by Best Buy's Geek Squad, and ongoing technical support will be available from the Geek Squad.	Internet Connectivity, Access to Devices, Technology Training	Healthy Aging CORE British Columbia. (2020). Active Aging + & Digital Learning Pilot info session recording & slides. https://bc.healthyagingcore.ca/resources/active-aging-digital-learning-pilot-info-session-recording-slides	11/01/2023
Digital Training for Seniors	Active	Kelowna, BC	Provincial	Project Literacy, Central Okanagan Society		This program is for adults 65+ and offers individual and group classes including one-to-one tutoring where seniors will be matched with a tutor who will assist them with their digital learning goals. They provide training with devices, email, social media, fraud awareness, and virus prevention.	Technology Training	https://eecs6330.rekdtech.com/resource/technology-training-for-seniors/	
Empowering Seniors Through Technology project	Inactive	Nova Scotia	Provincial	NS Community Technology Network Nova Scotia Department of Communities, Culture, and Heritage (Funder)	Indigenous people, Ethnic, minority and immigrant seniors	The Community Technology Network provided technology training to over 900 older adults across the province. Additional funding supported four pilots in culturally diverse and traditionally marginalized communities (Mi'kmaq and African Nova Scotian communities).	Technology Training		11/01/2023
enTECH@Home program	Active	Waterloo, ON	Local/Regional	University of Waterloo undergraduate student volunteers		The enTECH@Home program provides older adults in the Waterloo region with free phone- or email-based technology support. The program is operated by University of Waterloo undergraduate student volunteers who are part of the enTECH club.		https://eecs6330.rekdtech.com/resource/entechhome/	1/03/2023
FARFO Virtual Programs	Active	Ontario	Provincial	FARFO	Francophone seniors living outside Quebec	FARFO offers virtual programming for Francophone seniors.	Virtual Programs (Group)		

Friendly Calls	Inactive, program will resume in the summer 2023	Prince Edward Island	Provincial	Canadian Red Cross		The Canadian Red Cross (PEI) provides regular, pre-scheduled calls to individuals who are feeling isolated due to the pandemic. The service is provided as a routine safety check and to reduce loneliness. If need be, callers will be connected with other resources in the community that can help them with further support.	Telephone Check-ins		10/01/2023
Friendly Calls Program	Active	Canada	National	Canadian Red Cross		The Canadian Red Cross matches volunteers with seniors (55+) for a weekly phone call.	Telephone Check-ins	28/02/2023	28/02/2023
Friendly Check-in	Active	Calgary, AB	Local	Calgary Seniors Resource Society		The Friendly Check-In Program matches volunteers with a senior who they are responsible for checking in with regularly over the phone. The program is also intended to provide some positivity and spread kindness to seniors.	Telephone Check-ins	https://www.calgaryseniors.org/seniors-social-supports	28/02/2023
GetSetUp	Active	International	International	GetSetUp	Ethnic, minority and immigrant seniors	GetSetUp is an international online learning platform for older adults. They offer live classes taught by peers, social hours hosted by community members, and special events with guest speakers. Classes are taught in English, Spanish, Hindi and Mandarin with core teams in the U.S., Australia, and India.	Virtual Programs (Group), Virtual Education / Info, Innovative New Technology	https://eecs6330.rekdtech.com/resource/getsetup/	1/03/2023
Gluu Essentials	Active	Canada	National	Gluu Technology Society		Gluu aims to help seniors learn to use technology through online, self-paced lessons for Apple iPad, Apple iPhone, Android Smartphone & Android Tablets. Live Q&A sessions held every other week.	Technology Training		10/01/2023
Heart Over Heart (H2O) Network	Active	N/A	N/A	Heart Over Heart		H2O aims to foster mutually beneficial intergenerational interactions between younger and older adults through three programs: 1) Intergenerational Group Interactions (HIGI) Virtual meeting where both young and old can attend and engage in fun and meaningful discussions. 2) Intergenerational Mentorship Interactions (HIMI) Program that matches older mentors and younger mentees for regular (virtual) contact, mentorship, and career advice; and 3) Intergenerational Paired Interactions (HIPI) Program that matches older and younger adults for regular (virtual) contact, support & companionship on a 1-on-1 basis.	Telephone Check-ins, Virtual Programs (Group), Intergenerational	Malbeuf, J. (2021, January 2). Seniors and artists team up for Fort McMurray art project. CBC News. https://www.cbc.ca/news/canada/edmonton/fort-mcmurray-art-conversation-seniors-1.5841474	10/01/2023
Immigrant Seniors go Digital	Active	Vancouver, BC	Local	S.U.C.C.E.S.S.	Ethnic, minority and immigrant seniors	Immigrant Seniors go Digital offers classess to help immigrants and refugees 55 years+ enhance their digital literacy skills to use computers, tablets and smartphones, as well as build their confidence to access the internet safely. Classes are offered in English with support in Cantonese, Mandarin, Korean, or Farsi	Technology Training, Virtual Education / Info		10/01/2023
iPad donations	Inactive	Nova Scotia	Provincial	Government of Nova Scotia	Seniors in assisted living/ LTC	The Government of Nova Scotia provided funding for the purchase of iPads for long-term care homes to support connection with families.	Access to Devices, Policy / Funding		12/01/2023
JAVAconnect	Active	Canada and USA	National	Java Group Programs		JAVAconnects provides online weekly meetings for like-minded adults to share their experience on important topics… like Gratitude, Family, Loneliness and Helping Others. The technology has been developed to encourage engagement and group sharing by seniors and others, using minimal technical skills.	Telephone Programs (Group)	https://www.javaconnects.com/welcome	28/02/2023

Keep in Touch	Active	Lethbridge, AB	Local	Volunteer Lethbridge		The Keep in Touch Program connects individuals through a weekly telephone support system. Volunteers can also help find resources if needed.	Telephone Check-ins	Campbell, Q. (2020, December 28). 'Keep In Touch' program helping seniors in Lethbridge deal with isolation. Global News. https://globalnews.ca/news/7545073/lethbridge-keep-in-touch-program-helping-seniors-isolation/ Dahlman, R. (2020, September 14). Keep in Touch Program will help southern Alberta. Prairie Post. https://www.prairiepost.com/alberta/keep-in-touch-program-will-help-southern-alberta/article_fb2518dc-f6a2-11ea-af5f-6fb9e1db4241.html	10/01/2023
Kitchener Tech Connect	Active	Kitchener, ON	Local	The City of Kitchener		Kitchener's Tech Connects program offers a technology lending library and free technology training classes to adults 55+. Courses are offered on both an in-person and remote basis and individuals interested in this program have the option to borrow a technology device enabled with or without cellular data for up to 30 days.	Internet Connectivity, Access to Devices, Technology Training	https://eecs6330.rekdtech.com/resource/kitchener-tech-connects/	1/03/2023
Lean On Me	Active	Canada	National	Canadian CBI Health		Lean on Me program is designed to help reduce social isolation and support lonely seniors and at risk adults through planned social supportive virtual interactions (phone or video conferencing). It connects clients with an appropriate level of meaningful companionship. Self-reported data is used to create and evolve individualized support plans, connections to resources, and engagement.	Telephone Check-ins, Telephone Programs (Group), Virtual Education / Info	https://www.cbihealth.ca/funders/innovative-programs/reducing-social-isolation-program-lean-on-me	28/02/2023
Learn Technonolgy Skills	Active	Newfoundland	Provincial	Newfoundland & Labrador Public Libraries		Public libraries provide their digital literacy resources for seniors.	Virtual Education / Info	https://guides.nlpl.ca/seniorsresources/learn-technology	28/02/2023
Lonely No More: Rural Community Connections	Active	Southwestern Ontario	Regional	Gateway Centre of Excellence in Rural Health	Rural, remote and northern	Lonely No More is an effective virtual outreach model. This program enhances well-being through co-facilitating new networks and enabling improved community engagement by integrating peer support, coaching conversations, and system navigation. Participants in rural Southwestern ONtario can join weekly over-the-phone group chats These weekly chats occur in a party-line fashion with 3 to 5 rural older adults engaging together, facilitated by 2 trained Community Volunteers	Telephone Programs (Group)	https://www.gatewayruralhealth.ca/lonely-no-more	28/02/2023
Maintaining Community Connections	Inactive	Toronto, ON	Local	Harbourfront Centre		Harbourfront Centre, a non-profit cultural centre, had over 480 volunteers pre-pandemic but had to halt their programs when the pandemic hit. Many volunteers were older adults who reported missing the social aspects of volunteering. A check-in program was initiated where experienced volunteers would telephone, video call, or email other isolated volunteers. The centre also began to host zoom workshops for their volunteers.	Telephone Check-ins, Virtual Programs (Group)	Volunteer Toronto. (2020). Case Study: Maintaining Community. https://cdn.ymaws.com/www.volunteertoronto.ca/resource/resmgr/online_resources/Case_Study_Maintaining_Commu.pdf	10/01/2023
Mobility for Good	Active	Canada	National	Telus	Low income seniors	Mobility for Good for seniors provides access to a discounted smartphone and subsidized mobility rate plan for Canadian seniors receiving a Guaranteed Income Supplement (GIS) amount of $6,500 or more annually, ensuring that they stay connected to loved ones and can access important resources and information.	Internet Connectivity, Access to Devices	https://www.telus.com/en/social-impact/connecting-canada/seniors/application?INTCMP=tcom_social-impact_connecting-for-good-programs_mobility-for-good-modal_cta_to_seniors-application	28/02/2023

No Limits Community Connections	Active	Edmonton, AB	Provincial	Black Canadian Women in Action	Ethnic, minority and immigrant seniors	No Limits Community Connections aims to help visible minority seniors aged 55+ increase their mental, social, and emotional well-being during the pandemic with virtually engaging activities that also promote inclusion and community. Every week, seniors virtually meet with their matched volunteer mentor to socialize and troubleshoot basic technology and internet questions. Through an online platform, a technology expert and wellness professionals lead weekly workshops that help support seniors' wellness, as well as enhance their proficiency with technology, the internet, and social media.	Technology Training, Virtual Programs (Group)		11/01/2023
Notebook Project	Inactive	Winnipeg, MB	Local	Manitoba Association of Senior Centres (MASC)	Low income seniors	MASC partnered with Fort Garry Rotary Villa, a low-income housing building for older adults, to provide digital devices and training to residents. The Villa had on-site staff who were able to provide the training to small socially distanced groups of residents. The availability of WiFi within the building was a key enabler for the project.	Internet Connectivity, Access to Devices, Technology Training		11/01/2023
OASIS Programs	Active	Kingston, Bellville, London, ON	Provincial	The Oasis Senior Supportive Living Inc.		The OASIS Program is designed to strengthen and sustain healthy communities of older adults by addressing important determinants of healthy aging such as isolation, nutrition, physical fitness, and sense of purpose. It was developed as an innovative solution to support aging well at home. Since the pandemic, some programs have been running virtually.	Virtual Programs (Group)	https://www.oasis-aging-in-place.com	28/02/2023
Phone Pal Program	Active	Edmonton, AB	Local	Strathcona Place Society		The Phone Pal Program matches volunteers and seniors based on shared interests, cultural background, and language. Matches are also accommodated based on other preferences, such as age. Regular phone calls are made to the senior. Should something stand out in a conversation with a senior, the volunteer notes this in their weekly report, and the case referred to the Strathcona Place Outreach Team (SPOT) for follow-up.	Telephone Check-ins, Intergenerational	Healthy Aging CORE Alberta. (2020). Phone Pal Program. https://corealberta.ca/programs/phone-pal-program	10/01/2023
Project Joy	Inactive	Edmonton, Lethbridge, Calgary & Red Deer, AB	Local	Project Joy	Seniors in assisted living/ LTC	Project Joy was initiated during the pandemic and collected old tablets and smartphones to donate to older adults living in long-term care facilities. RJ Systems, a local technology company, assisted with the setup, refurbishment, and management of the devices. Each device could be used by about 5-8 older adults	Access to Devices	Poignant, G. (2021, February 6). Tech-savvy charity connects seniors with loved ones. St. Albert Today. https://www.stalberttoday.ca/beyond-local/tech-savvy-charity-connects-seniors-with-loved-ones-3318180	12/01/2023
Rainbow Circle	Active	Toronto, ON	Local	Sunshine Centres for Seniors	LGBTQ2S+ seniors	The Rainbow Tea & Talk program offers LGBTQ+ seniors an opportunity to stay social, keep connected with each other, and have fun while staying at home. The program is delivered over Zoom.	Virtual Programs (Group)	Sunshine Centres for Seniors. (2020). Introducing Rainbow Circle and Rainbow Tea and Talk, new programs for LGBTQ+ seniors! https://sunshinecentres.com/introducing-rainbow-tea-and-talk-a-new-program-for-lgbtq-seniors/	11/01/2023
Senior Centre Without Walls	Active	Winnipeg, MB	Provincial	A & O: Support Services for Older Adults		The first Senior Centre Without Walls in Canada was launched in Manitoba in 2009 by the organization A & O and provides isolated older adults with access to telephone-based social and educational activities. A process evaluation of the program found that it was successful in reaching its target audience of isolated older adults and participants reported feeling more connected and less lonely.	Telephone Programs (Group), Virtual Programs (Group)	Newall, N. E., & Menec, V. H. (2015). Targeting socially isolated older adults: A process evaluation of the senior centre without walls social and educational program. Journal of Applied Gerontology, 34(8), 958–976. https://doi.org/10.1177/0733464813510063	11/01/2023

Senior Centre Without Walls	Active	Edmonton, AB	Provincial	Edmonton Southside Primary Care Network		Seniors' Centre Without Walls is a free, phone-based program that offers older adults 55 years+ in Alberta a variety of interactive health and well-being information sessions, recreational activities, and friendly conversation.	Telephone Programs (Group)	Edmonton Southside Primary Care Network. (n.d.). Project Highlights (Data from July 2016-April 2019). Edmonton Southside Primary Care Network.	11/01/2023
Senior Centres Without Walls, Peterborough	Active	Peterborough, ON	Local	Age-Friendly Peterborough Activity Haven Senior Centre and the Peterborough Public Library		The Senior Centre Without Walls program offers adults 50 years of age and older telephone-based programming.	Telephone Programs (Group)	https://kawarthanow.com/2021/08/14/age-friendly-peterborough-launches-free-interactive-telephone-program-to-help-seniors-socialize/	11/01/2023
Senior Net	Inactive	Carbonear, NFLD	Local	Senior Net Team		Summer Students at the Saint Vincent de Paul Carbonear Foodbank offered help for seniors who were facing issues with digital technology such as setting up new devices, scheduling appointments, or renewing driver's licences.	Technology Training, Intergenerational	https://vocm.com/2021/07/31/new-program-offering-help-with-technology-to-seniors/	11/01/2023
Senior Tech Club program	Active	USA	International	The Senior Tech Club by Don Frederiksen		The Senior Tech Club is an ongoing online club where seniors learn to use their smart devices to their fullest potential. Membership is free and members gain access to a regular newsletter, an online community, and ongoing tech courses. The Senior Tech Club is founded and hosted by Don Frederiksen and focuses primarily on iPads and iPhones	Technology Training	https://eecs6330.rekdtech.com/resource/senior-tech-club/	1/03/2023
Seniors and Technology	Active	Saskatoon, SK	Local/Regional	The Saskatoon Council on Aging		Senior and Technology programs assist older adults to stay connected to friends and family and access information by learning how to use technology to enhance their lives. The program offers one-on-one lessons, advanced tech workshops, and an iPad lending library.	Access to Devices, Technology Training	https://scoa.ca/seniors-and-technology/	28/02/2023
Seniors Centre Without Walls	Active	Central Okanagen, BC	Regional	Seniors Outreach and Resource Centre		Seniors Centre Without Walls provides a variety of social programs over the telephone and Zoom to isolated older adults in the Central Okanagan area. The program is run by a practicum student and volunteers.	Telephone Programs (Group), Virtual Programs (Group)		11/01/2023
Seniors' Centres Without Walls Micro-Grant Program	Inactive (funding stoped)	Ontario	Provincial	Older Adult Centres' Association of Ontario (OACAO) Government of Ontario (Funder)		In September 2020, the Government of Ontario invested $467,500 in the OACAO to administer a new Seniors' Centres Without Walls Micro-Grant program, and other capacity-building initiatives. The purpose of these grants are to support seniors' organizations in helping older adults to stay connected to their communities through telephone-based social and educational programs.	Policy / Funding		11/01/2023
Seniors Connect Café	Active	Chilliwack & Sardis, BC	Local	Compassionate Neighbourhood Health Partners Society (CNHPS)		The Seniors Connect Café provides regular meetings where seniors can socialise and learn about community and health resources. For the fall and winter months there is also an evening virtual connection opportunity.	Virtual Programs (Group), Virtual Education / Info, Intergenerational	Bathe, A. (2021, February 28). 99-year-old and high school student find unlikely friendship. CBC News. https://www.cbc.ca/news/canada/british-columbia/senior-high-school-student-unlikely-friendship-1.5930296	10/01/2023
Seniors Forum Canada (SFC) Reduce Social Isolation Program	Active	Canada	National	Seniors Forum Canada		Seniors Forum Canada (SFC) offers manny different programs, including the Seniors Fitness Program via zoom, one-on-one virtual consultations with certified personal trainers, outdoor socialization, reducing cosial isolation, sisters' circle, and a new initiative "Sisters Helping Sisters".	Virtual Programs (Group)	https://seniorsforumcanada.com/programs/	28/02/2023

SmART Aging	Active (ON and OFF based on availability of the artists)	Newfoundland	Regional	Regional Health Authority, the Western Regional School of Nursing, health professionals and a local performing arts organizatio	Rural, remote and northern	SmART Aging is a community-based virtual arts program delivered by local professional artists (based on their availability) in western Newfoundland. The program connects socially or geographically isolated older adults with artists and other participants through online sessions that features a variety of expressive arts disciplines. Local artists develop engaging programming that is specifically aimed at the older adult population. Eight artist-led sessions are available using virtual technology, and older adults participate from the comfort of their own home and at no cost. The art sessions range in focus from letter writing to painting and drawing, as well as storytelling and theatre skills.	Virtual Programs (Group)	https://theconversation.com/online-arts-programming-improves-quality-of-life-for-isolated-seniors-168559	13/01/2023 program will resume in February, 2023
Social Inclusion and Digital Literacy	Inactive	Winnipeg, MB	Local	South Winnipeg Seniors' Resource Council		The Social Inclusion and Digital Literacy program provided isolated older adults with digital technology training and access to the internet and an iPad for 6 months. After the 6-month period, the older adults had the option of purchasing the iPad at a reduced cost.	Internet Connectivity, Access to Devices, Technology Training	Strachan, S. (2020, August 7). iPad program to reduce seniors' isolation. Winnipeg Free Press. https://www.winnipegfreepress.com/our-communities/souwester/iPad-program-to-reduce-seniors-isolation-572043811.html	11/01/2023
Social Robots	Active	N/A	N/A	Social Robots	Seniors in assisted living/ LTC	Social Robots is a social enterprise specializing in using companion robots to improve the quality of life for older adults. The goal is to help recreation leaders in retirement homes and LTC facilities to leverage technology to better engage and entertain residents and reduce the impact of social isolation, loneliness and boredom.	Innovative New Technology		
Story Share For Seniors	Active	Calgary, AB	Local	Storytelling Alberta and Calgary Seniors Resource Society	Ethnic, minority and immigrant seniors	The StoryShare program connects older adults with volunteer storytellers via telephone or video call. Volunteers are able to speak English, French, Spanish, Dutch and Urdu. StoryShare offers three free program options: Individual StoryShare Chat, Tellaround, Legacy Recording (by phone or video platform) (part of the Legacy Project).	Telephone Programs (Group), Virtual Programs (Group)	Lizee, T. (2021, February 22). Calgary outreach program connects with seniors virtually, records 'legacy stories'. Global News. https://globalnews.ca/news/7652278/alberta-seniors-virtual-storytelling-program/	11/01/2023
Student-Senior Isolation Prevention Project	Active	Toronto, Ottawa, Mississauga, London, Peterborough, ON; Winnipeg, MB; Calgary, AB; Saskatoon, SK	Local	SSIPP		SSIPP pairs student volunteers with seniors for technology training, social connection and comfort, health literacy, connection to community resources and grocery services. Isolated older adults are referred to the program by health care providers or coordinators.	Technology Training, Telephone Check-ins, Intergenerational	Parsons, C. (2020, April 16). 'We care and are here for them': U of T students help seniors cope with distancing during COVID-19. U of T News. https://www.utoronto.ca/news/we-care-and-are-here-them-u-t-students-help-seniors-cope-distancing-during-covid-19	21/02/2023
Studio Without Walls	Inactive	Saskatchewan	Provincial	University of Regina		Studio Without Walls was a telephone-based arts program that paired older adults with professional artists. The artists provided older adults with advice over the phone on various creative arts (e.g., painting, writing). The program targeted older adults living in rural areas, though all older adults were welcome to participate.	Telephone Check-ins	Atter, H. (2021, February 8). 'Studio without Walls' connects older adults to artists over the phone. CBC News. https://www.cbc.ca/news/canada/saskatchewan/studio-without-walls-research-project-1.5904911	11/01/2023
Sustaining Strength of Seniors	Inactive	Winnipeg, MB	Local	Grade 12 student at St. John's-Ravenscourt School.		A teen initiated and hosted an online weekly social group for local seniors. Gupta organized speakers, led craft activities and gave space to chat.	Virtual Programs (Group)	https://www.cbc.ca/news/canada/manitoba/teen-starts-online-social-group-winnipeg-seniors-1.6244009	11/01/2023
Tablet Provision Program	Inactive	New Brunswick	Provincial	Government of New Brunswick	Seniors in assisted living/ LTC	The Government of New Brunswick provided each long-term care facility with one tablet for every 10 residents (480 tablets total) to keep residents connected with family. Tablets also have applications to facilitate virtual care provision. The technology company BrunNet Inc. is responsible for providing the tablets and technical support	Access to Devices	Government of New Brunswick. (2020, April 22). Nursing homes provided with iPads; no new cases today [Press Release]. https://www2.gnb.ca/content/gnb/en/news/news_release.2020.04.0222.html	12/01/2023

Tablets for Loan for Seniors Project	Inactive	Vaughan, ON	Local	Vaughan Community Health Centre Human Endeavour (Technology partner)	Low income seniors	During the pandemic Vaughan Community Health Centre loaned tablets to low-income isolated older adults and provided them with data to stay connected and participate in virtual programming. Training was provided on how to use the tablets and a technology helpline was available to remotely access the tablets and troubleshoot any issues. Vaughan Community Health Centre partnered with the non-profit Human Endeavour who managed the helpline and data.	Internet Connectivity, Access to Devices, Technology Training		11/01/2023
Tablets for Seniors	Inactive	Prince Edward Island	Provincial	Government of PEI	Seniors in assisted living/ LTC	The Government of PEI contributed funding and partnered with the Community Foundation of PEI to provide tablets to LTC and community care facilities across PEI to address social isolation of older adults during pandemic visitor restrictions	Access to Devices		12/01/2023
Talk2Nice	Inactive	Canada	National	National Initiative for the Care of the Elderly		In response to the pandemic, Talk2Nice was a phone line and virtual community of volunteers from across Canada who regularly checked in with older adults at risk to ensure they have up-to-date information and were able to navigate the systems set up to help them. In addition to providing the older adults with a sense of community, the volunteers helped ensure the seniors had access to counseling and support by trained social workers.	Telephone Check-ins	https://socialwork.utoronto.ca/news/talk2nice-volunteers-provide-a-sense-of-community-for-older-adults-experiencing-increased-social-isolation-due-to-covid-19/	10/01/2023
Tech Savvy Empowered Older Women	Inactive	North York, ON	Local	North York Women's Centre	Very old and living alone	North York Women's Centre provided tablets and computer training to 53 older women who live alone so they could access virtual programs. Individualized in-home training was provided until the women became comfortable using the tablets. The Centre also paid for data for those who did not have internet plans (60% of participants). A virtual drop-in activity session was held every Friday on Zoom that about half of the women participated in.	Internet Connectivity, Access to Devices, Technology Training, Virtual Programs (Group)	Palamarchuk, A. (2020, December 9). Tech-savvy program helps North York seniors get 'connected'. Toronto News. https://www.toronto.com/news-story/10284066-tech-savvy-program-helps-north-york-seniors-get-connected-/	11/01/2023
Technology Support	Active	Edmonton, AB	Local/Regional	Edmonton Seniors Center		The program offers one-on-one tech support, as well as a course on how to build and maintain virtual connections using the computer and internet.	Technology Training	https://edmontonseniorscentre.ca/product-category/classes/technology/	28/02/2023
TechServe	Active	Canada	National	TechServe		TechServe connects tech-savvy millennial volunteers with older adults who just need a little bit of technical help to improve their everyday lives. TechServe is a Canadian non-profit that provides services to older adults through 1-on-1 tech support sessions, workshops in partnerships with older adults' associations, and a set of online digital literacy resources.	Technology Training, Intergenerational	https://eecs6330.rekdtech.com/resource/techserve/	1/03/2023
Telehealth Intervention Program for Older Adults (TIP-OA)	Active	Montreal, QC	Local	Jewish General Hospital and McGill University	People living with dementia, Caregivers	The Telehealth Intervention Program for Older Adults is a free service serving isolated and vulnerable seniors with mental health/cognitive issues and their caregivers. Volunteers call weekly to inquire about the general wellbeing, give out information about COVID-19, ask if the seniors need any help or support (e.g. food delivery, medication from their pharmacy), connect seniors with community organizations offering services, and give friendly company on the phone to increase a sense of connection.	Telephone Check-ins	Dikaios, E., Sekhon, H., Allard, A., Vacaflor, B., Goodman, A., Dwyer, E., Lavin-Gonzalez, P., Mahdanian, A., Park, H., Walsh, C., Sasi, N., Nazar, R., Gruber, J., Su, C. L., Hanganu, C., Royal, I., Schiavetto, A., Cinalioglu, K., Rigas, C., Launay, C., … Bukhari, S. N. (2020). Connecting during COVID-19: A protocol of a volunteer-based telehealth program for supporting older adults' health. Frontiers in Psychiatry, 11, 598356. https://doi.org/10.3389/fpsyt.2020.598356	10/01/2023

TelePALS	Active	Burlington, ON	Local	City of Burlington, in partnership with Older Adult Centres' Association of Ontario (OASAO) and spondored by Ministry for Seniors and Accessibility (MSAA)		Telephone Partners Accessing Leisure Services (TelePALS) offers free phone-based group social and learning programs for seniors.	Telephone Programs (Group)		10/01/2023
The Bright Spot	Active	Greater Toronto, ON	Local	YMCA		The Bright Spot is a free online community for seniors offering virtual programming and education.	Virtual Programs (Group), Virtual Education / Info		10/01/2023
Un brin de lecture	Inactive	Quebec	Provincial	Les Amis de BAnQ		Isolated older adults were matched with a volunteers from BAnQ (national library and archives of Quebec) who would call them once a week for 15- minute reading sessions - reading excerpts from books or other written works	Telephone Check-ins	Les Amis de BAnQ. (n.d.). Un brin de lecture.	10/01/2023
United Way of Lower Mainland's Safe Seniors, Strong Communities Program	Active	British Columbia	Provincial	A partnership between United Way's Better at Home program, bc211 and the B.C. Government through the Ministry of Health.		Seniors are able to receive the support they need during the COVID-19 crisis through a new province-wide initiative, Safe Seniors, Strong Communities. Seniors can request volunteer help in a variet of areas, including a friendly check-in call.	Telephone Check-ins	https://uwsvi.ca/news/safeseniors/	28/02/2023
UpToSpeed	Active	Canada	National	TechServe		UpTOSpeed is the for-profit arm of TechServe and they provide tech training and support to seniors. They address users' technology needs by providing instantaneous video and written tutorials, timely telephone and video chat technical support, appointment-based 1 on 1 online lesson, and monthly group online lessons. Users must create an account and pay a fee for services.	Technology Training	https://eecs6330.rekdtech.com/resource/uptospeed/	1/03/2023
Virtual Community Gatherings	Inactive	Ottawa, ON	Local	Inuuqatigiit Centre for Children, Youth and Families	Indigenous people	The Inuuqatigiit Centre for Children, Youth and Families provided laptops and training on their use to Inuit elders during the pandemic. They also hosted weekly community gatherings on Zoom where elders could sing, pray, share stories, and check up on each other in Inuktitut.	Access to Devices, Technology Training, Virtual Programs (Group)	Hwang, P. (2021, February 12). Ottawa-area Inuit elders gather online to beat pandemic blues. CBC News. https://www.cbc.ca/news/canada/ottawa/inuit-elders-gather-zoom-ottawa-1.5901453	11/01/2023
Virtual Programs	Active	Edmonton, AB	Local	Multiple organizations in Edmonton		The Edmonton Seniors Centre, Westend Seniors Activity Centre, Shaama Centre, MWSA, and Strathcona Place offer virtual programs.	Virtual Programs (Group)	Coordinated Pandemic Response Steering Committee. (2020). Coordinated Pandemic Response for Edmonton Senior Service Community. https://www.seniorscouncil.net/uploads/files/Edmonton-Senior-Serving-Pandemic-Response-Report-FINAL.pdf	11/01/2023
iPods for Memories	Active	Perth County, ON	Local	Alzheimer's Society Perth County	People living with dementia	The Alzheimer Society of Perth County offers some programming virtually.	Virtual Programs (Group)		10/01/2023

Yet Keen Seniors'Day Centre's virtual programs	Active	Ottawa, ON	Local	Yet Keen Seniors' Day Centre	Ethnic, minority and immigrant seniors	The Yet Keen Seniors' Day Centre offers programming in Cantonese and Mandarin on virtual and phone platforms, which includes exercise classes, mental health groups, holiday celebrations as well as learning opportunities for seniors.	Telephone Programs (Group), Virtual Programs (Group)	https://www.swchc.on.ca/programs/yet-keen-seniors%27-day-centre	28/02/2023
Youth Teaching Adults	Active	Canada	National	ABC Life Literacy Canada and Youth Empowering Parents		Youth Teaching Adults is a free introductory digital literacy program for adult learners, led by youth volunteer-tutors. The program encourages youth to develop their leadership skills through teaching and helps adults increase their digital literacy skills. Youth Teaching Adults works best in a one-on-one workshop setting either in person or virtual. Facilitator resources are also available for organizations that want to run a workshop.	Technology Training, Intergenerational		10/01/2023

APPENDIX D: REPORT METHODOLOGY

Both English and French language literature are included in this review. Data collection was conducted December 8, 2022 - February 28, 2023 and updated on May 1, 2023 and relied on the following approach.

1. Review of existing curated reference lists sources
    a) References from the Wister A.V. & Kadowaki, L (2021) white paper
    b) Centre for Studies in Aging and Health Reading list from 2020 on Social Isolation, Seniors and COVID-19
    c) Centre for Studies in Aging and Health Reading List from 2021 on Aging & Technology
    d) Mail chimp campaign to Social Isolation Community of Interest with recent articles specific to technology to reduce isolation: Community of Interest on Social Isolation & Loneliness (mailchi.mp)
2. New academic literature searches: A search of academic databases was conducted using the EbscoHost search engine.
    a) Social Isolation and Loneliness among seniors literature review: The literature search of English-language literature from academic journals was conducted the week of January 17, 2023, using the search engine EBSCOhost. In the EBSCOhost for simultaneous search the following databases were selected: CINAHL, Academic Search Complete. The keywords used in the search were senior or seniors (or synonyms), AND loneliness or social isolation. Limitations were full text, peer reviewed, English language, published between 2021 and 2023 articles.
    b) Communication Technologies and Internet Connection among seniors literature review: The initial search of English-language literature from academic journals was conducted the week of December 8, 2022 and updated on May 1, 2023, using the search engine EBSCOhost. In the EBSCOhost for simultaneous search the following databases were selected: CINAHL, Academic Search Complete. The keywords used in the search were *senior or seniors* (or synonyms), AND *communication technologies*, AND *internet connection*. Limitations were full text, peer reviewed, English language, published between 2015 and 2023 articles. 5 related articles from Statistics Canada and 1 related article from Unites States Census Bureau was added.
    c) Evidence for Information Communication Technologies and Internet impact on Social Isolation and Loneliness among seniors literature review. The initial search of English-language literature from academic journals was conducted the week of December 8, 2022, and updated on August 8, 2023, using the search engine EBSCOhost. In the EBSCOhost for simultaneous search the following databases were selected: CINAHL, Academic Search Complete. The keywords used in the search were *senior or seniors* (or synonyms), AND *communication technologies*, AND *internet connection* AND loneliness or social isolation. Limitations were full text, peer reviewed, English language, published between 2018 and 2023 articles. 5 related articles from Statistics Canada and 1 related article from Unites States Census Bureau was added.
    d) Search on Technologies and Internet Connectivity. The initial search of English-language literature from academic journals was conducted the week of December 8th,

2022, and updated on August 8, 2023, using the search engine EBSCOhost. All databases were selected. The keywords used in the search were *senior or seniors* (or synonyms), AND *loneliness or social isolation* AND *internet connection* AND *technology*. Limitations were full text, peer reviewed, English language, published between 2018 and 2023 articles. 23 articles were identified. 13 articles were assessed as potentially relevant and 8 were new to previous searches. No relevant new review articles were identified.

The program inventory was developed using the following approach:

1. Mining of the Wister A.V. & Kadowaki, L (2021) inventory for programs from the following sections that included technology components
    a) Befriending programs
    b) Telephone outreach programs (if the purpose was connection vs information access)
    c) Technology training and donation
    d) Seniors Centre without walls and activity programs
2. Review of the Ontario Age-Friendly Communities Outreach Program enewsletters from January 2022– May 2023 for news articles and resources that referred to programs that addressed social isolation and loneliness
3. Building-Connections-April-2021.pdf (sagelink.ca)
4. Grey literature search (Grey literature (e.g., reports, news articles, briefings, etc.) was located via: Google searches; searching the websites of relevant non-governmental organizations, research groups, and governmental organizations; and connecting with experts and service providers.

APPENDIX E: GLOSSARY

- **Ageism**: "the stereotypes (how we think), prejudice (how we feel) and discrimination (how we act) towards others or oneself based on age" (WHO, 2021).
- **Artificial Intelligence (AI)**: "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristics of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience" (Encyclopedia Britannica, 2023). AI is an enabler of both Social and Physical ICT approaches.
- **Ambient Assistive Devices** are generally electronic and embedded within the environment or on the person. They use sensors, artificial intelligence, and other technologies to monitor, assist, and adapt to an individual's needs, often without requiring direct interaction.
- **CareTV:** a technological solution, which allows users to interact with carers, family and friends from their home (van der Heide, 2012).
- The **Canadian Longitudinal Study on Aging (CLSA)** is a large, national, long-term study that will follow approximately 50,000 individuals who are between the ages of 45 and 85 when recruited, for at least 20 years. The CLSA will collect information on the changing biological, medical, psychological, social, lifestyle and economic aspects of people's lives. The CLSA's Data Collection Sites are in Victoria, Vancouver, Surrey, Calgary, Winnipeg, Hamilton, Ottawa, Montréal, Sherbrooke, Halifax and St. John's. The provinces included are BC, AB, MB, ON, QC, NS and NL.
- **Community-dwelling seniors**: individuals who are aged 65 and older living outside of nursing homes and congregate living (Chi et al., 2019). .
- **Congregate living**: facilities where people (most of whom are not related) live or stay overnight and use shared spaces (e.g., dining rooms), including assisted living, retirement homes (i.e., privately-owned residence that provides rental accommodation with care and services for seniors who can live independently), and long-term care homes (i.e., living accommodations for people who require on-site delivery of 24/7 serviced care).
- **COVID-19 pandemic**: "a global outbreak of coronavirus, an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus". World Health Organization "made an assessment that COVID-19 can be characterized as a pandemic" on March 11, 2020 (WHO, 2023).
    - **Post COVID-19 pandemic**: On May 5, 2023, WHO "accepted the recommendations, that given the disease was by now well-established and ongoing, it no longer fit the definition of a Public Health Emergency of International Concern" (WHO, 2023).
    - **Pre-pandemic**: the time before March 11, 2020, when WHO announced the COVID-19 as a pandemic.
- **Digital divide**: the gap between demographics and regions that have access to modern information and communication technology, and those that don't or have restricted access (Hanna, 2021).
- **Digital literacy**: the individual's knowledge, skills, and confidence to keep up with changes in technology" (ABC LifeLiteracyCanada, 2023).

- **Information and communication technology (ICT)**: "a diverse set of technological tools and resources used to transmit, store, create, share or exchange information" (United Nations Educational, Scientific and Cultural Organization, 2009). This includes computers, internet, broadcasting technologies, software applications, and wired and wireless telephone technologies (Rouse, 2023). It can be sub-divided into Social ICT and Physical ICT (Latikka, 2021).
- **Loneliness**: a subjective "distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or especially the quality of one's social relationships" (Hawkley & Cacioppo, 2010, p.1).
- **Long-term care (LTC)**: long-term care homes, also known as continuing care, personal care, and nursing homes, provide living accommodations for people who require on-site delivery of 24/7 supervised care, including professional health services, personal care and services such as meals, laundry, and housekeeping.
- **Pandemic Timelines**: Federal and provincial response to the COVID-19 pandemic began mid-March, 2020. On May 4, 2023, the World Health Organization announced that the COVID-19 Pandemic was no longer considered a public health emergency of international concern. For the purposes of this report we will consider pre-pandemic as before March 2020, post-pandemic after May 2023 and during the pandemic the period between.
- **Physical assistive technologies** are tangible tools or equipment designed to help individuals perform specific tasks, improve their physical abilities, or replace a lost function.
- **Physical information and communication technology (Physical ICT)** refers to physical technologies that can collect and transmit information about activities related to socialization and isolation other than communication between individuals and includes robots, wearables, smart technologies and smart homes (Latikka, 2021).
- **Randomized Control Trials** are those which compare randomly selected participants to receiving an intervention against a randomly selected group of participants not receiving the intervention.
- **Retirement home**: a privately-owned residence that provides rental accommodation with care and services for seniors who can live independently with minimal to moderate support and are able to fund this lifestyle on their own.
- **Seniors**: adults 65 years and older.
- **Smart home**: "a convenient home setup where appliances and devices can be automatically controlled remotely from anywhere with an internet connection using a mobile or other networked device" (Hayes, 2022).
- **Smart technology**: "the integration of computing and telecommunication technology into other technologies" and "its ability to communicate and work with other networked technologies, and through this ability to allow automated or adaptive functionality as well as remote accessibility or operation from anywhere" (Campbell, n.d.).
- **Social information and communication technology (Social ICT)** refer to technologies to support communication and activities of multiple forms (i.e., textual, audio, and/or visual) between an individual and others anytime and anywhere.

- **Social isolation**: “a lack in quantity and quality of social contacts” and “as involving a few social contacts and few social roles, as well as the absence of mutually rewarding relationships” (Keefe et al., 2006, p1).
- **Social Media**: “websites and computer programs that allow people to communicate and share information on the internet using a computer or mobile phone” (Cambridge Dictionary, n.d.).
- **Social Robots**: “are robots that interact with humans and each other in a socially acceptable fashion, conveying intention in a human-perceptible way, and are empowered to resolve goals with fellow agents, be they human or robot” (Daily et al., 2017).
- **Telecare**: the use of technologies such as remote monitoring and emergency alarms to enable the unwell, disabled, or elderly to receive care at home so that they can live independently.
- **Telehealth:** “delivery and facilitation of the health and health-related services including medical care, provider and patient education, health information services, and self-care via telecommunications and digital communication technologies”, provided by nurses, health professionals, pharmacists, social workers or trained volunteers. (NEJM Catalyst, 2018).
- **Virtual Reality (VR):** “the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or other sensory environment”. (Encyclopedia Britannica, 2023).
- **Wearables** include technologies worn on the body, such as fitness trackers, smartwatches, and smart jewelry, which can monitor health and activity levels to promote independence.

APPENDIX F: REFERENCES

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