Canadian Journal on Aging / La Revue canadienne du vieillissement

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You've Got E-Mail: A Pilot Study Examining the Feasibility and Impact of a Group-Based Technology-Training Intervention Among Older Adults Living in Residential Care

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Article

Cite this article: Ysseldyk, R., Morton, T.A., Haslam, C., Haslam, S.A., Boger, J., Giau, E., Macdonald, E.P., Matharu, A., & McCoy, M. (2024). You've Got E-Mail: A Pilot Study Examining the Feasibility and Impact of a Group-Based Technology-Training Intervention Among Older Adults Living in Residential Care. *Canadian Journal on Aging / La Revue canadienne du vieillissement* **43**(1), 45–56.
https://doi.org/10.1017/S0714980823000375

Received: 19 March 2022
Accepted: 19 March 2023

Mots-clés:
vieillissement; santé mentale; technologie; réseaux sociaux en ligne; lien social; établissements de soins; intervention

Keywords:
aging; mental health; technology; online social networking; social connection; residential care; intervention

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Résumé

Les personnes âgées vivant dans des résidences ont souvent du mal à entretenir des relations sociales constructives, ce qui peut compromettre leur santé et leur bien-être. La communication sur les réseaux sociaux en ligne peut atténuer ce problème, mais peu d'études en ont examiné la mise en œuvre et l'efficacité pour maintenir ou améliorer le bien-être. Cette étude pilote a utilisé un modèle pré-post randomisé en grappes pour examiner la faisabilité de la mise en œuvre d'une intervention de formation technologique de groupe de 12 semaines destinée à des personnes âgées vivant dans un établissement de soins (N = 48), en explorant les effets de cette formation sur la santé cognitive, la santé mentale et la confiance dans la technologie. L'analyse de la variance a révélé des augmentations significatives de la satisfaction de vie, des attitudes positives envers l'utilisation de l'ordinateur et une auto-perception de compétence parmi les participants qui ont participé à l'intervention, par rapport à une augmentation des symptômes dépressifs pour le groupe de contrôle. Ces résultats suggèrent que, malgré les difficultés liées à la mise en œuvre de ce type d'intervention dans les établissements de soins, la formation technologique en groupe peut renforcer la confiance des personnes âgées tout en préservant ou en améliorant leur santé mentale.

Abstract

Older adults living in residential care often experience challenges in sustaining meaningful social relationships, which can result in compromised health and well-being. Online social networking has the potential to mitigate this problem, but few studies have investigated its implementation and its effectiveness in maintaining or enhancing well-being. This pilot study used a cluster-randomized pre–post design to examine the feasibility of implementing a 12-week group-based technology-training intervention for older adults (n = 48) living in residential care by exploring how cognitive health, mental health, and confidence in technology were impacted. Analysis of variance revealed significant increases in life satisfaction, positive attitudes toward computer use, and self-perceived competence among participants who received the intervention, but increased depressive symptoms for the control group. These findings suggest that, despite challenges in implementing the intervention in residential care, group-based technology training may enhance confidence among older adults while maintaining or enhancing mental health.

Introduction

While it can be difficult for some older adults who are experiencing a decline in mobility and/or cognition to maintain active social lives (Choi & DiNitto, 2013; Cotten et al., 2014; Winstead et al., 2013), evidence shows that when retired, community-dwelling older adults maintain engagement with meaningful social groups, their mental and physical health is better than that of older adults who are more socially disconnected (e.g., Steffens, Jetten, Haslam, Cruwys, & Haslam, 2016). However, older adults who live within residential or long-term care (i.e., facilities that provide 24-hour access to a range of personal, therapeutic, and/or support services; Canadian Institute for Health Information, 2021) can feel particularly separated from the communities in which they once lived, thereby contributing to a sense of distance from

previous social networks (Winstead et al., 2013). In turn, social disconnection is a serious risk factor for a number of mental health outcomes such as depression (Cacioppo, Hawkley, & Thisted, 2010; Cornwell & Waite, 2009; Cotten et al., 2014), anxiety (Haslam et al., 2014; Haslam et al., 2019), psychological distress (Taylor, Taylor, Nguyen, & Chatters, 2018), and declining subjective well-being (Shankar, Rafnsson, & Steptoe, 2015).

One possible solution to this dilemma could be to harness online social networking to help older adults stay connected, despite their restricted mobility and physical separation (Bethell et al., 2021). Social networking technologies have the potential to help older adults maintain (or even expand) their social networks, continue social engagement, and decrease social disconnection (Ballantyne, Trenwith, Zubrinich, & Corlis, 2010; Hill, Betts, & Gardner, 2015; Winstead et al., 2013). Moreover, during the coronavirus disease (COVID-19) pandemic, many older adults were advised to self-isolate to an even greater extent than their younger counterparts while access to residential and long-term care homes was restricted to protect residents' physical health, which made maintaining social connections through online means (in many cases) essential (Government of Canada, 2020; Hartt, 2020; Haslam, 2020; Wu, 2020). This underscores not only the need for technological tools to keep older adults connected, but also points to the importance of access to social connection as a human right (Peisah, Byrnes, Doron, Dark, & Quinn, 2020) and, taken together, being able to use and benefit from technologies that might foster and support social connectivity (Lopez, Tong, Whate, & Boger, 2021). In response to these possibilities, the current study explores the feasibility of implementing a group-based technology-training intervention among older adults within residential care and its impact on older adults' cognitive and/or mental health.

Online Social Networking Among Older Adults

Social networking websites promote online social engagement and can provide an avenue for physically isolated older adults to fulfil their social needs (Chang, Choi, Bazarova, & Löckenhoff, 2015; Choi & DiNitto, 2013; Winstead et al., 2013). As people age, they tend to become increasingly selective with their social circle, prioritizing relationships that they consider truly important (Carstensen, 1992; Chang et al., 2015). In this regard, many older adults may gain more from social networking sites (e.g., Facebook) than their younger counterparts, in part because older adults are more likely to have *actual* friends as members of their online friend group – friends that they likely spend time with in-person (Chang et al., 2015). Indeed, because the Internet can be used to maintain and build both bridging and bonding social capital, by finding new ways to interact with existing social ties, to recover old social ties, and to create new social ties (Neves, 2013), older adults may receive substantial social benefits from online activity. This should be particularly true to the extent that this allows them to maintain and build social relationships that they value (Chang et al., 2015).

Active digital literacy among older adults, specifically regarding Internet and e-mail use, may also contribute to maintaining cognitive function (Xavier et al., 2014). For example, both community-dwelling older adults and those living in retirement care who participated in a Facebook intervention performed better on executive function (associated with working memory) and processing speed tests than a control group of older adults who were not using Facebook. However, it was unclear whether these benefits were derived from the cognitive tasks associated with learning to use online social networking or from the enhanced social engagement itself (Myhre, Mehl, & Glisky, 2016).

The uptake of technology for older adults has also been associated with a high degree of self-determination (Deci & Ryan, 2012), where technology usage and acceptance are fostered by self-perceived competence as well as the autonomy that emerges from using the technology (Dupuy, Consel, & Sauzéon, 2016). For example, older adults (including those receiving care within their own home, supported housing in the community, or living in residential care) who received three months of training to use computers, social networking sites, and the Internet had improved self-competence compared to those who had no training (Morton et al., 2016). Likewise, community-dwelling older adults who were taught to use new forms of technology over six months experienced increased autonomy compared to a control group (Dupuy et al., 2016).

However, the benefits of using technology for older adults are not restricted to skill learning. Even marginal levels of technology proficiency can affect attitudes toward – and confidence in using – technology in ways that can increase personal identity and social engagement (Morton et al., 2016). Indeed, by creating and maintaining meaningful social connections online, people's sense of self and associated social identities (i.e., their sense of belonging in various social groups) can be informed and supported, and this, in turn, has a range of benefits for mental health (Jetten, Haslam, Pugliese, Tonks, & Haslam, 2010; Morton et al., 2016).

Online Social Networking and Older Adults' Mental Health

While some research supports the claim that older adults' use of online social networking is associated with more positive mental health, there is by no means a consensus (see Chen, Wood, & Ysseldyk, 2021, for an overview). For example, in a sample of community-dwelling older adults, no link was found between high use of social networking sites and mental health indicators, such as loneliness and depression (Aarts, Peek, & Wouters, 2015). Other reviews have found that social networking is only associated with short-term mental health improvement (Chen, Schulz, & Chen, 2016), while the capacity for e-interventions to reduce social isolation or loneliness among older adults has been weak or inconsistent (Chipps, Jarvis, & Ramlall, 2017; Gardiner, Geldenhuys, & Gott, 2018). This contrasts with studies showing that computer use among some older adults is beneficial for health and well-being in helping lower social isolation, loneliness, and depression and increasing life satisfaction and perceived social support (Chang et al., 2015; Cotten et al., 2014; Erickson & Johnson, 2011; Heo, Chun, Lee, Lee, & Kim, 2015; White et al., 2002).

The lack of accord across these research studies suggests that the relationship between computer usage and mental health indicators among older adults is complex. The numerous ways and reasons older adults engage in technology, the settings in which they live, the amount of technology exposure and training they have received, and the extent to which they are physically and socially connected in person, might all have a role to play in these divergent findings. This suggestion is supported by previous research that has called for a greater understanding of the theoretical mechanisms through which such interventions might facilitate improvement in older adults' mental health and well-being (Gardiner et al., 2018). For example, Morton et al. (2016) demonstrated that while increased computer use was related to more positive well-being in a sample of older adults, computer use itself may not have been

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

solely responsible. Rather, the supportive training environment where older adults were encouraged to use computers as tools for social engagement seems likely to have also contributed to observed improvements. Thus, in line with research and theorizing in the "social cure" tradition (e.g., Bowe et al., 2020; Jetten et al., 2017; Jetten, Haslam, & Haslam, 2012; Ysseldyk, Haslam, & Haslam, 2013), for older adults who are experiencing social or physical disconnection, online tools may help enhance or maintain mental health and well-being by helping them build or sustain meaningful social connections.

The Present Study

Given a growing and robust body of research demonstrating positive links between social connections and mental health (e.g., Cacioppo et al., 2010; Jetten et al., 2012), coupled with the previous success of some technology training programs primarily among community-dwelling older adults (e.g., Morton et al., 2016; White et al., 2002), the present research assessed the potential social and mental health impacts of both technology-based and non-technology-based social group interventions with a particular focus on older adults living in residential care. This population was chosen because, despite being ostensibly surrounded by other people, loneliness and social disconnection among older adults in retirement care are widespread and, in some cases, increase upon moving into residential care (Jansson et al., 2017; Savikko et al., 2005). Moreover, despite the potential benefits of using technology to maintain older adults' social connections, empirical studies of Internet use in long-term or residential care remain uncommon (Seifert & Cotten, 2020).

This study was designed to explore two aims: first, the potential contribution of online social networking versus that of in-person social gatherings to older adults' well-being and, second, the viability of implementing a social networking technology intervention within residential care. We accomplished this by: (a) assessing the impact of social media technology on social connectivity and mental health (i.e., personal competence and autonomy, attitudes toward computers, social network activity, group memberships, cognitive function, depression, and life satisfaction) in a technology-training group intervention compared to a non-technology-based group intervention or "routine-as-usual" among older adults living in retirement residences, and (b) determining the feasibility (i.e., demand, acceptability, practicality, efficacy; Bowen et al., 2009; Orsmond & Cohn, 2015) of implementing the technology-training group program within a residential care setting. It was hypothesized that older adults who participated in the technology intervention would provide evidence of more social connectivity and better mental health than a control group, and that it would prove to be viable to implement the program in a residential care setting as per the standard feasibility criteria listed above (and described in more detail below).

Methods

Participants

Participants were recruited from five retirement homes that were all part of the same organization in four cities across Southern Ontario, Canada. A total of 59 individuals (19 men and 40 women, ranging in age from 65–95 years; M = 85.44; SD = 5.99) completed our study questionnaire at baseline (i.e., before the intervention, hereafter "Time 1" [T1]), and 48 individuals (17 men and 31 women; age M = 85.43; SD = 6.27) completed the follow-up questionnaire after the 12-week intervention (hereafter "Time 2" [T2]); see "preliminary baseline checks" below for analyses assessing differences between those who dropped out and those who completed the study). Of the participants who completed the 12-week study, 18 were married, 3 were single, and 27 were widowed. They had been living in residential care ranging between 1 and 108 months (M = 24.88 months, SD = 24.35). Only individuals living in assisted or independent residential care were eligible to participate in the study, whereas those living in areas designed to offer specialized memory care (i.e., for dementia or Alzheimer's disease) or in long-term care were excluded. Some participants were identified by staff as likely candidates for the research; however, other interested residents could also volunteer. Participants received a Certificate of Appreciation upon completion of the study. The Carleton University Research Ethics Board approved the study before its commencement (approval #106756).

Procedure

This study used a cluster-randomized (i.e., each retirement home was assigned to a study condition; Torgerson, 2001) pre–post intervention design. Potential participants were invited to an information session in a public space within each of the retirement homes (e.g., lobby, library) after which they could volunteer for the study based on their interest. After explaining the purpose of the study and obtaining informed consent, baseline (T1) questionnaire data were collected by a semi-structured interview with a member of the research team in a quiet, comfortable space within the retirement home.

The study used a training intervention (see Appendix A), which was run by a team of professional instructors in adult technology education. Although the team commonly conducts workshops for older adults within the community, sustained training programs within residential care are less common. In this case, older adults living in residential care took part in 12 weekly sessions to learn how to use technology and social networking sites (e.g., Facebook), to stay connected to friends and family. Moreover, a study-specific Facebook group designed to facilitate new group-based connections allowed us to examine whether the potential mental health benefits of connecting with an online-only group may differ from the effects of relationships that exist in both virtual and real worlds. Two control groups were included that involved either participating in a weekly in-person newspaper discussion group or allocation to a no-intervention group.

In this way, each retirement home was assigned to one of four study conditions with relatively equal sample sizes across the five homes: (a) a *technology-training* intervention condition (n = 11), (b) a *technology training + connection* intervention condition that included an additional Facebook connection group (i.e., within two of the retirement homes; n = 14), (c) a *newspaper club control* condition (n = 11), and (d) a *"routine-as-usual" control* (i.e., no intervention) condition (n = 12).[1] All participants completed the follow-up questionnaire at the end of the intervention period (T2).

Technology intervention conditions

Participants from three of the five retirement homes were placed in technology intervention groups, where they took part in weekly

[1]The group sizes reported here reflect participants who completed the study (n = 48).

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

three-hour workshops as part of a group facilitated by the technology instructor (who was not aware of the specific study hypotheses) for a total of 12 weeks. These workshops provided the opportunity for participants to learn more about using technology and the Internet. Participants were provided with digital tablets during the workshops (if they did not own a device already) for a hands-on learning experience, and each care home involved in a technology intervention group also received tablets for participants to sign out during their free time over the 12 weeks of the study. Within these three retirement homes, two experimental conditions were present:

Technology training. One retirement home was assigned to the *technology-training* condition, where participants received weekly technology workshops, including being taught how to use Facebook for the purpose of connecting with friends and family over social media.

Technology training + connection. Two of the retirement homes (in two different cities) were assigned to the *technology training + connection* condition (hereafter referred to as *technology-connection*), in which they received the same technology training as in the *technology-training* group; in addition to this, however, a Facebook group was created specifically for the participants of these two retirement homes to connect with each other for the first time over social media.

Control conditions

Each of the two remaining retirement homes participated in one of two control conditions designed to serve as "active" (i.e., newspaper club) and "passive" (i.e., routine-as-usual) control groups:

Newspaper club control. Participants in one of the retirement homes received an active control intervention in the form of a weekly in-person newspaper discussion group that was facilitated by one of the student researchers. This group was designed to mimic the social interactions and structure of the weekly technology information sessions, thus providing a comparison of face-to-face social interaction without technology.[2]

Routine-as-usual control. Participants from one retirement home received no intervention; they participated in their day-to-day routine as usual.[3]

Measures

Feasibility

Following Bowen et al. (2009) and others (e.g., Green & Glasgow, 2006; Ingram et al., 2020; Orsmond & Cohn, 2015), the feasibility components that were assessed in the present study included: *demand* (i.e., documented use of the intervention), *acceptability* (i.e., recipients' reactions to the intervention), *practicality* (i.e., existing factors affecting implementation ease or difficulty), and *efficacy testing* (i.e., assessing preliminary outcomes).

Demand was assessed through program attendance and participant drop-out; the program facilitators documented attendance during each session, and the total number of sessions attended by each participant over the 12 weeks was recorded.

Program acceptability was examined quantitatively using participant satisfaction ratings at T2 in the technology-training, technology-connection, and newspaper club conditions. Specifically, program satisfaction was rated with three items regarding the usefulness, clarity, and pace of the training/club ($\alpha = .70$). Each item was rated on a 5-point scale ranging from 1 ("not at all useful") to 5 ("very useful"). Participants in these three study conditions were also given the opportunity to provide qualitative feedback on program satisfaction, including open-ended questions about their experiences (e.g., "Is there anything else you would like to tell me about your experience with the [technology-training/newspaper club], or how you think it could be improved?").

Practicality was assessed by considering the extent to which the program could be carried out given the existing resources available, which included reporting on participants' access to technology hardware and Wi-Fi within the care homes. Specifically, participants indicated (a) whether or not they owned a computer/tablet at both T1 and T2, (b) where they typically accessed the Internet within the residence (e.g., personal room, café, library, hobby room), as well as (c) their perceptions of the reliability and speed of the Wi-Fi connection in the residence common areas at T2, rated on a scale ranging from 1 ("poor") to 5 ("excellent").

Finally, preliminary program efficacy testing was undertaken using measures of social connectivity, cognitive, and mental health, as described below.

Sense of Self and Social Relationships

Several social factors were assessed for each participant, including personal competence and autonomy, social network activity and satisfaction, as well as the number and types of social groups and activities in which they participated.[4] The quantitative measures that assessed these were as follows:

Personal competence and autonomy

Autonomy and competence were assessed with subscales from the Basic Needs Satisfaction Questionnaire based on self-determination theory (Gagné, 2003). The 13 items include statements such as "I feel pressured in my life", "People I know tell me I am good at what I do" and "I often do not feel very capable", rated on a scale ranging from 1 ("not at all true") to 5 ("very true"). The baseline (T1) Cronbach's alphas for autonomy and competence were $\alpha = .57$ and $\alpha = .69$, respectively, while the post-intervention (T2) alphas were $\alpha = .65$ and $\alpha = .72$.

Social network activity

Social network participation and satisfaction were assessed for 10 social relationships (as applicable): participants' spouse or partner, children, grandchildren, close family members, close neighbours, friends, people in the community, people they volunteer with, members of religious groups, and members of other social groups (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). Participants were first asked whether they had been in contact with each of these at least once every two weeks (scored 0 = no; 1 = yes), and then asked to rate their satisfaction with that level of contact on a scale ranging from 1 ("very dissatisfied") to 5 ("very satisfied").

[2]The retirement residence that received the newspaper club control condition had opened more recently than the other retirement residences in the study; this presented an opportunity to introduce a newspaper club into the residence for the first time, given that the other locations already had similar programming.

[3]No members of the "routine-as-usual" control group were part of a "newspaper club" within their retirement residence.

[4]Personal identity strength was also assessed but did not significantly differ across study conditions and as such is not reported here.

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

Group memberships

The number of participants' other group memberships (Haslam et al., 2008) was also assessed to see whether the extent of involvement in pre-existing social groups differed across study conditions. Participants were asked to list up to six groups that they belonged to, which for the present sample included a variety of religious, physical activity, recreational and volunteer groups, among others. Participants' total number of group memberships was summed and used to assess how much social engagement they typically had prior to (i.e., T1) and following the intervention (T2).

Computer Use and Attitudes

The Computer Attitude Scale (Jay & Willis, 1992) measured participants' attitudes toward the usefulness of computers, as well as their attitudes toward computers, in general. These 13 items assessed how participants felt about using or learning to use computers, with statements such as, "I feel comfortable with computers" and "Learning about computers is a waste of time" (reverse-scored), rated on a scale from 1 ("strongly disagree") to 5 ("strongly agree") (T1 α = .90; T2 α = .89).

Participants were also asked, "In an average week, how often do you use your computer/tablet?" rated from 1 ("less than once per week") to 5 ("every day"), and "When you do use your computer/tablet, how much time do you spend using it?" rated from 1 ("only a few minutes") to 5 ("more than two hours") at both T1 and T2. Finally, another set of questions comprising eight items assessed how useful participants typically found their computers/tablets to be for general tasks (e.g., "Finding information and advice"; "Meeting with and talking to new people"), rated from 1 ("not at all useful") to 5 ("very useful") at both T1 and T2, while participants were also asked how often they used their computers/tablets to access specific applications that were introduced during the training intervention (e.g. Facebook, Twitter), rated from 1 ("never") to 5 ("always") at T2.

Cognitive Functioning

The Addenbrooke's Cognitive Examination–Revised (ACE-R; Mioshi, Dawson, Mitchell, Arnold, & Hodges, 2006) was used to assess cognitive function. This 26-item test assesses performance in five specific cognitive domains – attention and orientation, memory, verbal fluency, language, and visuospatial abilities – and has demonstrated good sensitivity and specificity for mild cognitive impairment (Pendlebury, Mariz, Bull, Mehta, & Rothwell, 2012). In addition to the five subscale scores, participants' overall score out of 100 was computed (T1 α = .89; T2 α = .88).

Mental Health and Well-being

Two measures were used to index mental health and well-being[5]:

Depression

The eight-item Center for Epidemiologic Studies Depression Scale (CES-D; Karim, Weisz, Bibi, & Rehman, 2015; Radloff, 1977) assessed participants' depressive symptomatology within the past week with statements such as "I felt depressed" and "I felt sad," rated on a scale ranging from 1 ("rarely/none of the time") to 4 ("most/all of the time") (T1 α = .84; T2 α = .81). Responses were summed such that higher scores indicated more depressive symptoms.

Satisfaction with life

The five-item Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) assessed global life satisfaction with statements such as "I am satisfied with my life" and "In most ways my life is close to ideal" on a scale ranging from 1 ("not at all true") to 5 ("very true") (T1 α = .81; T2 α = .82). Responses were summed such that higher scores indicated more satisfaction with life.

Statistical Analyses

Preliminary analyses included an examination of potential baseline differences across the four study conditions on all variables of interest, and analyses to determine whether the assumptions of our planned analyses were met. Feasibility was subsequently assessed and indexed via program *demand* (i.e., attendance and drop-out analyses), *acceptability* (i.e., satisfaction across intervention groups), *practicality* (i.e., participants' access to technology hardware and Wi-Fi), and *efficacy testing* (i.e., on specified outcomes across study conditions). Specifically, a series of repeated-measure analyses of variance (ANOVA) were conducted to assess the potential impacts of time and the technology-training intervention (IVs) on social, cognitive, and well-being outcomes (DVs). Finally, qualitative analyses focused on summarizing themes generated by participants' responses to open-ended questions about program feasibility.

Results

Preliminary Analyses of Baseline Differences

Preliminary analyses were conducted to determine whether the assumptions of our planned analyses were met, indicating that depression scores were positively skewed at both T1 (n = 59, 1.473; n = 48, 1.028) and T2 (n = 48, 1.104) (i.e., most participants had relatively low levels of depression), whereas total ACE-R scores were negatively skewed at T1 (n = 59, -1.244; n = 48, -1.637) and T2 (n = 48, -1.364) (i.e., most participants had relatively high levels of cognitive functioning). However, transformations of these variables did not produce differential patterns of results; therefore, the findings presented here are analysed using participants' original data.

To test for any significant differences at baseline across the four study conditions, ANOVA were conducted using data collected from all participants at T1 (n = 59). These analyses revealed that participants across the four conditions did not differ in age, $F(3, 53) = 0.78$, $p = .511$, $\eta^2 = .042$, or sex, $\chi^2 = 6.45$, $p = .092$. However, there was a significant difference across study conditions on initial computer attitudes, $F(3, 55) = 3.28$, $p = .027$, $\eta^2 = .152$. Post-hoc comparisons revealed that the "technology-connection" group had slightly more positive attitudes toward computers at T1 (M = 3.89, SD = 0.68) than the "newspaper club" group (M = 3.17, SD = 0.73), despite recruitment materials being identical across the retirement homes/conditions. However, attitudes toward computers did not significantly differ across the "technology-training" or "routine-as-

[5]Anxiety, loneliness, and self-reported physical health were also assessed but did not significantly differ across study conditions and as such are not reported here.

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

Table 1. Descriptive statistics by group at baseline (T1) and post-intervention (T2)

	CONTROL (n = 23)		TECHNOLOGY TRAINING (n = 25)	
	T1 M (SD)	T2 M (SD)	T1 M (SD)	T2 M (SD)
Variable				
Sense of Self and Social Relationships				
Autonomy	4.05 (0.57)	4.14 (0.51)	4.20 (0.54)	4.27 (0.61)
Competence	3.62 (0.58)	3.78 (0.67)	**3.83 (0.84)**	**4.05 (0.75)**†
Social network activity	6.13 (2.05)	6.57 (2.13)	6.80 (2.14)	6.76 (1.85)
Social network Satisfaction	4.08 (0.59)	4.17 (0.62)	4.17 (0.72)	4.08 (0.70)
Total group Memberships	2.27 (1.89)	2.91 (2.07)	3.03 (2.06)	3.87 (1.81)
Computer Attitudes	3.58 (0.85)	3.58 (0.74)	**3.65 (0.64)**	**3.91 (0.77)****
Cognitive and Mental Health				
Total ACE-R	76.52 (16.67)	76.96 (16.24)	80.24 (11.96)	81.00 (12.28)
Depression (CES-D)	**12.52 (3.94)**	**13.90 (4.86)***	13.11 (4.92)	12.98 (4.93)
Life satisfaction (SWLS)	19.76 (3.61)	19.62 (3.84)	**19.13 (4.51)**	**20.64 (3.66)***

†p = .062
*p < .05
**p < .01
Notes. Social network activity = summed scores across 10 categories of family/friends contact (coded 0 = no, 1 = yes); ACE-R total scores are summed out of 100; CES-D is summed out of 32; SWLS is summed out of 25; key differences are bolded.

usual" groups. No other variables significantly differed at baseline as a function of study condition.

Feasibility

Demand

Given that 11 participants dropped out over the course of the study, additional analyses were conducted to determine whether there were differences at T1 among those who completed the 12-week study versus those who did not. There was no evidence of differential drop-out rates across the four study conditions[6]: χ^2 = 2.91, p = .406. However, significant differences between conditions were found in cognitive function. Specifically, participants who completed the study scored significantly higher at T1 on tests of attention, memory, and language (ps < .03), and somewhat (although not significantly) higher on tests of fluency and visuo-spatial ability (ps < .10). The total ACE-R score also differed significantly between those who completed the study (M = 78.46, SD = 14.38) and those who dropped out (M = 64.64, SD = 19.08), F (1, 57) = 7.30, p = .009, η^2 = .114).

Of the 48 individuals who completed the study, participants across all conditions (excluding those in the no-intervention control) attended an average of 7.37 (SD = 3.90) of 12 sessions. Mean attendance was 7.23 (SD = 3.83) of 12 sessions in technology-training, 7.15 (SD = 4.36) of 12 sessions in technology-connection, and 7.85 (SD = 3.44) of 12 sessions in the newspaper club control. Attendance did not significantly differ between these three groups, F(2, 43) = 0.13, p = .877, η^2 = .006.

Acceptability

Participants across all conditions (excluding the no-intervention control) also reported relatively high levels of program satisfaction (M = 4.31; SD = 0.73). Mean satisfaction was 4.26 (SD = 0.38) in the technology-training group, 4.17 (SD = 1.07) in the technology-connection group, and 4.55 (SD = 0.37) in the newspaper club control. Program satisfaction did not differ significantly between these three groups, F(2, 33) = 0.87, p = .429, η^2 = .050.

Practicality

Access to technology hardware and Wi-Fi was an important factor to implementing this program in residential care homes. At T1, 33 participants owned a computer/tablet and the number of participants who owned a computer/tablet did not differ across the study conditions, χ^2 = 4.30, p = .231, or across those who dropped out versus remained in the study, χ^2 = .067, p = .796. Although the number of participants who reported owning a computer/tablet significantly increased to 38 at T2, F(1, 46) = 5.29, p = .026, η^2 = .103; this did not differ as a function of study condition, F(1, 46) = 0.14, p = .715, η^2 = .003.

When asked where they accessed Wi-Fi within the residence, 19 participants reported doing so in the library, 13 in their personal rooms, 5 in the café, and 4 in the hobby room. Moreover, participants rated the reliability and speed of the Wi-Fi connection within the common areas to be only moderate (M = 2.95, SD = 1.14; i.e., on a scale rated from 1 to 5).

Efficacy Testing

To estimate the impact of the various interventions on social, cognitive, and well-being outcomes, a series of 2 (Time: T1, T2) × 4 (Study conditions: technology-training, technology-connection, newspaper club, routine-as-usual) repeated-measure ANOVA were conducted. In these analyses, the four groups did not differ on any of

[6]Although drop-out rates did not significantly differ across study conditions, it is interesting to note that approximately half (n = 6) of the 11 participants who dropped out of the study did so after completing the T1 baseline questionnaire but before attending any of the technology-training or newspaper club sessions. The others dropped out after attending only one (n = 1) or two sessions (n = 3), whereas one participant dropped out after attending seven sessions (of the technology-training intervention).

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the variables of interest either alone or in combination with time, *F*s < 2.14, *p*s > .109.

The two technology training groups (n = 25) and two control groups (n = 23) were combined for further exploratory analyses as the sample size was small and there were few baseline differences (as per the preliminary analyses described above). Additional baseline checks revealed that the two newly combined groups (i.e., technology vs. control) did not differ in age, $t(55) = 0.18$, $p = .859$; sex, $\chi^2 = 0.04$, $p = .834$; drop-out rate, $\chi^2 = 1.55$, $p = .214$; computer ownership, $\chi^2 = 2.57$, $p = .613$; or on any other variables of interest, *t*s < 1.51, *p*s > .137. Accordingly, a series of 2 (Time: T1, T2) × 2 (Study condition: control, technology) repeated-measure ANOVA were conducted to assess the potential impacts of the technology-training intervention on social, cognitive, and well-being outcomes. Descriptive statistics are presented in Table 1.

Sense of self and social relationships

When the impacts of the technology-training intervention were assessed on the variables related to participants' sense of self and social relationships, no significant main effects or interactions emerged for autonomy, social network activity, social network satisfaction, or number of group memberships. However, while the time × condition interaction for participants' self-perceived competence was not significant, $F(1, 46) = 0.23$, $p = .633$, $\eta^2 = .005$, there was a significant main effect of time, $F(1, 46) = 6.23$, $p = .016$, $\eta^2 = .119$, such that overall feelings of competence increased from T1 to T2 (see Table 1). Moreover, this increase was more evident among participants who received the technology-training intervention (M difference = 0.23, $p = .062$) than among control participants (M difference = 0.15, $p = .126$).

Computer use and attitudes

Analyses of the general ways in which participants used their computer/tablets (e.g., "Looking at photos," "Communicating with people I know") revealed no significant main effects or interactions as a function of time and study condition. Likewise, weekly usage did not differ significantly across time and study condition, $F(1, 32) = 0.28$, $p = .598$, $\eta^2 = .009$, nor did the amount of time that devices were used in an average sitting, $F(1, 28) = 2.22$, $p = .148$, $\eta^2 = .073$. However, an analysis of the specific applications (e.g., Facebook, Twitter) that participants reported using at T2 indicated that there were significant differences between the technology-training intervention and control condition in their use of e-mail, $F(1, 26) = 6.41$, $p = .018$, $\eta^2 = .198$, and video applications (e.g., Skype, FaceTime), $F(1, 26) = 5.34$, $p = .029$, $\eta^2 = .170$. Specifically, participants in the technology-training intervention used both e-mail (M = 4.30, SD = 1.13) and video applications (M = 2.53, SD = 1.48) more than control participants (M = 2.87, SD = 1.81; M = 1.25; SD = 0.71, respectively).

When changes in attitudes toward computers were examined, there was a slight (although non-significant) increase in positive attitudes over time, $F(1, 46) = 2.93$, $p = .094$, $\eta^2 = .060$. While this increase was not qualified by a significant statistical interaction between time and study condition, $F(1, 46) = 2.74$, $p = .105$, $\eta^2 = .056$, attitudes toward computers among participants in the control group remained unchanged over time (M difference = 0.004, $p = .974$), whereas attitudes toward computers became significantly more positive over time among participants of the technology-training intervention (M difference = 2.61, $p = .004$; see Table 1).

Cognitive and mental health

An analysis of the ACE-R scores revealed no significant main effects or interactions as a function of time and study condition. Nevertheless, there was a nearly significant interaction between time and study condition on life satisfaction, $F(1, 46) = 3.75$, $p = .059$, $\eta^2 = .075$. Given this, and our a priori hypothesis that mental health would improve among participants in the technology-training intervention, the simple effects across the control and intervention groups were examined. Specifically, while there was no difference in life satisfaction over time among control group participants (M difference = 0.14, $p = .782$), participants in the technology-training intervention reported significantly increased life satisfaction over time (M difference = 1.51, $p = .035$; see Table 1). Likewise, although the overall interaction between time and condition on depressive symptoms was not significant, $F(1, 46) = 2.02$, $p = .162$, $\eta^2 = .042$, there was evidence of significant increase in depressive symptoms among control participants (M difference = 1.38, $p = .046$) but not among participants in the technology-training intervention (M difference = 0.13, $p = .877$; see Table 1).

Qualitative Feedback

Qualitative feedback from participants on program acceptability and satisfaction suggested that those in the technology-training and technology-connection groups enjoyed the program, wanted it to continue, and wished to investigate further training on other devices and computer programs. Some participants reported that they (a) enjoyed interacting with others in the small groups, (b) had become friends with other participants in the study, and (c) would continue to check their Facebook group page after the study had ended. In contrast, at T2 participants in the newspaper club control group noted that they were hesitant or reluctant to use Facebook or computers. However, like the technology-training and technology-connection groups, participants in the newspaper group reported that they were generally satisfied with the newspaper club program, that it was exciting to keep up with current events, and that they enjoyed the social interaction with others.

Several participants provided feedback that could potentially be used to improve the technology training workshops. This included suggestions that participants involved should be "screened" beforehand in order to group individuals by skill level, how active they intended to be, and how committed they were to learn about new applications and computer programs.

Likewise, although not asked directly to share open-ended thoughts on Wi-Fi access, when participants were asked whether they had any comments on the program, those from both the technology-training and technology-connection groups reported that they had access to Wi-Fi only in common spaces and not in their private rooms. Moreover, they reported that the bandwidth (i.e., how fast data could be sent to and from a device, such as a tablet) at times made loading pages very slow and too limited to view videos – comments that also speak to the practicality aspect of program feasibility.

Discussion

This pilot study had two objectives: first, to explore the potential contribution of online social networking versus that of in-person social gatherings to older adults' social and mental well-being and, second, to establish the viability of implementing a social networking technology intervention within residential care. In addressing these objectives, the study provides preliminary evidence that a group technology-training intervention can be both feasible to implement and beneficial to older adults living in residential care in providing

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opportunities to develop online social networking skills in a supportive environment. Demand for the program and program acceptability both appeared to be reasonably high, with 81.36 per cent of all participants completing the study and attrition rates being consistently low across study conditions. Qualitative reports also indicated that participants were generally satisfied with the programs and provided positive feedback and constructive suggestions for improvements to the group-based technology-training program. These included recommendations to enhance existing infrastructure; in particular, lack of access to good Wi-Fi was identified as a significant barrier to the feasibility of technology-based interventions in residential care home settings.

The gains identified in older adults' social, cognitive, and mental health outcomes were generally modest. However, small increases in self-perceived competence, attitudes toward computers, and life satisfaction were nonetheless observed among older adults who participated in the technology-training program. Conversely, symptoms of depression slightly increased over time among control participants but not for the technology-training participants. Although the study sample size was relatively small, perhaps contributing to the modest effects, these findings add to the growing body of knowledge that suggests the use of technology can positively impact older adults' health and well-being. These findings thus bridge research from aging studies, technology-based research, and social psychology, with potential implications for older adults' mental health as well as the implementation of social interventions in residential care.

Implications for Implementing Social Interventions in Residential Care

Psychosocial programs in residential care have historically focused on recreation – that is, activities primarily aimed at entertainment and distraction (Theurer et al., 2015). In contrast, Theurer et al. (2015) proposed that a "social revolution in residential care" (p. 201) is needed, whereby programming focuses on providing opportunities for fostering meaningful group memberships, social productivity, peer support, and a sense of social connection. Implementing meaningful social interventions in residential (or long-term) care has been shown to be challenging in other research (e.g., Murfield, Cooke, Moyle, Shum, & Harrison, 2011; Ysseldyk, Paric, & Luciani, 2016). This was also evident in our study; while over 80 per cent of those enrolled completed the study, participants (across all intervention groups) attended an average of 7 out of 12 sessions. Although this level of engagement does not point to an enormous demand for the technology-training intervention, rates of attendance did not differ across the technology-training and newspaper club control groups, suggesting that it was not the technology-training intervention per se that impacted participant turnout, but rather a challenge that may be common to implementing interventions within residential care more broadly (Finnegan, Bruce, Lamb, & Griffiths, 2015). While we were unable to follow up with every participant who missed a session (or dropped out of the study) due to privacy concerns/restrictions, some participants noted that attendance was influenced by factors such as medical appointments, health issues, and fatigue. Nonetheless, participant satisfaction appeared to be high among those who completed the 12-week technology-training program, and many participants noted the value of both the training itself as well as the social connectedness it enabled.

It is also worth noting that participants' initial levels of cognitive function (indexed through the ACE-R) appeared to play a role in study attrition, with performance especially in the areas of attention, memory, and language being lower among participants who dropped out after baseline assessments. Indeed, this was the case across all study conditions. Although the present study did not include individuals with a diagnosis of dementia or Alzheimer's disease or residents living in long-term care, cognitive decline is nonetheless common over time among residents in retirement care (González-Colaço Harmand et al., 2014; Scocco, Rapattoni, & Fantoni, 2006), and this presents another challenge when it comes to implementing active (rather than passive; Theurer et al., 2015) social interventions in care home settings.

In addition to challenges inherent in employing social interventions within residential care in general, there were also challenges particular to implementing a technology-based intervention. Chief among these challenges were issues with satisfactory Internet access and speed within the care homes and especially within private rooms; this may have impacted participants' willingness to use personal social networking websites where they did not feel adequate privacy could be established. Additionally, access to a computer, tablet, or smartphone was necessary for participation in this program. While some older adults owned a computer or tablet, and tablets were loaned by the researchers for the duration of the study if needed, barriers to technology access could make the sustainability of such technology-based programs – and the ongoing use of skills gained – difficult. These barriers are both individual (connected to economic circumstances or explicit rejection of technology; Castleton, 2019; Fang et al., 2019), as well as structural (including the provision of Internet connectivity and the prioritization of this in care facilities; Moyle, Jones, Murfield, Dwan, & Ownsworth, 2018). To support the feasibility of similar technology training programs within residential care settings, organizations need to provide shared computers or devices and widespread Internet access. Indeed, these are essential for enabling older adults in residential care to acquire and improve their new technology skills and to be able to use them to be engaged citizens of the online world.

Implications for Older Adults' Mental Health and Well-being

As noted above, older adults who participated in the technology-training intervention showed increased positivity toward computers, slightly enhanced feelings of competence, and greater life satisfaction over the course of the 12-week program. In contrast, depressive symptoms moderately increased among members of the control group(s). Although formal tests for effects of condition across time changes were not significant (i.e., in the form of condition × time interactions), the trends in our findings suggest that, at least to some extent, the group-based technology-training program enhanced technology confidence among older adults while maintaining or enhancing mental health. In this way, the results of this study build on previous research in the "social cure" tradition, which suggests that group-based social connections can foster positive mental health and well-being (Bowe et al., 2020; Haslam, Jetten, Cruwys, Dingle, & Haslam, 2018; Jetten et al., 2012, 2017). In the present intervention, this was accomplished with a technology-training intervention group through which older adults could increase their social capital online. Indeed, while the risk of chronic and mental health illnesses in older adults living in residential care increases over time (Phillips, Rantz, & Petroski, 2011; Theurer, Wister, Sixsmith, Chaudhury, & Lovegreen, 2014), our technology-training intervention may have contributed to reducing this trend.

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

Interestingly, the results of this study did not reveal improvements to, or differential maintenance of, cognitive performance among the older adults who participated in the technology-training intervention compared to the control condition(s). However, as noted above, participants who had higher cognitive functioning at baseline were less likely to drop out of the study overall (and those with diagnosed cognitive impairment were not included in our sample). Thus, the greater cognitive capacity of those who remained in the study may have been a factor in the benefits they experienced from the intervention. For example, the improvements in self-perceived competence and positive attitudes toward computers among older adults in the technology-training group might be inextricably tied to the cognitive abilities needed to make use of that technology.

Like the absence of change in cognitive functioning, neither levels of self-perceived autonomy nor social network activity or satisfaction increased over time or differed across our study conditions. In this regard, the group-based nature of the interventions may have encouraged participants to rely less on themselves (i.e., requiring less need for autonomy), and the weekly in-person contact experienced within these new groups across study conditions (except for the "routine-as-usual" control group) may have been perceived as largely distinct from individual social relationships outside of the care home setting. Although the current study did not include an individually focused intervention for comparison to support this speculation, other research has found that improvements to mental health and well-being among older adults living in residential care were greater among those in receipt of group-based – as opposed to individually based – social interventions (Haslam et al., 2010).

Finally, our inclusion of a "technology-connection" group (for which we created a Facebook group with the specific aim to connect older adults living in two different cities who had never met in person) did not yield additional benefits relative to technology training alone. This could suggest that mental health benefits may be most prevalent when people interact in-person in addition to communicating online, rather than online (or in-person) alone (Chang et al., 2015; Hartt, 2020; Hu & Qian, 2021). Moreover, such a finding is especially timely given the lack of in-person contact that has been required by public health restrictions during the COVID-19 pandemic, during which the use of technology has become an invaluable and necessary way of staying connected to others, especially within long-term and residential care settings (Bethell et al., 2021; Government of Canada, 2020). In this regard, our findings provide further evidence that, although maintaining contact with others online may be a necessary step in protecting older adults' *physical* health, this alone may not be sufficient to simultaneously maintain long-term *mental* health (Hartt, 2020; Hu & Qian, 2021; Pinker, 2014).

Limitations

Like all research, this study has some limitations. First, our sample – and therefore capacity to detect reliable effects—was relatively small. This highlights the recruitment and attendance challenges associated with conducting research with older adults in residential (or long-term) care (Finnegan et al., 2015; Ysseldyk et al., 2016). Indeed, although it was necessary to limit the number of participants in each group to (a) ensure that each group would be a feasible size for the technology-training instructor to work with, and (b) form meaningful small group connections within each intervention group, recruitment and attendance challenges precluded us from collecting data from multiple groups within each intervention condition (despite conducting the study across five locations). Second, although we gathered some qualitative feedback from participants regarding their experiences and satisfaction with the study interventions, more in-depth interviews with participants could have been conducted to further explore their perceptions of the feasibility and sustainability of the technology-training program. As evidence for the effectiveness of technology-based programs grows, this is becoming an increasingly important focus for research. Third, given our objective to assess the feasibility and effectiveness of our intervention within an environment that was otherwise similar across all study conditions, sample demographics were fairly heterogeneous and generalizing our findings beyond residential care home settings within the particular organization with which we partnered (e.g., to community-dwelling older adults) should be made cautiously. Relatedly, given our cluster-randomization by care home (designed to minimize cross-contamination across study conditions), there may have been other confounding variables unique to a particular care home (or potential covariates at the individual or care home level) that were not captured by our analyses. Nonetheless, such a possibility would have been at least partially offset by our technology-connection condition (involving two separate care homes) in the first phase of analyses, and by our combining of the technology-training (three care homes) and control conditions (two care homes) in the second phase of analyses. Finally, this work takes on the perspective of the technology recipient, namely older adults in residential care homes. Research must also be done with the owners/operators of residential care homes as well as other stakeholders to clarify what is meaningful and realistic when it comes to establishing a feasible program design and implementation.

Conclusion

This research used two distinct technology-training groups, an "active" control group (i.e., the newspaper club), and a "passive" control group (i.e., routine-as-usual) to explore how technology training can affect older adults' cognition and mental health as well as their confidence in, and feelings about, using technology. Our study followed participants for a full 12-week period and indicated that, despite some challenges, the implementation of a sustained technology-training program within residential care is feasible and valued by residents, provided that appropriate training support and Internet access exist. These results may be especially timely given ongoing concerns about social threats arising from health crises, given the disproportionate impacts the COVID-19 pandemic has had on older adults living within residential and long-term care (Bethell et al., 2021; Government of Canada, 2020; Hartt, 2020; Wu, 2020). For older persons who lack the skill, desire, or resources to engage with online sources of social capital, it appears that technology-training interventions such as the one outlined in this research may help mitigate social disconnection and associated mental health consequences. Nevertheless, future research might explore ways to promote access to, and increase attendance rates in, active recreational programs (including technology-based programs) for all older adults living in residential care with consideration given to person-specific as well as structural barriers to participation. This, in turn, could help older adults (and all of us) achieve a greater sense of social connection and inclusion, even in the context of physical separation from our loved ones.

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press

Acknowledgements. Our appreciation to Tech Coaches, the Schlegel-UW Research Institute for Aging (RIA), and the staff and residents of Schlegel Villages for their support.

Funding. This research was funded by the Social Sciences and Humanities Research Council of Canada (SSHRC).

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Appendix A. Technology-training intervention schedule

WEEK	TOPIC(S)
1	**Getting to know the technology hardware and Google** – Differences between Mac and Android devices – Exploring and mastering how to use your interactive device – How to use the Google search tool
2	**Getting to know Maps, YouTube, and e-mail/Gmail** – How to send new messages and respond to e-mails – How to attach an item to an e-mail – Accessing your e-mail address book – How to access and use Maps and YouTube
3	**Getting to know the Camera and Games applications** – How to take pictures and record videos – How to view, sort, and edit photos and videos – How to access games
4	**Notes, Settings, and Contacts applications + the App Store** – Understanding your device settings – Adding and deleting contacts to your phone book – Taking notes on your device – How to add new apps to your device
5	**Introducing Skype and FaceTime** – Differences between Skype and FaceTime – How to use Skype and FaceTime to connect with friends/ family
6	**Introducing Instagram and Twitter** – How to set up an Instagram or Twitter account – How to follow a friend, celebrity, news, and so forth
7	**Introducing Facebook and Facebook Messenger** – Viewing a hands-off demonstration of technology coach's account
8	**Signing up and connecting with friends on Facebook** – Getting started – creating a Facebook account – Main features – news feed, requests, notifications – Setting your profile and cover photo
9	**Learning to use Facebook** – Searching for and adding friends – Responding to friend requests – Posting an update and/or photo on your timeline
10	**Learning to use Facebook (continued)** – Posting/sharing with a specific friend – Deleting or editing your post – Removing a friend's post from your timeline
11	**Optimizing your Facebook and Messenger with personal touches** – Accessing and discovering groups – "Following" and "liking" pages – Sending private messages to friends using Messenger – Using dictation (in Messenger and other apps)
12	**Wrap-up session: Answering your final questions**

https://doi.org/10.1017/S0714980823000375 Published online by Cambridge University Press