Not So Lonely Surfers: Computer Comfort, Internet Use and Life Satisfaction in Older Adults

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Abstract
Older adults often encounter diminished social support, loneliness and lower life satisfaction levels. Many of these struggles stem from a loss of social interaction with social network ties that are important to them. Information and communication technology (ICT) use offers promise in helping them maintain their social ties. In this longitudinal study, participants included 306 older adults in 19 different assisted and independent living communities. Through random assignment at the community level, residents were offered ICT training, interaction with trainees (placebo), and a survey only control condition with no interaction. Residents in each group were surveyed at pretest, posttest, and 3, 6, and 12 months post training. This analysis examines the use of the Internet as a tool for stress buffering to maintain and enrich social ties, reducing the impact of loneliness and improving life satisfaction measures. Significant interactions were found between ICT attitudes and loneliness, social support and life satisfaction.
Keywords: older adults, technology adoption, loneliness and ICT use, social support, technology training for older adults
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1 Introduction

It is common as people age to face a diminishing circle of contacts and social outlets, resulting in declining opportunities for human interaction (Cornwell, Laumann, Schumm, 2008). Loss of friends or family members to death, retirement, relocation for better climates, or moving to be close to specific relatives (e.g., an adult child and their family) can cause a loss of network ties to family, friends and acquaintances. The ability to gain new friends is often hampered by reduced mobility and increased health issues (Nilsson, Avlund, & Lund, 2011). These combined factors can frequently lead to a sense of loneliness (Fees, Martin, & Poon, 1999; Pinquart & Sorensen, 2001). To alleviate this problem, some individuals move to assisted and independent living communities (ALC) that provide varying levels of assistance in daily tasks and hypothetically offer a built in social support system. However, individuals in these situations may still feel lonely and disconnected from family and former friends (Newsom & Schulz, 1996; Zautra, Reich, & Newsom, 1995). Additionally, a fairly new factor that may contribute to their sense of loneliness is that the methods for communication have massively changed in the past few years, as information and communication technologies (ICTs) such as computers and mobile phones have been widely accepted across most demographics (Katz, 2011; Agar, 2013). Letter writing and personal visits have often been replaced by emails, texts or video calls (e.g., Skype or Facetime). To stay connected with the younger generations, older adults may need to learn how to use these new technologies (Carpenter & Buday, 2007; Winstead et al., 2012). Helping older adults to develop successful skills to cope with these social life technological, and personal life changes as well as reducing the negative effects of loneliness is a serious concern (Wheaton, 1985).

Using the Internet has been associated with lower levels of depression in older adults (Cotten, Ford, Ford, & Hale, 2012, 2014), reduced loneliness (Cotten, Anderson, & McCullough, 2013), and improved quality of life (Metz, 2000). Using mobile phones, tablets, and/or computers could open the doors for older adults to feel more connected to the outside world and able to participate in society again (Baker, 2013; Pavel, Jimison, Hayes, & Kaye, 2009). ICT use has the potential to not only benefit communication, but also to aid in acquiring information and building social networks (Chatman, 1992; Courtney, 2008). Despite the many positive benefits for older adults in using the Internet (Chou, Chang,

Lee, Chou, & Mills, 2013; Berkowsky, Cotten, Yost, & Winstead, 2013), they are the population sector in the United States that is least likely to go online (Carpenter & Buday, 2007; File, 2013). There are many barriers that need to be overcome in order to facilitate wider adoption of technology in this age cohort. These include economic pressures that keep older adults from purchasing devices capable of accessing the Internet as well as feeling unable to afford connection fees to access the Internet (Eggermon, Vendebosch, & Steyaert, 2006). Additionally, low technological skill levels make going online difficult or even impossible (Friemel, 2014; Choudrie, Ghinea, & Songonuga, 2013).

Finding ways to reduce feelings of isolation and loneliness as well as improve life satisfaction for older adults is imperative to not only the older adults themselves, it is also linked to better mobility (Metz, 2000), slower declines in cognitive function (Terrera, Minett, Brayne, & Matthews, 2014), and lower health care costs (Chou et al., 2013), thereby benefitting society at large. This study examines whether ICT use and related ICT attitudes can be a coping strategy to help older adults who are in assisted and independent living communities maintain social connectivity and also moderate the effects of loneliness on life satisfaction.

2 Social support, loneliness, Internet attitudes and life satisfaction

Social support and social interactions are complex areas to evaluate when dealing with older adults (Chatman, 1996). Assisted and independent living communities (ALC) often organize many activities to engage residents and these activities may take many forms. Social interactions also happen naturally with other facility residents and staff members. As helpful as these interactions may be, these types of activities do not always provide the personal level of help that alleviates loneliness and the feelings of social isolation (Cornwell & Waite, 2009; Fees et al., 1999). This level of support usually comes from interactions with people that are significant to the older adult such as family members or significant friends (Cornell & Waite, 2009). Unfortunately, many adult children have to move for employment or other opportunities and the older adult is left behind (Drucker, 2011). Even if family members are geographically close, family members may be busy with other activities, leaving the older adult feeling alone (Cornwell & Waite, 2009; Cornwell et al., 2008). Furthermore, not all social support is equal; those that represent the closest circle of family and friends usually bring the most perceived value in providing support (Garcia, Banegas, Perez-Regadera, Cabrera, & Rodriquez-Artalego, 2005). It is challenging to find strategies to foster helpful interactions that are meaningful to the older adult, especially since key people they may want to interact with (e.g., an adult child) might live far away or have a demanding occupation that doesn't allow for lengthy personal visits. Ultimately, the older adults' ability to cope with the levels of social support that they receive in relationship to their perceived needs for human interaction is a key factor related to their overall life satisfaction levels (Sherbourne & Stewart, 1991).

Regardless of the level of perceived loneliness, finding ways to successfully cope with these perceptions is important for the older adult (Wheaton, 1985). By using the communication and relational building potential of the Internet (e.g., e-mail, social networks), older adults can strengthen and deepen social ties. This allows the older adult to contact those that they want to communicate with, regardless of distance. This ability to interact with social ties and strengthen relationships is tied to lower feelings of loneliness in older adults (Sum, Mathews, Hughes, & Campbell, 2008) and lower levels of depression (Cotten et al., 2014, 2012; Winstead, et al., 2012). Research shows that satisfaction levels are high with contacts even when relationships are maintained at least partially through the Internet (Bradley & Poppen, 2003; Mellor, Firth, & Moore, 2008). Furthermore, many older adults can maintain and enrich relationships using a mixture of contact modes (e.g., face-to-face, video calls, e-mail, texting), which allows a sense of presence and immediacy (Chan, 2014; Xie, 2008). However, all of these benefits require not only access to the Internet, but fairly high skill levels in using the Internet. If skill levels are low, then it is logical that frustration in using the Internet would be high and the potential benefits would be minimized.

Differing skill levels and comfort with technology may help explain why research among older adults has found varying results, despite the potential for improving communication and maintaining social ties by using the Internet, (Elliot, Mooney, Douthit, & Lynch, 2014; Dickinson & Gregor, 2006; Hlebec, Lozar, Vehovar, 2006). With training, there is potential for even the frail elderly to benefit from using the Internet (White et al, 2002, 1999). Despite this potential, little research has worked on a large enough scale, and for a length of time to permit extensive observations (e.g., Dickinson & Gregor, 2006). Many intervention type studies are fairly small (e.g., thirteen participants for three weeks) or infrequent enough (e.g., one hour of computer access a week) that it is not surprising there is little significant change in communication patterns (Dickinson & Gregor, 2006). Additionally, many studies finding negligible effects for Internet use and communications with older adults were based on experiments done in the late

1990s or early 2000s. The rapid changes in usability and ubiquity of computers since then has radically lowered technological barriers, suggesting that these previous studies should be revisited to check for continued validity given current conditions.

Part of the problem in evaluating the efficacy of an ICT intervention and measuring the impact of using the Internet is that it requires a multi-dimensional approach. Previous research by Cotten and colleagues (Cotten, Golner, Hale, & Drentea, 2011) has demonstrated the importance of measuring not only ICT/ Internet use, but frequency, duration, purpose and functions performed when using the Internet (Cotten et al., 2013). Another issue that has rarely been addressed is the effects of limited skill levels, which are typical in many older adults. Frustration or fear of using technology may lead to increased apprehension, lowering the positive impact of the technology. Underlying, and not always obvious factors, may help explain why expected positive results are not always realized. Older adults have many stressors facing them every day, if ICT use is seen as difficult or frustrating, then it becomes an additional stressor, but if ICT use is seen as easy and rewarding then it becomes a coping resource.

Wheaton (1985), theorizes how people utilize stress buffering resources and coping techniques to deal with different stressors in their lives. In a sense, ICT use for the older adult may be like a relationship with a complex relative, providing wanted information and contact with others, but sometimes causing fear or apprehension if misunderstood. Many previous studies simply tried to evaluate the impact of Internet use, or usage rates without providing training for those with low ICT skills (Smith, 2014; van Biljon & Renaud, 2008). However, with low or non-existent ICT skills, the potential benefits of ICT use are unrealized. On the other hand, research that is based on measuring benefits after an ICT training intervention is also complex because these interventions often create a potential confound- the interaction with the trainer. In fact, this was one of the criticisms of an ICT training intervention research, especially since many older adults are lonely (Dickinson & Gregor, 2006). The concern was that improvements in life satisfaction and lower depression rates were a result of the interactions with the staff that came to the ALC for the intervention, rather than the interaction with the ICTs themselves (Dickinson & Gregor, 2006). A unique feature of this research is that this issue is addressed, allowing a more accurate measurement of the impact using the Internet had on the subjects.

There are other difficulties in accurately evaluating the impact of various interventions on older adults. For example, even if a subject reports that they may feel lonely, the level that this feeling affects their overall life satisfaction levels shows how well they are coping with the level of social support that they have (Wheaton, 1985). Their loneliness does not necessarily translate into lower life satisfaction if there are other factors at work (Schumaker, Shea, Monfries & Groth-Marnat, 1993). Effective coping strategies may reduce the negative impact of loneliness, declining health or difficult living situations (Birditt, 2014). Frequently, these coping strategies may be reliant upon the others, such as community programs for older adults. However, offering older adults tools that they can use autonomously as a coping strategy, such as ICTs, may prove to be very beneficial. This research examines the effect of levels of social support and loneliness on life satisfaction measures and examines whether attitudes towards ICT use for communication acts as moderator of loneliness levels.

3 Methods

The data from this randomized controlled trial is part of a long-term project that brought technology to 306 participants at 19 assisted and independent living communities in Alabama, which at the time of the study ranked as the state with the lowest rate of Internet access in the United States (United States Census Bureau, 2012). At the beginning of the intervention, each participating community was randomly assigned to one of three conditions: ICT/Internet training, attention control (placebo), and true control (no ICT/Internet training and no placebo). This research design addressed several criticisms of previous interventions (e.g., Dickenson & Gregor, 2006). The ICT training condition provided computers and Internet access in a communally available area. However, the Attention Control and True Control groups did not receive their computers until all longitudinal survey data had been collected. At that time, they were offered ICT training and computers were installed in these communities. During the data collection phase, the true control group only received surveys, but no training or interaction with the trainers. The attention control (placebo condition) brought the trainers in to interact with the participants for the same number of sessions and the same amount of time as the ICT group. They did not have computers installed at this time, nor were they taught how to use technology at that time. The ICT training condition brought trainers for a period of eight weeks, and twice per week for 1.5 hours per session. All participants went through detailed surveys with a pretest, posttest at the end of an 8-week training intervention, and follow up surveys at 3 months, 6 months, and 12 months. Baseline data was collected from within the first week or two of the project timeline. At the completion of the project, all of the

communities had computers and Internet access installed in accessible areas and training was offered for those who wanted to participate.

4 Hypothesis and Measures

Our socioemotional variables of interest include social support, loneliness, and life satisfaction measures; attitude towards the Internet as a communication tool is measured as a moderator. For this analysis of the data, the focus is not attempting to measure the actual use, but the comfort levels and perceptions of the Internet as being a method for communication and therefore a coping mechanism.

Key concepts were operationalized using scales that are widely used and tested for examining psychological and social measures. Social support is measured using the MOS social support scale (Sherbourne & Stewart, 1991). Full variables and Cronbach's alpha levels are given in Table 1. The concept of loneliness was measured using the UCLA loneliness scale, which had strong internal consistency with this population, having an alpha of .70. Items on the scale are also included in Table 1 (Russell, 1996). Life satisfaction indicators included questions developed by Diener, Emmons, Larsen & Griffin (1985), and also showed strong internal consistency with an alpha of .72. Perceptions of the Internet as a tool to aid communication, lower isolation and in general, to work as a coping strategy were assessed with the following questions adopted from Hiltz and Johnson (1990) and exact items used are also in Table 1.

Demographics were measured for age, race and education. Less than high school was 1, high school graduate or a GED was 2, some college was 3, college graduate was 4, and post-graduate studies were 5. Race and marital status were not included in the analysis because there was little variation in the sample.

Construct	Questions	Source and alpha levels
Social Support	Five point scale (1= none of the time to 5=all of the time) "Do you have someone (other than staff at the living community)…"	MOS Social Support Scale Sherbourne & Stewart, 1991 alpha=.95
	That would help you if you were confined to bed? You could count on to listen to when you need to talk? To give you good advice about a crisis? To take you to the doctor if you needed it? Who shows you love and affection? To have a good time with? To give you information to help you understand a situation? To confide in or talk to about yourself or your problems? Who hugs you? To get together with for relaxation? Whose advice you really want? To do things with to help you get your mind off things? To share your most private worries and fears with? To turn to for suggestions about how deal with personal problems? To do something enjoyable with? Who understands your problems?	

	To love you and make you feel wanted?	
Loneliness	Three point scale (1= hardly ever; 2= some of the time; 3= often)	UCLA loneliness scale Russell, 1996 alpha= .70
	How often do you feel that you lack companionship? How often do you feel left out? How often do you feel isolated from others?	
Life Satisfaction	Five point scale (1= strongly disagree to 5=strongly agree)	Diener, Emmons, Larsen & Griffin, 1985 alpha= .75
	In most ways my life is close to ideal The conditions of my life are excellent So far I have gotten the important things I want in life I am satisfied with my life as a whole If I could live my life over, I would change almost nothing	
Positive Attitude towards the Internet	Five point scale (1= strongly disagree to 5=strongly agree) "Please tell me how much you agree or disagree with the following statements, using the Internet has	Hiltz and Johnson, 1990 alpha= .91
	Made it easier for me to reach people Contributed to my ability to stay in touch with people I know Made it easier to meet new people Made it easier to get information I need Increased the quantity of my communication with others Made me feel less isolated Helped me connect to my friends and family Increased the quality of my communication with others Is useful to me	

Table 1: Operationalization of Constructs

Based on the review of previous research, the hypothesis was: attitudes towards the Internet as a communication tool will work as a mediated moderator between loneliness and life satisfaction levels even when social support is lower.

5 Results

IBM SPSS version 21 was used for the data analysis. Hayes PROCESS method was used for the mediation/moderation analysis (Hayes, 2013). Of the 306 participants, 245 were female (80%) with an average age of 83 years. The ages ranged from 51 to 102. Participants were in two basic living conditions with 45% in assisted living and 55% in independent living. Education levels were fairly high with the average participant having some college. Full demographics are in Table 2. The mean education level

was some college and the subjects were predominantly female. This is representative of the population living in these facilities.

	Mean	Std. Dev.	Minimum	Maximum
Age	81.98	8.79	51	102
Educational Level	3.31	1.14	1.00	5.00
	%			
Sex (Female)	0.80			
Race (White)	0.96			
Assisted Living	0.45			
Independent Living	0.55			

Table 2: Demographics Time 1
(N=301)

The initial pre-test (T1) had 306 participants, the ICT/placebo intervention occurred over 8 weeks, the post-test (T2) had 253 participants, at 3 months (T3) there was 245, at 6 (T4) months 235, and after 12 (T5) months 209 participants. The overall retention rate was approximately 68%. The data for the study arm and individual retention rates is in Table 3.

Study Arm	T1	T2	T3	T4	T5
ICT Training	101	74	74	74	65
	33%	32%	31%	34%	32%
Attention Control (Placebo)	112	86	83	77	71
	37%	37%	35%	36%	34%
True Control	93	74	81	65	70
	30%	32%	34%	30%	34%
Total	306	234	238	216	206

Table 3: Study Arm Retention

The overall social support, loneliness, and life satisfaction scales for the ICT group are shown in Table 4. There were no statistically significant differences in the measures of these factors in the means across the study groups for these variables.

	N	Mean	Std. Dev.	Minimum	Maximum
Life Satisfaction Scale					
T1	97	3.62	0.64	1.60	5.00
T2	70	3.72	0.53	1.80	5.00
T3	70	3.70	0.53	2.60	5.00
T4	70	3.71	0.52	2.60	5.00
T5	61	3.64	0.57	1.60	5.00
UCLA Loneliness Scale					
T1	97	0.83	0.30	0.60	1.80

T2	70	0.80	0.24	0.60	1.60
T3	70	0.78	0.24	0.60	1.60
T4	70	0.82	0.31	0.60	1.80
T5	61	0.77	0.29	0.60	1.80
Moss Social Support Scale					
T1	97	3.75	0.78	1.56	4.72
T2	70	3.72	0.70	1.89	4.72
T3	70	3.70	0.71	1.67	4.72
T4	70	3.68	0.73	2.17	4.72
T5	61	3.89	0.75	1.78	4.72

Table 4: Overall Scales for the ICT training group

The attitudes for the ICT training group towards the Internet as a positive method for maintaining communication was higher than that of the overall group norms, the initial mean was 3.8 (SD=0.76) for the ICT group and 3.68 (SD=0.77) for the overall group and after 3 months into the project, the ICT mean rose to 3.92 (SD=0.54) and at the same point the overall mean was 3.66 (SD=0.63). The data is shown in Table 5.

	All groups**			ICT training group		
ICT Attitudes	N	Mean	Std. Dev.	N	Mean	Std. Dev.
T1	104	3.68	0.77	101	3.80	0.76
T2	121	3.74	0.62	74	3.91	0.52
T3	121	3.66	0.63	74	3.92	0.54
T4	101	3.72	0.62	74	3.89	0.60
T5	99	3.67	0.65	65	3.86	0.57

**Those who did not use the Internet at all, or did not express an opinion are not included

Table 5: Positive attitudes towards the Internet

Figure 1 shows the mediation moderation regression analysis. When loneliness is viewed as an independent variable and life satisfaction as a dependent variable, the interaction of ICT attitude with social support on life satisfaction levels have an effect that changed through the course of the study.

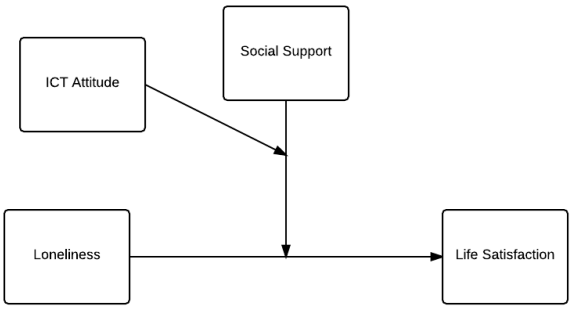

Figure 1: Mediation Moderation Analysis

Table 6 presents the mediation moderation regression analysis on life satisfaction over the five time points. At Time 1, loneliness has a significant negative direct effect (-0.33) on life satisfaction. Social support has a significant positive conditional effect (0.12) and the interaction effect of social support and ICT attitude is positive and significant (0.15). The estimated model at Time 1 accounts for 22.3% of the variation in the life satisfaction. Turning to Time 2, loneliness has a significant negative direct effect (-0.42) and social support has a significant positive conditional effect (0.16) on life satisfaction. At 3 months (i.e., Time 3), loneliness has a significant negative direct effect (-0.37) and social support has a significant positive conditional effect (0.13) on life satisfaction. The model accounts for 10.1% of the variation in the life satisfaction. At the 6-month follow up point, loneliness has a significant negative direct effect (-0.26) on life satisfaction. Moreover, the interaction effect of social support and ICT attitude is positive and significant (0.23). At the final time point, loneliness has a significant negative direct effect (-0.22) and social support has a significant positive conditional effect (0.13) on life satisfaction. The interaction effect of social support and ICT attitude is positive and significant (0.15). The model in the final time period accounts for 7.6% of the variation in life satisfaction. A mediation moderation analysis of both the true control group and the attention control group found no statistically significant impact concerning ICT attitudes. The null hypothesis was rejected for ICT attitudes as a moderator between loneliness and life satisfaction levels for those who had ICT training.

	T1		**T2**		**T3**		**T4**		**T5**	
Constant	3.84	***	2.32	*	3.48	***	5.13	***	3.93	***
Loneliness	-0.33	**	-0.42	**	-0.37	**	-0.26	*	-0.22	*
Social Support	0.12	*	0.16	**	0.13	*	0.10		0.13	*
ICT Attitude	-0.52	*	-0.21		-0.48	*	-0.85	*	-0.58	*
Social Support x ICT Attitude	0.15	*	0.02		0.12		0.23	*	0.15	*
R^2	0.223		0.154		0.206		0.235		0.442	
Model F	9.62	**	7.10	***	10.10	***	9.91	***	7.60	***
N	104		121		121		101		98	

* p > .05, ** p > .001, *** p > .0001

Table 6: Interactions
(Unadjusted Beta Levels)

6 Discussion

Loneliness levels and social support understandably are correlated with life satisfaction levels. As discussed previously, these are often hard for the individual to control as the individuals they want to communicate with may be far away. However, for those who saw the Internet as a way to sustain and improve their social network, there was a moderating effect on the life satisfaction levels. This model explained up to almost 24% of the variance. Although, it is far from comprehensive, this does show the potential of the Internet as a coping strategy. The data suggests that the older adults who felt confident in being able to use ICTs to communicate with others produced an interaction effect with social support. This appears to support the theory based on Wheaton's (1985) concept of stress buffering models.

Improving life satisfaction levels for older adults is challenging. This research indicates that providing technology, as well as training, so that older adults can see the Internet as a tool to maintain and strengthen social networks has the potential to meaningfully help with this challenge. As it becomes harder, or even impossible for older adults to go out to physically visit friends and family members, ICT devices allow them to maintain contact through email, social media, or videophone calls. Currently, for many older adults, using a technology that could allow them to stay connected is intimidating. This research found that providing training and access, along with time for them to explore at their own pace, not only brought a more positive view of ICTs, it appears to help improve their overall outlook. Giving

older adults the skills and tools that allow them to autonomously maintain contact with others has the potential to improve quality of life for many older adults.

This research is unique in that it addresses several issues that hampered previous studies. One feature is having both a true control group, where there is no particular interaction, and a control group that parallels the ICT training in providing interaction through games and activities using the same frequency and duration. This overall design provides an opportunity to better observe the impact of ICT use on older adults. Another design feature is providing extensive training so that older adults have assistance to feel more comfortable with ICTs. Most previous studies were with small groups at one facility or only short interventions (Wagner, Hassanein, & Head, 2010). A critical feature is a longer time frame for the older adults to become comfortable in using the computer autonomously. This was accompanied with repeated measurements that demonstrated how attitudes towards ICT use changed. For many, the Internet became a tool they could use to improve their communications with those who were meaningful in their lives. Just like any other coping strategy, it is not necessary to use it all the time. For the older adult who feels lonely or lacking in social support, knowing that the Internet is available, and feeling confident in using it to accomplish his or her goals, makes it effective.

7 Limitations and Suggestions for Future Research

Accurately measuring levels of life satisfaction and loneliness are often difficult with older adults. Even though the scales used in this research are widely used and thoroughly tested, there is still the issue of measurement error. Some individuals have been encouraged throughout their lives to not complain, even if they are internally suffering; at the same time, others may very vocal about their issues as an attention getting device (Hinrichsen & Molinari, 1998). Furthermore, outside situations, beyond the scope of this research may also be contributing to the sense of loneliness or life satisfaction of the participants. These factors could include unreported changes in physical or mental conditions, changing management conditions at the living facilities, changes in staff, or transfers of friends to different locations. Even though questions were asked about changes in physical or mental limitations, the answers were self-reported; therefore, they are subject to error. Also, declining health or decreased mobility may have made it difficult for participants to readily access the computers that were placed in the communities as part of this project. This would make it hard for the participants to develop comfort levels with using the computers that would allow them to easily use the computers for increasing their communication with others.

The current research used desktop and laptop computers that had special keyboards available for older adults with mobility or visibility issues. Future research could focus on the use of tablet computers and how those aid communication and life satisfaction. Tablet computers offer easier access for those with mobility issues and have interfaces that are relatively simple to learn. These devices could allow researchers to better explore the potential benefits of ICT devices for older adults without many of the current technological and spatial barriers.

Even though the Internet holds great promise for older adults in helping them cope with issues such as loneliness and maintain communication with family and friends, there are also risks. Some older adults have impaired cognitive function and may not understand the potential dangers on the Internet. There has been a great deal of effort in communicating how to be careful online with children, but very little online safety material is targeted towards older adults. Lonely older adults could become easy prey for online predators. Online safety information should be developed specifically to address the concerns and needs of older adults. Additionally, filters could be installed in computers, much like those for children, to protect older adults from either accidentally or unwittingly divulging private information. Hopefully, easy to use tools can be developed so that family members or ALC staff can readily assist older adults in helping them make the choices that will be best to help improve their quality of life.

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