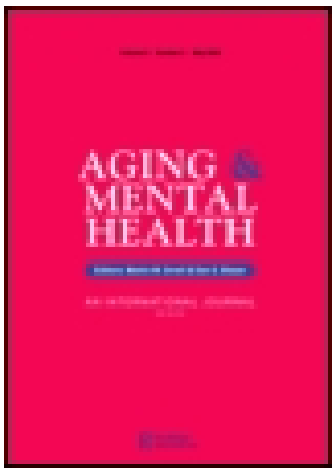

Aging & Mental Health
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/camh20

A randomized controlled trial of the psychosocial impact of providing internet training and access to older adults

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Published online: 09 Jun 2010.

To cite this article: H. White, E. McConnell, E. Clipp, L. G. Branch, R. Sloane, C. Pieper & T. L. Box (2002) A randomized controlled trial of the psychosocial impact of providing internet training and access to older adults, Aging & Mental Health, 6:3, 213-221, DOI: 10.1080/13607860220142422

To link to this article: http://dx.doi.org/10.1080/13607860220142422

Aging & Mental Health 2002; 6(3): 213–221

BrunnerRoutledge Taylor & Francis healthsciences

ORIGINAL ARTICLE

A randomized controlled trial of the psychosocial impact of providing internet training and access to older adults

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Abstract

The Internet (electronic mail and the World Wide Web) may provide new opportunities for communication that can help older adults avoid social isolation. This randomized controlled trial assessed the psychosocial impact of providing Internet access to older adults over a five-month period. One hundred volunteers from four congregate housing sites and two nursing facilities were randomly assigned to receive Internet training or to a wait list control group. The pre & post measures included the UCLA Loneliness scale, modified CES Depression scale, a measure of locus of control, computer attitudes, number of confidants, and overall quality of life. Participants received nine hours of small group training in six sessions over two weeks. Computers were available for continued use over five months and the trainer was available two hours/week for questions. At the end of the trial, 60% of the intervention group continued to use the Internet on a weekly basis. Although there was a trend toward decreased loneliness and depression in intervention subjects compared to controls, there were no statistically significant changes from baseline to the end of trial between groups. Among Internet users (n = 29) in the intervention group there were trends toward less loneliness, less depression, more positive attitudes toward computers, and more confidants than among intervention recipients who were not regular users (n = 19) of this technology. Most elderly participants in this trial learned to use the Internet and the majority continued to use it on a weekly basis. The psychosocial impact of Internet use in this sample suggested trends in a positive direction. Further research is needed to determine more precisely, which older adults, residing in which environmental contexts are more likely than others to benefit from this rapidly expanding information and communication link.

Introduction

Many older adults face barriers to communication, which impair their ability to gather information and engage in social interaction. Numerous studies suggest that social and emotional isolation is associated with adverse health outcomes and diminished quality of life (Chappell & Badger, 1989; Dugan & Kivett, 1994; Mullins *et al.*, 1991; Thompson & Heller, 1990). Particularly among older individuals, research indicates that social support network size (i.e., family members, friends and others with whom the person interacts) and satisfaction with social support affect health outcomes including affective states, such as feelings of depression or loneliness (Kahn & Antonucci, 1980; Kaplan *et al.*, 1987; Kaplan & Strawbridge, 1994).

The Internet (i.e., World Wide Web and electronic mail) is a novel vehicle of communication that has in recent years become more accessible to all persons and may provide a means of overcoming barriers to social interaction for the elderly (Hutchison, Eastman, Tirrito, 1997; Kubeck *et al.*, 1999; Post, 1996). Although an age bias against older adults using computer technology may still exist (Ryan *et al.*, 1992), increasing numbers of older adults are beginning to utilize this technology. A national survey conducted in November of 1995 found that of older adults aged 55 and over, 29% reported owning a personal computer (PC) (Adler, 1996) and, among these PC owners, 28% reported regularly using an on-line service.

The Internet, including e-mail, has the potential to enhance social support and psychosocial well-being for many older adults in a variety of ways. Primarily, older adults can use computers to communicate frequently, easily and inexpensively with family and friends who also have access to e-mail at work or at home. Elders can explore interests and hobbies through the Internet, or obtain consumer information and access to community resources. They can meet new people with similar interests through chat rooms and bulletin boards. In addition, the Internet may

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Received for publication 6th April 2001. Accepted 10th December 2001.

ISSN 1360–7863 print/ISSN 1364–6915 online/02/030213–09 © Taylor & Francis Ltd
DOI: 10.1080/13607860220142422

provide a novel way to control choices about interactions with others and time use that is not otherwise available, thus providing more autonomy for older adults. In essence, relatively isolated and disabled older adults can reconnect, strengthen and broaden their connection with the outside world by incorporating computer technology into their lives.

Only a few attempts have been made to investigate the role of computers in the lives of older adults. Early studies simply described the use of computer games (Riddick *et al.*, 1986; Schueren, 1986; Weisman, 1983; Zemke, 1986). One very early study introduced older adult congregate housing residents to the computer. Investigators observed that the participants enjoyed the more interactive functions including a game that simulated a conversation and the ability to 'message' with another computer user at a distant site (Danowski & Sacks, 1980). Another study incorporated e-mail and Internet training in a nursing home setting (McConatha *et al.*, 1994; McConatha, *et al.*, 1995). While generally showing positive effects, this study was small and required intensive one-on-one assistance throughout the intervention.

In a pilot study of 15 participants from a continuing care retirement community we recently examined the feasibility and psychosocial impact of introducing older adults to the World Wide Web (WWW) and e-mail (White *et al.*, 1999). The majority of this group of older adults was willing and eager to learn and utilize this new technology. In addition to the practical aspects learned from this feasibility study, we observed a trend towards decreased loneliness among the 15 participants in comparison to a group of eight residents from the community who did not participate in the project. Based on these findings, the present randomized trial was undertaken to determine the psychosocial effects of providing Internet access to older adults.

Methods

Subjects and design

Four congregate housing sites and two nursing facilities agreed to participate. Each site received IBM style computers, 386 or better (one site used Macintosh Performa™) and cost-free Internet service provider access. Donations made to several sites allowed for the purchase of a printer or other hardware. Sites were required to pay for phone line installation and maintenance and to provide a dedicated secured area where the computers could be used on a 24-hour per day basis.

Information sessions open to all residents on the general use of computers and the Internet were provided at each facility. Volunteers were sought at these sessions and through posted flyers. All residents of these communities were eligible to participate. At the nursing facilities health care personnel were asked to identify residents whom they thought had the cognitive ability to participate. Enrollment began in the autumn of 1996 and data collection was completed in January 1998. A total of 100 participants provided informed consent and entered the trial. At each of the six sites individual participants were randomly assigned to either intervention or control group.

There were 51 participants randomized to the intervention group. Nine participants dropped out of the training but nevertheless completed the follow-up interview. Reasons for not completing training were health problems (n = 7) and insufficient time (n = 2). One additional participant dropped out of training and refused to complete the follow-up interview. One participant died before the study ended and one participant could not be tested at the time of the follow-up interview due to progression of physical illness. A total of 39 intervention participants (76% of the initial 51) completed training and the follow-up interview after five months. A total of 48 intervention participants (94% of the initial 51) were used in the statistical analysis, including nine who dropped out of training. Of the 49 participants randomized to the control group, one participant died, one moved away, and two were not tested at the time of the follow-up interview. Therefore, 45 control participants (92% of the initial 49) were included in the statistical analysis. Of the 100 participants, 15% were African-American and 2% were Hispanic. There were no statistically significant differences between the intervention and control groups on the 13 demographic variables at baseline (see Table 1). Although more than 60% in each group rated their health as good or better, about the same percentage of participants indicated that their activity was limited due to their health. Of note, the majority (> 60% in each arm) of participants had no previous computer experience.

Intervention

After the baseline interview, subjects were randomly assigned to one of two study arms: (1) Internet training; or (2) wait list control. Control subjects were offered a token gift to compensate them for waiting five months for training. Intervention subjects received nine hours of group training (three two-hour sessions and three one-hour sessions, two elderly participants per computer with four to six in a class) over a two-week period, which covered basic computer operation, use of e-mail, and an introduction to accessing the WWW. We primarily used Simeon™, version 4.1.1, as the electronic-mail interface and a Netscape™, version 2.02, browser for the WWW. A training manual covering these topics was developed specifically for this study and distributed

TABLE 1. Baseline characteristics

	Intervention (n = 48) (%)	Control (n = 45) (%)
Age (mean ± SD)	71 ± 12	72 ± 11
Gender (% female)	71	82
Living situation (% alone)	81	89
Educational level (% High School graduate)	71	77
Self-rated health (% good or better)	64	67
Activity limitation due to health	63	64
IADL assistance	29	29
ADL assistance	13	9
Marital status (% married)	19	9
Work status (% paid employment)	8	7
Living environment		
Nursing facility	19	20
Congregate housing	81	80
Experience with computers		
None	69	62
Little	23	33
A lot	8	4
PC ownership	8	4

to each participant. The trainer was a young college graduate, well versed in the use of the Internet, who interacted well with older adults. After the initial training sessions the computer trainer was available at each site for about two hours per week to answer questions and help those who experienced difficulty. The trainer helped participants find places (websites) of interest on the WWW and, some participants agreed to be e-mail pals with middle school students in Kansas. The trainer also was available at other times by phone or e-mail. To avoid contamination, members of the intervention group were asked not to share what they were learning with members of the control group. Also, control group members were not provided access to the computer equipment.

Outcome measures

Interviews were conducted by two trained interviewers, at baseline and follow-up, approximately 20 weeks after training started. Demographic information, health status, functional status, and social contacts (in person, by phone, by letter, or by e-mail) were collected in addition to the outcome measures. The UCLA Loneliness scale (Russell *et al.*, 1980; Russell & Daniel, 1996) recently revised and validated with a sample of older adults and used successfully in the feasibility study, was included in a slightly modified form. The 20 questions are answered on a four-point scale; the anchors were modified to read: 'almost never', 'sometimes', 'often', and 'almost always' for a more evenly balanced expression of frequency (Bass *et al.*, 1974). Scores range from 20–80 with higher scores indicating higher levels of loneliness. A modified form of the CES-Depression scale was used to assess depressive symptoms (Kohout *et al.*, 1993). The 10 questions utilize a three-point scale (anchors: 'hardly ever or never', 'some of the time', 'much or most of the time') with higher scores indicating more depressive symptoms (scale 0–20). A scale previously validated in an elderly sample was used to measure Perceived Control of Life Situations using eight items answered on a four-point scale (1: agree strongly through to 4: disagree strongly) with higher scores indicating greater control (range 8–32) (Eizenman *et al.*, 1997). Attitudes towards personal computers, the World Wide Web, and electronic mail were assessed with nine questions scored on a five-point Likert scale regarding efficacy, interest, and utility of computers (Jay & Willis, 1992). Scores on this measure ranged from 9–36; lower scores indicated more favorable attitudes. A single life satisfaction item was included with five possible response categories ranging from 'not satisfied' to 'very satisfied'. Subjects also were asked to report the number of confidants in their lives (none, 1–2, 3 or more). At baseline participants were asked open-ended questions with regard to specific goals, concerns, and benefits they expected as a result of study participation. At follow-up they were asked whether they had met their goals, what problems they encountered, and the benefits they perceived from the intervention. They also were asked to estimate the average number of hours per week they spent on the computer using the WWW and e-mail.

Statistical analysis

Baseline differences in general characteristics and outcome measures were assessed by either the non-parametric Wilcoxon rank sum test for continuous measures or a Chi Square test for categorical measures. An intention-to-treat model of analysis was used to compare the intervention and control groups (i.e., the full potential of a randomized control trial to eliminate the influence of baseline confounding variables is only realized when the results are examined with all study subjects analyzed according to their random assignments). Thus,

TABLE 2. Outcome measures at baseline

	Intervention $n = 48$ median (interquartile range)	Control $n = 45$ median (interquartile range)	p value
UCLA Loneliness scale Lower score = less lonely Range: 20–60, 20 items	35 (31, 49)	34 (29,40)	0.17
Modified CES Depression scale Lower score = less depressed Range: 0–20, 10 items	4 (2,7)	4 (2,6)	0.82
Perceived Control scale Lower score = less control Range: 8–32, 8 items	15 (12,17)	15 (13,18)	0.60
Attitudes Toward Computers scale Lower score = more favorable attitude Range: 9–36, 9 items	12 (10,14)	13 (10,15)	0.23
Life satisfaction			0.21
Very satisfying	34	47	
Fairly satisfying	23	22	
Moderately satisfying	23	16	
Somewhat satisfying	13	13	
Not satisfying	7	2	
Number of confidants			0.17
Zero	2	0	
1–2	44	33	
3 or more	54	67	

subjects who did not complete the computer training but were willing to complete the follow-up interview were included. Change scores were calculated for the UCLA Loneliness, modified CES-D, Perceived Control, and Attitudes Toward Computers scales by subtracting the baseline score from the follow-up score. Again, differences in change scores between the two groups were assessed using the Wilcoxon rank sum test. For the life satisfaction and confidant questions change was categorized as better, worse or unchanged. Differences in change categories between the two groups were assessed using the Cochran-Mantel-Haenszel Chi Square test.

Chi Square tests were used to further evaluate potential differences in characteristics of the subgroup in the intervention group who actually used the technology on a regular basis compared to the subgroup that did not. The Wilcoxon test was used to identify differences in outcome measures. E-mail users were defined as having a non-zero answer to one or more of three questions stated 'How many times per week do you communicate with (your children, other relatives, or friends) on e-mail?' WWW users were defined as having a non-zero answer to the question 'How many hours a week do you spend using the World Wide Web or Netscape?' Internet users were defined as those participants using either e-mail or WWW.

Results

Psychosocial outcome measures

At baseline there were no significant differences between the intervention and control groups on the outcome measures (see Table 2). The scores on the modified CES-D scale were quite low indicating few symptoms of depression and thus not allowing much room for improvement. As might be expected from a group of volunteers, the attitudes toward computers were very positive. Also, life satisfaction was high and almost all participants had at least one confidant.

There were no statistically significant differences in the change scores on the outcome measures comparing the intervention and control groups (see Table 3). Overall, both groups became less lonely according to the UCLA Loneliness scale with a slightly greater tendency towards less loneliness in the intervention group. There was very little change for both groups on the other measures.

A description of Internet users

Among members of the intervention group, 29 (60%) reported using the WWW at least once a week. Of these 29, 14 reported using e-mail on a weekly basis to communicate with family or friends. Despite the lack of statistically significant improvement in the psychosocial outcome measures, additional analyses were done to better characterize the members of the intervention group who used this technology on a regular basis.

Among World Wide Web users increased age was not a deterrent for using the WWW (users mean age = 71, $n = 29$; non-users mean age = 69, $n = 19$). Those in the intervention group who lived with someone else (89%) were more likely to use the WWW than those who lived alone (54%). Lack of education was not a hindrance to learning to use

TABLE 3. Change scores for the outcome measures

	Intervention $n = 48$ median (interquartile range)	Control $n = 45$ median (interquartile range)	p value
UCLA Loneliness scale	-2 (-8,3)	-1 (-5,2)	0.52
Negative value = less lonely at exit			
Modified CES Depression scale	0 (-2,1)	0 (-1,2)	0.39
Negative value = less depressed at exit			
Perceived Control scale	0 (-2,1)	-1 (-3,1)	0.42
Negative value = less control at exit			
Attitudes Toward Computers scale	-1 (-3,1)	0 (-3,1)	
Negative value = more favorable at exit			
Life satisfaction			0.90
Worse	29	24	
Unchanged	48	56	
Better	23	20	
Number of confidants			0.66
Less	12.5	15	
Unchanged	75	78	
More	12.5	7	

the WWW; nine members of the intervention group had less than a high school diploma and six of these used the WWW regularly. A higher percentage of men (79%) than women (53%) used the WWW. More than half (51%) of those with no prior computer experience used the WWW weekly. Those with previous computer experience were especially likely to use the WWW (80%) at least once a week. Self-reported health did not appear to be related to use of the WWW; 65% of those with good to excellent health used WWW compared to 53% of those with fair to poor health. Similarly, activity limitation due to health and need for assistance with IADLs did not differentiate WWW users compared to non-users.

Electronic-mail users were a smaller and perhaps more select group. Again, age was not a deterrent (users mean = 72, $n = 14$; non-users mean = 70, $n = 34$), and participants who lived with someone else (55%) used e-mail more than those who lived alone (23%) did. Perhaps education is more of a factor for e-mail use since only one of our subjects with less than a high school diploma used e-mail. The gender trend was opposite that seen for WWW users; a higher percentage of women (35%) than men (14%) used e-mail. More of those with prior computer experience (47%) used e-mail compared to those without experience (21%). Those with self-reported health of good or excellent tended to use e-mail regularly (42%) compared to those with fair or poor health (6%). However, there was a higher percentage of e-mail users among those who needed assistance with IADLs (43%) than those who did not need assistance (24%). Similarly, there were more e-mail users among those reporting activity limitation due to health (38%) compared to those without limitation (16%).

As a final step, we contrasted the subgroup of 29 Internet users, which included the smaller group that also used e-mail with the subgroup of 19 members of the intervention group who did not regularly use the Internet on the change scores of the predetermined outcome measures (see Table 4). In this analysis there were trends in the direction expected on four of the outcome measures, but again no statistically significant differences. In general, the Internet users reported less loneliness, less depression, more positive attitudes toward computers, and more confidants than the intervention recipients who were not regular users of this technology.

Observations

Many observations made during the course of this trial indicated that study participants benefited from the intervention in meaningful ways. For example, at one congregate housing site participants formed a computer interest group and started publishing a community-wide newsletter using the computers. We also gained insights through recorded observations made of each participant by the computer trainer after training. In addition, participants in the intervention group answered open-ended questions at the end of the trial about their goals, difficulties and challenges encountered using the computer, and the benefits of computer use. Several excerpts from this database follow:

- Ms. A (78-year-old female from a nursing facility site)
  Trainer: Ms. A is very persistent and stubborn on the computer, but it has been remarkable tool for her. She is able to write to her priest, whom she adores. She also reads the Pope Page and the Vatican news.
  Ms. A: E-mail is the best. It helps me to be able to send letters instead of putting them in the mail.
- Ms. B (84-year-old female from congregate housing site)

TABLE 4. Change scores for the outcome measures of the Internet (e-mail &/or www) users *vs*. non-users in the intervention group

	Internet users* $n = 29$ median (interquartile range)	Internet non-users $n = 19$ median (interquartile range)	p value
UCLA Loneliness scale Negative value = less lonely at exit	-3 (-8,1)	1 (-6,3)	0.14
Modified CES Depression scale Negative value = less depressed at exit	0 (-3,1)	1 (-1,2)	0.10
Perceived Control scale Negative value = less control at exit	-1 (-3,0)	0 (-2,7)	0.08
Attitudes Toward Computers scale Negative value = more favorable at exit	-1 (-3,1)	0 (-1,3)	0.10
Life satisfaction			0.74
Worse	24	37	
Unchanged	55	37	
Better	21	26	
Number of confidants			0.08
Less	10	16	
Unchanged	69	84	
More	21	0	

* Internet user is defined by a non-zero answer to 1 or more of 3 questions stated 'How many hours a week do you spend using (email, the World Wide Web, or the Internet)?'

Trainer: Having problems because of vision, colors on screen, and chair too low. But still trying! I'll see what kinds of things we can come up with to help. (Later) Seems to be doing quite well, after modifying colors on the screen and adjusting chair.

Ms. B: (Problems) I had trouble remembering the procedure. The only thing that was really discouraging was my eyesight. (Benefits) It was a benefit in that it was something I wanted to do and I did it!

- Mr. C (48-year-old male, confined permanently to wheelchair due to disability, from congregate housing site)

  Trainer: Great guy, great on the computer, and a lot of fun. Emerged as a leader of the class.

  Mr. C: (Goal) To learn to use a personal computer. (Problems) Learning the basics: how to get on the World Wide Web, Internet, and Simeon (e-mail). I didn't know anything about it. (Benefits) It's allowed me to have more reading information: to not rely on the news, but to go out and find things that I'm interested in.
- Ms. D (51-year-old female living with parent because of chronic disability, from congregate housing site)

  Trainer: Did extremely well. Very competent on the computer, just lacks confidence, maybe not getting a lot of confidence and self-esteem from (other sources).

  Ms. D: (Goals) To learn how to operate the computer, surf the Internet and use the e-mail. (Problems) Problems using the mouse. (Benefits) Helped me to learn how to communicate with my family, keep in touch with information on the Internet.
- Ms. E (80-year-old female from congregate housing site)

  Trainer: Ms. E was my first 'born computer user'. She was concerned initially that she would learn it all, but then realized that the web would provide constant education.

  Ms. E: (Goal) To learn all I could. (Benefits) It's become my whole life. I eat, sleep…I look for people who have them [computers] or know about them.
- Ms. F (71-year-old female from congregate housing site)

  Trainer: Ms. F did very well on the computer. She enjoys sending e-mail to family members and using the web to read her 'bitchuaries' from the Charleston Daily Mail.

  Ms. F: (Goal) Wanted to learn all about it. (Benefits) Gives me something to do and I've always wanted to learn how to do it.

Discussion

In a group of frail older adult volunteers with minimal prior computer experience, we were able to teach Internet and computer skills successfully. We made computer training and Internet use available to older adults in subsidized housing and nursing facilities that might not otherwise have had access. Indeed, very few had previous computer experience and almost none owned a computer. Yet, to a great extent we found older adults eager to learn to use the Internet. A high percentage of the intervention group (60% of the total or 74% of those who completed training) were using the Internet on a weekly basis at the end of the five months.

This study expands our previously published pilot study (White *et al.*, 1999) in three important ways. First, this trial recruited a much larger and more diverse sample of 100 frail elderly. The pilot

study involved 33 residents of a continuing care retirement community all of whom were highly educated and with adequate financial resources. The present study cast a much broader net, soliciting volunteers from subsidized housing units, a veteran's administration nursing facility, and a community nursing facility. This recruitment resulted in a more educationally, socially, and racially diverse sample. Second, this was a randomized design, which advertised and recruited interested and eager elderly into one of two groups: one that received Internet training and access and one that did not receive training until after completion of the study. Our pilot study was not randomized, but included a comparison group derived from a small convenience sample of elderly, many of whom were either unable to attend or not interested in attending the computer training sessions. Third, we were motivated and able to modify our research protocol and computer training procedure based on lessons learned from the pilot experience. This served to strengthen the overall methodological rigor of the randomized controlled trial. Although the trial results were not as positive as anticipated, the strong RCT study design and the multiple strong trends, all in expected directions position the present study as a model for future research on Internet use in special or vulnerable populations.

These observations are encouraging for several reasons. First, the Internet can only become an effective tool for health promotion, health care delivery and other social services if the older adults who are likely to benefit from such programs are willing and motivated to access it (Redford & Whitten, 1997). Second, these results help to dispel any lingering assumptions that older adults are not interested or unwilling to learn to use this technology. Even though most of our participants had a high school diploma, even those without a diploma were among those who used the Internet regularly. Although seniors with more education are more likely to own a computer (Adler, 1996), it may be that those with more education simply have greater financial capabilities or other means of access to computers. Presently, senior centers, libraries, and other public institutions are beginning to bring this technology to a broader group of seniors.

These participants found it easier to learn to use the World Wide Web than e-mail and were more likely at five months to be using the WWW rather than e-mail. Using the WWW may have been easier because it required fewer steps and did not require typing. Those with previous computer experience were more likely to use e-mail.

Socio-demographic and health characteristics may help predict who is most likely to use the Internet capability. We detected a gender difference between the use of the World Wide Web and e-mail, in that men in this sample were more inclined to use the WWW and women were more likely to use the communication-based e-mail. Those who lived with someone else were more likely than others to use the Internet; perhaps because they received encouragement from their companion. Interestingly, those who perceived their health to be good were much more likely to use e-mail, yet many of these participants did report functional impairments.

Unfortunately, health or time constraints kept a substantial number of participants (24% of the intervention group) from completing their training even in this group of motivated volunteers. Although the perception may be that older adults have a lot of time on their hands, in reality this may not be the case. In fact, many older adults are taking care of other family members and friends. Additionally, seeking and obtaining health care can take a substantial amount of time. Our participants were frail, over 60% reported activity limitation due to health. Such individuals are at risk for acute illness, which can hinder the acquisition of these new skills.

Despite successful implementation of the intervention, there were no statistically significant differences between intervention and control groups on the psychosocial scales. We were particularly interested in the UCLA Loneliness scale, which we had used in our pilot study. In the present study, both groups showed a decrease in loneliness, and the decrease was more pronounced in the intervention group. However, the change in loneliness between intervention and control participants was not statistically different. Looking only at the intervention group and comparing users to non-users there were trends toward decreased loneliness and depression.

Contamination of the control group by members of the intervention group seems unlikely, since the intervention group members were asked not to share what they were learning with control group members and control group members did not have access to the computers. The fact that we did not observe statistically significant differences may be due to ceiling effects on the measures. The scores on the modified CES-D were low at baseline indicating low levels of depression and little room for improvement. Similarly, the attitudes toward computers were quite positive at the start of the trial and thus could not improve appreciably. Participants may still have been learning the technology. Therefore, a longer follow-up period may have been necessary to capture the full effect of this intervention. Although the psychosocial effects of communication via the Internet were of primary interest, we recognize that effects experienced in group training and through communal computer equipment constitute potential confounding influences. Other potential problems include inadequate targeting of the intervention to those

most likely to benefit and perhaps a need for a more intense intervention.

There was no evidence of adverse effects from Internet use, although negative psychosocial outcomes have been reported in younger adults introduced to the Internet. A study of 169 subjects including 28% adolescents found that greater use of the Internet was associated with declines in participants' communication with family members in the household, declines in the size of their social circles, and increases in their depression and loneliness (Kraut *et al.*, 1998). Whereas younger people may use the Internet to displace more engaging social activity for less engaging activity and strong social ties for weak and less meaningful social interaction, older adults seem more likely to use the Internet to develop new social activity to replace activities that have become more difficult for them to perform and to strengthen existing social ties with family and friends through the Internet. Although we did not automatically track Internet usage, we found many older adults who expressed concern about becoming 'addicted' to this technology and in general they did not spend large amounts of time on-line.

Despite the statistical equivalence of the study arms, the findings should be of interest to investigators curious about the psychosocial effects of this technology on older adults and serve to influence the design of future research studies. *A priori* we chose an array of standardized outcome measures covering a variety of psychosocial domains that may have been affected by this intervention. However, older adults in this study appeared to gain from exposure to this technology in several ways not captured in our measures including self-efficacy, mastery, and empowerment. Measures of these concepts should be considered for inclusion in future studies. Considering the expense of providing this intervention at multiple sites, we believed that a randomized controlled design was important in order to compare this new technology to other usual activities in which older adults participate. Targeting the intervention to a specific group of older adults who are more likely to benefit may be important. Strengthening the intervention may be feasible by using computer interfaces that are simpler to learn, adding more individualized training, and providing individualized resources rather than relying on shared resources. Subsequent studies should include an automatic computer measure of Internet time to more accurately track individual participants' use.

In summary, the Internet is an exciting new technology with much potential for enriching the lives of many older adults. As a source of information, social activity, and interpersonal communication, the Internet may expand the constrained boundaries of congregate housing, retirement communities, and even skilled care nursing facilities. Depending on the older user, this expansion may include more frequent contacts with family and friends, new opportunities to pursue former interests, as well as avenues to meet new friends and to 'travel' to places no longer accessible due to health limitations.

Computers are now more affordable that ever and the potential uses of the Internet are becoming limitless. For instance, there are on-line libraries that allow users to read books for free; holiday shopping and banking can be done on-line through secure websites. Further research in this area is needed to determine more precisely, which older adults, residing in which environmental contexts are more likely than others to benefit from this rapidly expanding information and communication link. Such knowledge will move research to the next level, of tailoring Internet instruction to older learners, and providing access that, despite disability, is user friendly and equipped with services attractive to older adults.

Acknowledgements

The authors thank Meredith Drosback and Andrew Barnes for their assistance with data collection for this study.

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