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PREDICTORS OF COMPUTER USE IN COMMUNITY-DWELLING ETHNICALLY DIVERSE OLDER ADULTS

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Abstract

Objective—In this study we analyzed self-reported computer use, demographic variables, psychosocial variables, and health and well-being variables collected from 460 ethnically diverse, community-dwelling elders in order to investigate the relationship computer use has with demographics, well-being and other key psychosocial variables in older adults.

Background—Although younger elders with more education, those who employ active coping strategies, or those who are low in anxiety levels are thought to use computers at higher rates than others, previous research has produced mixed or inconclusive results regarding ethnic, gender, and psychological factors, or has concentrated on computer-specific psychological factors only (e.g., computer anxiety). Few such studies have employed large sample sizes or have focused on ethnically diverse populations of community-dwelling elders.

Method—With a large number of overlapping predictors, zero-order analysis alone is poorly equipped to identify variables that are independently associated with computer use. Accordingly, both zero-order and stepwise logistic regression analyses were conducted to determine the correlates of two types of computer use: email and general computer use.

Results—Results indicate that younger age, greater level of education, non-Hispanic ethnicity, behaviorally active coping style, general physical health, and role-related emotional health each independently predicted computer usage.

Conclusion—Study findings highlight differences in computer usage, especially in regard to Hispanic ethnicity and specific health and well-being factors.

Application—Potential applications of this research include future intervention studies, individualized computer-based activity programming, or customizable software and user interface design for older adults responsive to a variety of personal characteristics and capabilities.

Introduction

Computer use is a common means for many people to purposefully occupy their time, act on their environment, obtain new information, and communicate (Papacharissi & Rubin, 2000; Cline & Haynes, 2001; Durkin & Barber, 2002). These benefits may be especially important for older adults, who are at risk for activity disengagement and health-related decline (Albert & Knoefel, 1994; Cassel, 2002; Phelan, Anderson, LaCroix, & Larson, 2004; McIntyre & Bryant, 2005; Wilson, 2005). Accordingly, at the level of self-reported motivation, older adults have indicated that they use computers for combating loneliness; increasing their

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sense of connectedness or social support; developing new skills, such as word processing or information gathering; and providing entertainment and communication (Carpenter & Buday, 2007; Clark, D. J., 2002; Gatto & Tak, 2008; Selwyn, 2004; Sayago & Blat, 2010; Zemke, 1986). More investigation into the typical older adult computer user should be conducted to inform future research and applications in regard to this population.

Hypothesizing that computer use and computer learning have a positive effect on older adults' health and well-being outcomes, several intervention studies have been undertaken to assess whether computer training or use enhances psychosocial outcomes in community-dwelling older adults. Although their aims differ from the present question in that they intend to measure causal effects of computer training, these investigations may be of some use in understanding the relationship of individual health-related differences to computer use. Slegers, van Boxtel, and Jolles (2006) examined the effects of a computer training intervention for computer-interested older adults in comparison to a non-intervention control group (i.e., the intervention group was composed of self-selected participants who indicated they were interested in computer-based instruction, whereas the control group consisted of self-selected participants who were not interested in computer-based instruction). Following the intervention, the older adults who received computer-based instruction had greater positive change in social functioning, life satisfaction, mood, and perceived autonomy. However, because of the nature of group composition, it is questionable if these results represent anything beyond participants' self-selection into groups based on interest in computer instruction. Furthermore, it should be noted that this study was conducted in the Netherlands and cannot be assumed to generalize to populations in the United States and elsewhere. To determine which particular aspects of computer training for older adults are most effective in producing positive outcomes, Billipp (2001) provided older adult recipients of home health care with computers and randomly assigned them to one of four groups for three months: single session computer training by a home health care nurse, weekly computer training by a nurse, initial computer training by a nurse with weekly follow up by a significant other, and no training. Although no training or single session training had no effect on self-esteem or depression, weekly training by a nurse trainer led to reduced depression, and training initiated by a nurse with follow up by a significant other produced improved self-esteem and reduced depression (Billipp, 2001). This result should be interpreted cautiously however, due to the confounding of continued social interaction with training in the two conditions associated with positive change. Because of problems with selection and exposure biases, the results of the above intervention studies do not establish plausible evidence that computer activity-based interventions or training have positive outcomes. Ostensibly, they are also of limited use in determining the correlating factors of computer use among diverse, community-dwelling older adult populations. However, they indicate a trend of research in this area that may benefit from a more substantial evidence base on the characteristics of older adult computer users.

A number of additional computer intervention experiments have been conducted in nursing homes (McConatha, McConatha, & Dermigny, 1994; McConatha, McConatha, Deaner, & Dermigny, 1995; White et al., 1999; White et al., 2002; Shapira, Barak, & Gal, 2007; Sherer, 1996). Mostly outdated, these have produced mixed results regarding the impact of exposure to computers on residents' psychosocial functioning and well-being. In addition, these studies may not generalize to community-based contexts, as institutionalized elders live in very different environments, are probably older, and likely have reduced levels of cognitive and psychological functioning than their community-dwelling peers. In a more general sense, problems such as contamination effects, unsuitable generalization of results, and inappropriate inferences of causality plague the wider experimental literature on computer-based interventions for older adults. These limitations hinder the ability to make solid inferences about this population and improve understanding of their health, well-being

and participation with computers in order to inform future applications (Dickinson & Gregor, 2006).

Research studies on the correlates of computer use and characteristics of non-institutionalized older adults have focused on demographic, psychosocial, and health-related variables. Although it is generally thought that younger, more educated elders and those who employ active coping strategies are more likely to use computers than others, there are few recent studies to this effect with large sample sizes of diverse, community-dwelling older adults. Nonetheless, with respect to demographic factors, existing research generally shows that younger and more educated older adults report greater interest and facility, along with less anxiety, in using computers (Carpenter & Buday, 2007; Czaja et al., 2006; Ellis & Allaire, 1999; Gatto & Tak, 2008; Morell, Mayhorn, & Bennett, 2000), although the age gap may be narrowing (Jones & Fox, 2009). However, contrary to the inverse correlational trend in other studies between age and computer use, Jung et al. (2010) found no significant correlation between age and enrollment in a public computer access program (n = 91). Older adults who are White or more affluent report more computer access, more likelihood of having a computer in their homes, and higher overall rates of use than other groups (Spooner & Rainie, 2000; Morrell, Mayhorn, & Bennett, 2000; Cline & Haynes, 2001; Gatto & Tak, 2008). Gender discrepancies in the direction of more computer use or knowledge among older adult males than females have also been found (Cline & Haynes, 2001). In addition, this difference has been found among low-income, non-English-speaking groups (Jung et al., 2010). However, such gender differences are not always observed (Carpenter & Buday, 2007; Karavidas, Lim, & Katsikas, 2005) and some literature reports a narrowing trend in the gender gap in computer and Internet use in all age groups, including older adults (Fallows, 2005; Cline & Haynes, 2001). In addition, any such gender differences may be moderated by ethnicity; for instance, more Black females than Black males are online, whereas this is not the case in other groups (Spooner & Rainie, 2000; Cline & Haynes, 2001). In regard to older adults' computer usage, there appears to be additional, individual-level differences that may compound group-level differences by gender and ethnicity.

Individual differences on the level of psychosocial variables such as attitudes towards computers and aging, cognitive abilities, coping styles, self-efficacy, social support, and life satisfaction have been studied as they relate to computer use among older adults (Carpenter & Buday, 2007; Czaja et al., 2006; Jung et al., 2010; Karavidas, Lim, & Katsikas, 2005; Wright, 2000). For example, Jung et al. (2010), in a study of low-income, ethnically diverse elders' enrollment in a computer and Internet training course at a senior center, found that self-efficacy, as well as low levels of computer anxiety and aging anxiety, were significant predictors of program enrollment, but perceived social support and a sense of belonging to the neighborhood or senior center were not. Investigating similar constructs, Wright (2000) surveyed 136 older adult computer users about their participation in computer-mediated communication, satisfaction with social support, and individual coping styles, and found that older adults who communicated via email more frequently had greater satisfaction with their online social support network. However, the extent of online communication in this sample was unrelated to social support, problem-focused coping, or emotion-focused coping. Nevertheless, Carpenter and Buday (2007) found that, among middle and high income White elders living in a naturally occurring retirement community (i.e., a community or building in which a large proportion of residents are older adults aging in place, usually not purposefully built this way), computer use was related to more extensive social networks and higher satisfaction with social circumstances but unrelated to several physical and mental health measures including cognitive function. Czaja et al. (2006) examined the relationship of demographics, cognitive abilities, and attitudes towards computers and computer anxiety in a large sample of older adults (n = 461). Findings indicate that younger, more educated individuals with higher cognitive abilities, low computer anxiety, and a

greater sense of computer self-efficacy are more likely to use computers, the World Wide Web, and other technology for broad purposes. In conjunction with other previous correlational studies these findings suggest that computer use among older adults may be associated with personal characteristics that reflect a positive, prosocial orientation to life, a high sense of computer self-efficacy, and lower levels of computer-related anxiety.

In regard to individual differences, measurement of psychosocial and well-being factors has been conducted in two ways: (a) factors specifically related to computer use such as computer anxiety (Czaja et al., 2006; Jung et al., 2010; Karavidas, Lim, & Katsikas, 2005), and (b) broader personality factors not specific to computers such as physical health, coping style, and satisfaction with social network (Carpenter & Buday, 2007; Jung et al., 2010; Wright, 2000). Results pertaining to general well-being factors such as social support and cognitive function are not consistent across all investigations. Discordant findings regarding social support exist between the investigations of Jung et al. and Wright. A similar contradiction is found pertaining to cognitive function between the studies of Czaja et al. and Carpenter and Buday. Concerning non-computer specific psychosocial factors, more investigation is needed to clearly understand the less intuitive individual differences predicting computer use.

The objective of the current study was to investigate, in a more comprehensive manner than has been previously achieved, the predictors of computer use among community-dwelling older adults. In addition, it was designed to address inconsistencies in the literature which have been outlined above, such as those surrounding age, social support, and other mental health factors. Relative to most earlier investigations, we included a larger, more ethnically diverse sample and a wider array of predictors, focusing on individual psychosocial and well-being factors not specific to computers. We also included a more stringent significance threshold and data analysis methods intended to minimize collinearity and identify which variables were independently associated with computer use. In doing this, two criterion measures of computer involvement were examined: emailing and general computer use.

Based on the available literature, we hypothesized that among community-dwelling older adults computer use is related to: (a) demographic variables; (b) psychosocial variables including coping style, social support, and social network; and (c) physical and psychological well-being. In regard to demographic variables, we predicted that younger, more educated elders, who are male, identify as White, and who have higher education and income would use computers at a higher frequency than those who do not fit this profile. In hypothesizing about psychosocial variables, we predicted that elders who indicated a larger, more supportive social network with greater perceived control, and active and behaviorally and mentally engaged coping strategies would demonstrate higher levels of computer use. Although no previous studies exist on the relationship between religious coping and computer use, we supposed that older adults who use religious coping may use computers more due to the likelihood that religious older adults have large social networks and support. Regarding physical and psychological well-being, we predicted that computer use positively correlates with general health, physical functioning, and role-related physical health as well as mental health, social functioning, role-related emotional health, vitality, and life satisfaction. Additionally, we conjectured that depression and bodily pain negatively correlate with computer use among the community-dwelling older adult population.

Method

Design

The research design consisted of a correlational, secondary analysis. Data used in the current study were initially collected as part of the baseline assessment for the Well Elderly II study,

a randomized controlled trial of a lifestyle-based occupational therapy intervention (Clark et al., 2011; Jackson et al., 2009). As part of the assessment plan of the Well Elderly II trial, data was collected on measures of demographic, psychosocial, and health-related variables. Using logistic regression, we examined both zero-order and higher-order associations between these variables and the two forms of computer use to test the three study hypotheses.

Participants

The Well Elderly II sample consisted of 460 older adults aged 60 years or older who were recruited from 21 different sites in the greater Los Angeles area. Recruitment sites included senior centers, senior housing complexes, and retirement communities. To be study eligible, prospective participants had to be living in the community, fluent in either English or Spanish, free from marked dementia, able to complete the assessment battery with assistance, and capable of participating in the intervention. Recruitment, assessment instruments, and test administration were language-adapted to allow for the inclusion of Spanish-speaking participants. Further details of the Well Elderly II Study methodology can be found in Clark et al. (2011) and Jackson et al. (2009).

The sample was comprised of 303 women and 157 men and the mean age of participants was 74.9 ± 7.7 years. Ethnic representation consisted of 172 White, 149 Black, 92 Hispanic (65 of whom enrolled in the Spanish language study segment), 18 Asian, and 29 Other (who self-identified as *other* or did not specify their racial/ethnic affiliation) participants. More than one-half of the participants had less than $12,000 in annual income, and only about 12% had $36,000 or greater in annual income.

Measures

Computer use was measured by two items contained on the Meaningful Activity Participation Assessment (MAPA; Eakman, 2008; Jackson et al., 2009), a self-administered survey in which older adults specify, for each of 29 activity items, their frequency of participation (1 = *not at all*, 2 = *less than once a month*, 3 = *once a month*, 4 = 2-3 *times a month*, 5= *once a week*, 6 = *several times a week*, 7 = *every day*). The two computer-oriented items pertained to frequency of computer use for *email* and *general* (i.e., non-email) computer use. In order to prevent excess responder burden, we chose to focus on computer use and one specific, well-recognized use—emailing—rather than all available types of technology that currently permeate our society.

Five demographic variables were included as possible predictors of computer use: gender, age, ethnicity, monthly income (<$1000, $1000-$1999, $2000-$2999, and >$3000 per month), and education level (<high school, high school, some college, 4 years or more college). These variables were measured through a self-report questionnaire.

Seven psychosocial variables were included as potential predictors: active coping, religious coping, behavioral disengagement, mental disengagement, social support, perceived control, and size of social network. These variables were measured, respectively, through the active coping, religious coping, behavioral disengagement, and mental disengagement subscales of a multidimensional coping inventory (COPE; Carver, Scheier, & Weintraub, 1989); the Interpersonal Support Evaluation List (ISEL; Cohen, Mermelstein, Kamarck, & Hoberman, 1985); an adapted version of the Perceived Control Scale, based on the work of Eizenman, Nesselroade, Featherman, & Rowe (1997); and the Lubben Social Network Scale (LSNS; Lubben, 1988). The COPE was designed to measure both dispositional and situation-specific coping and has demonstrated acceptable test-retest reliability when measuring dispositional coping (Carver, Scheier, & Weintraub). The ISEL measures perceived availability of social

resources (Cohen et al., 1985) and has been shown to demonstrate good internal consistency and moderate criterion validity (Cohen & Hoberman, 1983). The LSNS has demonstrated adequate internal consistency and construct validity (Lubben, 1988).

Twelve physical and psychological well-being variables were included: physical functioning, role-related physical health, bodily pain, general health, physical composite (factor loading of the previous four variables), social functioning, role-related emotional health, vitality, mental health, mental composite (factor loading of the previous four variables), depression, and life satisfaction. These variables were measured, respectively, via the eight subscales and two component summary scales of the RAND 36-Item Health Status Survey, Version 2 (SF-36; Ware & Sherbourne, 1992); the Center for Epidemiologic Studies Depression scale (CES-D; Radloff, 1977); and the Life Satisfaction Index-Z (LSI-Z; Wood, Wylie, & Sheafor, 1969). The SF-36 is a widely used 8-scale measure of 4 dimensions each of physical and mental health that exhibits good internal consistency, test-retest reliability, and construct validity (Ware & Gandek, 1998; Ware & Sherbourne, 1992). Jordan-Marsh et al. (2008) found internal consistency and validity adequate on some foreign language translations (including the Spanish translation used in the present study) of the SF-36 when administered to non-English speaking older adults. The CES-D was designed to measure depressive symptoms in the general population and has been reported to have high internal consistency and moderate test-retest reliability (Radloff, 1977) as well as good criterion validity (Beekman et al., 1997). The LSI-Z was designed to measure life satisfaction in older adults (Wood, Wylie, & Sheafor, 1969) and may indicate health-related quality of life (Clark et al., 1997).

Each of the physical and psychological well-being measures has documented validity for use with older adult populations (Jackson et al., 2009; Clark, F., 2002; and Clark et al., 2011). Previously translated versions were used for Spanish-speaking participants. The possible range, as well as the sample mean and standard deviation, for each of the seven psychosocial and twelve well-being variables are presented in Table 1. In addition, a description of the scales and examples of items from each is provided in Table 2.

Although self-report measures are widely employed in health and behavioral research, their use in this study has been carefully considered in regard to the population being studied. Conducting survey research with older adults presents unique caveats owing to age-related changes in vision, cognition, memory, testing fatigue, and question response format (Fowler, 2008; Jackson, et al., 2009; Pinquart, 2001; Schechter, Beatty, & Willis, 1999). Anticipating potential problems stemming from such differences, assessments were chosen that were brief and were formatted in large print, and a trained tester was available to read questionnaires to respondents when necessary (Jackson et al., 2009). In addition, some measures, such as the MAPA and LSI-Z, were specifically designed for the older adult population.

Data Analysis

Due to the U-shaped distribution of frequency of participation scores for both email and general computer use, each of these two items was dichotomized into categories of *non-use* (self-reported usage = 0) and *use* (self-reported usage = 1 - 6). The resulting dichotomies were treated as criteria in the primary study analyses. Dummy variables for ethnicity were created by forming three (White, Black, Hispanic) dichotomous variables. Age was converted to a three-level ordinal variable for basic descriptive reporting; however, in the main prediction analysis it was analyzed in its continuous form.

Zero-order relationships between each of the 26 predictors and the two computer use variables were assessed by conducting likelihood ratio tests of the standardized coefficients

obtained in logistic regression analysis (Tabachnick & Fidell, 2007). To examine higher-order relationships, we conducted, separately for each computer use criterion variable (i.e., email and general computer use), a forward-backward stepwise logistic regression analysis to test each study hypothesis. This statistical analysis method was chosen to allow us to predict computer use as a dichotomous outcome variable from several predictors which are a mix of continuous, discrete, and dichotomous variables (Tabachnick & Fidell, 2007). First, to test hypotheses pertaining to demographic items, we conducted a stepwise analysis that included only the demographic variables as candidate predictors. Following this analysis, the second and third groups of hypotheses (pertaining to individual psychosocial and well-being factors, respectively) were tested by forcing the significant demographic variables into the model and conducting stepwise logistic regression analyses that considered either the 7 psychosocial variables or the 12 well-being variables as candidate predictors. Separate regression equations were generated in testing hypotheses about psychosocial and well-being items in an effort to minimize collinearity. For both entry and removal, significance was assessed using a Wald chi-square test (two-tailed) of each logit coefficient at the .01 alpha level.

Despite its proneness to type I errors (Tabachnick & Fidell, 2007), we felt that stepwise regression was justified in the current context because: (a) due to the large number of overlapping predictors, zero-order analysis is poorly equipped to identify variables that are independently associated with computer use; (b) the large number of predictors would be expected to produce a high degree of collinearity if simultaneous regression was used; (c) the large sample allowed for an acceptably high ratio (approximately 20 to 1) of research participants to predictors; and (d) our use of an alpha level of .01 is associated with a reduced type I error rate relative to the more commonly selected value of .05. Logistic regression analysis was chosen to accommodate the dichotomous criterion variables and to avoid the need to make assumptions of normality or homoscedasticity (Tabachnick & Fidell, 2007).

Results

Of the 460 study participants, 108 (23%) reported computer use for email and 120 (26%) indicated general computer use. A strong association was present between the two types of computer use ($\chi^2[1] = 297.27$, $p < .0001$; phi-prime = .80).

Figure 1 presents the percentages of computer users within various demographic categories. For each demographic variable, meaningful between-category differences were present for both types of computer usage. The percentage of older adults who reported computer use was higher for males, younger participants, and higher educational groups. With respect to ethnicity, computer use was highest for White and lowest for Hispanic older adults. Income was non-monotonically linked to computer usage, which successively increased in the $0-$999, $1000-$1999, and $2000-$2999 monthly income groups, but decreased within the $3000+ monthly income group. For selected comparisons, very pronounced differences in usage were present (e.g., computer usage was approximately four times greater for Whites than Hispanics).

Tables 2 and 3 present, respectively, zero-order and higher-order test results for the 26 predictor variables. Our hypothesis pertaining to demographic characteristics received strong confirmation in both types of analysis. Consistent with the above descriptive results, at the zero-order level male gender, White ethnicity, higher levels of education, and higher relative income category were all significantly ($p < .01$) associated with both email and general computer use. Hispanic ethnicity ($p < .001$) negatively correlated with the two criterion variables, and age was positively related ($p < .01$) to email-specific computer use

only. In the stepwise logistic regression analysis of demographic variables, younger age ($p < .01$) and higher levels of education ($p < .001$) were predictive of computer use for email and general computer use. Additionally, non-Hispanic ethnicity ($p < .01$) was independently predictive of general computer use.

With respect to psychosocial variables, at the zero-order level, higher levels of active coping predicted both email and general computer use (both p-values < .01). Perceived control significantly correlated with email use, whereas mental disengagement was negatively associated with general computer use (both p-values < .01). In addition, higher levels of religious coping and behavioral disengagement predicted less computer use of both types. In the stepwise analysis, after forcing into the model significant demographic variables, behavioral disengagement independently predicted both email and general computer use (both p-values < .01). Although they did not meet the stringent significance threshold, active coping ($p = .0258$) and religious coping ($p = .0183$) approached significance as independent predictors of general computer use. Likewise, religious coping approached significance as a psychosocial predictor of reduced email use ($p = .0102$).

At the zero-order level, a wide array of physical and psychological well-being indices was associated with computer use. General health, physical functioning, role-related physical health, mental health, role-related emotional health, and both physical and mental composites were all significantly linked to email use ($p < .001$ for all predictors except mental health and mental composite [$p < 01$]). For general computer use, both composites and all eight SF-36 subscale constructs except vitality were significantly predictive (all p's < .001 except bodily pain and social functioning [$p < .01$]). Depression was significantly negatively related to general computer use ($p < .01$). After adjusting for significant demographic variables, general health and role-related emotional health were the only well-being variables significantly related to emailing ($p < .01$) and general computer use ($p < .01$), respectively.

Discussion

We hypothesized that among community-dwelling older adults computer use is related to demographic variables, general psychosocial variables, and physical and psychological well-being. Specifically, we predicted that the likely profile of an older adult computer user is one who is younger, more educated, male, White, with higher education and relative income, as well as more physically and mentally healthy with active, engaged, and religious coping strategies and a greater, more supportive social network. In general, our results support these hypotheses with some exceptions. For example, tests for 19 of the 26 demographic, psychosocial, and well-being variables were significant at the zero-order level.

In contrast to the general pattern noted at the zero-order level, only one psychosocial and one well-being variable entered each higher-order stepwise model. This result implies that many such variables that are predictive at the zero-order level are not independently associated with computer use but rather contribute to a profile of clustered personality considerations that characterize older adult computer users. In this regard, the computer users in this sample tended to be: (a) socially advantaged (White and younger aged, with higher relative income and educational levels); (b) behaviorally active; and (c) physically and emotionally healthy. As a whole, these characteristics are likely to have, in a mutually reinforcing way, promoted the ability and motivation to access and successfully use computers.

A particularly noteworthy finding of these results pertains to ethnicity—particularly Hispanic ethnicity—in predicting computer use. In the current study, only 8% and 7%,

respectively, of Hispanics reported email and general computer use. These considerably low values are in accord with the direction of results reported by the Pew Internet & American Life Project (Spooner & Rainie, 2001), which indicated fewer Hispanic Internet users 55 years or older compared to Whites and Blacks. In a recent Pew report on Hispanic Internet usage trends from 2006 to 2008 (Livingston, Parker, & Fox, 2009), survey data showed that Hispanics ages 65 and older are increasingly using the Internet, but foreign born and Spanish speaking individuals still significantly lag behind. Additionally, a recent report released by the Public Policy Institute of California (Baldassare, Bonner, Paluch, & Petek, 2008) notes that Hispanics, especially those with lower incomes or who speak Spanish, are substantially less likely than other ethnic groups to use computers or access the Internet. It should be noted that 65 of the 92 Hispanic participants in the Well Elderly II study completed their assessments in Spanish (Jackson et al., 2009) and a large number were undocumented immigrants, all living in a vast urban setting. In the present study, the Hispanic recent immigrants tended to possess fewer resources and experience less stable living conditions relative to other study participants, which could account for substantially reduced computer use in this sample.

Differences in both types of computer usage among other demographically defined groups were mostly consistent with prior literature. However, income represents a curious exception. Computer use increased with rising income among the three lowest income categories ($0-999, $1000-1999, and $2000-$2999), but the proportion of computer users in the $3000+ monthly income category was noticeably reduced relative to the trend among other economic categories. We can think of two reasons this fairly unexpected result may have occurred. First, older adults with lower income levels relative to their peers may represent greater participation at community and senior centers (Krout, Cutler, & Coward, 1990), where computer training programs, free Internet access, and user-friendly support systems are sometimes available. In this regard, there were a large percentage of older adults in this study who were recruited at senior centers (Clark et al., 2011; Jackson et al., 2009). Second, the highest income category studied represented a fewer number of participants than the lowest income category. Although this study was not specifically intended to focus on low-income older adults, the majority of participants in the study sample fell within the lowest income category (less than $1000 in monthly income). It is possible that the cutoff points for income categories in this study may not have been granular enough to reflect a more nuanced distribution, resulting in a camouflaging of greater variability within categories than is captured by the data in its present form. Future studies should address this.

Previous research in this area has reported mixed findings in regard to gender with some investigations revealing more computer use among men than women (Cline & Haynes, 2001; Jung et al., 2010) and some studies which show this is not the case or that the trend is diminishing (Fallows, 2005; Karavidas, Lim, & Katsikas, 2005; Spooner & Rainie, 2000). While male gender was a significant predictor of both types of computer use in our study at the zero-order level, it approached, but failed to reach significance for either criterion variable as an independent predictor. These results may be indicative of decreasing gender discrepancies as indicated by some previous research (Fallows, 2005), or they may reflect the conclusions of Spooner and Rainie (2000) that gender differences are moderated by race or ethnicity.

As hypothesized, behavioral disengagement was negatively associated with general computer use after controlling for other psychosocial variables. In other words, older adults who tend to be actively involved, rather than withdrawn, were more likely to use computers. Correspondingly, active coping approached significance as an independent predictor of greater general computer use. These results may be indicative of a dispositional proactive approach to challenges, such as learning to use technology later in life. In developing and

validating their measure of coping types, Carver, Scheier, and Weintraub (1989) found that behavioral disengagement was associated with higher trait anxiety, external locus of control, lower self-esteem, and lower levels of hardiness, all of which could inhibit the motivation to develop new skills.

As noted in the results section, religious coping approached significance as a psychosocial predictor of reduced email and general computer use. Despite not reaching the established stringent significance level, this is a notable finding because it is a departure from the predicted direction of association. It was hypothesized that religious coping would predict more, not less, computer use. At least two explanations could account for this trend. First, religiously affiliated older adults may devote more time to spiritually-related activities and have less time to spend on computing or other activities. Second, religious coping may be indicative of an emphasis on traditional values, which could signify a relative disinterest with technological novelty. However, the role of religious coping in predicting computer use may be complicated by the fact that religion may have widely varying functions in peoples' lives. For example, religious coping could potentially incorporate emotion-focused coping, positive reinterpretation and growth (a form of acceptance), or active coping (Carver, Scheier, & Weintraub, 1989). The inclusion of such diverse possibilities may have diminished the capacity of religious coping to significantly predict computer use. A more conclusive understanding of this phenomenon should be investigated in future studies of computer use among older adults.

As indicated in the introduction, older adults have expressed the belief that computer use can directly lead to positive outcomes such as enhanced skill development and increased social support (Clark, D. J., 2002; Gatto & Tak, 2008; Sayago & Blat, 2010; Selwyn, 2004). Because the current investigation was correlational, we did not intend to infer such causal relationships. However, in order to narrow the scope of future efforts in the area, we can speculate on possible causal interpretations. First, in line with previous research on computer-based interventions (e.g., Slegers, van Boxtel, & Jolles, 2006; Cody et al., 1999; Karavidas, Lim, & Katsikas, 2005; Billipp, 2001), it is possible that email and general computer use can directly increase positive psychosocial functioning and well-being. For example, the skillful use of emailing may facilitate interpersonal connections or performance success pertaining to key social roles (e.g., volunteer worker or grandmother) and thereby serve as a buffer against role-linked emotional problems. Alternatively, the causal sequence might also be opposite, such that, for example, role-related emotional health or general physical health could facilitate participation in email and general computer use. An additional possibility is that an unknown third variable, such as hardiness (Magnani, 1990), could simultaneously cause both well-being and computer use. Having established correlational linkages between individual psychosocial and well-being items and computer use, future work may endeavor to disentangle the directionality of these findings. Another option for forthcoming investigations pertains to the increasingly popular use of other types of technology, such as cell phones, for accessing the Internet.

In connection with the possible interpretations indicated by our data, the results highlight important implications for designing future studies. We suggest additional research be carried out in this area including intervention studies and investigations pertaining to the effects of using computer-based activity programming in this population. This proposal is based on findings that customized individual and small group treatments, such as activity-based and lifestyle interventions, have been effective in improving well-being outcomes (e.g., Diabetes Prevention Program Research Group, 2002; Jackson, Carlson, Mandel, & Zemke, 1999) and hold potential to maximize health benefits for older adults through matching computer-based interventions or instruction to personal needs. In addition, because these results indicate that individual differences within the broader demographic of older

adults are related to computer use and email use, it may be beneficial to older adults for practitioners and program designers to recognize the need for individualized programs or interventions, tailored engineering of software and user interfaces for a variety of personality dispositions, and customizable products. Such designs should take into consideration the range of individual differences and multiple personal details that may be differentially related to older adults using computers generally, email applications, and other aspects of technology. For example, we can envision a software-based educational program that takes into account individual details such as coping style or personal disposition and match feedback, challenge, speed, and interface details to these characteristics.

There is a growing recognition for the need to understand individual differences in human factors research for the purpose of well-designed applications suited to individual capabilities and needs (Karwowski et al., 2003). This leads us to conjecture that careful consideration of individual differences and design of customized instructional and support programs are more likely to positively impact the well-being of older adults, perhaps through the use of computerized educational modules and applications that promote healthy daily activity involvement. For example, toward this end the Internet could be used by older adults to obtain self-care oriented health information (El-Attar, Gray, Nair, Ownby, & Czaja, 2005), access information pertaining to local public transportation or leisure activities (Morell, Mayhorn, & Bennett, 2000), maintain health-promoting relationships with friend or family through email communications, or stay mentally active (Ball, Corr, Knight, & Lowis, 2007).

In regard to our findings surrounding Hispanic computer users, we can speculate that computer training programs which specifically target this underrepresented population and tailor interventions to meet their needs may be most successful. In particular, intervention programs, software, and user interfaces should reflect cultural relevance and be language-adapted to local Hispanic populations as suitable. Again, more research is required to determine the accuracy and particulars of these suggested applications. Knowing the correlates of computer use with individual psychosocial and well-being factors may provide insight into which older adults are likely to use computers under conditions similar to those studied here. However, additional research is needed to indicate who among the community-dwelling older adult population might use computers if given the appropriate opportunities or supports. We intend that these suggestions serve to focus future research efforts in this area.

One limitation of this study pertains to the reliance on non-random sampling. Specifically, convenience sampling was conducted at sites such as senior community centers and senior housing complexes. It is possible that individuals recruited from these locations differ from other older adults in unknown ways, including computer access directly stemming from facility-based resources. A second limitation concerns the adequacy of self-report measures, particularly in the older adult population. As mentioned in the methods section, measures were chosen on the basis of demonstrated validity in this population, and efforts were made to decrease age-related challenges in answering survey questions. However, some drawbacks with the self-report format may remain. Another limitation is that the results may not generalize to older adults in other geographic locales, such as rural areas, as this study was conducted in a large urban setting. Finally, although this study included a relatively diverse group of older adults, further investigations should include groups not fully represented here such as Asians and Native Americans and older adults with a wider range of annual income levels.

Conclusion

The purpose of this study was to document the predictors of computer use in community-dwelling older adults. This investigation included a larger, more ethnically diverse sample than has been examined in most previous studies, incorporated a broad set of candidate predictors and expanded on previous work to specifically include psychological and health variables not limited to computer-specific aspects. Our findings suggest that email and computer use among older adults living in the community may be predicted by younger age, higher levels of education, behaviorally active coping style, general health, and role-related emotional health, informing future research and, as we have suggested above, computer-based activity interventions. Hispanic ethnicity was negatively related to email and computer use, suggesting the need for outreach to this community.

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Key Points

- A growing need to understand individual differences to inform design and a lack of conclusive prior research in the area informed our study.
- We analyzed self-reported computer use, health and well-being factors and psychosocial factors in community-dwelling older adults.
- A large sample size (N = 460) of ethnically diverse participants was included.
- Younger age, greater level of education, non-Hispanic ethnicity, behaviorally active coping style, general physical health, and role-related emotional health each independently predicted computer usage.
- Results suggest the need for outreach to the Hispanic older adult community.

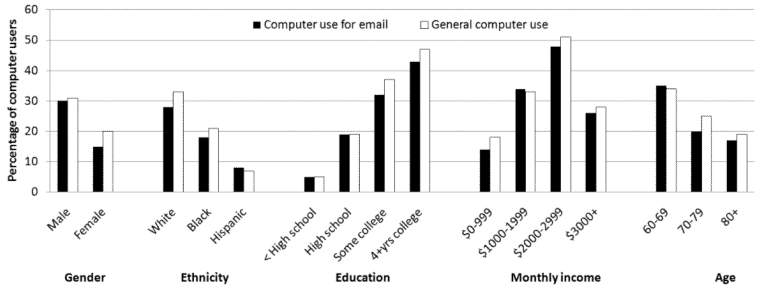

Figure 1.
Percentage of participants from each demographic category that report using computers for email and for general purposes.

Table 1

Possible Range and Sample Mean ± SD (N = 460) for Study Assessments

	Possible Range	M	SD
Psychological			
Lubben Social Network Scale	0 - 50	26.32	9.29
ISEL Perceived Social Support	0 - 18	10.77	3.05
Perceived control	8 - 32	23.63	3.38
Multidimensional Coping Inventory			
Active coping	4 - 16	2.93	0.78
Religious coping	4 - 16	3.00	1.05
Behavioral disengagement	4 - 16	2.07	0.77
Mental disengagement	4 - 16	2.28	0.66
Well-being			
RAND SF-36 Health Survey			
Physical composite	0 - 100	41.26	10.32
General health	0 - 100	44.77	10.29
Physical functioning	0 - 100	38.51	12.14
Role physical	0 - 100	41.03	10.87
Bodily pain	0 - 100	43.85	11.52
Mental composite	0 - 100	47.47	11.29
Mental health	0 - 100	47.47	11.54
Social functioning	0 - 100	45.02	11.19
Role emotional	0 - 100	39.89	13.26
Vitality	0 - 100	50.00	9.78
Life Satisfaction Index-Z	0 - 26	16.85	5.64
CES-Depression	0 - 60	13.73	10.91

Table 2

Description and Sample Items for Study Assessments

	Description	Sample Items
Psychological		
Lubben Social Network Scale	Social network size in older adults	"How many relatives do you see or hear from at least once a month?"
ISEL Perceived Social Support	Perceived availability of social resources	"When I feel lonely, there are several people I can talk to."
Perceived control	Beliefs of control over life circumstances	"I can do just about anything I really set my mind to."
Multidimensional Coping Inventory		
Active coping	Taking active steps to deal with stressors	"I do what has to be done, one step at a time."
Religious coping	Turning to religion in times of stress	"I seek God's help."
Behavioral disengagement	Reducing one's effort to deal with stressors	"I admit to myself that I can't deal with it, and quit trying."
Mental disengagement	Avoiding thinking about stressors	"I daydream about things other than the problem."
Well-being		
RAND SF-36 Health Survey		
Physical composite	Aggregate scale of the four immediately below	
General health	General health perceptions	"I seem to get sick a little easier than other people."
Physical functioning	Participation in physical activities	"Does your health limit you in lifting or carrying groceries?"
Role physical	Participation in usual roles enabled by physical health	"Are you limited in the kind of work or other activities you do as a result of your physical health?"
Bodily pain	Felt pain	"How much bodily pain have you had in the last 4 weeks?"
Mental composite	Aggregate scale of the four immediately below	
Mental health	General mental health perceptions	"Have you been a very nervous person in the last 4 weeks?"
Social functioning	Participation in social activities	"Does your physical health or emotional problems interfere with your normal social activities with family, friends, neighbors, or groups?"
Role emotional	Participation in usual roles enabled by emotional health	"Have you had to cut down on the amount of time you spent on work or other activities?"
Vitality	Feelings of energy	"How often in the past 4 weeks did you feel full of pep?"
Life Satisfaction Index-Z	Perceived satisfaction with life in older age	"I am just as happy as when I was younger."
CES-Depression	Feelings of in the past 7 days	"I thought my life had been a failure."

Table 3

Zero-order Standardized Regression Coefficients and Significance Test Results

	Regression Weights	
Predictors	**Email**	**General**
Demographic		
Gender (male)	0.730 *	0.633 *
Ethnicity		
White	0.820 **	0.779 **
Black	−0.334	−0.202
Hispanic	−1.314 **	−1.775 **
Education	0.642 **	0.721 **
Income (monthly)	0.310 **	0.275 *
Age	−0.039 *	−0.031
Pyschosocial		
Lubben Social Network Scale	−0.012	−0.008
ISEL Perceived Social Support	0.017	0.024
Perceived control	0.101 *	0.080
Multidimensional Coping Inventory		
Active coping	0.390 *	0.427 *
Religious coping	−0.359 **	−0.429 **
Behavioral disengagement	−0.597 **	−0.584 **
Mental disengagement	−0.313	−0.445 *
Well-being		
RAND SF-36 Health Survey		
Physical composite	0.038 **	0.040 **
General health	0.048 **	0.040 **
Physical functioning	0.041 **	0.043 **
Role physical	0.040 **	0.044 **
Bodily pain	0.017	0.025 *
Mental composite	0.028 *	0.035 **
Mental health	0.031 *	0.035 **
Social functioning	0.014	0.030 *
Role emotional	0.037 **	0.043 **
Vitality	0.026	0.026
Life Satisfaction Index-Z	0.039	0.038
CES-Depression	−0.028	−0.035 *

* $p < .01$

** $p < .001$

Table 4

Stepwise Logistic Regression Results

	Email				General			
Predictors	**Coefficient (β)**	**SE[+]**	**Wald χ^2**	***p*-value**	**Coefficient (β)**	**SE[+]**	**Wald χ^2**	***p*-value**
Demographic								
Gender (male)	0.603	0.240	6.328	0.0119	0.489	0.239	4.206	0.0403
Ethnicity								
White	0.578	0.249	5.390	0.0203	0.225	0.250	0.806	0.3693
Black	−0.239	0.260	0.846	0.3577	−0.373	0.262	2.036	0.1536
Hispanic	−0.927	0.392	5.582	0.0182	−1.350	0.434	9.690	0.0019 *
Education	0.671	0.103	42.706	0.0001 **	0.691	0.109	40.097	0.0001 **
Income (monthly)	0.194	0.101	3.697	0.0545	0.119	0.103	1.334	0.2482
Age	−0.050	0.016	9.758	0.0018 *	−0.053	0.016	11.157	0.0008 **
Person-relevant psychosocial[a,b]								
Lubben Social Network Scale	−0.005	0.012	0.183	0.6686	−0.002	0.013	0.022	0.8826
ISEL Perceived Social Support	0.019	0.037	0.269	0.6039	0.003	0.037	0.007	0.9314
Perceived control	0.064	0.035	3.429	0.0641	−0.006	0.036	0.026	0.8709
Multidimensional Coping Inventory								
Active coping	0.292	0.162	3.250	0.0714	0.354	0.159	4.970	0.0258
Religious coping	−0.279	0.109	6.594	0.0102	−0.257	0.109	5.569	0.0183
Behavioral disengagement	−0.541	0.169	10.308	0.0013 *	−0.488	0.164	8.842	0.0029 *
Mental disengagement	−0.234	0.182	1.644	0.1998	−0.153	0.197	0.605	0.4369
Well-being[a,b]								
RAND SF-36 Health Survey								
Physical composite	0.004	0.015	0.061	0.8050	0.010	0.013	0.662	0.4157
General health	0.034	0.012	7.757	0.0054 *	0.005	0.014	0.150	0.6990
Physical functioning	0.017	0.012	2.081	0.1491	0.018	0.001	2.500	0.1139
Role physical	0.015	0.013	1.276	0.2586	0.012	0.016	0.574	0.4488
Bodily pain	−0.010	0.012	0.674	0.4117	−0.002	0.012	0.033	0.8566
Mental composite	0.006	0.013	0.204	0.6514	−0.003	0.018	0.027	0.8699

Predictors	Email				General			
	Coefficient (β)	SE[+]	Wald χ^2	*p*-value	Coefficient (β)	SE[+]	Wald χ^2	*p*-value
Mental health	0.015	0.013	1.324	0.2498	0.012	0.013	0.801	0.3710
Social functioning	−0.018	0.013	1.926	0.1652	−0.002	0.013	0.031	0.8613
Role emotional	0.017	0.011	2.139	0.1436	0.031	0.010	9.638	0.0019 *
Vitality	−0.005	0.016	0.082	0.7740	−0.001	0.015	0.006	0.9388
Life Satisfaction Index-Z	0.007	0.024	0.088	0.7668	0.012	0.023	0.266	0.6058
CES-Depression	−0.007	0.013	0.308	0.5788	−0.007	0.014	0.253	0.6147

[*] $p < .01$

[**] $p < .001$

[+] SE, standard error

[a] Stepwise results after forcing in education and age to email use model.

[b] Stepwise results after forcing in Hispanic ethnicity, education, and age to general use model.