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Internet Use, Social Integration, and Psychological Well-Being in Older Adults

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INTERNET USE, SOCIAL INTEGRATION, AND PSYCHOLOGICAL WELL-BEING IN OLDER ADULTS

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SOCIOLOGY

Previous studies examining the relationship between information and communication technologies (ICTs) and mental health provide conflicting evidence regarding the possible benefits and detriments of ICT use on mental well-being. While ICTs may enhance social cohesion and motivate individuals to engage in new communication methods to strengthen social bonds and develop new social relationships, ICTs may also motivate individuals to retreat from the real world into a virtual one, thus severing established social ties. These positive and negative changes in social integration can have significant effects on mental health, as research has shown that social relationships and social engagement can drastically affect such mental well-being measures as depression and life satisfaction.

While previous literature provides conflicting evidence regarding the potential effects of ICT use on mental status, a substantial portion of the empirical research that focuses on older populations suggests that ICT use may improve mental health, although it is unclear to what extent factors of social life may mediate this relationship. This study uses data from the 2004 graduate sample of the Wisconsin Longitudinal Study (WLS) to examine the relationship between Internet use and psychological well-being in older adults and to determine if social integration acts as a mediator in this relationship. The findings generated from ordinary least squares (OLS) regression analyses suggest that Internet use serves as a significant predictor for measures of social integration (e.g., visits with friends, involvement with clubs/organizations) as well as measures of psychological

well-being (e.g., autonomy, environmental mastery, personal growth, positive relations to others, purpose in life, self-acceptance, and overall psychological well-being). The findings also suggest that measures of social integration only partially mediate the relationship between Internet use and psychological well-being, supporting the notion that ICTs may have a positive impact on older adults even when taking factors of social life into account. The results of this study may have broad social, economic, and political applications, as the findings may help motivate and direct the distribution of ICT-related resources that will benefit the fast-growing segment of older adults in the American population.

Keywords: ICTs, Internet use, social integration, mental health, psychological well-being

DEDICATION

To my parents, Ron and Kathy, for their unyielding support, and to my brother, Jonathan, for teaching me the true meaning of commitment and perseverance.

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Finally, I would like to thank those responsible for the collection and management of the data associated with the Wisconsin Longitudinal Study at the University of Wisconsin-Madison. This research project would not have been possible without their hard work and diligence.

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LIST OF ABBREVIATIONS

ICTs	information and communication technologies
OLS	ordinary least squares
SES	socioeconomic status
WLS	Wisconsin Longitudinal Study

CHAPTER ONE

INTRODUCTION

It is estimated that between 2010 and 2050 the number of Americans aged 65 and over will more than double from 40 million to over 80 million (Vincent and Velkoff 2010). The rapid expansion of this segment of the American population over the next few decades will have significant social, economic, and political effects on American life as more resources, both public and private, will be devoted to the programs and interests that best serve this group, such as the US Social Security program and the Medicare insurance program (Vincent and Velkoff 2010). Given this, conducting research on older adults (i.e., individuals aged 65+) and the process of aging has increased in importance over the past few years. The results of studies conducted in such fields as social gerontology, geriatrics, and sociology may have substantial effects on American policy in the present and near future.

One area which has become increasingly popular over the past few years is examining the effects information and communication technologies (ICTs) may have on older adults, particularly regarding mental health outcomes. Prior research on ICT use and well-being suggests that using computer-based communication applications, such as the Internet, can be both beneficial (Cotten et al. 2012; Shaw and Gant 2002; Valkenburg and Peter 2007) and detrimental (Huang 2010; Kraut et al. 1998; Prezza, Pacilli, and Dinelli 2004) to an individual's mental health status. While ICTs may enhance social cohesion

and motivate individuals to engage in new communication methods to strengthen social bonds and develop new social relationships, ICTs may also motivate individuals to retreat from the real world into a virtual one, thus severing established social ties to family, friends, and the community. These positive and negative changes in social integration can have significant effects on mental health, as previous research has shown that social relationships and social engagement can drastically affect such mental well-being measures as depression and life satisfaction (Barger, Donoho, and Wayment 2009; Berkman et al. 2000; Seeman 1996).

While studies have found support for both the positive and detrimental effects ICTs may have on mental health, the results of these studies vary depending on what segment of the population is being investigated. With regards to older adults, there is a general consensus that ICT use positively affects mental well-being (Chen and Persson 2002; Cotten et al. 2012; Stark-Wroblewski, Edelbaum, and Ryan 2007; Sum et al. 2008; White et al. 1999; White et al. 2002; Xie 2007). Yet while significant support has been found for the notion that older adults may benefit from ICTs, few studies have investigated the avenues through which the relationship between ICTs and mental health is actually enacted. More specifically, while the relationship between ICTs and mental health has characteristically been framed using theories of social integration and social ties, few studies have actually conducted investigations to determine what role social interactions play in this relationship in older adults.

From this, a central research question arises: what role does social integration play in the relationship between ICT use and mental well-being in older adults? To answer this question, this study implements a cross-sectional analysis of a sample of older adults to

determine if a relationship exists between ICTs and mental well-being and to determine if social integration acts as a mediator in this relationship. Specifically, this study uses data from the 2004 graduate sample of the Wisconsin Longitudinal Study (WLS) to determine if a relationship exists between Internet use and psychological well-being in a selection of older Americans and to determine if measures of social integration mediate this relationship.

This study has the potential to make a significant contribution to the field of social gerontology and sociology. While previous studies (see for example, LaRose, Eastin, and Gregg 2001) have been conducted that examine the role social integration plays in the relationship between ICT use and mental health, there are no studies, to the author's knowledge, that conduct an analysis on mediation strictly for older adults. In addition, previous research conducted examining ICT use and mental health in older adults has restricted the measures of mental well-being to oft-used depression and loneliness scores (see for example, White et al. 2002); this study measures mental health using a scale of psychological well-being developed by Ryff (1989) that incorporates feelings of autonomy, environmental mastery, personal growth, positive relations to others, purpose in life, and self-acceptance. Incorporating these measures into the mental health discussion may help gerontologists and sociologists in illustrating a more complete picture of the effects ICT use may have on older cohorts. Finally, because this study involves an investigation on topics that are particularly popular in social scientific research, the results of this study may have broad social, economic, and political applications, as the findings may help motivate and direct the distribution of resources that will benefit the fast-growing segment of older adults in the American population. As

an example, evidence of a mediating relationship between ICT use, social integration, and mental health may motivate organizations associated with promoting the well-being of older adults to invest in the development of programs that teach older adults with no ICT experience how to use the technology to communicate with others and possibly develop new social relationships.

CHAPTER TWO

LITERATURE REVIEW

As defined by Blaschke, Freddolino, and Mullen (2009), ICTs consist of any computer-based or computer-assisted device or application used for the purposes of communication and the dissemination of information, examples of which include the Internet and email programs. ICT use among American adults aged 18+ has steadily increased over the past decade; according to the Pew Internet and American Life Project, which routinely conducts surveys to gauge Internet use among the American population, the percentage of adults that use the Internet has increased from less than half to approximately 79% between 2000 and 2010 (Lenhart et al. 2000; Zickuhr 2010). As such, ICTs are becoming more prevalent in American life, motivating researchers to conduct a number of studies focused on revealing how these applications and devices positively or negatively affect their users.

Previous literature published on the topic of ICT use present arguments that are conflicting with regard to their overall affect on mental well-being. In a study where college students were instructed to participate in anonymous chat sessions online, Shaw and Gant (2002) found that levels of both loneliness and depression decreased among participants over the course of the study and that levels of self-esteem increased. In opposition to these findings, a study conducted by Kraut et al. (1998) found that greater use of the Internet was associated with higher levels of loneliness and depression in a sample of families residing in the Pittsburgh area; however, a 3-year follow-up survey of

the original respondents found that these negative effects dissipated over time (Kraut et al. 2002). Kraut et al. (2002) also conducted a longitudinal study from 1998-1999 involving a sample of Pittsburgh households that had recently purchased a new computer or television and found that more use of the Internet was positively associated with such outcomes as trust in others and positive affect. Prezza et al. (2004) found that, among a sample of Roman adolescents, a positive relationship existed between use of the Internet and feelings of loneliness. Finally, a meta-analysis of 40 scholarly articles conducted by Huang (2010) found a small correlation between high Internet use and reduced well-being. Thus while some studies conclude that ICT use has a beneficial effect on individuals with regards to mental health outcomes, others find a negative relationship between ICTs and mental well-being. The inconsistencies found in the results of these studies can be partially explained by the differences in sample, as the findings tend to differ depending on what portion of the population is under study. With regards to older adults, a majority of the recent literature suggests that ICT use has a positive relationship with mental health measures (see for example, Cotten et al. 2012).

ICT Use and Older Adults

According to the Pew Internet and American Life Project, only 15% of Americans aged 65+ indicated that they ever went online in 2001 (Fox et al. 2001). This number has increased substantially over the past decade, as a recent Pew report found that 58% of older adults aged 65-73 and 30% of those aged 74+ went online, with the most popular online activities consisting of email use, utilizing a search engine, and looking up health information (Zickuhr 2010). In addition, another Pew study found that a large portion of

the aged American population own an ICT device (Zickuhr 2011). Regarding those aged 66-74, Pew finds that 68% own a cell phone, 48% own a desktop computer, and 30% own a laptop computer; of those aged 75+, 48% indicate that they own a cell phone, 28% own a desktop computer, and 10% own a laptop computer (Zickuhr 2011). Because ICT ownership and ICT use has increased among American older adults in the past few years, it is important to determine how these evolving technologies may positively or negatively affect this growing portion of the population.

Lawhon, Ennis, and Lawhon (1996) suggest that ICT use has a wealth of positive effects on the lives of older adults, as they encourage socialization, increase productivity, enhance self-esteem, allow for the learning and mastering of new skills, enhance daily functioning, and allow for the completion of creative and fun activities. In one of the first intervention-based studies focused specifically on ICT use and older adults, White et al. (1999) investigated how these positive attributes of ICT use may affect psychosocial well-being by conducting a pilot investigation involving the implementation of a computer-based training intervention in a retirement community. Results of the pilot study suggested that computer use reduced loneliness in the intervention group when compared to a control group that did not receive the training. A follow-up study produced similar results, as participants in an ICT intervention trended towards decreased levels of loneliness and depression, although these findings were not statistically significant (White et al. 2002).

Other studies provide evidence to the existence of a relationship between ICT use and mental well-being in older adults. A survey of Internet users in Australia found that greater use of the Internet was associated with lower levels of social loneliness, consistent

with the findings of the White et al. intervention studies (Sum et al. 2008). Chen and Persson (2002) examined Internet use among young and older adults and found that Internet-using older adults scored higher in levels of personal growth and purpose in life when compared to non-users. A study conducted in the rural Midwestern portion of the US found that older adults who reported using email as a communication tool were less likely to report health-related limitations and more likely to report an increased sense of independence (Stark-Wroblewski et al. 2007). Qualitative interviews conducted among older Chinese regarding Internet use and well-being suggested that use of the Internet led to improved self-evaluations, as some respondents indicated that they felt younger and more in-line with younger generations (Xie 2007). Finally, a report published by Ford and Ford (2009) investigating Internet use and levels of depression in older adults found that Internet use was associated with decreased depressive classification.

While a majority of studies concerning older adults have yielded similar results, not all previous research has produced results supporting the notion of ICTs positively affecting older adults. As an example, a study conducted by Slegers, Boxtel, and Jolles (2008) failed to find any positive or negative effects of ICT use on functioning, well-being, and mood. Dickinson and Gregor (2006) also make the claim that use of ICTs does not necessarily affect the well-being of older adults, arguing that the studies published thus far on the topic have insufficiently addressed the effects of ICT training support on well-being, provided little evidence regarding the true direction of causality, and inappropriately generalized findings of specific samples to the general population of older adults. However, based on a review of previous literature, it appears that the

general consensus among researchers is that ICT use may have a positive relationship with mental health outcomes.

The Possibility of Mediators

While the results of research conducted on older adults regarding ICT use and mental health have been relatively consistent, such uniform findings have eluded other researchers looking at other populations. The conflicting findings of research conducted on ICT users regarding mental status suggest that ICT use alone can not predict levels of well-being. Critiquing current ICT research, Cotten (2008) states that it is not enough to simply look at whether or not being an ICT user affects mental status, as the specific activities performed with ICTs as well as the amount of use may also affect an individual's mental health. Thus one possibility that may explain the discrepancies found in previous research is that mental health can be affected by *what* is done online rather than *if* an individual is online, and researchers should begin to focus more on activities done and time spent online. Another possibility is that the relationship between ICT use and mental health may be mediated by other factors. That is, ICT use may not be *directly* affecting mental health outcomes. Instead, ICT use may be significantly affecting other unknown factors, and changes in these factors may be leading to a change in mental state. Identifying these unknown factors may allow researchers to better understand the avenues through which ICT use affects mental health and may lead to findings that explain why the relationship between ICT use and mental health changes depending on the population under study.

LaRose et al. (2001) explored the possibility of mediating factors in the relationship between ICT use and mental health and found that ICT use could positively and negatively affect an individual's level of depression, and that this relationship was mediated by such factors as social support, Internet-related stress, and self-efficacy. As an example, those who used the Internet as a means of communication through email were found to have increased levels of social support, which in turn led to decreased levels of depression. Another study that tested the possibility of mediating factors found that Internet-based communication among adolescents was positively associated with time spent with friends and the quality of existing friendships, which in turn positively affected life satisfaction (Valkenburg and Peter 2007). Studies such as these suggest that ICT use alone does not affect mental well-being and that other factors are at play.

The studies conducted by LaRose et al. (2001) and Valkenburg and Peter (2007) investigate the possibility that factors of social life may play a role in the relationship between ICT use and mental health. The author of this paper suggests that, in the relationship between ICT use and mental health, social integration acts as a mediator. Social integration refers to "the extent to which an individual participates in a broad range of social relationships" (Brissette, Cohen, and Seeman 2000: 54). Put another way, social integration refers to the degree in which an individual participates in various social relationships, whether they are small and intimate in nature (such as in marriage) or large and impersonal (such as in some community-based organizations). In the discussion of ICT use and mental health, social integration may act as a mediator because previous research has shown that ICT use can have an effect on social relationships (for example, see Ellison, Steinfield, and Lampe 2007) and that social ties can have an effect on health

outcomes, including mental status (Barger et al. 2009; Berkman et al. 2000; Seeman 1996).

It should be noted that while studies have been conducted linking ICT use, social life, and mental health, most of these studies conducted on older adults focus primarily on social support rather than on social integration per se (for example, see LaRose et al. 2001). Social support refers to the *functional* qualities of social ties (House 1987), such as the availability of emotional assistance in times of grieving. While similar, the term social integration refers to the *existence* or *quantity* of social ties (House 1987), such as involvement or participation in social groups. Because much of the literature previously published on older adults involves social support rather than social integration, the author of this study believes that investigating this particular concept as a possible mediator between ICT use and mental health will contribute more to the gerontological and sociological literature.

Social Integration Theory

Ideas regarding social integration date back to the days of Durkheim, who, in his seminal text *The Division of Labor in Society* (1893), suggested that social integration and cohesion are products of a society's move toward modernity and are a consequence of the individuals within said society becoming more individualistic. Durkheim contends that traditional societal structures are based on a certain collective consciousness, that the primitive hunter-gatherer societies from centuries ago were predominately composed of groups that placed a faith and reliance on the collective culture and action of the group; however, as a society moves towards modernity, the individuals of the group become

more individualistic and specialized, and a new division of labor emerges wherein individuals embody a specific role within the group. This movement towards specialization, while allowing for an individual to take a more distinct and noticeable role within a group, also restricts what can be accomplished by each individual; those in the group are no longer solely responsible for their own survival, as their specialized role within the group prevents them from conducting all the necessary tasks that assure sound living. A new type of reliance emerges: despite members of the group becoming more individualistic, each individual must rely on the actions of others to survive as others rely on them. It becomes necessary for individuals within the group to interact with others and to integrate into the evolving structure of the group, and failure to do so may have negative consequences on the individual and on the group as a whole.

Durkheim further touches upon the potential effects of social integration on the well-being of individuals in *Suicide* (1897). Durkheim postulates that the suicide rates measured among various groups could be influenced by such things as social integration and social regulation. With regards to integration, Durkheim contends that too little could lead to *egoistic* suicide, wherein an individual ends his/her life because he/she does not feel that he/she is a valid part of society and thus lacks a general feeling of purpose and support. In contrast, too much social integration could lead to *altruistic* suicide, wherein an individual is forced to end his/her life for the good of society, as in the case of a martyr. In both cases, Durkheim argues that the macro-concept of social integration, that is the existence of social relationships that allow for individuals to function as a group in modern society, affects what is typically considered to be an individualistic act; we can thus see how societal characteristics can yield influence on the individual level.

This is an important consideration to the current study, as mental health, like suicide, is typically viewed as an outcome specific to the individual.

Since Durkheim's early writings regarding the importance of social relationships within groups, theories of social integration have emerged as important foundations to ideas and postulates regarding how social life can be tied to individual factors such as mental well-being. Faris (1934) is one of the earliest to write on how social integration, and specifically social isolation, may negatively affect an individual's mental health status, arguing that hospital records of those diagnosed as schizophrenic often describe such patients as having a deficiency in social contacts. Sieber (1974) also touches upon the benefits of social life on mental health, arguing that an individual's accumulation of social roles may have a variety of positive effects that include the accumulation of role privileges, the development of status security, the enhancement of status and role performance, and the enrichment of self-esteem. These benefits, Sieber argues, outweigh the potential negative effects of role accumulation, such as the stress associated with enacting a variety of personas simultaneously. This is a stance supported in later writings by Thoits (1983, 2011) who argues that social integration and the accumulation of roles gives meaning to an individual's existence, and a lack of integration may result in a distressed psychological state.

Linking ICT Use, Social Integration, and Mental Health

Based on the theoretical framework of social integration outlined by Durkheim and amended by such theorists as Faris, Sieber, and Thoits, DiMaggio et al. (2001) bring ICT use into the social integration conversation, suggesting that ICTs have the possibility of

both enhancing social cohesion as well as promoting social isolation. On the one hand, ICTs provide individuals advanced technological means of efficiently accessing already established support networks as well as the means to access new networks and resources that can increase overall social capital. On the other hand, ICT use may reduce social interaction and social capital by motivating individuals to retreat from the real world into a virtual one, eroding their support networks as contact with friends and family decrease. From this perspective, it is possible to argue that ICT use may have a beneficial or a detrimental effect on mental health, as social isolation may increase or decrease depending on how an individual uses the technology.

Some research has touched upon the possibility of social relationships playing a role in the relationship between ICT use and mental health in older adults. A study conducted by Wright (2000) found that greater involvement with an online community, indirectly measured through frequency of online communication, was associated with decreased levels of perceived stress, and a study conducted by Nimrod (2010) found that ICT use may provide a means for social support and personal growth and preservation. However, to the author's knowledge, no study has yet been conducted that specifically tests whether or not social integration acts as a mediator in the relationship between ICT use and mental health in this particular portion of the population. Most studies focus primarily on social support or, if focusing on the quantity of social relationships, limit the scope of social contact measures. This study will contribute to discussion of ICT use and older adults by examining a variety of social integration measures to determine if social integration mediates the relationship between ICT use and mental well-being; the measures used will be discussed more thoroughly in the next chapter.

Hypotheses

Based upon the review of literature, there is an empirical and theoretical basis for the notion that social integration affects mental health (see Thoits 2011). Empirical research also provides evidence for the notion that ICTs may affect social contacts and support and that ICT use may also affect mental health (see for example, Valkenburg and Peter 2007). From a theoretical perspective, it can be argued that ICT use may provide older adults with a means of enhancing their social integration which, in turn, positively affects their mental status. The purpose of the current study is to determine what role social integration plays in the relationship between ICT use and mental health in older adults. Specifically, this research focuses on determining whether or not social integration acts as a mediator between ICT use and mental well-being in older adults (see Figure 1).

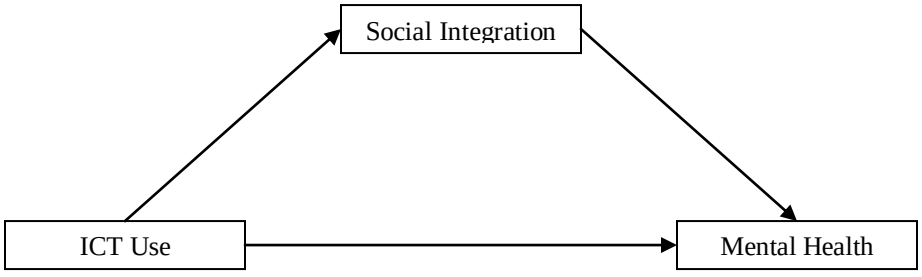

Figure 1. Conceptual Model: ICT Use, Social Integration, and Mental Health

To guide this investigation, the author presents 3 hypotheses, each of which represents a crucial step expected when testing for mediation as outlined by Baron and Kenny (1986):

Hypothesis 1: For older adults, a significant positive relationship will exist between Internet use and an individual's level of social integration such that Internet users will have higher levels of integration compared to non-users.

Hypothesis 2: For older adults, a significant positive relationship will exist between Internet use and mental well-being such that Internet users will have higher levels of mental well-being compared to non-users.

Hypothesis 3: For older adults, an individual's level of social integration will partially mediate the relationship between Internet use and mental well-being.

Hypothesis 1 is derived from the theoretical notion that ICTs may provide a means for older adults to enhance their social ties, whether through engaging in new social endeavors online or through communicating with established social contacts. Hypothesis 2 is derived from the empirical literature that provides support for the notion that ICTs positively benefit older adults with regards to mental status. Hypothesis 3 is derived from the theoretical argument that, while ICT use may positively affect the mental health of older adults, this relationship is partially mediated by social integration. Hypothesis 3 only proposes partial mediation because an intervention-based study conducted in Israel found that older adults who began using computers in the course of the study, compared to a control group that received a non-ICT based intervention (i.e., an intervention based around hobby-related activities), indicated that they felt less lonely, less depressed, and more empowered when compared to non-users (Shapira, Barak, and Gal 2007). The results of this study suggest that, even when controlling for the social interaction of the study personnel, ICT use still significantly affects psychological outcomes, and thus social integration acts only as a partial mediator.

CHAPTER THREE

METHODOLOGY

This chapter outlines the dataset, measures, and analytic procedures used in this study to answer the central research question previously described: what role does social integration play in the relationship between ICT use and mental health in older adults?

Data

This investigation utilizes publicly available data collected from the Wisconsin Longitudinal Study (WLS), an ongoing longitudinal study conducted by the Center for the Demography of Health and Aging at the University of Wisconsin-Madison. The WLS graduate sample consists of a one-third random sample of men and women who graduated from a Wisconsin high school in 1957 (*N*=10,317). Surveys have been conducted over the study period in-person (1957) as well as by phone (1975, 1992, and 2004) and mail (1992 and 2004). Over the years, the WLS has collected data on a number of diverse topics, including social backgrounds, aspirations, education, military service, family, work experience, retirement, and social participation. Additional information regarding the WLS can be found at http://www.ssc.wisc.edu/wlsresearch.

The current study uses data pooled primarily from the 2004 wave of the WLS. Because those who graduated from high school in 1957 would most likely be aged to their mid-60s by 2004, the most recent wave of the WLS provides a unique opportunity

to conduct a cross-sectional research project with a large population of older adults who are alike with regards to age (ages range from 63-67). Because the 2004 wave also contains an abundance of questions with regards to ICT use, social life, and mental health, the WLS is an optimal dataset to use to answer the central research question of the investigation. Most of the data used in this study are pooled from the 2004 graduate mail-in survey, although some demographic information, such as the respondents' sex, is pooled from earlier waves and from the 2004 phone-interview. The author chose to primarily use the 2004 mail-in survey data, rather than the 2004 phone-interview data, because only a sub-sample of respondents were asked questions regarding ICT use and mental health in the phone-interview, and no questions were asked regarding social participation in the phone-interview; these questions, however, were asked of all respondents in the mail-in survey.

For the current investigation, the sample is limited only to those for whom a 2004 survey was administered. Of the original sample totaling 10,317 respondents, 3,472 did not respond to the 2004 mail-in survey, although 1,288 of these respondents were determined to be deceased at the time of data collection. Censoring for the deceased, the retention rate for the 2004 graduate mail-in survey was calculated to be approximately 75.81%. For the study, the sample was also restricted to those who had responded to the survey questions that contained the variables of interest to this investigation, primarily questions regarding ICT use, social life, and mental well-being, as well as certain basic demographic characteristics. Of the potential 6,845 respondents, 1,351 were found to have missing values on key variables, or roughly 20% of those with valid mail-in responses. Specifically regarding the variables, there were 1,125 missing scores for

social life, 1,072 missing scores for mental well-being, and 1,963 missing scores for the various demographic measures. While the number of respondents with missing values was fairly large, a preliminary look at the data prior to the analyses revealed that the sample characteristics of the respondents with missing data were not drastically different from the sample characteristics of the analytic sample (small differences were found only in the education, employment, and ICT use measures). In addition, a preliminary look at the data revealed a number of respondents were missing values for *multiple* measures, making mean-imputation of scores based on other variables difficult. Because those with missing data did not appear to be different from those with valid responses, and because mean-imputation for missing scores did not seem to be a viable option, it was decided that cases that did not supply sufficient information regarding the variables of interest would be censored from the analysis. The final sample size for this study totaled 5,494 individuals.

Measurement

As stated previously, the primary outcome of this investigation is mental well-being, measured in this study not with depression or loneliness scores, but instead with a set of scores related to psychological well-being that incorporate measures of autonomy, environmental mastery, personal growth, positive relations to others, purpose in life, and self-acceptance. This is measured in the WLS using an abbreviated version of the Ryff (1989) scales for psychological well-being, also used in the previously mentioned study conducted by Chen and Persson (2002). The original instrument constructed by Ryff includes questions regarding autonomy, environmental mastery, personal growth,

positive relations to others, purpose in life, and self-acceptance, with each dimension being measured through twenty items. The WLS uses an abbreviated version of the scales for the 2004 mail-in survey, as it has been shown that shorter versions correlate highly with the original 20-item scales (Ryff and Keyes 1995). For each dimension of psychological well-being, respondents of the WLS were asked to what extent they agreed or disagreed with statements related to that particular dimension, with responses ranging on a 6-point scale from "strongly agree" (assigned a score of 1) to "strongly disagree" (assigned a score of 6). Responses were then coded and summed such that those with positive well-being had higher scale scores. For all dimensions except purpose in life, five questions were used to construct the scales of psychological well-being; for purpose in life, six questions were used.

Because a number of respondents completed some, but not all, of the items for each measure of psychological well-being, the WLS constructed a measure for each dimension with imputed means for missing components. Missing responses were imputed to the individual mean of valid items prior to summing if the respondent had answered at least three of the questions in a given scale. While using imputed scores for the dependent measure in statistical analyses has the potential to produce inaccurate results, previous studies (for example, see Shrive et al. 2006) have shown that, when sufficient data are available for the other items in a given scale, imputing scores based on scale items for each individual can produce reliable results and can prevent overall scale mean scores from being under-estimated due to missing values. Prior to the analyses presented in this investigation, the mean-imputed psychological well-being scores were centered such that the lowest possible score was equal to a value of 0; thus, for all dimensions except

purpose in life, the maximum score attainable is 25, and for purpose in life the maximum score attainable is 30. Table 1 contains information on how to interpret *high* and *low* scores with regards to each of the dimensions included in Ryff's scales of psychological well-being. Table 2 includes the questions asked in the WLS to gauge the value of each psychological well-being dimension.

Table 1. Measuring Psychological Well-Being

Measure	Score Description	Possible Scores	α
Autonomy	*High Score*: is self-determining and independent and is able to resist social pressures to think and act in certain ways *Low Score*: is concerned with the expectations and evaluations of others and conforms to social pressures	Max: 25 Min: 0	.637
Environmental mastery	*High Score*: controls complex array of external activities and makes effective use of surrounding opportunities *Low Score*: has difficulty managing everyday affairs and lacks a sense of control over external world	Max: 25 Min: 0	.666
Personal growth	*High Score*: has a feeling of continued development and is open to new experiences *Low Score*: lacks a sense of improvement or expansion over time and feels bored and uninterested in life	Max: 25 Min: 0	.680
Positive relations to others	*High Score*: has warm and trusting relationships with others and understands the give-and-take of human relationships *Low Score*: has few close relationships, finds it difficult to be warm and concerned for others, and is isolated or frustrated in interpersonal relationships	Max: 25 Min: 0	.825
Purpose in life	*High Score*: has goals and objectives for living and feels there is meaning to past and present life *Low Score*: lacks a sense of direction and has no outlooks or beliefs that give life meaning	Max: 30 Min: 0	.751
Self-acceptance	*High Score*: possesses positive attitude towards self and feels positive about past life *Low Score*: feels dissatisfied with self and is troubled about personal qualities and past life	Max: 25 Min: 0	.693

Score descriptions adapted from Ryff and Keyes (1995). The final summed score for psychological well-being ranges between 0-155 (α = .873)

Table 2. Psychological Well-Being Items in the WLS

Measure	WLS mail-in questionnaire items: "To what extent do you agree that…"
Autonomy	"…you have confidence in your opinions even if they are contrary to the general consensus?" "…you are not afraid to voice your opinions, even when they are in opposition to the opinions of most people?" "…it's difficult for you to voice your opinions on controversial matters?" "…you tend to be influenced by people with strong opinions?" "…you judge yourself by what you think is important, not by what others think is important?"
Environmental mastery	"…you are quite good at managing the many responsibilities of your daily life?" "…you have difficulty arranging your life in a way that is satisfying to you?" "…you have been able to create a lifestyle for yourself that is much to your liking?" "…you are in charge of the situation in which you live?" "…the demands of everyday life often get you down?"
Personal growth	"…you have the sense that you have developed a lot as a person over time?" "…when you think about it, you haven't really improved as a person over the years?" "…you think it is important to have new experiences that challenge how you think about yourself and the world?" "…life has been a continuous process of learning, changing and growing?" "…you gave up trying to make big improvements or changes in your life a long time ago?"
Positive relations to others	"…you often feel lonely because you have few close friends with whom to share your concerns?" "…it seems that most other people have more friends than you do?" "…people would describe you as a giving person, willing to share your time with others?" "…maintaining close relationships has been difficult and frustrating for you?" "…you have not experienced many warm and trusting relationships with others?"
Purpose in life	"…you are an active person carrying out plans you set out for yourself?" "…you don't have a good sense of what it is you're trying to accomplish in life?" "…you sometimes feel as if you've done all there is to do in life?" "…you used to set goals for yourself, but now that seems like a waste of time?" "…you live life one day at a time and don't really think about the future?" "…some people wander aimlessly through life, but you are not one of them?"
Self-acceptance	"…in general, you feel confident and positive about yourself?" "…when you compare yourself to friends and acquaintances, it makes you feel good about who you are?" "…in many ways, you feel disappointed about your achievements in life?" "…when you look at the story of your life, you are pleased with how things have turned out?" "…that you like most aspects of your personality?"

All psychological well-being items were measured by asking each respondent how much they agreed or disagreed with a series of statements focused on that particular measure. Responses were coded such that those with higher scores indicated having a stronger sense of well-being.

Once scores were calculated for each individual dimension, a final measure of psychological well-being incorporating all dimensions was created by summing all mean-imputed scores of the six separate Ryff measures. This final continuous scale has a minimum value of 0 and a maximum value of 155, with higher scores being associated with higher levels of well-being. Total estimated psychological well-being was calculated in this manner because, in other waves of the WLS, psychological well-being is estimated by summing together the various dimension components of Ryff's measures. The calculated Chronbach's α for this summed scale equals .873, indicating that there is a high rate of inter-correlations between the measures contained in the scale and that the summed score is a reliable measure of overall psychological well-being in the WLS.

The primary predictor variable of the investigation is ICT use, measured in this study through overall Internet use. In the WLS mail-in survey, respondents were instructed to check a specific item-box if they did not use either the World Wide Web or email. Based on this item, respondents were separated into two groups: those who use the Internet (re-assigned a value of 1) and those who do not (re-assigned a value of 0). While data are available in the WLS regarding time spent on the Internet as well as on the activities performed online, it is not as exhaustive as the author would prefer – activity questions and time spent doing each activity are limited to the unspecific and broad categories of email, recreation, and work-related – and so the focus of this investigation is limited to comparing ICT users and non-users; time spent online and activities performed online are not included for reasons of parsimony. The downside of restricting the investigation to this measure is discussed in more detail in the limitations section of this manuscript.

The mediating variable of the analysis is social integration which, in previous research, has been operationalized in a variety of ways (see Bissette, Cohen, and Seeman 2000). Some studies (for example, see Kaplan et al. 1988) have utilized complex index measures incorporating various measures of social integration into one scale variable; however, attempts to replicate these scales using the WLS data were unsuccessful, as the items that were included, while theoretically related, statistically showed very little inter-correlation and thus could not be adequately combined into a reliable scale measure. As such, rather than using a single index to measure social integration, four separate variables associated with social integration are utilized individually in the mediation analyses.

The variables that were selected from the WLS to measure social integration are based on the measures used in the previously mentioned study by Kaplan et al. (1988). In that study, Kaplan et al. (1988) created an index (called the Social Connections Index, used for evaluating the relationship between social connections and mortality) containing a summation of items regarding marital status, frequency of visits with family and friends, the number of unique homes visited, frequency of receiving guests and telephone calls, and participation in clubs and organizations. The items contained in the Social Connections Index provided a template for the variables to be included in this study regarding social contacts and social participation but were slightly adapted due to the data available in the WLS.

The variables selected from the WLS to measure social integration include frequency of visits with family, frequency of visits with friends, frequency of telephone communication with others, and participation in clubs and organizations. Table 3

contains a summary of how the WLS measures were recoded for the investigation. While the original variables in the WLS were continuous without upper-limit cutoffs, the variables were recoded and condensed for this investigation to limit the effects of outlier values. For each of these variables, a higher score indicates an increased level of social connectedness and social participation; thus, for these mediating variables, higher scores translate into higher levels of social integration.

Table 3. Coding for Social Integration Items

Item	Coding
Visits with friends	0 = no visits in last month 1 = one visit in last month 2 = two visits in last month 3 = three visits in last month 4 = four visits in last month 5 = five or more visits in last month
Visits with family	0 = no visits in last month 1 = one visit in last month 2 = two visits in last month 3 = three visits in last month 4 = four visits in last month 5 = five or more visits in last month
Communication via telephone	0 = no phone conversations in typical week 1 = one hour spent on phone per week 2 = two hours spent on phone per week 3 = three hours spent on phone per week 4 = four hours spent on phone per week 5 = five or more hours spent on phone per week
Involvement in clubs and organizations	0 = not involved in any groups 1 = involved with one group 2 = involved with two groups 3 = involved with three groups 4 = involved with four groups 5 = involved with five or more groups

In addition to the primary predictor, mediators, and outcomes, a number of demographic variables are also included in the analyses as controls, as it has been shown

that individual demographic characteristics may affect mental health status (for a detailed overview of how other individual characteristics theoretically and empirically affect mental status, see Avison, McLeod, and Pescosolido 2007). Demographic variables used for this investigation include sex, education, perceived socioeconomic-status (SES), self-rated health, marital status, and employment. While race is typically examined in social science studies such as this, the number of minority respondents in the WLS is incredibly low; because of this, the racial profile of minorities in the WLS is considered to be personally identifiable information and is not included in the publicly available dataset. Thus, race was not included in this investigation. It should also be noted that participants in the WLS were only included in the initial 1957 sample if they were high school graduates, thus there is no data available for Wisconsin residents who did not graduate high school.

Table 4. Coding for Demographic Measures

Item	Coding
Sex	dichotomous 0 = male, 1 = female
Education	dichotomous 0 = high school, 1 = more than high school
Perceived SES	continuous scale, range 0-9 0 = "worse off," 9 = "better off"
Self-rated health	dichotomous 0 = fair/poor/very poor, 1 = excellent/good
Marital status	dichotomous 0 = not married, 1 = married
Employment	dichotomous 0 = not currently employed, 1 = currently employed

Table 4 contains information regarding the coding of all demographic measures included in the investigation. Questions regarding each of the demographic variables used were included in the 2004 mail-in survey except for sex, education, and employment. Sex was ascertained at baseline and was included in the analyses as a dichotomous measure. Education was determined in the 2004 phone-interview survey by asking each respondent what the highest educational degree they had attained was (responses included high school degree, associate's degree, bachelor's degree, master's degree, and doctorate/professional degree). For the investigation, responses were recoded into two categories, as the author was most interested in investigating differences between high school graduates and those who continued their education beyond high school. Education was thus transformed into a dichotomous variable: those with a high school diploma and those who received an education beyond high school. Perceived SES was determined by asking each respondent to compare themselves with others nationally with regards to education, income, and employment using a 10-point scale; higher scores indicated that the respondent felt that they were "better off" compared to others with regards to SES, while lower scores indicated that the respondent felt that they were "worse off." This measure was retained as a continuous measure for the analyses. Self-rated health was determined by asking the respondent how they would personally rate their current health status (responses included excellent, good, fair, poor, and very poor). Due to the low variance among some of the responses, this variable was also recoded into a dichotomous measure: those reporting excellent/good health and those reporting fair/poor/very poor health. Marital status was determined by asking the respondent to describe their current marital status, and for the analyses responses were recoded such

that the measure became a dichotomous measure: those who indicated that they were married and those that did not. This recode was done due to the low variance in responses. Finally, employment was determined using a question in the 2004 phone-interview that asked the respondent to classify themselves as employed or not; this dichotomous measure was retained as originally constructed for the analyses.

Analytic Procedures

This study utilizes ordinary least squares (OLS) regression techniques to test for mediation as outlined by Baron and Kenny (1986). For each separate dimension of psychological well-being as well as for the total summed measure of psychological well-being, three separate steps, each with their own regression model, are run in concordance with the standard procedures associated with mediation testing as well as in concordance with the hypotheses presented by the author. In the first step, the social integration measures are regressed on the ICT use measure to determine if a significant relationship exists between the independent predictor and the potential mediators. In the second, the psychological well-being measures, whether a single dimension or the summed total of all dimensions, are regressed on the ICT use measure to determine if a relationship exists between the independent and dependent variables. In the third step, the psychological well-being measures are regressed both on the ICT use measure as well as on the social integration measures which previously showed a significant relationship with the predictor. Significant results in these three steps will provide support for the hypothesis that social integration mediates the relationship between ICT use and mental well-being.

Where significant mediation is found, the proportion mediated is calculated using the formula adapted from MacKinnon (2008: 82):

$$\text{proportion mediated} = (c - c')/c$$

In this formula, c indicates the OLS coefficient for the primary predictor in the model where the outcome is regressed only on the primary predictor; c' indicates the OLS coefficient for the primary predictor in the model where the outcome is regressed on the primary predictor and mediators. For the presentation of results in the next chapter, the value for proportion mediated is transformed into a percentage by multiplying the value by 100; this is done for ease of interpretation.

In addition to the regression models for each of the first three steps, a final regression is run for each measure of psychological well-being that includes all other demographic variables to determine if any relationship previously found in the mediation tests weakens considerably from their inclusion. This procedure is repeated for each dimension of psychological well-being as well as for the summed total measure.

No weighting is required for the WLS data. Regression analysis is conducted using the SPSS (ver. 16) software package.

CHAPTER FOUR

RESULTS

The summary of the results for the mediation analyses begins with a statistical description of the final analytic sample with regards to demographic characteristics as well as the predictor, mediating, and outcome measures. From here, results from each of the four mediation regression models are presented separately for each individual measure of psychological well-being as well as for the overall summed measure.

Descriptive Statistics

Table 5 contains descriptive statistics for the final analytic sample. With regards to sex, approximately 53% of the sample reported being female. A majority of the sample reported being a high school graduate, with only 32% of the sample reporting having attained a degree beyond high school. As mentioned previously, perceived SES was measured using a 10-point scale with scores ranging from 0-9; in the final sample, the mean score for perceived SES was approximately 5.71, indicating that, for the most part, the sample consisted of individuals who felt their socioeconomic standing was adequate. With regards to self-rated health, the majority of respondents indicated that they were in good or excellent health, as only 15% of the final sample reported being in fair, poor, or very poor health. Of the sample, 80% of respondents indicated that they were married at the time of the survey. With regards to employment, 43% of the final sample indicated that, at the time of the survey, they were employed.

Table 5. Descriptive Statistics, WLS Sample

Measure	Complete Sample (N = 5,494)	Internet Users (N = 3,501)	Non-Internet Users (N = 1,993)
Female	53%	54%	53%
More than high school education	32%	41%	16%
Perceived SES	5.71 (1.42)	5.91 (1.40)	5.36 (1.39)
Excellent/good health	85%	88%	79%
Married	80%	82%	76%
Employed	43%	46%	39%
Use the Internet	64%	100%	0%
Visits with friends	2.70 (1.78)	2.77 (1.76)	2.57 (1.82)
Visits with family	2.77 (1.73)	2.73 (1.73)	2.83 (1.72)
Communication via telephone	2.49 (1.64)	2.49 (1.61)	2.49 (1.68)
Involvement in clubs/organizations	3.06 (1.68)	3.22 (1.65)	2.78 (1.69)
Autonomy	17.73 (3.70)	17.99 (3.64)	17.28 (3.75)
Environmental mastery	19.74 (3.66)	20.13 (3.50)	19.05 (3.81)
Personal growth	20.00 (3.61)	20.48 (3.43)	19.17 (3.77)
Positive relations to others	18.76 (4.89)	18.99 (4.81)	18.35 (5.01)
Purpose in life	22.57 (4.52)	23.13 (4.30)	21.58 (4.72)
Self-acceptance	19.58 (3.76)	19.89 (3.62)	19.03 (3.94)
Overall psychological well-being	118.39 (19.03)	120.62 (18.10)	114.46 (19.98)

Descriptives for continuous and scale variables are expressed as means with standard deviations. Descriptives for nominal measures are expressed as percentages and indicate what proportion of the group has that particular attribute.

As previously mentioned, whether or not an individual reported using the Internet is used in the analyses as the primary predictor variable. A majority of the final sample reported using the Internet, with 64% of respondents indicating that they used the Internet. With regards to the social integration measures, used in the analyses as mediators, the final sample had a mean score of 2.70 on the condensed scale measuring visits with friends (wherein scores ranged from 0-5) and a mean score of 2.77 on the condensed scale measuring visits with family (wherein scores ranged from 0-5). For phone conversations in a typical week, the final sample had a mean score of 2.49 (wherein scores ranged from 0-5) on the condensed scale. For involvement with clubs and organizations, the final sample had a mean score of 3.06 (wherein scores ranged from 0-5) on the condensed scale.

As stated previously, each individual measure of psychological well-being (used in the analyses as outcome variables) had a score range from 0-25 except for purpose in life, which had a score range of 0-30. In the analytic sample, the mean scores for each individual psychological well-being measure were as follows: autonomy, 17.73; environmental mastery, 19.7; personal growth, 20.00; positive relations to others, 18.76; purpose in life, 22.57; and self-acceptance, 19.58. With regards to the total summed measure of psychological well-being (which had a score range of 0-155), the mean score for the analytic sample was 118.39. Overall, these statistics seem to suggest that the respondents in the sample, on the whole, enjoyed a relatively elevated level of mental well-being.

Table 5 also contains descriptive statistics separated for respondents who identified as Internet users and for respondents who claimed to not use the Internet. These statistics reveal that, with regards to demographic characteristics, Internet users were more educated, had higher scores for perceived SES, were healthier, had a higher percentage of married respondents, and had a higher percentage of employed. Only a slight difference was found in the number of females present in the sample. With regards to the social integration measures, Internet users had higher mean scores for visits with friends and involvement in clubs/organizations but lower mean scores for visits with family. There was relatively no difference in mean scores for communication via telephone. With regards to the psychological well-being variables, Internet users had higher mean scores for *all* measures, including the overall psychological well-being score. These statistics suggest that, within the sample, Internet users had better mental health than non-users.

Autonomy

As outlined by Baron and Kenny (1986), appropriate mediation testing begins with a regression between the predictor and potential mediators to determine if any relationship exists between these measures and to determine if the mediators should be included in future models (mediating variables that are found to not have a significant relationship with the primary predictor would be subsequently left out in future steps). Results of the regressions wherein the social integration measures were regressed on the ICT measure are presented in Table 6.

Table 6. Internet Use and Social Integration: Results from OLS Regression

	Visits with friends	Visits with family	Communication via telephone	Involvement with clubs/organizations
Internet use	.205***	-.094	-.007	.446***
	(.050)	(.048)	(.046)	(.047)

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

A significant relationship was found with only two of the four social integration measures: visits with friends and involvement with clubs/organizations. With regards to visits with friends, it was found that Internet users, on average, scored .205 points higher on the visits with friends scale compared to non-users, indicating that Internet users reported visiting their friends more than non-users. With regards to involvement with clubs/organizations, it was found that Internet users, on average, scored .446 points higher on the involvement with clubs/organizations scale compared to non-users, indicating that Internet users reported being involved with more clubs and organizations than non-users. Both of these results were found to be significant at the $p<.001$ level.

Because neither visits with family nor frequency of phone conversations were found to have a significant relationship with Internet use, these variables were not used in any further regression analyses for autonomy as well as the other measures of psychological well-being.

The second step to mediation testing as proposed by Baron and Kenny (1986) is to regress the primary outcome on the primary predictor. The results of this regression, wherein the autonomy scale was regressed on the Internet use measure, are presented in Table 7, Model 1. Internet use was found to have a significant relationship with autonomy at the $p<.001$ level, such that those who reported using the Internet scored, on average, .718 points higher on the autonomy scale compared to non-users.

Table 7. Results of Mediation Analysis: Autonomy

	Model 1	Model 2	Model 3
Internet use	.718***	.670***	.384***
	(.103)	(.104)	(.105)
Visits with friends		.123***	.100***
		(.028)	(.028)
Involvement with clubs/organizations		.052	-.020
		(.030)	(.030)
Female			-.629***
			(.101)
More than high school education			.132
			(.113)
Perceived SES			.520***
			(.038)
Excellent/good health			.317*
			(.137)
Married			-.457***
			(.123)
Employed			.138
			(.009)
Adjusted R^2	.009	.013	.066

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p< .05$; ** $p < .01$; *** $p < .001$

The third step to mediation testing is to regress the primary outcome on both the predictor and mediating variables. The results of this regression, wherein autonomy was regressed both on the Internet use measure as well the previously-significant social integration measures (visits with friends and involvement with clubs/organizations), are shown in Table 7, Model 2. Both Internet use and visits with friends were found to have a significant relationship with psychological well-being at the $p<.001$ level. Internet users, on average, were found to score .670 points higher on the autonomy scale compared to non-users, holding all other measures constant. Regarding visits with friends, a 1-point increase in the visits with friends scale was associated with a .123 point increase in the autonomy measure, holding all other measures constant. There was no significant relationship found between involvement with clubs/organizations and autonomy. Overall, the inclusion of the social integration variables into the model mediated the relationship between Internet use and autonomy by approximately 7% (this was calculated by taking the difference in the Internet use coefficients between Models 1 and 2, dividing this figure by the coefficient from Model 1, and multiplying this by 100).

The final model for the autonomy analyses (shown in Table 7, Model 3) includes the demographic characteristics. Sex, perceived SES, self-rated health, and marital status were all found to have significant relationships with autonomy. Women, compared to men, scored on average .629 points lower in autonomy; a 1-point increase in the perceived SES scale was associated with a .520 point increase in autonomy; those reporting good or excellent health, compared to those who reported worse health, scored on average .317 points higher on autonomy; and those who reported being married, compared to those who did not, scored on average .457 points lower on autonomy.

Despite the inclusion of these demographic characteristics, both Internet use and visits with friends retained a positive, significant relationship with autonomy. Internet users scored, on average, .384 points higher on the autonomy scale when compared to non-users, and a 1-point increase in the visits with friends scale was associated with a .100 point increase in autonomy. Both of these relationships were found to be significant at the $p<.001$ level. The results suggest that visits with friends acts as a small but significant partial mediator between Internet use and autonomy, even when accounting for demographic characteristics.

Environmental Mastery

Because the first step of the mediation testing for the environmental mastery variable is the same as the first step conducted for the autonomy analyses, the results will only be briefly reiterated: Internet use was found to have a significant positive relationship with visits with friends as well as with involvement in clubs/organization (as shown in Table 6). Table 8, Model 1 shows the results of the second step wherein the environmental mastery scale is regressed on the ICT variable. Internet use was shown to be a significant predictor of environmental mastery ($p<.001$) such that Internet users scored, on average, 1.080 points higher on the environmental mastery scale compared to non-users. Visits with friends and involvement in clubs/organizations were added for the third step and the results are presented in Table 8, Model 2. All three variables (Internet use, visits with friends, and involvement with clubs/organizations) were found to have a significant positive relationship with environmental mastery. Internet users, on average, scored .961 points higher on the environmental mastery scale compared to non-users, holding all

other variables constant; a 1-point increase in the visits with friends scale was associated with a .289 point increase in the environmental mastery scale, and a 1-point increase in the involvement with clubs/organizations scale was associated with a .135 point increase in the environmental mastery scale. The social integration measures were found to mediate the relationship between Internet use and environmental mastery by approximately 11%.

Table 8. Results of Mediation Analysis: Environmental Mastery

	Model 1	Model 2	Model 3
Internet use	1.080***	.961***	.461***
	(.102)	(.101)	(.098)
Visits with friends		.289***	.193***
		(.028)	(.026)
Involvement with clubs/organizations		.135***	.035
		(.030)	(.028)
Female			.174
			(.094)
More than high school education			-.022
			(.105)
Perceived SES			.753***
			(.035)
Excellent/good health			2.027***
			(.127)
Married			-.314**
			(.115)
Employed			.040
			(.092)
Adjusted R^2	.020	.047	.175

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

The final model for the environmental mastery analyses (shown in Table 8, Model 3) includes the demographic characteristics. Perceived SES, self-rated health, and marital status were shown to have a significant relationship with environmental mastery. A 1-point increase in the perceived SES scale was associated with a .753 point increase in environmental mastery, those reporting good or excellent health scored (on average)

2.027 points higher in environmental mastery compared to those reporting worse health, and those who were married scored (on average) .314 points lower in environmental mastery compared to those who were not. Internet use and visits with friends retained a significant relationship with environmental mastery ($p<.001$): Internet users (on average) scored .461 points higher in environmental mastery compared to non-users, and a 1-point increase in the visits with friends scale was associated with a .193 point increase in environmental mastery. Involvement in clubs/organizations, however, was not found to have a significant relationship with environmental mastery when demographic characteristics were accounted for. Like in the autonomy analyses, the results suggest that a relationship exists between Internet use and environmental mastery, and that visits with friends partially mediates this relationship, although to a relatively small degree.

Personal Growth

Table 9, Model 1 shows the results of the second step of the mediation wherein the personal growth measure was regressed on the primary predictor (for results of the first step, see Table 6). Internet use was found to be a significant predictor of personal growth at the $p<.001$ level; Internet users, on average, scored 1.306 points higher on the personal growth scale compared to non-users. Model 2 shows the results of the third step of the mediation analyses, wherein the social integration measures are added. All three independent variables were shown to have a significant relationship with personal growth at the $p<.001$ level. Internet users, on average, scored 1.123 points higher in personal growth compared to non-users, and a 1-point increase in the visits with friends and involvement with clubs/organizations scales was associated with .298 and .275 point

increase (respectively) in personal growth. Overall, the social integration measures were found to mediate the relationship between Internet use and personal growth by 14%.

Table 9. Results of Mediation Analysis: Personal Growth

	Model 1	Model 2	Model 3
Internet use	1.306***	1.123***	.591***
	(.100)	(.098)	(.096)
Visits with friends		.298***	.198***
		(.027)	(.026)
Involvement with clubs/organizations		.275***	.173***
		(.029)	(.027)
Female			1.068***
			(.092)
More than high school education			.369***
			(.104)
Perceived SES			.675***
			(.034)
Excellent/good health			1.219***
			(.125)
Married			-.124
			(.113)
Employed			.463***
			(.090)
Adjusted R^2	.030	.075	.183

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

Table 9, Model 3 shows the results of the final model for personal growth wherein demographic measures were included in the analysis. All demographic variables except marital status had a significant relationship with personal growth (all at the $p<.001$ level). Women, on average, scored 1.068 points higher in personal growth compared to men, and those who received education beyond high school, on average, scored .369 points higher in personal growth compared to high school graduates. A 1-point increase in perceived SES was associated with a .675 point increase in personal growth. Those who reported being in excellent or good health, on average, scored 1.219 points higher in personal growth compared to those who rated their health as fair, poor, or very poor.

With regards to employment, those who reported being employed at the time of data collection scored, on average, .463 points higher in personal growth compared to those who were not employed. In addition to these demographic variables, the primary predictor and both mediating variables were found to have a significant relationship with personal growth ($p<.001$). Internet users, on average, scored .591 points higher in personal growth compared to non-users, holding all other measures constant. A 1-point increase in the visits with friends scale was associated with a .198 point increase in personal growth, and a 1-point increase in the involvement with clubs/organizations scale was associated with a .173 point increase in personal growth, holding all other measures constant. Overall, it appears that Internet use is positively associated with personal growth, and that both visits with friends as well as involvement in clubs/organizations partially mediate this relationship, although to a relatively small degree.

Positive Relations to Others

Table 10, Model 1 shows the results for the second step in the mediation regression, wherein positive relations to others is regressed on Internet use (for the results of the first step, see Table 6). Internet use was found to have a significant relationship with positive relations to others ($p<.001$) such that Internet users, on average, scored .644 points higher on the positive relations to others scale compared to non-users. Model 2 shows the third step of the mediation analyses and includes the mediators. Overall, all variables had a significant relationship with positive relations to others. Internet users scored, on average, .347 points higher in the positive relations to others scale compared to non-users ($p<.01$). A 1-point increase in the visits with friends scale was associated with a .741

point increase in positive relations to others (p<.001), and a 1-point increase in the involvement with clubs/organizations scale was associated with a .324 point increase in positive relations to others (p<.001). The social integration measures mediated the relationship between Internet use and positive relations to others by approximately 46%, a much larger percentage compared with the models from previous outcomes.

Table 10. Results of Mediation Analysis: Positive Relations to Others

	Model 1	Model 2	Model 3
Internet use	.644***	.347**	.042
	(.137)	(.131)	(.131)
Visits with friends		.741***	.646***
		(.036)	(.035)
Involvement with clubs/organizations		.324***	.261***
		(.038)	(.038)
Female			1.699***
			(.125)
More than high school education			-.776***
			(.141)
Perceived SES			.659***
			(.047)
Excellent/good health			1.082***
			(.170)
Married			1.039***
			(.154)
Employed			.338**
			(.123)
Adjusted R^2	.004	.101	.173

Results presented as unstandardized regression coefficients with standard errors in parentheses
* p< .05; ** p < .01; *** p < .001

Model 3 contains both the predictors and mediators and also includes the demographic measures. All demographic measures had a significant relationship with positive relations to others at the p<.001 level except for employment, which was significant at the p<.01 level. Women, on average, scored 1.699 points higher in the scale compared to men, holding all other measures constant. Receiving an education beyond high school was associated with a .766 point decrease in positive relations to others. A 1-point

increase in perceived SES was associated with a .659 point increase in positive relations to others, while those who reported being in excellent or good health scored, on average, 1.082 points higher on the scale compared to those who reported being in fair, poor, or very poor health. Being married was associated with a 1.039 point increase in positive relations to others, and being employed was associated with a .338 point increase. Noticeably, Internet use was no longer a significant predictor of positive relations to others in the final model, suggesting that the demographic characteristics may have explained away much of the relationship that was found in previous models. Both mediators, however, still retained a significant relationship with the outcome at the $p<.001$ level. A 1-point increase in the visits with friends scale was associated with a .646 point increase in positive relations to others, while a 1-point increase in involvement with clubs/organizations was associated with a .261 point increase in the outcome.

Purpose in Life

Table 11, Model 1 shows the results of the second step of the mediation analyses for the purpose in life outcome (for results of the first step, see Table 6). Internet use was found to have a significant positive relationship with purpose in life such that Internet users, on average, scored 1.549 points higher in the purpose in life scale compared to non-users. Model 2 shows the results of the third step of the analyses wherein the mediators are included. All variables were found to be significantly related to purpose in life ($p<.001$). Internet users, on average, scored 1.326 points higher in the purpose in life scale compared to non-users. A 1-point increase in visits with friends was associated with a .330 point increase in purpose in life, and a 1-point increase in involvement with

clubs/organizations was associated with a .349 point increase in the outcome. The social integration measures mediated the relationship between Internet use and purpose in life by approximately 14%.

Table 11. Results of Mediation Analysis: Purpose in Life

	Model 1	Model 2	Model 3
Internet use	1.549***	1.326***	.611***
	(.125)	(.124)	(.121)
Visits with friends		.330***	.246***
		(.034)	(.032)
Involvement with clubs/organizations		.349***	.208***
		(.036)	(.034)
Female			.497***
			(.115)
More than high school education			.424**
			(.130)
Perceived SES			.818***
			(.043)
Excellent/good health			1.990***
			(.156)
Married			.626***
			(.141)
Employed			.523***
			(.113)
Adjusted R^2	.027	.067	.182

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

Model 3 shows the results of the final model wherein demographic measures were included in addition to the primary predictor and mediators. All variables in the model were significantly related to purpose in life at the $p<.001$ level except for education, which was significant at the $p<.01$ level. Being female was associated with a .497 point increase in purpose in life, and receiving an education beyond high school was associated with a .424 point increase. A 1-point increase in the perceived SES scale was associated with a .818 point increase in the purpose in life scale. Those reporting excellent or good health scored, on average, 1.990 points higher in the outcome scale compared to those

reporting fair, poor, or very poor health. Being married was associated with a .626 point increase in purpose in life, and being employed was associated with a .523 point increase. Regarding the primary predictor, Internet users scored, on average, .611 points higher in the outcome scale compared to non-users. With regards to the mediators, a 1-point increase in visits with friends was associated with a .246 point increase in purpose in life, and a 1-point increase in involvement with clubs/organizations was associated with a .208 point increase in the outcome. The results of these models suggest that Internet use is a significant predictor of purpose in life and that the social integration measures included only partially mediate this relationship (and to a relatively small degree).

Self-Acceptance

The final individual measure of psychological well-being used in this investigation is self-acceptance. Table 12, Model 1 shows the results of the second step in the mediation analyses (for results of the first step, see Table 6). Internet use was found to have a significant relationship with self-acceptance ($p<.001$) such that Internet users scored, on average, .856 points higher in self-acceptance compared to non-users. Model 2 shows the results of the third step wherein the social integration measures are included in the regression. All included variables were shown to have a significant relationship with self-acceptance at the $p<.001$ level. Internet users, on average, scored .684 points higher in self-acceptance compared to non-users, holding all other measures constant. A 1-point increase in visits with friends was associated with a .290 point increase in self-acceptance; also, a 1-point increase in involvement with clubs/organizations was associated with a .253 point increase in the outcome measure. Overall, the social

integration measures mediated the relationship between Internet use and self-acceptance by 20%.

Table 12. Results of Mediation Analysis: Self-Acceptance

	Model 1	Model 2	Model 3
Internet use	.856***	.684***	.173
	(.105)	(.104)	(.100)
Visits with friends		.290***	.201***
		(.028)	(.027)
Involvement with clubs/organizations		.253***	.142***
		(.030)	(.029)
Female			.414***
			(.096)
More than high school education			-.234*
			(.108)
Perceived SES			.872***
			(.036)
Excellent/good health			1.521***
			(.130)
Married			.343**
			(.118)
Employed			.116
			(.094)
Adjusted R^2	.012	.049	.181

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

Model 3 shows the results of the full model that includes the demographic measures. Of the demographic characteristics, sex, perceived SES, and self-rated health were found to be significant at the $p<.001$ level; being a woman was associated with a .414 point increase in self acceptance and being in excellent or good health was associated with a 1.521 point increase, while a 1-point increase in perceived SES was associated with a .872 point increase in the outcome. Martial status was found to be significant at the $p<.01$ level wherein those who were married, on average, scored .343 points higher in self-acceptance compared to those who were not, holding all other measures constant. Education was significant at the $p<.05$ level such that having received an education

beyond high school was associated with a .234 point decrease in self-acceptance compared to those who received only a high school education, holding all other measures constant. Employment was not found to have a significant association with self-acceptance.

While significantly related to self-acceptance in previous models, it appears that the inclusion of demographic characteristics helped to explain away some of the association between the primary predictor and outcome, as Internet use was not significantly related to self-acceptance in Model 3. Both mediators, however, retained a significant relationship with the outcome at the $p<.001$ level. A 1-point increase in the visits with friends scale was associated with a .201 point increase in the self-acceptance scale, holding all other measures constant. Also, a 1-point increase in the involvement with clubs/organizations scale was associated with a .142 point increase in the outcome, holding all other measures constant.

Overall Psychological Well-Being

The final outcome used in the investigation is the summed measure of psychological well-being that incorporates the scores of the previous six individual measures: autonomy, environmental mastery, personal growth, positive relations to others, purpose in life, and self-acceptance. As with the previous measures, mediation testing was done using the steps recommended by Baron and Kenny (1986). Results of the first step of the mediation testing can be seen by referencing Table 6.

Table 13, Model 1 shows the results of the second step of the mediation wherein the summed psychological well-being measure is regressed on the primary predictor.

Internet use was found to have a significant relationship with overall psychological well-being such that Internet users, on average, scored 6.154 points higher in psychological well-being compared to non-users. Model 2 shows the results of the third mediation step which includes the visits with friends and involvement with clubs/organizations measures. All three variables were shown to have a significant relationship with overall psychological well-being. Internet users, on average, scored 5.110 points higher on the outcome compared to non-users. A 1-point increase in the visits with friends scale was associated with a 2.070 point increase in psychological well-being, and a 1-point increase in the involvement with clubs/organizations scale was associated with a 1.388 point increase in psychological well-being. The social integration measures mediated the relationship between Internet use and overall psychological well-being by approximately 17%.

Table 13. Results of Mediation Analysis: Overall Psychological Well-Being

	Model 1	Model 2	Model 3
Internet use	6.154***	5.110***	2.262***
	(.528)	(.515)	(.496)
Visits with friends		2.070***	1.584***
		(.141)	(.133)
Involvement with clubs/organizations		1.388***	.800***
		(.151)	(.142)
Female			3.222***
			(.473)
More than high school education			-.108
			(.533)
Perceived SES			4.297***
			(.177)
Excellent/good health			8.156***
			(.643)
Married			1.112
			(.581)
Employed			1.617**
			(.464
Adjusted R^2	.024	.086	.220

Results presented as unstandardized regression coefficients with standard errors in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$

Model 3 shows the results of the final mediation and includes the demographic variables in addition to the Internet use and social integration measures. Regarding the demographic variables, sex, perceived SES, and self-rated health were all found to have significant relationships with the psychological well-being scale at the $p<.001$ level. Women, on average, scored 3.222 points higher on the outcome compared to men. A 1-point increase in the perceived SES scale was associated with a 4.297 point increase in the psychological well-being score, and those reporting to be in excellent or good health scored, on average, 8.156 points higher on the outcome scale compared to those in fair, poor, or very poor health. Employment was found to be significant at the $p<.01$ level; those who indicated they were employed scored, on average, 1.617 points higher in psychological well-being compared to those who were not employed. Neither education nor marital status was found to be significant predictors of overall psychological well-being.

In the final model, the primary predictor as well as both social integration measures were found to have a significant relationship with psychological well-being at the $p<.001$ level. Internet users, on average, scored 2.262 points higher in psychological well-being compared to non-users, holding all other measures constant. A 1-point increase in the visits with friends scale was associated with a 1.584 point increase in the outcome, and a 1-point increase in the involvement with clubs/organizations scale was associated with a .800 point increase in the psychological well-being scale. These results suggest that social integration only partially mediates the relationship between Internet use and psychological well-being, and these relationships exist even when accounting for demographic characteristics.

CHAPTER FIVE

CONCLUSION

The central purpose of this research investigation was to explore the relationship between ICT use and mental well-being in older adults and to determine if the *existence* or *quantity* of social ties, or social integration, mediates this relationship. Using data available through the WLS, ICT use was operationalized through Internet use, mental well-being was operationalized using a series of psychological well-being measures developed by Ryff (1989), and social integration was operationalized through frequency measures associated with visitation with friends and family as well as phone conversations and involvement with clubs/organizations. The first steps of the mediation analyses revealed that, with regards to the relationship between the predictor and potential mediators, Internet use had a significant relationship only with visits with friends and involvement with clubs/organizations (the lack of a relationship between Internet use and visits with family and phone conversations dictate that these specific social integration measures can not statistically serve as adequate mediators in the final models). With regards to the other models included in the mediation analyses, results from OLS regression provided evidence to suggest the following:

Autonomy – Internet use is positively associated with autonomy, and social integration (specifically visits with friends) acts only as a partial mediator. This relationship is consistent even when controlling for demographic characteristics.

Environmental mastery – There is a positive relationship between Internet use and environmental mastery, and social integration (specifically visits with friends) acts only as a partial mediator. This relationship persists even when controlling for demographic characteristics.

Personal growth – Internet use is positively associated with personal growth, and measures of social integration (specifically visits with friends and involvement with clubs/organizations) act as partial mediators. This relationship is consistent even when taking into account demographic characteristics.

Positive relations to others – Internet use is positively associated with positive relations to others, and social integration (specifically visits with friends and involvement with clubs/organizations) acts only as a partial mediator. However, the relationship between Internet use and positive relations to others disappears when demographic characteristics are accounted for.

Purpose in life – Internet use is positively related with purpose in life, and this relationship is partially mediated by social integration (specifically visits with friends and involvement with clubs and organizations). This association persists even when taking demographic characteristics into account.

Self-acceptance – Internet use is positively associated with self-acceptance, and social integration (specifically visits with friends and involvement with clubs/organizations) acts only as a partial mediator. However, the relationship between Internet use and self-acceptance disappears when demographic characteristics are accounted for.

Overall psychological well-being – A positive relationship exists between Internet use and overall psychological well-being, and this relationship is only partially mediated by social integration (specifically visits with friends and involvement with clubs/organizations). This relationship is consistent even when controlling for demographic characteristics.

Speaking in general terms, the results of the analytic procedures provided support for the conceptual model outlined in the literature review and the three mediation hypotheses proposed. Thus, it would appear that there exists a significant relationship between ICT use and mental health, and that social integration acts as a partial mediator.

Table 14. Predictors of Psychological Well-Being: Summary of Results

	Psychological Well-Being Outcomes[†]						
Measure	AUTO	EM	PG	PRTO	PIL	SA	PWB
Female	-		+	+	+	+	+
More than HS education			+	-	+	-	
Perceived SES	+	+	+	+	+	+	+
Excellent/good health	+	+	+	+	+	+	+
Married	-	-		+	+	+	
Employed			+	+	+		+
Internet use	+	+	+		+		+
Visits with friends	+	+	+	+	+	+	+
Involvement with clubs/ organizations			+	+	+	+	+

Positive sign (+) denotes positive relationship significant at the $p<.05$ level
Negative sign (-) denotes negative relationship significant at the $p<.05$ level
[†]Outcome abbreviations: AUTO (autonomy), EM (environmental mastery), PG (personal growth), PRTO (positive relations to others), PIL (purpose in life), SA (self-acceptance), and PWB (overall psychological well-being)

Table 14 contains a summary list of all significant relationships for all variables, both positive and negative, found in the final models for each individual well-being outcome. While general support was found for the notion that ICT use positively affects mental well-being, it should be noted that Internet use was not found to be a significant predictor of certain individual measures of psychological well-being (positive relations to others and self-acceptance) when demographic characteristics were taken into account. In fact, in reviewing the full (i.e., final) models for all individual measures of psychological well-being, only three variables were found to have a persistent significant relationship across all psychological well-being dimensions: perceived SES, self-rated health, and visits with friends. Particularly, the coefficients derived for perceived SES and self-rated health tended to be some of the largest in magnitude across the models. These results suggest that, in addition to Internet use and social integration, SES and self-rated health may be strong predictors of mental health in older adults.

In addition to the unstandardized coefficients derived from the OLS regressions, Tables 7-13 also contain adjusted R^2 values for each model to help evaluate model fit (i.e., to evaluate how well *all* variables contained in the model can predict the outcome). These values estimate the proportion of variability in the data that is accounted for by the variables included in the model; higher values indicate that the model as a whole is a stronger predictor of the outcome measure. In reviewing the R^2 values for each measure of psychological well-being, we can see that the predictor variables (including the mediators and demographic characteristics) predict some measures better than others. Model fit was best for the overall psychological well-being measure, where the final model accounted for approximately 22.0% of the total variance. The model fit was

weakest for the measure of autonomy, wherein the final model accounted only for 6.6% of the variance. For the other individual dimensions of psychological well being, the R^2 values ranged between 17.3%-18.3% of variance explained. These values suggest that while the variables included in the models may be strong predictors of the outcomes, there are other measures not accounted for in the analyses that may have strong relationships with psychological well-being. The possibility of other factors influencing well-being is discussed later in this chapter.

Discussion

Previous research conducted investigating the potential effects of ICT use on mental health outcomes has been inconsistent with regards to the direction of the significant relationships found; while some research has found evidence to suggest that ICTs positively benefit individuals (Cotten et al. 2012; Shaw and Gant 2002; Valkenburg and Peter 2007), others have found a negative association between ICT use and mental status (Huang 2010; Kraut et al. 1998; Prezza, Pacilli, and Dinelli 2004). However, with regards to older populations, there is a general consensus among empirical research supporting the notion that ICTs have a positive effect on mental health (Chen and Persson 2002; Cotten et al. 2012; Stark-Wroblewski et al. 2007; Sum et al. 2008; White et al. 1999; White et al. 2002; Xie 2007). The research presented in this investigation supports previous findings and suggests that ICT use has the potential to positively benefit older adults with regards to such mental outcomes as feelings of autonomy, environmental mastery, personal growth, purpose in life, and overall psychological well-being. The findings also suggest that ICTs may positively benefit older adults with regards to

positive relations to others and self-acceptance, although these relationships were deemed insignificant when demographic measures were accounted for.

While there has been a relatively consistent finding regarding the positive influence ICTs may have on older adults, there is the possibility that factors of social life may have an effect on the relationship between ICT use and mental status. The author proposed that, with regards to the relationship between ICT use and mental health in older adults, social integration may act as a mediator because previous research has shown that ICT use can have an effect on social relationships (for example, see Ellison, Steinfield, and Lampe 2007) and that social ties can have an effect on health outcomes, including mental status (Barger et al. 2009; Berkman et al 2000; Seeman 1996). The results of the analyses support this notion and provide evidence to suggest an association between ICT use, social integration, and mental health in older adults. It appears that being online gives older adults a new technological tool that can be utilized to communicate and socialize with new contacts as well as maintain previously established social ties, and the results of being able to create new social relationships and maintain old bonds positively affects mental status. That is, being connected allows older adults to strengthen social bonds which, in turn, strengthen psychological well-being. Yet while the results from the OLS regression analyses provide evidence to support this idea, social integration was found to only partially mediate the relationship between ICT use and mental status, suggesting that ICTs may do more than just positively affect an older adult's social ties. That is, there may be a psychological benefit of ICTs for older adults beyond building and strengthening social bonds.

Implications

With the finding that ICTs may positively affect the mental health of older adults in the US, the question arises: what are the implications of these results? That is, how can the knowledge garnered from this sociological inquiry best be applied in a real-world setting? As previously stated, the proportion of older adults who are purchasing and using ICTs in the US is increasing (see Fox et al. 2001; Zickuhr 2010, 2011). However, there are still a significant number of older adults who do not go online for various reasons, including a lack of Internet access or a lack of knowledge on how to use the technology. This inequality in access and ability to use ICTs is often referred to as the "digital divide" and may have serious consequences in a world where technological advancement is rapid. If a significant proportion of older adults continue to lack access to or knowledge of how to utilize ICTs, or if this proportion grows, these individuals will be unable to garner the social and psychological benefits associated with their use. As friends and family members purchase and use new smartphones and computers and continue to rely on evolving virtual social networks, those who are unable to use ICTs may suffer from decreased social integration as a result of not being able to participate in these networks; this may, in turn, prove detrimental to mental health.

As such, it seems imperative that applied gerontologists and sociologists develop strategies to decrease the digital divide among older adults so that individuals may enhance their social networks and benefit from an improved psychological state. An example may be to implement community-level ICT training programs specifically designed for older adults that cater to the online activities that may best promote social integration, such as email use. Another possibility is to develop initiatives whose

purpose is to provide free or reduced-cost ICT access to individuals who are located in retirement communities. By taking an active role in decreasing the digital divide, older adults may more fully benefit from ICT use with regards to social life and mental health. In turn, these positive influences on mental health may lessen the financial burden of organizations and institutions that fund programs and treatments that focus on mental well-being in older adults.

Limitations and Future Research

While this investigation supports previous research while making a significant contribution to the discussion on ICT use and mental health in older adults, the study is not without its share of limitations. A central limitation associated with this study involves the use of cross-sectional data. While cross-sectional analysis may provide evidence towards potential associations between variables, it can not definitively prove causation; causation can only be inferred from cross-sectional analysis based on theory. While the WLS dataset consists of longitudinal data, certain variables used in the investigation were measured only at a single time point, and thus a longitudinal analysis was not possible.

A second limitation is that the WLS sample, while providing the means to conduct a cross-sectional investigation with a large group of older adults, is not representative of the general US older adult population. An article published within the past few years on CNN.com made the claim that Wisconsin, more than any other state in the US, could serve as a microcosm of American life due to the state's closeness to US averages on 12 measures including race, income, and housing (Preston 2006). However, as mentioned

previously in the methodology chapter, there is an incredibly low number of minority respondents in the WLS, and individuals with less than a high school education were not included in the original WLS sample. Thus, the findings of this investigation can not be generalized to minority older adults and older adults who never completed high school. As such, the results of this study are most applicable to white non-Hispanic Americans with at least a high school degree.

A third limitation associated with this study is the age of the data being used. This investigation used responses gathered from WLS participants in a mail-in survey in 2004, making the data approximately 8 years old. While this may not be a drastically old dataset by normal means, it is possible that the findings from this investigation may be outdated due to the rapid development of technology over the past several years. To put it in perspective, this survey was conducted long before smartphones became a staple of communication in the US. It is possible that the relationship between ICT use and mental health in older adults has changed within the past few years as the technology has evolved, and it is thus imperative to continually conduct research on the effects of ICTs.

A final limitation is that the analyses could not adequately take into account the motivations study participants had in utilizing the Internet. It is possible that those who use the Internet primarily as a communication tool will be characteristically different from those who use the Internet primarily for recreation. Unfortunately, data regarding motivations to use the Internet are limited in the 2004 graduate sample of the WLS and thus this measure could not be adequately incorporated into the analyses.

As previously stated, it is important to continually conduct research on the effects of ICTs due to the rapid evolution of ICTs in the modern world. Future research should

investigate the effects of specific ICT applications and devices on the well-being of older adults, as it may be that certain ICTs are more likely to be used to promote social integration compared to others. Future research should also attempt to determine other mediating factors in the relationship between ICT use and mental health, as it is possible that there are variables not included in this investigation's models that can affect the association. Finally, from an applied perspective, it may be advantageous to conduct research on successful strategies and interventions that may lessen the digital divide and allow a larger proportion of older adults to enjoy the potential benefits of ICT use.

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