The Impact of Age and Internet Use on Depression

By

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Abstract

      Internet use is a prominent part of most adults' lives. It is used for purposes of entertainment, staying informed, shopping, and staying socially engaged. Researchers are becoming increasingly aware of the impact internet use has on users' mental health. There is research supporting both the benefits of internet use on reducing depression and the negative impact internet use has on depression.   Using the 2016 wave of the GSS dataset this study examined the impact of age and internet use on depression. Using OLS regression and bivariate analyses this study found that older adults reported lower levels of depression than younger adults and used the internet far less frequently as well. However, within the older adult population, those who used the internet frequently were more depressed than other older adults who did not use the internet frequently.

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INTRODUCTION

On Janurary 30th, 2020, the World Health Organization's Director General declared the

coronavirus (COVID-19) outbreak a public health emergency of national concern (WHO 2020).

To respond to this outbreak, health and public service professionals set social distancing orders

in place to help reduce the spread of the virus and to ease the demand on hospitals and other

medical services. While these social distancing orders play an important role in reducing the

spread of the virus, they may also have negative consequences, namely social isolation and

depression (Hwang, Rabheru, and Peisah et al 2020). The effects of social distancing may be

even more pronounced in the elderly. Loneliness in the elderly is already a major public health

concern and given their vulnerability to the virus it is especially important they follow social

distancing practices (Patel and Clark-Ginsberg 2020; Liu, Chen, and Lin et al 2020; Garg 2020).

To compensate for reduced face to face social interaction amidst the COVID-19

pandemic it is expected that internet use will rise (Jovic, Pantovic-Stefanovic, and Mitkovic-

Voncina et al 2020). The internet can provide many resources during this time of restrictions,

such as online shopping, health care information, entertainment, and social media use to stay in

contact with friends and family. While these may help reduce the negative effects of social

distancing, there are conflicting views on the impact internet use has on users' mental health. On

one side, internet use may be an important tool in combatting depression. It is especially

convenient for individuals with disabilities and limited mobility and can be used in the comforts

of their own home at any time of the day or night (Blit-Cohen and Litwin 2004). This allows the

internet to provide social engagement where little or none may otherwise be possible, which

could make it an especially useful tool for combatting depression. Becoming computer literate is also associated with increased self-esteem, especially in elder users, and can help combat role loss in elders leaving the workforce (Lai, Leung, Kwok et al 2020).

However, studies also find that internet use may not be the most effective tool against combatting loneliness and may have drawbacks regarding users' wellbeing. The more time spent online can take away from time and effort spent maintaining face to face relationships, which are typically more meaningful than online relationships (Kraut, Patterson, and Lundmark et al 1998). While the impact of social media is associated with poorer mental health in teenagers and young adults, there is limited research on the impact it has on elders' mental health. (Woods and Scott 2016; Hunt, Marx, Lipson et al 2018; Coyne, Rogers, and Zurcher et al 2020). While elders' advanced years and developed maturity may make them less susceptible to the negative influence of social media, more research needs to be conducted to understand the effects of social media on the elderly population.

LITERATURE REVIEW

Internet Use and Depression

There is much debate as to the effects of internet use on users' rates of depression, with literature supporting both the positive and negative effects (Nie and Hillygus 2002). From one perspective, researchers ask what other activities are being replaced by internet use, such as activities that could have a more impactful benefit on an users' mental health. From the other perspective, researchers ask if internet use can help, or engage on its own, social interaction that otherwise would not have happened, leading to a richer social life with greater levels of social support which therefore reduces depression.

Benefits of Internet Use

Due to the minimal physical movement required for its use, the internet can be a great resource for entertainment, information, and social interaction for those who have disabilities limiting their ability to pursue those things elsewhere (Blit-Cohen and Litwin 2004). Also, internet use is not constrained by time and space the same way face to face interaction is. A user may engage in internet use, such as games, media entertainment, and chatting with others, at any time of the day or night (Blit-Cohen and Litwin 2004). Staying in contact and communicating with family and friends is one of the most positively mentioned aspects of internet use, especially in older generations (Gatto, and Tak 2008). Internet use can help maintain those close relationships and reduce the strain that appears within long-distance relationships, allowing families to maintain still meaningful interaction with each other despite there being a considerable geographic gap between members (Climo 2001).   Online communities can also give the opportunity to give and receive support when going through difficult times, as noted by Vilhauer (2009) in her study of the psychosocial effects of online support groups in women with breast cancer. Given the higher rates of disabilities and transportation and mobility constraints in the elderly, use of the internet may provide opportunities for social engagement where there may otherwise be little to none (Mellor, Firth, and Moore 2008).

Drawbacks of Internet Use

According to Fokkema and Knipscheer (2007), it is not necessarily the lack of quantity of relationships that proves problematic but the lack of quality of relationships, for experiences of

loneliness appear when people notice that their current relationships do not feel adequately meaningful. This can be especially true for elderly individuals. Elderly individuals do not typically require as much social stimulation as younger people, and the elderly tend to pick their social groups with more discretion, choosing more familiar and reliable relationships with others (Adams, Sanders, and Auth 2004). This can result in a strong yet narrow social group, which can make members difficult to replace. Utilizing the internet to make strong connections can be problematic given that online relationships may not be as meaningful as face-to-face relationships (Kraut, Patterson, and Lundmark et al 1998). The ability to connect with people around the world from the comforts of one's own home can be great for increasing the number of relationships, but they may be more trivial than relationships with those from the nearby community.

A large part of the internet's ability to increase social connections lies in social media. Most research on the effects of social media on mental health has focused on youth and young adults. Most of the studies shows that the impact social media has is generally a negative one (Coyne, Rogers, and Zurcher et al 2020). It is associated with narcissistic behavior, low self-esteem, and body image issues (Richards, Caldwell, and Go 2015). As children and young adults attach more meaning to their social media statuses, their self-esteem becomes more dependent on the responses of others. More effort is spent trying to portray themselves in an ideal and unrealistic light and in comparing themselves to others who are also portraying themselves in an unrealistic way. A low sense of self-esteem and investing too much of one's emotional energy into social media and online relationships can serve as barriers against managing a healthy social life with quality face to face relationships. More research needs to be done on social media's effects on the elderly. Due to their heightened maturity compared to that

of children and young adults, their self-esteem may be less likely to be impacted by the responses of others. But while they may be less susceptible to the negative consequences of social media and internet use, there may still be risk involved.

As noted by Putnum (2000) in his influential article, *Bowling Alone,* social capital is on the decline, largely due to a reduction in social and civic engagement. As he stated, church membership, labor unions, PTA (parent teacher association), fraternal and civic organizations such as Boy Scouts and Women's Club, and bowling leagues, have all seen a decrease in participants. He also found, using the GSS, that Americans spend less time with neighbors and are overall less trusting. While he posited several hypotheses as to why this could be the case, such as more women entering the workforce, his re-potting hypothesis, which states that Americans are relocating more, reducing the "roots" placed in communities, and higher divorce rates and fewer children, perhaps his most remembered theory is how the technological trends of the time disrupted opportunities for social capital. Putnam states that, "There is reason to believe that deep-seated technological trends are radically 'privatizing' or 'individualizing' our use of leisure time and thus disrupting many opportunities for social-capital formation." (Putnam 2000:9). When elaborating on this "technological trend," his emphasis is on television, with television drastically impacting the way Americans spend their days and nights. Television, he states, allows individuals to satisfy their entertainment preferences more effectively, but at the cost of "positive social externalities associated with more primitive forms of entertainment" (Putnam 2000:9).

Putnam's theories of television's impact on social capital can be applied to even more modern technologies, particularly the use of internet. Seniors' internet use is steadily on the rise. Just 14% of seniors regularly used the internet in 2000, whereas 67% of seniors aged 65 and

older regularly used the internet in 2016 (PEW 2017). While the benefits of internet use and the interconnectedness it can bring may be true, those benefits may come at a cost, such as fewer relationships that take place face to face, which studies have found are likely to be stronger than relationships that take place solely online (Kraut, Patterson, and Lundmark et al 1998).

Age and depression

Age is a complex variable when discussing its association with depression (Riley 1987). When conceptualizing age as an element of maturity, people continue to develop and mature throughout the lifespan. They become more experienced, develop useful skillsets, and gain social and psychological insights that may amalgamate into general proficiency in life (Mirowsky andRoss 1992). The progression into middle age is often associated with more stable careers, marriage, and higher incomes, all of which are associated with reduced rates of depression (Essex and Nam 1987; Gove and Geerken 1977; Gove, Hughes, and Style 1983). However, each stage in life has its own associative attributes that build upon previous life stages and that can lead to depression. As noted by Mirowsky and Ross (1992), the 18th year is generally thought of as the first year of adult hood. It is commonly associated with drastic life changes and big decisions, such as graduating, pursuing more education, navigating the job market, and serious relationships, which can lead to anxiety and depression. Transitioning into middle age is associated with more stability and decreased depression rates, after which depression rates subsequently rise (Mirowsky and Ross 1992).

Depression in the Elderly

There are many risk factors for depression the elderly face. When looking at the psychosocial risk factors for depression, social support is an important component to discuss.

Social support is generally defined as a reliable group of people that one can go to in order to feel cared for, valued, and loved (Liu, Gou, and Zuo 2016). A lack of social support is associated with feelings of depression (Gariépy, Honkaniemi, and Quesnel-Vallée 2016.) Loneliness, an attribute of depression, can arise when one's social needs are not met by their social network, whether due to a lack of quality relationships, quantity of relationships, or both (West, Kellner and Moore-West 1986). As stated earlier, the elderly tend to choose their social networks with more discretion than younger age groups, having smaller social networks consisting of more familiar and reliable members (Adams, Sanders, and Auth 2004). Due to the higher rates of loss in the elderly, this can make maintaining an adequate social network difficult, and can lead to less than adequate social support. Also, due to potential age-related cognitive reduction, losses can be especially problematic for the elderly, especially when that loved one is a spouse (Hansson and Stroebe 2007.) Smaller social networks and high rates of loss can leave elders struggling to maintain adequate levels of social support, which can exacerbate other risk factors for depression they face.

Some specific factors associated with depression in the elderly include not having children, as well as having children but having minimal contact with them (Buber and Engelhardt 2008). Also, those who are widowed, divorced, or were never married report higher rates of depression (Tiedt 2013). This may be from mourning a recent loss, difficulty adjusting after a separation, or a lack of social support from not having an intimate partner. Living alone is also a strong predictor of depression in the elderly, with those living alone being especially vulnerable to experiencing social isolation (Tong, Lai, and Zeng et al 2011.) While social isolation is a distinct state from loneliness and is not inseparably tied to loneliness or depression, they are positively correlated and social isolation is associated with poorer health outcomes in

the elderly (Tomaka, Thompson, and Palacios 2006.) There are many other personal factors that may make interacting with others more difficult (Mott and Riggs 1992). For instance, many elders live on a limited income, which can cause expenses for purposes of entertainment and socializing to take lower priority. Also, as couples age, one may have to assume caretaking responsibilities for their spouse or live-in partner. This can put a strain on time and emotional reserves of the caretaker.

Poor health is a strong predictor of depression, with a two-way relationship existing between depression and coexisting medical conditions. Illnesses have the potential to predispose sufferers to depression, and depression is associated with poorer results from those suffering from chronic conditions, as well as higher mortality rates (Jiang, Alexander, and Christopher et al 2001). Functional ability is conceptualized as the ability of individuals to accomplish activities and duties done day to day, and reduced functional ability is associated with advanced ages (Avlund, Kreiner, and Schultz-Larson 1996). Nearly 50% of older persons currently live with a disability (Un.org 2019). Disabilities further reduce one's functional abilities, resulting in a reduction in an individual's ability to complete Activities of Daily Living (ADLs). This can reduce their ability to fill their day with activities meaningful to them, and can lead to discouragement, increased effort for previously simple tasks, a reliance upon others, and reduced opportunities to engage socially with others (Tollén, Fredriksson, and Kamwendo 2008).

While physical health may be excellent, the loss of mental faculties can also result in depression. One explanation is that depression may be a reaction to the loss of mental faculties, where the individual can become depressed in the early stages of the disease, perhaps even before a diagnosis (Geerlings, Bouter, and Schoevers et al 2000). This stance views depression as a result of a neurodegenerative disease, stemming from the individual's perception of their

slipping cognitive abilities. There is also evidence of a strong two-way relationship between depression and neurodegenerative diseases in the elderly, especially that of Alzheimer's, where those suffering from depression are at a higher risk of developing Alzheimer's (Geerlings, Bouter, and Schoevers et al 2000).

Another component to neurological and cognitive decline that can cause depression is the difficulty they can cause in staying socially engaged (Singh and Misra 2009). As memory begins to slip and conversations become harder to keep up with, motivation to stay socially engaged may diminish. As one loses the ability to get around, motivation to make efforts to see others can falter, and may also be dangerous to do so. Also, falls, surgical procedures, and long recovery periods are all more common in the elderly and can impact their ability and willingness to socialize. They can make it more difficult for elderly persons, both emotionally and physically, to engage in their surroundings and interact with others. As elders' retreat from socializing, their social network can falter and leave them with unsatisfactory social support leading to depression. Staying engaged with others is an important part of later life (Solomon and Peterson 1994), to the point that some researchers find the social environment in aged care facilities are as important as biological or genetic factors in someone's aging experience, with social engagement even being an accreditation standard in aged care facilities (Brownie and Horstmanshof 2011). There are many sources that can contribute to the loss of mental faculties besides neurological diseases. For example, fogginess from medication, reduced alertness, and slight confusion can all make an elderly individual feel less inclined to engage with others.

Hypotheses

The literature generally finds that depression levels are highest among adolescents and young adults and decrease into middle age, remaining lower until increasing again in very late life (Mirowsky and Ross 1992; Essex and Nam 1987; Gove and Geerken 1977; Gove, Hughes, and Style 1983). Thus, it is hypothesized that older individuals (those 65+) will have lower depression levels than younger individuals. It is also hypothesized that internet use will impact depression levels, though given the disagreement among scholars about the nature of its effect, no specific direction is stated. Finally, literature suggests that any negative effects of internet use on depression will be lower and its positive benefits greater among the elderly (Blit-Cohen and Litwin 2004; Orsolya 2013). Thus, the third and final hypothesis is that frequent internet use will result in lower levels of depression among older individuals (those 65+) than among younger individuals. Each of these hypotheses will be investigated controlling for a variety of demographic and personal characteristics.

METHODOLOGY

The data for this study came from the 2016 General Social Survey, conducted by the National Opinion Research Center at the University of Chicago (n=2867). The survey was conducted face-to-face, and when face-to-face surveys could not be scheduled, by telephone. The respondents were randomly selected and included various racial, sexual, age-related, and geographical demographics, which produced a representative sample of people living in the U.S. The survey data produced a margin of error of +/- 3 with a 95% confidence interval.

The Dependent Variable

A condensed five-item version of the CES-D (Center for Epidemiological Studies Depression) index was the dependent variable for this study. It was formed from the 20 item CES-D index. The original 20 item scale was a self-reported Lickert-type questionnaire created to measure depressive symptoms in its respondents and is one of the most prominent and reliable measures of depressive symptoms in adult populations (Radloff 1977; Andresen, Malmgren, and Carter et al 1993). The condensed 5 item index asked respondents how much time in the past week they (1) Felt depressed, (2) Had restless sleep, (3) Felt happy, (4) Felt lonely, (5) Felt sad. The response options were (1) None or almost none of the time, (2) Some of the time, (3) Most of the time, (4) All or almost all of the time. The question asking if the respondent felt happy was reverse coded. The five items showed high inter-item correlation, producing an alpha coefficient of .76 (Feigelman, Cerel, McIntosh et al 2018). There are many reasons to justify the use of a shortened version of the 20-item scale, such as reduced participant response burden, reduced response time, and higher response rate, especially in handicapped or ill participants (Carpenter, Andrykowski, and Wilson et al 1998). Scores on the condensed five item CESD-scale ranged from five through twenty and had a mean of 8.6.

Independent Variable

The respondents' age and internet use were the primary independent variables in this study. Age was originally a continuous variable measured using the survey question that asked about the respondent's age. The response options ranged between 18 and 88, with those 89 or older combined. For this study I recoded the continuous age variable into a dichotomous variable labeled as 65+. Respondents 64 years and younger were coded as zero while those 65 and over were coded as one. Internet use was measured using the variable that asked

respondents if they used internet or web-enabled applications, for purposes other than email, more than occasionally. The recoded variable was labeled as frequent internet use, and the response options were recoded to (0) no, and (1) yes.

Control Variables

Sex was measured using the variable, *Sex*, which asked whether the respondent is male or female. For this study, the response options were recoded to (0) Female, and (1) Male, and the variable was relabeled *Male*, as the variable measured the effect of being male upon depression. Race was measured by asking the respondents' about their race, with response options of (1) White, (2) Black, and (3) other. The variable was recoded into a dichotomous dummy variable and labeled as Non-white, with response options of (0) White, and (1) Nonwhite. Respondent's perception of their physical health was measured using the variable *Health,* which asked respondents' if their health, in general, was (1) Excellent, (2) Good, (3) Fair, or (4) Poor. The variable was recoded into a dichotomous dummy variable labeled Perceived Health with responses of Excellent or Good being recoded as (0) Good and responses of Fair or Poor being recoded as (1) not good. Education was measured by asking the respondent what their highest year of school completed was. It was a continuous variable with answer options ranging between 0 and 20 and was relabeled as Highest Year of School Completed. Respondents were asked about the number of persons living in their household, with response options ranging from 1 through 16. The variable was recoded into a dichotomous dummy variable labeled as Lives Alone with those who do not live along coded 0 and those who do coded 1. Employment was measured by the question, "Do you currently work for pay?" The response options were recoded into a dichotomous dummy variable labeled as Currently Unemployed and coded as one if the respondent was employed and zero if not. To measure the size of the town the respondents lived

in the variable SRCBELT was used, which had six answer options ranging between the 12

largest cities in the United States, and a rural location. The response options were recoded into

(0) Not Rural, and (1) Rural, and relabeled as Lives in Rural Area. Marriage was measured

using a variable which asked respondents how they would describe their marriage. The response

options were (1) Very happy, (2) Pretty happy, (3) Not too happy, and Not Applicable. The

response options were recoded into a dichotomous dummy variable labeled as Married with any

of the three responses representing those who are married (coded as one) and those labeled as

inapplicable representing those who are not married (coded zero). Income was measured using

the variable asking respondents to report their income for the previous year. The income

variable was recoded into a dichotomous dummy variable with those making over $50,000 coded

one for high income and those making less than $50,000 coded zero for low income.

FINDINGS

Characteristics of the Sample

The characteristics of the variables used in this study can be seen in Table 1. The

dependent variable, CES-D index, had scores that ranged between 5 and 20 with a mean of 8.6

(S.D=2.72). The average age of the sample was 49.16 (S.D=17.693) and ranged from 18 through

89, with those 89 or older categorized together. Just under 80% (78.1) of the sample fell

between the ages of 18 and 64, while 21.9% were aged 65 or older. A majority (70.7%) of the

sample used internet frequently, with 29.3% reporting they did not use the internet frequently.

The sample had slightly less men than women, with men making up 44.5% of the sample. Most

(73.2%) of the respondents were white, 17.1% were black, and the rest were categorized as other.

A majority (70.9%) of the sample reported that self-perception of their physical health was good.

Most (70.4%) lived with someone else, while 42.1% reported being married, and only 10.9%

lived in a rural area. The sample was evenly split regarding income, where 49.6% of

respondents made less than 50,000 dollars in the previous year and the rest (50.4%) made 50,000

or more, and 36.5% reported being unemployed at the time of the survey. The mean highest year

of school completed was 13.74 (S.D=2.968) and ranged from zero through 20.

Bivariate Correlations

Table 2. shows results of the bivariate correlations between the CES-D index and each

independent and control variable. Looking at the table, the correlation coefficient of -.081 for

males ($p<.05$) showed that being male has a weak and negative relationship with depression,

indicating that men scored lower on CES-D index than women. Age had a significant

relationship with depression when looking at the dichotomous variable 65+, with those 65 and

older being less depressed than those 64 and younger (R=-.102; $p<.01$). Frequent internet use

had a negative relationship with depression, producing a correlation coefficient of -.091 ($p<.01$)

More education reduced depression (R=-.126; $p<.001$), and perception of one's health as poor

had a moderately strong and positive relationship with depression (R=.336; $p<.001$). Living

alone had a weak and positive relationship with depression, which produced a correlation

coefficient of .109 ($p<.01$). Those who were married were less depressed than those not married

(R=-.188; $p<.001$), as were those who earned an income of 50,000 or more (R=-.239; $p<.001$).

Race, unemployment, and living in a rural area did not have a significant bivariate relationship

with depression.

T-tests between CES-D Index, Age, and Internet Use

An independent samples T-test was conducted to examine the difference in mean scores

on the CES-D index in those 64 and younger and 65 and older. As seen in Table 3, the mean

CES-D scores were 8.73 (S.D = 2.77) for those 64 and younger and 8.04 (S.D = 2.58) for those

65 and older, a difference of .69. Separate variances were assumed due to the different group

sizes, (759 participants 64 and younger and 202 participants 65 and older) and the analysis of

variance test indicated a significant difference in the variance of the groups (F = 4.390, *p*<.036).

The test produced a t-value of 3.313 (*p*<.05), which indicated that there was a significant

difference in mean scores on the CES-D index between those 64 and younger and those 65 and

older. These findings support the first hypothesis that older individuals have lower depression

levels than younger individuals.

Table 4. shows the results of another independent samples T-test examining the

difference in means on the CES-D index by internet use. Those who used internet frequently had

a mean of 8.42 (S.D = 2.52) and those who did not had a mean of 8.97 (S.D = 3.19), a difference

of .55. Again, due to the difference in group sizes, (280 who did not use the internet frequently

and 680 who did use the internet frequently), equal variables could not be assumed. The analysis

of variance test indicated the variance between the groups was significant (F = 13.689, *p*<.001).

The T-test indicated a significant difference in mean CES-D scores between those who use the

internet frequently and those who do not use the internet frequently (t = 2.570, *p*<.005). These

findings suggest that frequent internet use can decrease depression.

Chi-Square Test Distributing Internet Use by Age

As can be seen in Table 5, the distribution of internet use by age showed that frequent

internet use was much more common in those 64 and under compared to those 65 and older, with

77.3% of those 64 and under having reported frequent use. Infrequent use of the internet was

much more prevalent in the older population with slightly over half (55.2%) of the respondents

65 and older having reported not using internet frequently (Chi-Square =159.812, df = 1,

p<.001). Gamma was calculated to further clarify the strength and direction of the association between the variables. Gamma indicated a moderate and negative association between the variables (Gamma=-.615, *p*<.001), suggesting that as age increased, internet use decreased.

Regression of CES-D Index, Age, and Internet Use

To examine the linear effects of the two independent variables, age and internet use, upon scores on the CES-D index, an OLS regression was used. Looking at Table 6, we see that being 65 and older had a negative effect on depression, with those 65 or older scoring .877 (*p*<.000) units lower on the CES-D index than those who were 64 and younger, again supporting the first hypothesis. Internet use also had a significant and negative relationship with CES-D scores, with frequent internet use reducing CES-D scores by .735 (*p*<.000), reaffirming the results of the t-test above. The model explained 2.4% of variation in respondents' scores on the CES-D index and produced a F value of 11.995 (*p*<.000), which indicated that age and internet use did indeed influence scores on the CES-D index and were significant when controlling for each other.

Regression Between CES-D Index, Independent, and Control Variables

To test the first two hypotheses, which are older individuals (those 65+) will have lower levels of depression than younger individuals, and internet use will impact depression levels, ordinary least squares regression was used. The analysis examined the effects of sex (Male), race (Non-white), age (65+), education (Highest Year of School Completed), health (Perceived Poor Health), living alone (Lives Alone), employment (Currently Unemployed), location (Lives in Rural Area), marriage (Being Married), income (High Income), and internet use (Frequent Internet Use) upon scores on the CES-D index. Looking at model A in Table 7, being male, 65 and older, perceiving your health as poor, being unemployed, and earning a high income were all

significantly associated with depression scores at the .05 level. When controlling for the other variables, males' scores on the CES-D index were .397 points lower than females ($p<.05$). Those 65 and older had scores that were 1.209 points lower than those 64 and younger ($p<.001$). Perception of one's health as poor increased scores by 1.695 ($p<.001$). Being unemployed increased scores by .530 points ($p<.01$) and earning an income above 50,000 dollars decreased scores by .134 points ($p<.05$). When controlling for all other variables, race, education, living alone, living in a rural area, marriage, and frequent internet use did not have a significant association with depression scores. Given the results of the regression showed a negative relationship between age and depression, or older individuals (65+) had lower depression levels than younger individuals, I found support for the first hypothesis. Also, while the two independent variables, age and internet use, had significant effects when controlling for each other, internet use was no longer significant when controlling for the other variables, not supporting the second hypothesis. The model explained about 18.1% of the variance in respondents' scores on the CES-D index and produced a F value of 17.272 ($p<.001$).

Model B in Table 7 examined the same variables as model A, with the inclusion of an interaction term between age and internet use. Being male, 65 and older, perceiving ones' health as poor, being unemployed, earning a high income, and the age and internet use interaction term were all significantly associated with depression scores at the .05 level. Males scored .402 points lower than females ($p<.05$). Those 65 or older were less depressed, producing scores 1.843 points lower than those 64 or younger ($p<.001$). Those who perceived their health as poor had scores that were 1.697 points lower than those who did not perceive their health as poor ($p<.001$). Those who were unemployed scored .528 points lower than those employed ($p<.01$), while earning an income of 50,000 dollars or more decreased scores by .543 ($p<.01$). The

significance of the age interaction term (B=1.06, *p*<.05) indicated that the effect of internet use on depression scores between those 64 and younger and those 65 and older were different. More specifically, high internet use increased CES-D scores in those 65+, but slightly decreased CES-D index scores in those 64 and younger. As can be seen in Table 8, among the older group, high internet use increased predicted CES-D scores from 6.947 to 7.585, while among the younger age group high use decreased predicted CES-D scores from 8.79 to 8.368. The former difference was statistically significant. The latter was not.   Thus in Model B, the effect of age on depression was significant as was hypothesized, but the effect of internet use was only significant for the those 65+ for whom high internet use is associated with increased depression. The model explained 18.7% of variation in the respondents' scores on the CES-D index and produced a F value of 16.419 (*p*<.001).

DISCUSSION

After reviewing previous literature, three hypotheses were formed, older individuals (those 65+) will have lower depression levels than younger individuals, frequent internet use will impact depression levels, and frequent internet use will result in lower levels of depression among older individuals (those 65+) than among younger individuals. The findings from both bivariate and multivariate analyses found that older individuals scored lower on the CES-D scale than younger individuals and that internet use was not a statistically significant predictor of depression when controlling for other variables, not supporting the first two hypotheses. However, when an OLS regression examining only the effects of internet use and age on CES-D scores was conducted, internet use was significant and associated with lower CES-D scores. This suggests that the other variables, combined, minimize the individual effect of internet use on depression and collectively play a larger role in the respondents' depression levels. The lower

levels of depression found in the elderly in the OLS regression reaffirmed the t-test between CES-D scores and age.

With the inclusion of an age and internet use interaction term, the analyses did not support the third hypothesis that frequent internet use will result in lower levels of depression among older individuals than among younger individuals. This implies that older individuals, the group who reported lower levels of depression, were more affected by internet use than the more depressed group, younger individuals. When looking at the distribution of internet use by age, those 64 and younger had a much smaller percentage of infrequent internet use compared to those who were 65 and older, who were split relatively evenly (55% not using internet frequently, 45% using internet frequently). A more in depth look into the differences between each age group in frequency of internet use may be helpful in further explanations of the result of the interaction term. Given the conflicting literature on the internet's effect on depression, one side that sees internet use as a helpful tool to combat depression, and the other that sees it as a catalyst towards depression, more research needs to be conducted investigating the effects of internet use by different age groups. This proposes that internet use may not be an adequate source for social engagement for elders. As elders begin facing physical and cognitive difficulties in maintaining meaningful face to face relationships, other adaptations may need to be explored to keep them socially engaged instead of relying on online relationships. However, this could be due to many reasons. This study does not inquire about how the respondents in the survey used the internet, how much time they spent on the internet, or their skills in internet use. Training in internet use could help them use it more effectively which could reduce the positive relationship between internet use and depression scores.

Using ordinary least squares regression, this study found other variables that had a significant effect on CES-D scores. In congruence with previous research, men were less depressed than women (Albert 2015). Employment and income were significantly associated with depression scores, with those who were unemployed and those who earned less than $50,000 a year scoring higher on the CES-D scale than those who were employed and earned an income of $50,000 or more, which aligns with previous literature (Essex and Nam 1987; Gove and Geerken 1977; Gove Hughes, and Style 1983). Income on its own has less of an influence on depression than previously thought, however, unemployment and financial strain are much more closely associated with depression and having a higher income would seemingly put one in a position to experience reduced financial strain (Zimmerman and Katon. 2005) Those who perceived their physical health as poor scored higher on the CES-D scale than those who did not. This was expected given the positive association between depression and physical health and disabilities (Jiang, Alexander, and Christopher et al 2001).

Both models produced significant F-ratios and explained nearly 20% (18.1% for model A and 18.7% for model B) of the variation in CES-D scores in the respondents, leaving just over 80% of the variation in CES-D scores to variables not included in the analyses. Future research should attempt to identify those variables not accounted for.

Limitations

Given this study used a secondary data set, I did not have control over the crafting of questions. This posed a few issues in finding acceptable control variables that had to be worked around. For example, participants who were asked the questions for the CES-D index, this studies dependent variable, were not asked about their marital status. However, they were asked to describe their marriage. To account for this, and to be able to include marriage in the

regression analysis, those who described how their marriage was were recoded as married, and those labeled as inapplicable were recoded as not married. While this still gave a representative view of those who were and were not married, the results may have been different than if a more conventional measurement of marriage was used.

Another limitation of this study is that of the independent variable, internet use. The question only asked if the respondent used the internet more than occasionally. Internet use, especially as it pertains to feelings of depression, is a complex variable. How the participant used the internet, who they engaged with, how long each session lasted, and how comfortable they were with using the internet are all important questions that could help provide a more in-depth view of the relationship between internet use and depression. Adding questions about specific internet use could provide more insight into the findings. Also, given the age variable was dichotomized to represent those under 65 and those 65 and older, it provided a limited view of internet use across different ages. There could be a big difference between how someone in their 20s uses the internet compared to someone in their 50s, and the same could be said for someone in their late 60s compared to someone in their late 80s. This limitation is even more apparent given the significance of the age and internet use interaction term, which indicated that internet use increased older individuals' CES-D scores. However, given the limited information provided by the variable measuring internet use, this study allotted to focus on broad overviews into depression, internet use, and age.

Given the complex relationship between depression and internet use, a quantitative study may have difficulty in capturing the subtle differences in use and feelings of respondents. For future research, a qualitative component, whether through open ended survey questions, or through interviews, may be helpful to capture the in-depth usage of internet amongst

participants, and their feelings about the impact of said internet usage. Also, this study could not produce any findings on the effects of internet use on youth because the GSS does not collect data on those under 18.

CONCLUSION

To date, there is conflicting literature on the impact of internet use on depression. This study sought to help close the gap in literature and to provide insight into the effects of internet use on depression, and the role that various demographic and personal characteristics play as well. Using a data set representative of adults living in the United States, this study found that individuals 65 and older had lower levels of depression than younger individuals aged 64 and younger and used the internet far less frequently than their younger counterparts. However, those older individuals who did use the internet more frequently were more depressed. Some of the personal characteristics this study found associated with increased levels of depression were being unemployed, earning a low income, and perceiving one's physical health as poor. Future research should look further into the different ways internet is used by different age groups to better understand the effect of internet use upon depression.

REFERENCES

Adams, K, S. Sanders, and E.A. Auth. 2004. "Loneliness and Depression in Independent Living Retirement Communities: Risk and Resilience Factors." *Aging & Mental Health* 8:475–85. doi:10.1080/13607860410001725054.

Albert, Paul R. 2015. "Why Is Depression More Prevalent in Women?" *Journal of Psychiatry & Neuroscience : JPN* 40(4):219–21. doi:10.1503/jpn.150205.

Andresen, E. M., Judith Malmgren, W. B. Carter, and D. L. Patrick. 1993. "Screening for Depression in Well Older Adults: Evaluation of a Short Form of the CES-D (Center for Epidemiologic Studies Depression Scale." *American Journal of Preventive Medicine* 10:77–84.

Avlund, Kirsten, Svend Kreiner, and Kirsten Schultz-Larson. 1996. "Functional ability scales for the elderly". *Eur J Public Health* 6(3):35-42.

Blit-Cohen, Edith, and Howard Litwin. 2004. "Elder Participation in Cyberspace: A Qualitative Analysis of Israeli Retirees." *Journal of Aging Studies* 18(4):385–98. doi:10.1016/j.jaging.2004.06.007.

Brownie, Sonya, and Louise Horstmanshof. 2011. "The management of loneliness in aged care residents: an important therapeutic target for gerontological nursing." *Geriatric Nursing* 32(5):318-325.

Buber, Isabella, and Henriette Engelhardt. 2008. "Children's Impact on the Mental Health of Their Older Mothers and Fathers: Findings from the Survey of Health, Ageing and Retirement in Europe." *European Journal of Ageing* 5(1):31–45. doi:10.1007/s10433-008-0074-8.

Carpenter, Janet, Michael Andrykowski, John Wilson, Lynne Hall, Mary Rayens, Barbara Sachs, and

L. Cunningham. 1998. "Psychometrics for Two Short Forms of the Center for Epidemiologic

Studies-Depression Scale." *Issues in Mental Health Nursing* 19:481–94.

doi:10.1080/016128498248917.

Climo, Jacob. 2001. "Images of Aging in Virtual Reality: The Internet and the Community of Affect."

Generations 25(3):64–68.

Coyne, Sarah M., Adam A. Rogers, Jessica D. Zurcher, Laura Stockdale, and McCall Booth. 2020.

"Does Time Spent Using Social Media Impact Mental Health?: An Eight Year Longitudinal

Study." *Computers in Human Behavior* 104:106160. doi:10.1016/j.chb.2019.106160.

Essex, Marilyn J., and Sunghee Nam. 1987. "Marital Status and Loneliness among Older Women:

The Differential Importance of Close Family and Friends." *Journal of Marriage and Family*

49(1):93–106. doi:10.2307/352674.

Feigelman, William, Julie Cerel, John L. McIntosh, David Brent, and Nina Gutin. 2018. "Suicide

Exposures and Bereavement among American Adults: Evidence from the 2016 General Social

Survey." *Journal of Affective Disorders* 227:1–6. doi:10.1016/j.jad.2017.09.056.

Fokkema, Tineke., and Kees Knipscheer. 2007. "Escape loneliness by going digital: A quantitative

and qualitative evaluation of a Dutch experiment in using ECT to overcome loneliness among

older adults." *Aging & Mental Health* 11(5):496-504

Garg, Shikha. 2020. "Hospitalization Rates and Characteristics of Patients Hospitalized with

Laboratory-Confirmed Coronavirus Disease 2019 — COVID-NET, 14 States, March 1–30,

2020." *MMWR. Morbidity and Mortality Weekly Report* 69(15):458-464.

doi:10.15585/mmwr.mm6915e3.

Gariépy, Geneviève, Helena Honkaniemi, and Amélie Quesnel-Vallée. 2016. "Social Support and

Protection from Depression: Systematic Review of Current Findings in Western Countries."

British Journal of Psychiatry 209(4):284–93. doi:10.1192/bjp.bp.115.169094.

Gatto, Susan L., and Sunghee H. Tak. 2008. "Computer, Internet, and E-Mail Use Among Older

Adults: Benefits and Barriers." *Educational Gerontology* 34(9):800–811.

doi:10.1080/03601270802243697.

Geerlings, M. I., L. M. Bouter, R. A. Schoevers, A. T. F. Beekman, C. Jonker, D. J. H. Deeg, W. Van

Tilburg, H. J. Adèr, and B. Schmand. 2000. "Depression and Risk of Cognitive Decline and

Alzheimer's Disease: Results of Two Prospective Community-Based Studies in the

Netherlands." *British Journal of Psychiatry* 176(6):568–75. doi:10.1192/bjp.176.6.568.

Gove, Walter R., and Michael R. Geerken. 1977. "The Effect of Children and Employment on the

Mental Health of Married Men and Women." *Social Forces* 56(1):66–76. doi:10.2307/2577413.

Gove, Walter R., Michael Hughes, and Carolyn Briggs Style. 1983. "Does Marriage Have Positive

Effects on the Psychological Well-Being of the Individual?" *Journal of Health and Social

Behavior* 24(2):122–31. doi:10.2307/2136639.

Hansson, Robert O., and Margaret S. Stroebe. 2007. *Bereavement in Late Life: Coping, Adaptation,

and Developmental Influences*. Washington, DC, US: American Psychological Association.

Hunt, Melissa G., Rachel Marx, Courtney Lipson, and Jordyn Young. 2018. "No More FOMO:

Limiting Social Media Decreases Loneliness and Depression." *Journal of Social and Clinical

Psychology* 37(10):751–68. doi:10.1521/jscp.2018.37.10.751.

Hwang, Tzung-Jeng, Kiran Rabheru, Carmelle Peisah, William Reichman, and Manabu Ikeda. 2020.

"Loneliness and Social Isolation during the COVID-19 Pandemic." *International*

Psychogeriatrics 32(10):1217–20. doi:10.1017/S1041610220000988.

Jiang, Wei, Jude Alexander, Eric Christopher, Maragatha Kuchibhatla, Laura H. Gaulden, Michael S.

Cuffe, Michael A. Blazing, Charles Davenport, Robert M. Califf, Ranga R. Krishnan, and

Christopher M. O'Connor. 2001. "Relationship of Depression to Increased Risk of Mortality and

Rehospitalization in Patients with Congestive Heart Failure." *Archives of Internal Medicine*

161(15):1849. doi:10.1001/archinte.161.15.1849.

Jovic, Jelena, Maja Pantovic-Stefanovic, Marija Mitkovic-Voncina, Bojana Dunjic-Kostic, Goran

Mihajlovic, Srdjan Milovanovic, Maja Ivkovic, Andrea Fiorillo, and Milan Latas. 2020. "Internet

Use during Coronavirus Disease of 2019 Pandemic: Psychiatric History and Sociodemographics

as Predictors." *Indian Journal of Psychiatry* 62(Suppl 3): S383–90.

doi:10.4103/psychiatry.IndianJPsychiatry_1036_20.

Kraut, Robert, Michael Patterson, Vicki Lundmark, Sara Kiesler, Tridas Mukophadhyay, and William

Scherlis. 1998. "Internet paradox: A social technology that reduces social involvement and

psychological well-being?" *American psychologist* 53(9):1017.

Lai, Gabriel Chun-Hei, Alvin Chung-Man Leung, Ron Chi-Wai Kwok, Yanyan Li, Tina Rochelle,

Shanshan Zhang, George Yui-Lam Wong, and Angel Lu. 2020 "The Moderating Effect of

Different Types of Internet Use on the Relationship between Transitional Aging Changes and

Self-Esteem of Older Adults." *In Proceedings of the 53rd Hawaii International Conference on*

System Sciences.

Lelkes, Orsolya. 2013. "Happier and Less Isolated: Internet Use in Old Age." *Journal of Poverty and Social Justice* 21(1):33–46. doi:10.1332/175982713X664047.

Liu, Kai., Ying Chen, Ruzheng Lin, and Kunyuan Han. 2020. "Clinical Features of COVID-19 in Elderly Patients: A Comparison with Young and Middle-Aged Patients" *Journal of Infection* 80(6):e14-e18.

Liu, Lijun., Gou, Zhenggang., & Zuo, Junnan. 2016. "Social support mediates loneliness and depression in elderly people". *Journal of health psychology* 21(5): 750-758.

Mellor, David, Lucy Firth, and Kathleen Moore. 2008. "Can the Internet Improve the Well-Being of the Elderly?" *Ageing International* 32(1):25–42. doi:10.1007/s12126-008-9006-3.

Mirowsky, John, and Catherine E. Ross. 1992. "Age and Depression." *Journal of Health and Social Behavior* 33(3):187–205. doi:10.2307/2137349.

Mott, S., and A. Riggs. 1992. "Older People: The Effect of Health on Their Social Interactions." *Australian Journal on Ageing* 11(4):19–26. doi:https://doi.org/10.1111/j.1741-6612.1992.tb00565.x.

Nie, N. H., and D. Sunshine Hillygus. 2002. "The Impact of Internet Use on Sociability: Time-Diary Findings." *IT&Society* 1(1):1-20.

Patel, Sonny S., and Aaron Clark-Ginsberg. 2020. "Incorporating Issues of Elderly Loneliness into the Coronavirus Disease–2019 Public Health Response." *Disaster Medicine and Public Health Preparedness* 14(3):e13–14. doi: 10.1017/dmp.2020.145.

Pew Research Center: Internet, Science & Tech. 2020. *Technology Use Among Seniors*. [online] Available at: <https://www.pewresearch.org/internet/2017/05/17/technology-use-among-

seniors/#:~:text=As%20is%20true%20of%20the,older%20say%20they%20go%20online.>
[Accessed 13 November 2020].

Radloff, Lenore Sawyer. 1977. "The CES-D Scale: A Self-Report Depression Scale for Research in
the General Population." *Applied Psychological Measurement* 1(3):385–401.
doi:10.1177/014662167700100306.

Richards, Deborah, Patrina HY Caldwell, and Henry Go. 2015. "Impact of Social Media on the
Health of Children and Young People: Social Media and the Health of Young People." *Journal
of Paediatrics and Child Health* 51(12):1152–57. doi:10.1111/jpc.13023.

Riley, Matilda White. 1987. "On the Significance of Age in Sociology." *American Sociological
Review* 52(1):1-14.

Singh, Archana, and Nishi Misra. 2009. "Loneliness, Depression and Sociability in Old Age."
Industrial Psychiatry Journal 18(1):51–55. doi:10.4103/0972-6748.57861.

Solomon, R. and M. Peterson. 1994. "Successful Aging: How to Help Your Patients Cope with
Change." *Geriatrics (Basel, Switzerland)* 49(4):41–47.

Tiedt, Andrew D. 2013. "Cross-National Comparisons of Gender Differences in Late-Life Depressive
Symptoms in Japan and the United States." *The Journals of Gerontology: Series B* 68(3):443–54.
doi:10.1093/geronb/gbt013.

Tollén, Anita, Carin Fredriksson, and Kitty Kamwendo. 2008. "Elderly Persons with Disabilities in
Sweden: Their Experiences of Everyday Life." *Occupational Therapy International* 15(3):133–
49. doi:https://doi.org/10.1002/oti.254.

Tomaka, Joe, Sharon Thompson, and Rebecca Palacios. 2006. "The Relation of Social Isolation, Loneliness, and Social Support to Disease Outcomes Among the Elderly." *Journal of Aging and Health* 18(3):359–84. doi:10.1177/0898264305280993.

Tong, Hong, Daniel Lai, Qun Zeng, and Wen Xu. 2011. "Effects of Social Exclusion on Depressive Symptoms: Elderly Chinese Living Alone in Shanghai, China." *Journal of Cross-Cultural Gerontology* 26:349–64. doi:10.1007/s10823-011-9150-1.

Un.org. 2019. *Ageing and disability | United Nations Enable*. [online] Available at: https://www.un.org/development/desa/disabilities/disability-and-ageing.html [Accessed 12 Dec. 2019].

Vilhauer, Ruvanee P. 2009. "Perceived Benefits of Online Support Groups for Women with Metastatic Breast Cancer." *Women & Health* 49(5):381–404. doi:10.1080/03630240903238719.

West, Donald A., Robert Kellner, and Maggi Moore-West. 1986. "The Effects of Loneliness: A Review of the Literature." *Comprehensive Psychiatry* 27(4):351–63. doi:10.1016/0010-440X(86)90011-8.

Who.int. 2020. "Mental Health Of Older Adults." [online] Available at: <https://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults> [Accessed 5 November 2020].

Woods, Heather Cleland, and Holly Scott. 2016. "#Sleepyteens: Social Media Use in Adolescence Is Associated with Poor Sleep Quality, Anxiety, Depression and Low Self-Esteem." *Journal of Adolescence* 51:41–49. doi:10.1016/j.adolescence.2016.05.008.

Zimmerman, Frederick J., and Wayne Katon. 2005. "Socioeconomic Status, Depression Disparities, and Financial Strain: What Lies behind the Income-Depression Relationship?" *Health Economics* 14(12):1197–1215. doi:https://doi.org/10.1002/hec.1011.

Appendices

Appendix A-Tables

Table 1: Descriptive Statistics and Frequencies for the Dependent and Independent Variables.

Male	Female	Male			Total
	N (% Valid)	N (%Valid)			100%
	1591(55.5)	1276(44.5)			2867
Non-White	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	2100(73.2)	767(26.8)			2867
65+	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	2240(78.1)	627(21.9)			2867
Perceived Health	Good	Not Good			Total
	N (% Valid)	N (% Valid)			100%
	1337(70.9)	548(29.1)			1885
Lives Alone	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	2017(70.4)	850(29.6)			2867
Currently Unemployed	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	936(63.5)	537(36.5)			1473
Lives in Rural Area	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	2555(89.1)	312(10.9)			2867
Married	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	1654(57.9)	1204(42.1)			2858
High Income	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	1288(49.6)	1308(50.4)			2596
Frequent Internet Use	No	Yes			Total
	N (% Valid)	N (% Valid)			100%
	570(29.3)	1376(70.7)			1946
	Mean	**Std. Dev.**	**Min**	**Max**	**N**
Highest Year of School	13.74	2.968	0	20	2858
CESD Index	8.5827	2.74159	5	20	961

Table 2: Bivariate Correlations Between CESD Index and Independent Variables.

Variables	CESD Index
Male	-.081*
Non-White	.058
65+	-.102**
Highest Year of School Completed	-.126***
Perceived Poor Health	.336***
Lives Alone	.109**
Currently Unemployed	.138***
Lives in Rural Area	.012
Married	-.188***
High Income	-.239***
Frequent Internet Use	-.091**

*$P<.05$,**$P<.01$,***$P<.001$

Table 3: T Test Between CESD Score and Age

	64 and Younger	65 and Older	Difference in Means	T Value
Mean CESD Index Score	8.7273	8.0396	.68767	3.313*

*$P<.05$

Table 4: T Test Between CESD Score and Internet Use

	Uses Internet Frequently	**Does Not Use Internet Frequently**	**Difference in Means**	**T Value**
Mean CESD Index Score	8.4191	8.9679	.54874	2.570*

*P<.05

Table 5:   Distribution of Internet Use by Age

	64 and under		65 and up		Total	
	Number	Percent	Number	Percent	Number	Percent
Not frequent internet use	353	22.7%	217	55.2%	570	29.3
Frequent internet use	1,200	77.3%	176	44.8%	1376	70.7
Total	1153	100	393	100	1946	100

Chi-Square=159.812,P<.05;gamma=-.615

Table 6: Linear Effects of Age and Internet Use on Depression

Variable	Regression Coefficient (S.E.)
Constant	9.284***
	(.180)
65+	-.877***
	(.221)
Frequent Internet Use	-.735***
	(.198)
P<.001, N=959	R square=.024

Table 7: Regression Models of the Effects of Age and Internet Use on Depression With Control Variables and Interaction Term.

Variable	Beta (S.E) Model A	Model B
Constant	8.602	8.791
	(.449)	(.454)
Male	-.397*	-.402*
	(.170)	(.170)
Non-white	.039	.030
	(.199)	(.199)
65+	-1.209***	-1.843***
	(.237)	(.352)
Highest Year of School	.008	.012
	(.030)	(.0330)
Perceived Poor Health	1.695***	1.697***
	(.197)	(.196)
Lives Alone	.302	.294
	(.223)	(.223)
Currently Unemployed	.530**	.528**
	(.200)	(.200)
Lives in Rural Area	.035	.015
	(.281)	(.280)
Married	-.405	-.402
	(.218)	(.218)
High Income	-.515*	-.543**
	(.206)	(.206)
Frequent Internet Use	-.134	-.422
	(.208)	(.239)
Age x Internet Use Interaction	___	1.060*
		(.435)
	N=869	N=869
R square	.181	.187

*P<.0, **P<.01. ***P<.001

Table 8. Combined Effects of Age (65+) and High Internet Use on CES-D Scale with Controls Set to Zero

Age Group	Internet Use	Constant	Effect of Being 65+	Effect of High Internet use	Effect of Being 65+ and High Internet Use	Total Effects
65+	High	8.79	-1.843	-0.422	1.06	7.585
65+	Low	8.79	-1.843			6.947
<65	High	8.79		-0.422		8.368
<65	Low	8.79				8.79

Appendix B – Institutional Review board Approval

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129
FWA: 00005331/IRB Regn.. 0003571

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Tuesday, March 09, 2021

Protocol Title ***The Impact of Age and Internet Use in Depression***
Protocol ID **21-1132 4**

Principal Investigator **Boman Hamilton** (Student)
Faculty Advisor Brandon Wallace
Co-Investigators Meredith Dye and Ugur Orak
Investigator Email(s) *bmh6y@mtmail.mtsu.edu; brandon.wallace@mtsu.edu*
Department/Affiliation Sociology

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category ***(4) Study involving existing data*** *(Analysis of data from public records).* A summary of the IRB action and other particulars of this protocol are shown below:

IRB Action	**EXEMPT from further IRB Review** Exempt from further continuing review but other oversight requirements apply		
Date of Expiration	3/31/2022	*Date of Approval:* **3/9/21**	*Recent Amendment:* NONE
Sample Size	THREE THOUSAND records collected from adult individuals		
Participant Pool	**Data collected from adult invididuals (public records)**		
Exceptions	Non-research purpose data are allowed		
Type of Interaction	Non-interventional or Data Analysis Virtual/Remote/Online Interview/survey In person or physical– Mandatory COVID-19		

	Management (refer next page)		
Mandatory Restrictions	**1. All restrictions for exemption apply. 2. The participants must be 18 years or older. 3. NOT approved for new data collection.**		
Approved IRB Templates	*IRB Templates:* NONE *Non-MTSU Templates:* NONE		
Research Inducement	NONE		
Comments	NONE		

IRBN007 *(Ver: 2.0; Rev: 08/14/2020)* FWA: 00005331 IRB Registration. 0003571
Institutional Review Board, MTSU FWA: 00005331 IRB Registration. 0003571

Summary of the Post-approval Requirements: The PI and FA must read and abide by the post-approval conditions (Refer "*Quick Links*" in the bottom):

◻◻***Final Report:*** The Faculty Advisor (FA) is responsible for submitting a final report to close-out this protocol before 3/31/2022; if more time is needed to complete the data collection, the FA must request an extension by email. REMINDERS WILL NOT BE SENT. **Failure to close-out (or request extension) may result in penalties** including cancellation of the data collected using this protocol or witholding student diploma.

◻◻***Protocol Amendments***: IRB approval must be obtained for all types of amendments, such as: o Addition/removal of subject population and sample size.
o Change in investigators.
o Changes to the research sites – appropriate permission letter(s) from may be needed. o Alternation to funding.
o Amendments must be clearly described in an addendum request form submitted by the FA. o The proposed change must be consistent with the approved protocol and they must comply with exemption requirements.

◻◻***Reporting Adverse Events:*** Research-related injuries to the participants and other events , such as, deviations & misconduct, must be reported within 48 hours of such events to compliance@mtsu.edu.

◻◻***Research Participant Compensation:*** Compensation for research participation must be awarded as proposed in Chapter 6 of the Exempt protocol. The documentation of the monetary compensation must Appendix J and MUST NOT include protocol details when reporting to the MTSU Business Office. ◻◻***COVID-19:*** Regardless whether this study poses a threat to the participants or not, refer to the COVID-19 Management section for important information for the FA.

COVID-19 Management:
The FA must enforce social distancing guidelines and other practices to avoid viral exposure to the participants and other workers when physical contact with the subjects is made during the study.

◻◻The study must be stopped if a participant or an investigator should test positive for COVID-19 within 14 days of the research interaction. This must be reported to the IRB as an "adverse event."

◻◻The FA must enforce the MTSU's "Return-to-work" questionnaire found in Pipeline must be filled and signed by the investigators on the day of the research interaction prior to physical contact.

◻◻PPE must be worn if the participant would be within 6 feet from the each other or with an investigator.

◻◻Physical surfaces that will come in contact with the participants must be sanitized between use ◻◻**FA's Responsibility:** The FA is given the administrative authority to make emergency changes to protect the wellbeing of the participants and student researchers during the COVID-19 pandemic. However, the FA must notify the IRB after such changes have been made. The IRB will audit the changes at a later date and the PI will be instructed to carryout remedial measures if needed.

Post-approval Protocol Amendments:
The current MTSU IRB policies allow the investigators to implement minor and significant amendments that would

not result in the cancellation of the protocol's eligibility for exemption. ***Only THREE procedural amendments will be entertained per year*** *(changes like addition/removal of research personnel are not restricted by this rule).*

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

Post-approval IRB Actions:

The following actions are done subsequent to the approval of this protocol on request by the PI or on recommendation by the IRB or by both.

Date	IRB Action(s)	IRB Comments
NONE	NONE.	NONE

Mandatory Data Storage Requirement:

All research-related records (signed consent forms, investigator training and etc.) must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data must be stored for at least three (3) years after the study is closed. Additionally, the Tennessee

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State data retention requirement may apply (*refer "Quick Links" below for policy 129*). Subsequently, the   data may be destroyed in a manner that maintains confidentiality and anonymity of the research subjects. **The IRB reserves the right to modify/update the approval criteria or change/cancel the terms listed in this notice**. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

Post-approval Responsibilities:
http://www.mtsu.edu/irb/FAQ/PostApprovalResponsibilities.php Exemption Procedures:
https://mtsu.edu/irb/ExemptPaperWork.php
MTSU Policy 129: Records retention & Disposal: https://www.mtsu.edu/policies/general/129.php