The Importance of Type, Amount, and Timing of Internet Use for Understanding Psychological Distress*

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Objective. Few social scientists have examined how Internet usage, including using the Internet for health purposes, may affect mental health. This study assesses whether the type or amount of online health activities and the timing of Internet use are associated with psychological distress. *Methods.* We use data from the National Cancer Institute's 2005 Health Information National Trends Survey. *Results.* When we compare Internet users to non-Internet users, using the Internet and using the Internet for health purposes are negatively associated with distress. However, among Internet users, the number of online health activities is positively associated with distress. Greater distress is also associated with using the Internet on weekdays and looking online for information on sun protection. *Conclusions.* Internet usage is not necessarily positively associated with psychological distress. The effects depend on the type, amount, and timing of Internet usage.

Introduction and Literature Review

People increasingly use the Internet for health purposes; recent studies indicate that 61 percent of adults in the United States and three-quarters of Internet users have looked for online health information (Fox and Jones, 2009). Unfortunately, few social scientists have examined how this usage may be related to mental health. Given the National Institute of Mental Health's (2007) estimate that 26 percent of adults in the United States

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experience mental health problems and the growing importance of the Internet for society (DiMaggio et al., 2001), a better understanding of the relationship between Internet usage and mental health outcomes is needed. Although a seminal early study suggested that Internet usage was detrimental to mental health (Kraut et al., 1998), other studies have produced positive, conflicting, or negligible results (Dickinson and Gregor, 2006; Ford and Ford, 2009; Boase et al., 2006; Fogel et al., 2002, 2003; Quan-Haase et al., 2002), or find that negative effects are short-lived (Kraut et al., 2002).

Unfortunately, many researchers do not examine Internet usage in detail. To understand the social impacts of Internet usage, particularly in relation to mental health, researchers must examine not only general Internet usage, but also more specifically the types, amount, and timing of usage. Using existing data from the National Cancer Institute's Health Information National Trends Survey (HINTS), we examine whether the types, amount, and timing of Internet use, including for 10 different types of health purposes, is associated with psychological distress. To understand differences in types of users, particularly online health users, we compare this group to non-Internet users and Internet users who do not engage in online health activities. Our research advances prior work by examining how type, amount, and timing of Internet activities affect psychological distress among these three groups.

Types of Online Health Activities

There is a wide range of online health activities. First, Internet users can search for health information, and it is estimated that 40–80 percent[1] engage in this type of activity (Drentea et al., 2008; Fox, 2006; Cole, 2008; Fox and Jones, 2009). Individuals are most likely to research medical problems, including particular diseases (64 percent), medications (60 percent), health promotion (e.g., disease prevention (53 percent), diet and vitamins (49 percent), fitness (44 percent)), and mental health issues (19–22 percent) (Fox, 2006; Brodie and Flournoy, 2000; Dickerson et al., 2004). Fox and Jones (2009) report that over half those searching for online health information are searching on behalf of other people. Second, Internet users can purchase medical products online, such as prescription drugs, but few individuals currently use the Internet for this purpose (Fox, 2004; Fox and Rainie, 2000). Third, individuals can use the Internet to communicate with health-care providers, members of social networks, and lay people about health issues (Cotten, 2001; Drentea and Moren-Cross, 2005). Studies show

[1]Internet usage estimates, particularly those for specific types of online activities, vary considerably, as studying Internet usage is much like studying a ''moving target'' (DiMaggio et al., 2001) depending on specific sampling procedures, measures utilized, and the timing and length of data collection.

that 9–24 percent have communicated with physicians online (Cole, 2008; Fox and Rainie, 2000), and 15 percent have participated in an online community, including support groups (Cole, 2008).

Though recent reports (Fox and Jones, 2009) examine a wide range of online health activities, the studies are mainly descriptive and are not linked with health outcomes in general or mental health outcomes more specifically. Explanatory studies linking types of online activities to mental health typically examine a much smaller range of online health activities (e.g., Drentea et al., 2008; Andersson et al., 2005; Takahashi et al., 2009; Houston and Allison, 2002; Baker and Moore, 2008) and/or specialized samples (e.g., cancer patients (Fogel et al., 2002), depressed individuals (Houston and Allison, 2002; Andersson et al., 2005)), with conflicting results as to whether online health activities are beneficial or detrimental for mental health.

For example, Fogel et al. (2002) found no association between depression levels and online health information searching among women with breast cancer. Others find that online health searching negatively impacts mental health. Drentea et al. (2008) found that visiting health websites was associated with more days of poor mental health, yet also higher self-esteem. Similarly, Bessière et al. (2008), examining respondents six months apart, found that depression levels increase or decrease depending on how the respondents used the Internet and what their level of social support was at the first survey. The lack of agreement is not surprising given the different types of online activities, samples being examined, and the range of contextual factors that may impact these processes.

We also see mixed results regarding online support groups. Some studies find they decreased depression levels in women with breast cancer (Lieberman et al., 2003; Winzelberg et al., 2003), while another study found that online cancer support group participation led to higher depression levels than those in a face-to-face cancer support group (Klemm and Hardie, 2002). Though face-to-face interaction may be better, online support may be better than no support, especially when support networks of individuals sharing rare ailments are few and far between or when there is great geographical distance between individuals with the same ailment (Cotten, 2001).

It is unclear whether Internet use leads to psychological distress (causation) or if those with psychological distress are more likely to use the Internet (selection). Supporting the social selection argument, Shapira et al. (2000) studied 20 subjects who experienced problematic Internet use and found that all 20 had been diagnosed at some point with a psychiatric condition. In addition, Berger, Wagner, and Baker (2005) found that people with a psychiatric stigmatized illness (i.e., anxiety and depression) were more likely than those with a nonstigmatized illness to search for health information online, communicate with a physician online, and seek more healthcare services after their Internet use.

Our research advances the field by incorporating a wider range of types of health-related Internet usage than have prior studies, linking these types to

psychological distress, and examining these relationships within a national sample of U.S. adults.

Amount of Internet Usage

Amount of Internet usage has been examined in greater detail than either type or timing of use; however, the results for the relationship between amount of usage and mental health also vary depending on measures and samples being used. A few studies show that a higher amount of Internet usage is associated with worse mental health such as increased loneliness, stress, and depressive symptoms (Morgan and Cotten, 2003; Moody, 2001; Kraut et al., 1998). Yet, the majority of research finds a positive impact of usage amount on mental health (Drentea et al., 2008; Cotten and Jelenewicz, 2005; Rohall, Cotten, and Morgan, 2002). General Internet usage allows individuals to establish or continue relationships; thus it can decrease feelings of isolation and depression, and enhance well-being (Cotten, 2001; Drentea and Moren-Cross, 2005; Morgan and Cotten, 2003; Miyata, 2002; Ko and Kuo, 2009). However, greater use may be associated with mental health problems (Drentea et al., 2008). Drentea et al. (2008) found that searching for health information online six or more times in the past year was associated with lower self-esteem and more days of poor mental health. This suggests that researchers must incorporate not just types of online activities, but also the amount of online activities, particularly when examining mental health outcomes.

Timing of Internet Usage

Though researchers have not examined this issue in detail, the timing of Internet usage is also critical when thinking about potential impacts on mental health. Early work in this area by Nie, Hillygus, and Erbring (2002) found that the timing of Internet use was important for determining the social impacts of Internet use, with Internet use during the weekends associated with decreased time spent with social network members. They suggested that time online displaced face-to-face interaction, and was primarily an asocial activity. A later follow-up report by Nie et al. (2005) found that increases over the course of a year in time spent online at (1) work and (2) home were both associated with decreased active time spent with families and friends. Nie et al. (2005) also found that about a third of the time that individuals spend on the Internet was spent at work. Liff et al. (2004) note that due to role conflicts and time demands, females may be less likely to have home Internet access. This suggests that females may have to rely on other venues for their Internet access, such as work.

Time online during the weekday for non-work-related activities may have a detrimental effect on well-being as it may impede work responsibilities (Eastin,

Glynn, and Griffiths, 2007; Dabbish and Kraut, 2006) or result in boundary-spanning demands related to work-family balance (Schieman and Young, 2008). There is increasing evidence that suggests that the use of information and communication technologies (ICTs) is associated with greater blurring of boundaries between work and family life (Chesley, 2005, 2006; Wajcman, Bittman, and Brown, 2008). Employees may be required or choose to check email and text messages at night and on the weekend; conversely, they may often respond to family queries during the workday. We would expect Internet use during the weekday for personal reasons to be associated with higher levels of psychological distress as it may interfere with work demands.

How Type, Amount, and Timing are Linked with Mental Health

As the prior sections have shown, type, amount, and timing of Internet use may all be important in relation to mental health outcomes. Theoretically, there are several interrelated ways through which type, amount, and timing of Internet use may impact mental health. First, information seeking can help individuals acquire resources, which can enable them to make life decisions. Seventy-four percent of adults use the Internet (Pew Internet & American Life Project, 2010) and close to half report that the Internet has played an important role in making important life decisions (Boase et al., 2006). Access to information is easily available online and usually has low access costs, thus yielding more knowledge on which to base decisions, which may potentially impact well-being (Boase et al., 2006; Cotten, 2001; Horrigan and Rainie, 2002). Second, purchasing health products online may impact the consumer's mental health. Online pharmacies may be particularly useful for individuals who (1) have geographical or mobility constraints, (2) have stigmatized illnesses, or (3) want to purchase "lifestyle drugs" (e.g., sexual dysfunction, hair loss) (Gandhi and Nguyen-Khoa, 2000; Eysenbach, 1999). Finally, building on the idea of social capital, which "refers to connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000:19), Internet use allows individuals to increase contact with their social networks and connect with experts for information and support (Boase et al., 2006; Cotten, 2001; Drentea and Moren-Cross, 2005). Online interactions fill communication gaps between face-to-face and phone interactions (Boase et al., 2006; Quan-Haase et al., 2002) and enhance social capital by facilitating communication with both strong and weak social ties, across geographic distances and time (Boase et al., 2006). It also allows for more frequent contact with social network ties, which results in ties being more easily mobilized when needed for help (Quan-Haase et al., 2002), thereby potentially enhancing mental health. However, as noted in the prior section, use of ICTs may also result in boundary-spanning demands and the blurring of boundaries, such that increased contact with social ties may not enhance well-being.

Conflicting findings on the association between type, amount, and timing of Internet usage and mental health may be due to methodological issues, such as varying samples and measures, but we also need more specific data on these dimensions. Researchers typically do not assess the types of online health information that individuals may seek, or the amount of time people spend on specific types of Internet activities (e.g., Drentea and Moren-Cross, 2005; Cotten and Gupta, 2004). If researchers do examine the amount of time spent in specific activities, they often do not include online health information searching (e.g., Morgan and Cotten, 2003; Cotten and Jelenewicz, 2005; Nie, Hillygus, and Erbring, 2002), or link specific types of Internet usage to mental health (e.g., Boase et al., 2006; Drentea et al., 2008; Goldner, 2006a, 2006b). It is also likely that different types, amount, and timing of Internet use may have differing effects on mental health in different situations. For example, higher levels of personal use during the workday may lead to higher levels of distress, while higher levels during the weekend may not have the same effect. We build on this literature and attempt to address some of these shortcomings by examining how types, amount, and timing of Internet use may be associated with psychological distress in a national sample of U.S. adults. The findings from this study should yield more detailed understandings of whether and how specific types of online activities and amount and timing of Internet use correlate with psychological distress.

Methods

We conduct a secondary data analysis using data from the National Cancer Institute's (NCI) 2005 Health Information National Trends Survey (HINTS) ($N = 5{,}586$). Incorporated into this study are questions about how people use a variety of communication channels, including the Internet and 10 types of online health activities. These questions are not specific to individuals seeking cancer-related information and were asked of all participants. Random-digit dialing was used in combination with a list of known working telephone numbers to draw a nationally representative sample of households, with random selection of one adult from each household. Further details of the sampling methodology and the survey instrument are available online at the NCI HINTS website (http://hints.cancer.gov/). The response rate for the initial contact was 34.0 percent, and of those recruited, 61.3 percent completed the extended interview, yielding an overall response rate of 20.8 percent (Cantor et al., 2005).[2] The average interview lasted approximately 30 minutes and participants were offered monetary incentives to complete the survey.

[2]With communication technologies such as caller ID and call blocking, the difficulty of reaching respondents by phone has dramatically increased (Curtin, Presser, and Singer, 2000; Howard, Rainie, and Jones, 2001). Despite the trends of decreasing response rates, studies have not found a strong relationship between response rate and nonresponse bias in RDD surveys (Curtin, Presser, and Singer, 2000; Keeter et al., 2006).

We deleted cases when missing data were less than 5 percent on our dependent, sociodemographic, and Internet usage variables. The percentage of missing data was higher for household income (19.6 percent) and a regression method was used to impute missing data. The final sample size was reduced to $N = 5{,}053$. All inferential analyses use the sampling and jackknife replicate weights recommended in the HINTS documentation to adjust for the complex sample design and participant nonresponse (see Cantor et al., 2005).

Measures

Dependent Variable. Psychological distress is our mental health outcome, and is assessed using the K6 scale (Kessler et al., 2002). The K6 consists of six questions that measure how frequently respondents experienced symptoms of nonspecific psychological distress. Respondents were asked how often during the past 30 days have they felt: (1) sad, (2) nervous, (3) restless or fidgety, (4) hopeless, (5) everything was an effort, and (6) worthless. Responses are coded: 0 = none of the time to 4 = all of the time. Scores range from 0 to 24, with higher levels representing a greater frequency of symptoms and greater psychological distress (Cronbach's alpha = 0.813). Previous research finds the K6 significantly outperforms the General Health Questionnaire (GHQ-12) in screening for DSM-IV anxiety and mood disorders (Furukawa et al., 2003), and reliably identifies both one-month and 12-month prevalence rates of depression in the general population (Cairney et al., 2007).

Independent Variables. Key independent variables include a series of variables measuring whether individuals use the Internet and, if so, the type and amount of online health activities carried out during the past 12 months, and the timing of their Internet use. First, to distinguish between Internet users and nonusers we use the variable: "Do you ever go on-line to use the Internet, World Wide Web, or send/receive e-mail?" coded 1 = yes (Internet user) and 0 = no (nonuser).

Type of Online Health Activity. Type of online health activity is measured using 10 items assessing whether respondents have done these activities in the past 12 months: (1) looked for health or medical information for yourself, (2) looked for health or medical information for someone else, (3) bought medicine or vitamins online, (4) participated in an online support group for people with a similar health or medical issue, (5) used email or the Internet to communicate with a doctor or a doctor's office, (6) looked for information about physical activity or exercise, (7) looked for information about diet or nutrition, (8) looked for information about sun protection, (9) looked for information about quitting smoking, and (10) done anything else

health related on the Internet. Responses are coded 1 = yes and 0 = no to indicate if participants have engaged in the activity.

Amount of Online Health Activity. To measure the amount of online health activities, we created an index of the total number of the 10 types of online health activities used during the past 12 months.[3] To demonstrate more clearly the relationship between different levels of online health activity and distress, we used this index to create a categorical variable indicating four levels of online health activity during the past 12 months: no online health activities, 1–2 activities, 3–4 activities, and 5 or more activities. Drentea et al. (2008) found that these categories revealed important differences in the association of levels of Internet usage with well-being. We follow their model and include this categorical measure as a series of dummy variables in the negative binomial regression models.

Timing of Internet Use. The timing of Internet use is measured as the number of hours per day that a participant uses the Internet for personal reasons. We use two variables, one for hours per day during the week and another for hours per day on weekends.

Control Variables. Standard sociodemographic variables are included to statistically control for gender (1 = female), age (coded in years), race (1 = white), and marital status (1 = married). Education is measured as the highest level of completed education and coded as one of 11 categories (1 = never attended school or only attended nursery school/kindergarten to 11 = professional school or doctorate degree). Annual combined family income is measured in dollars and coded as one of 10 categories (1 = less than $10,000 to 10 = greater than or equal to $200,000). Approximately 19.6 percent of cases ($n = 1,093$) have missing data for income. Due to the higher percentage of missing data for income, we use the impute command in Stata 10, a regression-based method for imputing missing data. Variables used to impute income include gender, age, race, education, marital status, and employment status. We also include a measure of perceived health status to control for general health status. Health status is measured by a single item that asks participants to rate their general health on a Likert scale coded 1 = poor to 5 = excellent.

Data Analysis

We use univariate analysis to examine the distributional properties in our variables, and conduct bivariate analyses to test for significant differences

[3]This measure is constructed from cases with no missing data on all 10 items (95.0 percent of cases), reducing the number of cases in the Internet user subsample to 3,087.

between the full sample and the subsample of Internet users. Inferential statistics are used to examine the relationship between psychological distress and our independent variables measuring Internet use and online health activities. Because our dependent variable (psychological distress) is a count variable, we use a negative binomial regression model (NBRM). Count models are more appropriate when the dependent variable measures the total number of occurrences of an event over a period of time (Cameron and Trivedi, 1998)—in this case, the frequency at which participants have experienced any of six symptoms of nonspecific psychological distress during the past 30 days. Coefficients from NBRMs represent changes in the log of expected counts of the dependent variable associated with a one-unit change in the independent variable, holding all other variables constant. To facilitate the interpretation of the coefficients in Tables 2 and 3, in the text we sometimes present our results as the percent change in the expected count of the outcome variable, calculated by using the formula: percent change $= 100 \times [\exp(b) - 1]$ (Long and Freese, 2006).

In Table 2 we use data from the full sample ($N = 5{,}053$) to assess the relationships between distress, sociodemographics, and health status (Model 1), timing of Internet use (Model 2), and a final model that includes all measures (Model 3). In Table 3 we conduct a similar analysis using the subsample of Internet users ($n = 2{,}929$). We assess the relationship between distress, sociodemographics, and health status (Model 1), timing of Internet use (Model 2), types of online health activities, including searching for yourself or someone else for health information and health communication (Model 3), seeking information on health behaviors or doing anything else health related online (Model 4), engaging in all 10 types of online health activities and timing of Internet use (Models 5 and 6), and examine amount of online health activities and timing of Internet use (Models 7 and 8).

Results

Table 1 shows the means and standard deviations or percentages for the variables used in this analysis among the full sample ($N = 5{,}053$) and Internet users ($n = 2{,}929$). Statistical tests (results not shown) indicate that Internet users are significantly more likely to be younger, white, married, have higher education, higher income, better health status, and report less psychological distress than nonusers. Thirty-one percent of the full sample and 45 percent of Internet users report having a bachelor's degree or higher. Similarly, higher percentages of the Internet users report incomes of $50,000 or more compared to the full sample (60 percent vs. 43 percent).

Among the full sample, about 58 percent reported using the Internet. Internet users report spending an average of 1.6 hours online each weekday and 1.1 hours online each weekend day. Among Internet users, 15.3 percent did not use the Internet for any type of health activity during the past 12

TABLE 1

Sample Characteristics[a]

	Full Sample ($N = 5,053$)		Internet Users ($n = 2,929$)	
	Mean (*SD*) or %		Mean (*SD*) or %	
Female	65.82%		64.22%	
Age (continuous)	52.05	(17.770)	46.28	(15.272)
18–19 years	1.82%		2.63%	
20–29 years	10.11%		13.01%	
30–39 years	15.02%		19.02%	
40–49 years	18.60%		23.05%	
50–59 years	19.18%		21.75%	
60–69 years	15.50%		12.87%	
70–79 years	12.99%		6.52%	
80+years	6.79%		1.16%	
Race				
White	76.92%		82.38%	
Hispanic	9.32%		5.52%	
Black or African American	8.13%		6.52%	
American Indian or Alaska Native	1.56%		0.85%	
Asian	1.94%		2.83%	
Native Hawaiian or other Pacific Islander	0.22%		0.17%	
Multiracial	1.90%		1.71%	
Marital status				
Married	53.75%		61.28%	
Divorced	12.07%		10.52%	
Widowed	13.52%		5.36%	
Separated	2.53%		2.15%	
Never married	13.56%		16.46%	
Living with partner	4.57%		4.20%	
Education (11 categories)	6.82	(2.203)	7.70	(1.946)
Less than high school graduate	12.57%		3.52%	
High school graduate	27.45%		18.81%	
Technical, vocational, or associate degree	28.85%		32.57%	
Bachelor's degree	18.72%		26.77%	
Graduate degree	12.41%		18.33%	
Income (10 categories)	5.76	(2.331)	6.66	(2.027)
< $10,000	5.09%		2.46%	
$10,000 to < $15,000	6.87%		2.46%	
$15,000 to < $20,000	7.76%		3.52%	
$20,000 to < $25,000	7.98%		5.26%	
$25,000 to < $35,000	13.69%		9.70%	
$35,000 to < $50,000	15.46%		16.35%	
$50,000 to < $75,000	19.67%		25.37%	
$75,000 to < $100,000	10.47%		14.89%	
$100,000 to < $200,000	10.49%		16.29%	
$200,000+	2.53%		3.72%	
Health status	3.28	(1.044)	3.49	(0.971)
Internet use[b]				
Internet user	57.95%		100.00%	
Timing of Internet use				
Internet weekday hours	0.936	(1.432)	1.62	(1.562)
Internet weekend hours	0.626	(1.064)	1.08	(1.209)
Type of online health activity				
1. Information for yourself	35.70%		61.59%	

TABLE 1—continued

	Full Sample ($N = 5,053$)		Internet Users ($n = 2,929$)	
	Mean (*SD*) or %		Mean (*SD*) or %	
2. Information for someone else	35.48%		61.22%	
3. Bought medications	8.19%		14.13%	
4. Used support groups	2.59%		4.47%	
5. Sent email to doctor	6.06%		10.45%	
6. Information on exercise	26.04%		44.93%	
7. Information on diet	31.41%		54.18%	
8. Information on sun protection	7.54%		13.01%	
9. Information on quitting smoking	4.93%		8.50%	
10. Done anything else health related?	13.89%		23.97%	
Amount of online health activities				
Uses Internet, but no online health activities	8.89%		15.33%	
1–2 types of online health activities	15.56%		26.84%	
3–4 types of online health activities	19.45%		33.56%	
5+ types of online health activities	14.07%		24.27%	
Mental health outcome				
Psychological distress, K6 score (0–24)	4.42	(4.040)	3.96	(3.646)

[a]Descriptives estimated without sampling or replicate weights.

[b]Values for non-Internet users are recoded to zero.

NOTE: Percentages for categorical variables may not add to 100 percent due to rounding error.

months; 26.8 percent reported one to two types of health activities, 33.6 percent reported three to four types, and 24.3 percent reported five or more types. The four most frequently reported types of online health activities are looking for (1) health or medical information for yourself, 61.6 percent; (2) health or medical information for someone else, 61.2 percent; (3) information about diet or nutrition, 54.2 percent; and (4) information about physical activity or exercise, 44.9 percent.

The next two tables show the results from the NBRMs—Table 2 for the full sample ($N = 5,053$) and Table 3 among Internet users ($n = 2,929$). In the full sample (Table 2), women report higher levels of distress, controlling for differences in age, education, race, income, marital status, and health status. Age, education, income, and health status are negatively associated with distress. Timing of Internet use (Model 2) is not significantly related to distress. After adjusting for the amount of online health activities in Model 3, timing of Internet use (i.e., hours using the Internet on weekdays) is positively associated with distress. The amount and timing of Internet use are significant predictors of distress in Model 3, indicating each dimension of Internet usage has independent relationships to distress. Compared to those who do not use the Internet, using the Internet with no online health activities is associated with an average decrease of 14.2 percent in the expected frequency of distress symptoms. Amount of online health activities is also

TABLE 2

Regression of Psychological Distress on Demographics and Internet Use (Internet Users and Nonusers, $N = 5{,}053$)

	Model 1	Model 2	Model 3
Female	0.101** (0.032)	0.104** (0.032)	0.096** (0.032)
Age	–0.007*** (0.001)	–0.006*** (0.001)	–0.007*** (0.001)
White	–0.025 (0.040)	–0.028 (0.039)	–0.008 (0.040)
Married	–0.091* (0.036)	–0.078* (0.036)	–0.069 (0.036)
Education	–0.023** (0.009)	–0.027** (0.009)	–0.024** (0.009)
Income	–0.053*** (0.009)	–0.055*** (0.009)	–0.052*** (0.009)
Health status	–0.248*** (0.017)	–0.248*** (0.017)	–0.239*** (0.017)
Timing of Internet use			
Internet hours weekday		0.021 (0.011)	0.030* (0.012)
Internet hours weekend		0.017 (0.015)	0.019 (0.016)
Amount of online health activities[a]			
Uses Internet, but no online health activities			–0.153 (0.079)
1 or 2 types of online health activities			–0.135* (0.057)
3 or 4 types of online health activities			–0.138* (0.054)
5+ types of online health activities			0.029 (0.061)
Constant	3.059*** (0.078)	3.016*** (0.078)	3.023*** (0.077)
Alpha	–0.778*** (0.048)	–0.785*** (0.049)	–0.796*** (0.049)
Likelihood-ratio test of alpha = 0[b]	3917.029***	3907.089***	3808.010***

[a]Reference group is does not use the Internet.

[b]Comparing NBRM against PRM. Computed without sampling or replicate weights.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

NOTE: NBRMs estimates use sampling and replicate weights. Robust standard errors in parentheses.

associated with lower distress; one to two types is associated with a decrease of 12.6 percent and three to four types with a decrease of 12.9 percent.

Table 3 presents results for Internet users only. Model 1 indicates the same general pattern among sociodemographic variables and health status as in Table 2 except that marital status is also significant, with an average decrease of 11.9 percent in the expected frequency of distress symptoms.

Models 2–5 of Table 3 introduce variables measuring timing of Internet use, and types and amount of online health activities. Hours of Internet use for personal reasons on weekdays (Model 2) is associated with greater distress and mediates the relationship between marital status and distress (Models 2, 3, and 5). All 10 types of online health activities are added to Model 3. After controlling for sociodemographics, health status, and timing of Internet use, only one type of online health activity is significantly associated with distress: looking for sun protection information ($b = 0.154$).

TABLE 3

Regression of Psychological Distress on Demographics and Internet Use (Internet Users, $n = 2{,}929$)

	Model 1	Model 2	Model 3	Model 4	Model 5
Female	0.099* (0.043)	0.111* (0.043)	0.092* (0.044)	0.073 (0.044)	0.087* (0.044)
Age	–0.007*** (0.001)	–0.007*** (0.001)	–0.007*** (0.001)	–0.007*** (0.001)	–0.007*** (0.001)
White	–0.044 (0.058)	–0.025 (0.058)	–0.013 (0.058)	–0.032 (0.058)	–0.015 (0.058)
Married	–0.126* (0.050)	–0.098 (0.050)	–0.090 (0.051)	–0.116* (0.051)	–0.092 (0.050)
Education	–0.031** (0.011)	–0.029* (0.011)	–0.033** (0.011)	–0.037*** (0.011)	–0.035** (0.011)
Income	–0.047*** (0.013)	–0.046*** (0.012)	–0.045*** (0.012)	–0.047*** (0.013)	–0.046*** (0.012)
Health status	–0.226*** (0.024)	–0.219*** (0.023)	–0.209*** (0.024)	–0.215*** (0.025)	–0.210*** (0.024)
Timing of Internet use					
Internet hours weekday		0.030* (0.012)	0.030* (0.013)		0.029* (0.012)
Internet hours weekend		0.024 (0.015)	0.017 (0.016)		0.017 (0.016)
Type of online health activity					
Information for yourself			0.043 (0.048)		
Information for someone else			0.001 (0.046)		
Bought medications			–0.019 (0.056)		
Used support groups			0.134 (0.095)		
Sent email to doctor			0.009 (0.066)		
Information on exercise			0.090 (0.054)		
Information on diet			–0.076 (0.054)		
Information on sun protection			0.154** (0.058)		
Information on quitting smoking			0.049 (0.064)		
Done anything else health related?			0.061 (0.051)		

TABLE 3—continued

	Model 1	Model 2	Model 3	Model 4	Model 5
Amount of online health activities[a]					
1 or 2 types of online health activities				0.034 (0.083)	0.029 (0.081)
3 or 4 types of online health activities				0.046 (0.079)	0.031 (0.078)
5+ types of online health activities				0.228** (0.084)	0.204* (0.083)
Constant	3.056*** (0.121)	2.877*** (0.132)	2.803*** (0.140)	2.991*** (0.143)	2.841*** (0.148)
Alpha	–0.813*** (0.066)	–0.830*** (0.066)	–0.854*** (0.067)	–0.833*** (0.066)	–0.846*** (0.066)
Likelihood-ratio test of alpha = 0[b]	1905.090***	1879.435***	1782.875***	1813.749***	1801.420***

[a]Reference group is no online health activities.

[b]Comparing NBRM against PRM. Computed without sampling or replicate weights.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

NOTE: NBRMs estimates using sampling and replicate weights. Robust standard errors in parentheses.

In Models 4 and 5 of Table 3, the 10 types of online health activities are summed to create categories of the amount of online health activity during the past year. In Model 4, reporting five or more online health activities is associated with an average increase of 25.6 percent in the expected frequency of distress symptoms compared to using the Internet but reporting no online health activity, holding other variables constant. Weekday hours of Internet use is associated with distress (Model 5), but does little to mediate the coefficient for five or more online health activities, suggesting that timing of Internet use and amount of online health activities have largely independent relationships with distress.[4]

These results suggest that social selection may be operating, with levels of distress driving Internet use. To explore this, we post hoc compared mean distress scores. When we examine the full sample, Internet users have significantly lower distress scores than non-Internet users (4.3 vs. 5.3, respectively; $p < 0.001$). Among Internet users, however, mean distress scores increase with greater amounts of online health activities (i.e., mean distress score of 3.9 for 0 online health activities, 4.0 for one to two activities, 4.2 for three to four activities) and are significantly higher among those who reported the greatest amount of online health activities (5.2 for five or more activities vs. 3.9, $p < 0.01$). This implies that more distressed people are using the Internet at higher levels, perhaps given their greater need.

Discussion

Our study expands the limited and sometimes contradictory findings regarding the relationships between Internet use and mental health. Similar to the prior research examined earlier in this article, we find that Internet usage has both positive and negative associations with psychological distress. The specific effect depends on the type, amount, and timing of Internet usage.

Our results suggest that when comparing Internet users to non-Internet users, the timing, amount, and type of Internet usage are each important but in different ways. Weekday usage of the Internet for personal reasons is associated with higher distress, while using the Internet for online health activities is associated with decreased distress (compared to not using the Internet) (see Table 2). This lends support to prior research (Cotten, 2001; Drentea and Moren-Cross, 2005; Ko and Kuo, 2009; Miyata, 2002; Morgan and Cotten, 2003). However, among the Internet users in this sample, frequent online health activities are associated with higher distress levels, as is

[4]The 10 separate measures of type of online health activities are not added to Model 4 or 5 due to issues of multicollinearity with the categorical variable representing the number of online health activities.

the timing of using the Internet for personal reasons during the weekday (see Table 3).

Does this mean that more frequent Internet use leads to distress, or that those with greater distress use the Internet more frequently (i.e., causation vs. selection arguments)? The post hoc mean distress scores suggest that selection may be operating. Our results support research by Mitchell and Wells (2007), who found that overuse of the Internet is a common primary presenting problem in individuals who seek treatment for mental health issues. This also supports Sirgy, Lee, and Bae's call for more research that examines the extent of Internet use because "heavy users of the Internet in a specific life domain may experience the full range of costs and benefits in that domain, compared to those who use the Internet lightly in that life domain" (2006:243). In other words, those who frequently conduct online health activities are more likely to experience greater benefits *and* costs due to their more frequent usage. Unfortunately, our data prevent us from determining whether selection or causation processes are at work in this study. Longitudinal data are needed to ascertain the causal ordering between online health information searching and distress levels.

Regarding timing, hours of weekday Internet use for personal reasons are associated with higher levels of distress (Tables 2 and 3), suggesting that there is something different among those using the Internet during the weekday. It may be that those with more mental health and health problems are more likely to not work during the day and spend time researching their problems, or they may be so highly distressed that they use their work time for Internet health-related purposes. Perhaps more likely, it may be that Internet use during the weekday impedes work responsibilities (Dabbish and Kraut, 2006; Eastin, Glynn, and Griffiths, 2007) or that it results in boundary-spanning demands or the blurring of boundaries related to work-family balance (Chesley, 2005, 2006; Schieman and Young, 2008). The measure available does not allow us to better ascertain the nature of the weekday usage and whether this usage is associated with work strain and demands and/or work-life balance.

Although the findings presented here advance the research in this area, there are some limitations. First, we do not know what respondents actually did with the information they found online, whether they perceived it as useful, or when the searching occurred within the past 12 months. Second, the 10 types of online health activities are measured over the past 12 months, while distress is measured as symptoms experienced during the past 30 days. In addition to the potential for recall bias, it is possible that health information gathered before the last 30 days may no longer impact distress. Longitudinal research is needed to better disentangle the timing, causal ordering, and selection versus causation processes involved in these relationships. Third, the response rate is relatively low and the extent to which participants do not represent the general population on key variables may result in biased estimates. To minimize this effect, in our analyses we

followed the NCI's recommendation of using the provided weights to adjust for nonresponse and the complex survey design. Fourth, we have very little information about the access to and use of offline health resources. One reviewer suggested that if individuals do not have access to offline resources, they may be more likely to turn to the Internet for information. While this may certainly be the case, we suspect that if individuals are without access to offline health resources, they may also tend to be on the wrong side of the digital divide and thus not have access to online resources. Further research is clearly needed in this area. Finally, the data set did not include measures assessing whether and how individuals used email, instant messaging, and social networking sites, which could potentially have the strongest effects on social support and distress. The use of email, in particular, has been noted by some researchers as aiding individuals in building, maintaining, and extending relationships with others, and enhancing social support and well-being (Boase et al., 2006; Cotten, 2001; Morgan and Cotten, 2003; Howard, Rainie, and Jones, 2001; Rohall, Cotten, and Morgan, 2002).

Health professionals should encourage a dialogue with their patients about the potential costs and benefits of Internet usage. Using the Internet for health purposes can be beneficial because it can increase access to health information, medical products, and communication with health-care providers. Yet, some online health activities, such as frequent searching, may be associated with increased distress. Though it is possible that people with greater distress are more likely to seek out these online health resources, and in the long run are more likely to benefit from them, health professionals must also be attentive to the possibility that the Internet is exacerbating, rather than lessening, psychological distress in their patients. Thus, it is important that they educate patients about all possible impacts.

In conclusion, this study expands research by examining how type, amount, and timing of Internet usage are related to one aspect of well-being—psychological distress. Findings suggest that not all types of Internet usage are beneficial. As we continue to see the convergence of technologies (e.g., mobile devices that can function as computers, cell phones, and Internet connections), additional research must examine not just Internet usage via computers. Clarifying the ways that individuals go online, the ubiquity of their connection potential, and how these relate to boundary-spanning demands and the blurring of boundaries may yield further information about the pathways through which ICT usage impacts well-being. Further research is also needed that examines a wide range of types of Internet use (communicative and noncommunicative), modes of connection (computer, mobile phone, etc.), levels (amount and timing), and perceptions of these Internet uses, as well as a range of well-being outcomes in order to further elucidate the specific processes through which particular types, amount, and timing of Internet use may be related to health outcomes.

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