Social Media and Change in Psychological Distress Over Time: The Role of Social Causation

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This article tests the relationship between information and communication technologies (ICT), such as the Internet, cell phones, and social media, and change over time in psychological distress (PD) and risk of serious psychological distress (SPD) associated with depression and anxiety disorders. Using a longitudinal panel design, survey data from a representative sample of American adults, findings revealed that home Internet and social network site (SNS) use are associated with decreased PD over time. Having extended family who are also Internet users further decreases PD. PD increased or decreased in relation to change in the PD of extended family who also use SNSs. For most people, ICT substantively reduce PD; in rare cases, an extreme spike in PD of extended family also on SNSs, there was a trivial increase to the risk of SPD. PD did not change when extended family not on social media experienced a change in their PD.

Keywords: Persistent Contact, Pervasive Awareness, Social Conditions, Isolation, Social Support, Well-being, Psychiatry

Introduction

There is a high level of public, scholarly, and clinical interest in the relationship between mental health and the use of new information and communication technologies (ICT), including the Internet, social media, and cell phones. A growing body of research has linked these technologies to an increased risk of emotional problems, such as psychological distress (PD), including anxiety, depression, and a range of other non-specific declines in mental health. However, this body of work has suffered from serious shortcomings. These shortcomings include conceptualizing and operationalizing depression and anxiety in ways that do not coincide with clinical definitions, thus exaggerating the significance of emotional changes in response to the everyday use of communication technology. A reliance on self-selected and non-representative samples that do not generalize to the general adult population, and experimental studies that may not generalize outside of the laboratory. Often, this work conflates statistical significance with meaningful, substantive impact. In addition, there has been a near singular focus on the role of *individual causation* (e.g., depression comes from individual traits, as well as from

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impulses and problems that can be controlled) while largely ignoring the role of *social causation* in mental health (e.g., depression comes from social conditions largely outside of an individual's control). Thus, not only may scholarship in this area misrepresent the magnitude and role ICT play in how most people experience PD, but also it has failed to recognize how social media may contribute and potentially protect against anxiety and depressive symptoms as result of social conditions.

This article makes a distinction between a change in PD that is unlikely to contribute to a clinical problem, and a change in PD that puts one at risk of serious psychological distress (SPD). This type of PD occurs at a level associated with depression and other mood and anxiety disorders as defined in the *Diagnostic and Statistical Manual of Mental Disorders, 5th ed.* (*DSM*). The data for this analysis are drawn from a longitudinal panel survey of a representative sample of American adults. Individual use of ICT, including frequency of home Internet use, mobile Internet use through a smartphone, text messaging, email, and use of social network sites (SNS) like Facebook, were not associated with declines in PD. In fact, home Internet and SNS use resembles the protective influence on mental health of other forms of communication, such as in-person and telephone contact. Having extended family who are also Internet users was associated with further decreases in PD. Social media users, specifically users of SNSs, experience changes in PD over time in relation to changes in the mental health of people in their personal network who also use SNSs. When a member of an individual's extended family who uses SNSs experiences an increase or a decline in their PD, that change is mirrored in the individual. Those without extended family on SNSs do not experience this "social causation." This relationship may be driven by the persistent contact and pervasive awareness that is afforded by many social media (Hampton, 2016). In rare, extreme cases, when a family member on SNSs experiences an extreme increase in PD, there is a trivial increase in an individual's risk of experiencing SPD at a level associated with clinical depression or another mood and anxiety disorder. For most people, ICT are substantively protective of mental health.

ICT and mental health

Meaningful mood disorder

Nearly 50% of the U.S. adult population will experience a *DSM*-defined mental disorder in their lifetime. In any 12-month period, approximately 30% of the population will experience a disorder (Kessler et al., 1994). A subset of these mood and anxiety disorders that indicate PD, including depression and generalized anxiety, account for approximately 25% of all 12-month mental disorders (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). PD has been of particular interest to those exploring a relationship between ICT use and mental health. However, many of these studies do not closely follow established constructs or measures of depression, anxiety, or other indicators of PD, or their severity.

Among the most problematic approaches to the study of ICT and mental health are those that inherently problematize media use. This includes the articulation of new disorders such as "nomophobia," which is caused by separation or fear of separation from one's cell (mobile) phone and is supposed to be an anxiety disorder "of the modern world" (King, Valença, & Nardi, 2010) that is experienced by as many as 53% of mobile users (Bragazzi & Del Puente, 2014). The disorder is identified through frequency of use, and survey questions which ask whether people "feel anxious" because they "could not keep in touch with my family and/or friends" without a smartphone (Yildirim & Correia, 2015). Rarely do such studies identify a meaningful cutoff for "excessive" use, and they assume by default that any use can be inherently problematic. In addition, they utilize survey measures that often fail to separate the independent and dependent variables. To ask a participant if he/she believes that a cell phone or any technology causes his/her disorder or some negative emotion is to do a roundabout over hypothesis testing. The source of PD can be difficult to identify and is easily misattributed when primed

by the researcher. Validity requires that researchers separate a person's use of a technology from his/her assessment of a disorder (Schwarz, 1999).

Experiments are often the preferred method for isolating change in a dependent variable from its cause. However, it is often difficult or impossible to identify the causal mechanism. For example, a sensationalistic experiment in which student subjects were physically separated from their cell phones and assessed for change in their state of anxiety (Cheever, Rosen, Carrier, & Chavez, 2014), suggested a causal link to cell phone withdrawal. However, it is not clear what about cell phone separation is inducing anxiety. It could be being out of touch with friends or family. It could also simply be fear on the part of a financially stretched student that an experimenter will lose an expensive piece of equipment, which he/she has unexpectedly forfeited for the duration of an experiment. It is even less clear why anxiety as a result of this manipulation should be considered unexpected or abnormal. Minor changes in emotion related to anxiety are, in fact, normal. A larger magnitude of change in the state of anxiety has been observed through 20 minutes of walking, meditation, or sitting quietly (Bahrke & Morgan, 1978). A small, nonspecific, short-term, and easily reversible change in emotion does not rise to the magnitude of a clinical mood or anxiety disorder. Further, the lack of external validity inherent in experiments means that there is no expectation that what is observed in the laboratory resembles the anxiety people experience in their day-to-day lives.

Survey methods are more appropriate for establishing the prevalence of PD and whether there are more than short-term effects related to Internet, cell phone and social media use. A recent meta-analysis by Tokunaga (2017) found 187 such studies of Internet use and depression, most frequently utilizing validated measures, such as Beck's Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Center for Epidemiological Studies Depression Scale (Irwin, Artin, & Oxman, 1999). Tokunaga (2017) identified a significant, positive relationship across the literature between depression and Internet use. With rare exceptions (e.g., Bessière, Pressman, Kiesler, & Kraut, 2010), nearly all prior work is cross-sectional and based on samples of adolescents and university students. Cross-sectional studies do not disentangle the directionality of the relationship, i.e., whether Internet use leads to depression or whether depressive individuals seek out the Internet more often. Perhaps more important, it is also not clear if the relationship is substantive, or of clinical concern. For example, Twenge, Joiner, Martin, and Rogers (2018) report as substantive a very small association between social media use and depression (a correlation of .06 for girls and no relationship for boys). Minimally higher scores on this or other scales related to PD are unlikely to be meaningful (Daly, 2018). A much smaller body of work distinguishes between modest associations with PD and movement into SPD, which might require a clinical intervention.

Individual vs. social factors

Research on ICT as a risk factor for PD has largely followed the dominant, epidemiological model of mental health, which focuses on individualistic explanations. Tokunaga (2017) summarizes variations in this approach, including the disease model, the cognitive-behavioral model, social cognitive theory, and self-control failure. Although these models offer different pathways, they share a focus on individual behavior or deficiency and suggest that the individual can largely control his or her fate in relation to mental health. ICT are the source of anxiety and depression because of a mental disorder (i.e., abnormalities in the delivery of serotonin and dopamine) (Young, Yue, & Ying, 2011). They are also the source of habit-forming behavior, a lack of self-regulation, or loss of self-control that contributes to anxiety or depression through loneliness and interpersonal withdrawal (Kim, LaRose, & Peng, 2009). This approach to studying mental health emphasizes identifying the individual traits associated with lower mental health, including personality, age, and gender, and the corresponding interventions to promote

mindfulness, enhance positive experiences, and develop programs to enhance positive individual traits (Duckworth, Steen, & Seligman, 2004). If excessive use of or addiction to ICT contribute to lower mental health, it is assumed that they can be overcome by an individual's rebalancing of his/her mind and body. However, medical sociologists and others, who argue for greater attention to "social causation" have questioned models that focus on individually-based risk factors for mental health problems.

Social causation refers to a set of theories that emphasizes the role that social conditions play in the risk of disease. This approach views social factors as a "fundamental cause" of disease that is likely to persist even when individual risk factors have been mitigated (Link & Phelan, 1995). Studying social conditions is not entirely new in ICT research. Scholars have explored how PD is related to media use as a result of loneliness (Tokunaga, 2017), social displacement (Nie, 2001), social support (Cotten, Ford, Ford, & Hale, 2014), and a fear of missing out or excessive upward social comparison (Przybylski, Murayama, DeHann & Gladwell, 2013). However, there is little empirical support for the hypothesis that Internet use displaces contact (Robinson Kestnbaum, Neustadl, & Alvarez, 2002). There is more support for the finding that Internet use supplements in-person and other communication (Rainie & Wellman, 2012). Internet use, including the use of social media, is related to higher levels of perceived social support (Lu & Hampton, 2017). Social support, higher levels of contact (in-person, as well as other mediated forms of contact, such as the telephone) are associated with lower levels of PD (Shaw & Gant, 2002). There has also been little success in verifying the argument that people experience negative mental health outcomes when their contacts on SNSs experience positive life events (Hampton, Lu, & Shin, 2016). While the role of these social conditions is important, these examples resemble individually-based factors, in that they are generally considered to be under an individual's control (e.g., feel isolated or lacking support, make more friends; Internet use displacing in-person contact, get off the computer, etc.). What is missing are examples of social conditions that are largely beyond an individual's control. There are various examples of such conditions, including the experience of lower socioeconomic status and discrimination.

Theories of social causation in mental health that emphasize social factors outside of individual control include social disorganization theory (Faris & Dunham, 1939), labelling or social reaction theory (Scheff, 1999), and social exclusion (Foucault, 1963). Indeed, researchers often attempt to control for these effects through variables, such as race, gender, education, income, marital status, and residential stability. However, these variables cannot account for some social conditions, for example, the experience of stressful life events or social stress and its negative relationship with mental health (Turner, Wheaton, & Lloyd, 1995). This includes the influence of network events; the negative emotional impact experienced as a result of undesirable events in the lives of friends and family (Kessler, McLeod, & Wethington, 1985).

Some research suggests that the role that network events play in mental health is enhanced by social media. Social media users are more aware of negative events happening in the lives of friends and family, and, as a result, they experience higher levels of stress (Hampton et al., 2016). Similar relationships have not been explored for indicators of PD. That is, variation in one's PD may be influenced by changes in the mental health of friends and family to whom one is connected through social media. To the extent that there is any relationship in the general population between PD and ICT, and whether it reaches a level of a clinical concern, may better be explained through theories of social causation than individual experience with technology.

Persistent relationships and pervasive awareness

The specific mechanisms through which mental health is influenced by social conditions is not always known. There is a growing body of research to demonstrate that emotions flow through networks, and

this is often described as a form of "contagion." For example, people embedded in networks in which others feel lonelier, happier, or more depressed, are more likely to express these same state over time (Cacioppo, Fowler, & Christakis, 2009; Rosenquist, Fowler, & Christakis, 2011). Kramer, Guillory, and Hancock (2014) and Coviello et al. (2014) demonstrate emotional contagion between Facebook friends. A common explanation for network contagion is unconscious mimicry (Bastiampillai, Allison, & Chan, 2013). Alternatively, some of the perceived mimicking in mood may actually be associated with the "cost of caring"—the mental health-damaging effects of providing social support (Kessler et al., 1985)—or relief from the burden of providing support as someone else's life situation improves (Kalra, Kamath, Trivedi, & Janca, 2008). Whatever the mechanism, be it mimicking, the burden of social support, or some other factors, contact and awareness would seem to be basic prerequisites for social conditions to influence people through networks: having a connection and being aware of someone's mood or life events. It may be that social media afford contact and awareness in ways that make social conditions more influential.

Social media, such as SNSs, provide higher levels of relational persistence and pervasive awareness (Hampton, 2016). Over time, social media help sustain relationships, which are otherwise likely to go dormant. They might include colleagues from a past job, friends from a previous neighborhood, high school classmates, or extended family members. Relational persistence runs counter to historic trends, which suggest that in contemporary society, people tend to lose contact with ties because of the mobility afforded by new technologies or when they experience major life course events, such as changing jobs or moving (Hampton & Wellman, 2018). Social media also provide an ongoing awareness of events and activities in the lives of others. Social media users are more aware of the life events of strong and weak ties (Hampton et al., 2016), their political opinions (Hampton, Shin, & Lu, 2017), social resources (Hampton, Lee, & Her, 2011), and available support (Lu & Hampton, 2017). As a result of their role in relational persistence and awareness, social media may play a unique role relative to other ICT in how social conditions influence PD.

ICT and change in psychological distress

Evidence that links higher levels of PD to ICT use is largely reliant on cross-sectional studies of adolescents and college students. These populations are undergoing major life course events associated with significant emotional turmoil. They may have a disproportionate exposure to PD in their on- and offline networks, making them more susceptible to negative social conditions. Higher PD related to ICT may be short term, developmental, mild in intensity, and not present in samples of adults. Given these issues, and the relatively small associations between ICT and PD in prior work, there is little reason to expect that in the general, adult population, the use of ICT increases PD. However, similar to in-person and telephone contact, some ICT do provide access to social contact, social sharing, and the exchange of support, which may reduce PD. Internet access might also improve access to health information and resources (Cotten, Goldner, Hale, & Drentea, 2011). The corresponding reduction in PD may even rise to such a magnitude that there is a decline in the likelihood of experiencing SPD, which is PD at the level associated with depression and other *DSM* mood and anxiety disorders.

H1: Individual use of ICT, including higher frequency of use, is associated with decreased PD over time.

H2: Individual use of ICT, including higher frequency of use, is associated with a reduced risk of SPD over time.

ICT refers to a range of general and specific technologies. Because of variation in the affordances of different technologies and the tendency for self-selection in the preference to use different technologies,

scholarship on ICT has stressed the importance of distinguishing between different types of media use and their outcomes (Hampton, 2017). However, with rare exceptions (Cotten et al., 2011), it is most often assumed that different types of ICT move PD in the same direction with similar magnitude. A recent review reflects this assumption; it finds that specific and general measures of ICT have roughly equivalent impacts on PD (Tokunaga, 2017). While identifying and measuring the variation in ICT use can help isolate specific affordances, such differentiation is not necessary to identify broad, underlying relationships. Frequency of general Internet use, or home Internet use, is one of the most common types of ICT uses associated with PD. Although, some have argued that the addition of mobile Internet access—and its potential for constant connectivity—is more significant (Twenge et al., 2018). Some are even more specific, focusing on email, text messaging, or social media. There is no doubt that there is variation in the affordance for different ICT to provide access to health information, social support, etc., and this likely influence the relationship to PD. However, identifying and disentangling these affordances are largely beyond the scope of this work. Given the limited previous work on change in PD that explores variation in the type of use based on adult populations, it is premature to make many specific hypotheses about variation in PD based on different types of ICT.

However, as previously discussed, social media are distinct from other ICT in how they augment people's social environment. Like other ICT, social media use affords the exchange of social support and information, which is hypothesized to reduce PD and the risk of SPD over time (H1 and H2). Social media have greater affordances for relational persistence and awareness, which are essential to the spread of mood and emotions through personal networks. As such, changes in the social conditions of a tie on social media is likely to influence that person's PD.

H3: An increase in the PD experienced by a social tie connected through social media corresponds to an increase in a person's own PD, whereas a decrease in the PD experienced by a social tie is associated with a decrease in a person's PD.

H4: When a tie on social media experiences decreased PD, the risk that a person will experience SPD declines, and vice versa.

Methods

This article is based on data collected as part of the Panel Study of Income Dynamics (PSID). The PSID is the longest-running, longitudinal, household, panel survey in the world. The PSID began in 1968 with a representative sample from more than 5,000 families living in the United States. Since then, the PSID has continuously collected data on adult respondents from these original families, including anyone born or adopted by a member of the sample family. Descendants and their spouse/partner are added to the sample and followed even after they establish separate families. In the 1990s, a sample of new, immigrant families was added to the PSID sample. The PSID is a probability survey that is representative of individuals in the United States. More details on the PSID design, retention, incentives, and interview procedure can be found elsewhere (*PSID main interview user manual*, 2017).

In 2015 and 2016, the PSID included a series of questions about use of ICT. Both surveys included a measure of PD. The 2015 survey was completed by 9,048 individuals, and nearly all interviews were conducted over the telephone (97%). The PSID reports separate response rates for the initial 1968 sample and descendants (89.1%) and the immigrant sample that was added in the 1990s (81.4%). Eligibility for the 2016 PSID was based on having been a respondent on the 2015 PSID or having been a spouse/partner of a respondent, being at least 30-years-old, and having completed the 2015 PSID in English. The 2016 supplement was administered through a combination of Web (75%), paper (24%), and telephone (1%)

interviews. The age and language truncation and exclusion of spouses/partners who had not personally completed the 2015 interview reduced to 5,388 the number of participates eligible to be included in this analysis. 5,129 participants completed both waves, a retention rate of 95.2%.

The unique genealogical structure of the PSID makes it possible to construct a relational database of participants. These relational data allow for the testing of hypotheses related to social causation. The PSID links participants based on the role of child, parent, grandparent, grandchild, great-grandparent, great-grandchild, and sibling. From these data, it was possible to extrapolate the roles of aunt or uncle, niece or nephew, and cousin. Of the 5,129 participants who completed both the 2015 and 2016 PSID, 3,790 participants had members of their extended family (kinship relations living outside of their household) who had also completed both waves. In total, there were 13,630 relationships among participants in the 2015/2016 sample. The number of relationships per participant included as many as 19 extended family members.

Psychological distress

The K6, a six-item scale that was developed for the *US Health Interview Survey*, measures PD. The K6 is a measure of non-specific PD (Kessler et al., 2002). The K6 has advantages over measures of more specific forms of PD. Although depression is a concept distinct from anxiety, most self-report scales, including Beck's Depression Inventory and the Center for Epidemiological Studies Depression Scale, do not adequately differentiate between these constructs (Orme, Reis, & Herz, 1986; Stulz & Crits-Christoph, 2010). The K6, as a measure of non-specific PD does not have the same issues with discriminant validity. It has been validated as a predictor of *DSM* mood and anxiety disorders, including current depression (Cairney, Veldhuizen, Wade, Kurdyak, & Streiner, 2007; Furukawa, Kessler, Slade, & Andrews, 2003). The K6 asks about six symptoms: "In the past 30 days, how often did you feel [. . .] 1) "so sad nothing could cheer you up," 2) "nervous," 3) "restless or fidgety," 4) "hopeless," 5) "that everything was an effort," and 6) "worthless"?

Participants responded on a five-item scale that ranged from "all of the time" to "none of the time." The K6 was scored based on the unweighted summing approach, such that "none of the time" equaled zero and "all of the time" equaled four, with a combined score that ranged from 0-24 (PD_{t1}, M=3.05, SD=3.85, alpha=.814; PD_{t2}, M=4.68, SD=4.52, alpha=.844). A cut-off of 13 identified those who have severe PD (Pratt, Dey, & Cohen, 2007) (SPD_{t1}, 3.4% $\geq$ 13; SPD_{t2}, 6.7% $\geq$ 13). This cut-off for SPD has been associated with serious mental illnesses (e.g., major depression) and higher rates of chronic, obstructive, pulmonary disease; heart disease; and mortality (Pratt, 2008; Weissman, Pratt, Miller, & Parker 2015). PD_{t1} is used in lagged regression to model change in a person's PD over time. For those models that include a predictor based on change in family member's PD over time, family member's PD is modeled as a difference score: time 1 subtracted from time 2 (ΔPD; M=-1.66, SD=4.07).

ICT and social contact

The 2015 PSID provided four measures of ICT use. Participants were asked how often they used the Internet at home, accessed the Internet through a smartphone, used email, and sent text messages through a cell phone. Participants responded on a five-point scale, which included "every day," "a few times a week," "once a week," "less than once a week," or "never." Participants who responded "never" were given a follow up question asking if they had engaged in the activity in the past year. These questions were recoded as days per month (0–30) of home Internet (M=18.56, SD=13.20), mobile Internet (M=18.12, SD=13.86), email (M=19.60, SD=13.06), and text message use (M=21.42, SD=12.32). These measures are time non-varying; they were not asked again of participants in 2016. In

2016 PSID asked participants, "Which of the following social activities did you do yesterday?" Options included: "went on (or posted to) social networking sites" (42.9%), "socialized in person with friends or relatives" (62.2%), and "talked on the phone with friends or relatives" (65.5%). These three variables were coded as dichotomies.

For each relational pair, two variables were constructed to indicate the potential for information/communication to be shared online. If both members of the pair reported that he/she used the Internet at home or through a mobile device, they were both Internet users (74.2%); if both used SNSs, both were SNS users (21.2%). It is important to note that these measures of shared Internet/SNS use contain an unknown number of false positives, family pairs that use the Internet/SNS but did not directly communicate online. Because the error is in the direction of including false positives (as opposed to undercounting pairs that communicate), the lack of measurement precision, inclusion of false communication pairs, makes it less likely to find a statistically significant relationship between these variables and the outcome as hypothesized. Including these false positives makes rejecting the hypothesis more likely.

Control variables

There is variation in the prevalence of PD in the U.S. population. Those segments of the adult population found to experience higher levels of PD include women (62.7%), those with fewer years of education (M=14.03, SD=2.20), lower family income (M=81.63k, SD=110.63k), unmarried or living with a partner (57.1%), black or African American (34.6%), Hispanic (4.0%), low residential stability (38.3% rent), and those with personality traits higher in neuroticism (M=5.62, SD=2.81) and openness (M=7.22, SD=2.56). (The remaining Big 5 personality measures were also included; each item was measured using a 15-item scale that was scored to range from 0–12 (Gerlitz & Schupp, 2015); agreeableness, M=10.11, SD=2.01; extraversion, M=7.71, SD=2.48; conscientiousness, M=9.99, SD=2.04) (Neff & Hoppe, 1993; Pratt, Dey, & Cohen, 2007; Rantanen, Pulkkinen, & Kinnunen, 2005; Ulbrich, Warheit, & Zimmerman, 1989). As such, controls are introduced for each of these variables.

Analysis

Model 1, using SPSS v.23, included all participants who completed both the 2015 and 2016 PSID. PD_{t2}, the dependent variable, was predicted using a lagged regression model controlling for a person's PD_{t1}, and controls for demographics and personality. Only measures of individual media use were included.[1] The same set of predictors was used in Model 2, a binary logistic regression to predict the likelihood that a person will have SPD_{t2}.

Model 3 and Model 4 expand on the two prior models with relational data to test the role of change in the social conditions of extended family. These models include participants who have at least one extended family member who also completed both waves of the PSID. Model 3, using HLM7, uses a nested structure—a hierarchical linear model (HLM) of relationships nested in individuals (Raudenbush and Bryk, 2002). This model includes cross-level interactions predicting PD_{t2} based on change in a family member's PD and whether a person and his/her family member are both Internet or SNS users. To predict the likelihood of SPD_{t2}, Model 4 replicates this structure, using a binomial HLM with a scalar variance estimation for overdispersion.

[1] Diagnostics suggest that there is no multicollinearity between the measures of ICT use, all VIF were between 1 and 2.5.

Prior research generally fails to articulate the relative magnitude of any relationship between ICT use and PD in comparison to other known contributors. An interpretation of the relative importance of predictors in the final HLM model is facilitated by transforming non-dummy variables to z-scores (standardized coefficients) and re-estimating the model along with unstandardized dummy variables (a standardized coefficient on a dummy variable is uninterpretable). A fuller explanation of this approach can be found in the Appendix.

Findings

ICT and psychological distress

Model 1, in Table 1, provides support for H1, although for a small subset of ICT. Frequency of individual home Internet use and use of SNSs were significantly related to reduced PD over time. There was no relationship between frequency of email use, mobile Internet, or text messaging and change in PD. No measures of individual ICT use were associated with higher levels of PD.

The introduction in Model 3 of predictors for social conditions—change in the mental health of extended family and their use of the Internet and SNSs—modifies the relationship between SNSs and PD. Model 3 finds the same relationship between individual media use and PD; frequency of home Internet use (b=-.014) and individual use of SNSs (b=-.316) are related to lower PD over time. However, as hypothesized (H3), having an extended family member who also uses SNSs attenuates individually-based factors with social conditions that can be associated with either increased or decreased PD over time, depending on the direction of change in an extended family member's PD. The magnitude of the relationship is such that, for those with extended family on SNSs, the influence of SNSs on an individual's PD is virtually nonexistent in the absence of change in an extended family member's PD ($B^{SNS} + B^{Both\ SNS}$ =-0.038). In this context, the influence of SNSs on a change in PD is tied to having an extended family member who is also using SNSs and experiences his/her own change in PD (b=0.037). If an individual's extended family member experiences an increase in PD, the individual's PD increases. If the family member's PD declines, so does the individual's. In the absence of a model that includes social conditions, findings would misattribute the magnitude of the relationship between social media and PD. SNS use influenced change in PD over time only as a result of social conditions. And, change in an extended family member's PD has no impact on an individual's PD in the absence of SNSs (b =.012, p>.05).

Unexpectedly, Model 3 also reveals that social conditions influence the role of general Internet use on PD. Having an extended family member who is also an Internet user further reduces PD (b=-.417). Unlike SNSs, this relationship is not influenced by a change in an extended family member's PD (b =-.033, p>.05).

Based on standardized coefficients in Model 3, one standard deviation higher frequency of Internet use was associated with a decline of .18 on the K6. However, once social conditions are included, the magnitude of the relationship is considerably higher. Having an extended family member who was also an Internet user reduces the K6 by a combined .55 points. Being a user of SNSs further reduces the K6 by an additional .32. However, as previously discussed, having an extended family member who also uses an SNS almost negates the otherwise protective influence of using SNSs. In this condition, the relationship between SNSs use and PD is dependent on change in the PD of extended family. A one standard deviation increase in the PD of an extended family member on an SNS was associated with an increase in a person's PD of .15. As such, it would require an exceedingly rare circumstance, an increase in PD of nearly four standard deviations by an extended family member who is also on an SNS, to completely negate the protective influence of other ICTs on an individual's PD. However, if a family

Table 1 Regressions predicting PD and SPD at time 2.

	Model 1 PD (OLS)				Model 2 SPD (binomial)				Model 3 PD (HLM)				Model 4 SPD (binomial HLM)			
	b	B		SE	b	e[b]		SE	b	B[c]		SE	b	e[b]		SE
K6 time 1	.363	1.395	***	.013	.124	1.133	***	.014	.373	1.492	***	.010	.162	1.176	***	.008
Age	-.016	-.227	***	.004	-.008	.992		.006	-.013	-.180	***	.002	a			
Male	.552	.552	***	.100	.102	1.107		.149	.471	.471	***	.055	a			
Education	-.134	-.295	***	.024	-.126	.882	***	.035	-.116	-.257	***	.015	-.045	.956	**	.017
Black	.570	.570	***	.111	.384	1.468	*	.152	.512	.512	***	.072	.490	1.632	***	.077
Hispanic	.169	.169		.232	-.271	.763		.373	a				a			
Income ($1,000)	-.000	-.037		.000	-.004	.996	*	.002	a				-.005	.995	***	.001
Married	-.342	-.342	**	.106	-.268	.765		.155	-.240	-.240	***	.066	a			
Rents	.365	.365	**	.111	.162	1.176		.154	.524	.524	***	.065	a			
Conscientiousness	-.172	-.351	***	.025	-.074	.928	*	.031	-.207	-.419	***	.017	-.043	.958	*	.021
Extraversion	-.074	-.184	***	.020	-.055	.947	*	.028	-.088	-.217	***	.012	-.127	.881	***	.016
Agreeableness	-.069	-.138	**	.024	-.076	.927	*	.032	-.039	-.081	*	.015	-.061	.941	***	.002
Openness	.095	.243	***	.020	.099	1.104	***	.028	.117	.309	***	.012	.132	1.141	***	.015
Neuroticism	.674	1.893	***	.019	.376	1.457	***	.026	.663	1.894	***	.014	.383	1.467	***	.012
In person	-.360	-.360	***	.096	-.406	.666	**	.135	-.537	-.537	***	.061	-.612	.542	***	.069
Telephone	-.227	-.227	*	.099	-.248	.780		.140	-.280	-.280	***	.058	a			
SNS	-.206	-.206	*	.102	-.500	.607	**	.156	-.316	-.316	***	.074	-.488	.614	***	.090
Email	.003	.045		.005	.013	1.013		.008	a				a			
Texting	-.008	-.093		.005	-.005	.995		.007	a				a			
Mobile Internet	-.006	-.080		.005	-.008	.992		.007	a				a			
Home Internet	-.013	-.173	**	.004	-.009	.991		.006	-.014	-.183	***	.003	a			

(Continued)

Table 1 Continued

	Model 1 PD (OLS)				Model 2 SPD (binomial)				Model 3 PD (HLM)				Model 4 SPD (binomial HLM)			
Intercept	5.338	4.800	***	.579	-1.895	.150	*	.774	5.145	5.310	***	.378	-3.763	.023	***	.357
Level 2: Tie ΔPD (slope)									.012	.047		.016	-.011	.989		.013
Both Internet (intercept)									-.417	-.363	***	.092	-.112	.894		.097
Level 2: Tie ΔPD (slope)									-.033	-.134		.019	-.001	.999		.018
Both SNS (intercept)									.338	.278	***	.087	.165	1.179		.112
Level 2: Tie ΔPD (slope)									.037	.149	*	.018	.050	1.051	**	.019
Inter-class correlation										.087	***			0.334	***	
Adjusted R^2	.482								.504[d]							
Nagelkerke R^2					.391								b			

Note: b is unstandardized coefficient, B is unstandardized coefficients for dummy variables and all other variables z-scores, e^b is odds ratio. To avoid model misspecification due to inclusion of irrelevant variables, only variables confirmed as statistically significant in prior models are included.

There is no comparable measure of explained variance (R^2) for binomial HLM. [c]See Appendix for discussion of how standardized coefficients were constructed. [d]Approximate, based on Snijders and Bosker (2012).

***p<.001 **p<.01 *p<.05

member who is also on an SNS experiences even a modest decrease in their PD, it is associated with an even larger overall protective relationship of ICT.

The magnitude of the relationship between ICT and change in PD varies according to the type and amount of ICTs people use, the ICTs used by members of their extended family, and change in the PD of extended family using SNSs. Is this relationship ever substantive? In the least favorable context, a very rare situation, when an extended family member also on an SNS experiences a nearly unimaginable decline in their mental health, ICT use is inconsequential to an individual's PD. In a more typical situation, a person with frequent home Internet use one standard deviation above the mean, who has extended family who also use SNSs, use of ICT is related to a modest decrease on the K6 of about -.58 points, with variation of +/-.15 points (1 SD) representing the typical change in PD experienced by an extended family member. Compare this to the two largest known contributors to change in PD, prior year PD and neuroticism. Those who were one standard deviation higher in PD in the prior year, tended to score 1.49 points higher on the K6 in the following year. One standard deviation higher score in neuroticism (the inability to remain mentally balanced and avoid negative emotions) was associated with 1.89 point increase on the K6. Comparatively, the relationship between PD and use of ICT or social contact of any type was of a lower magnitude. In person contact was associated with a drop of .54 points on the K6, while telephone contact was about half of that, at .28 points. But, given the relatively short time period of one year, and given ICT typically have a combined magnitude that is larger than other known predictors of change in PD, save prior PD and neuroticism, the relationship for most people is protective and non-trivial. A test of the relationship between ICT and the risk of experiencing SPD, PD at the level associated with depression and other *DSM* mood and anxiety disorders provides additional clarification.

Serious psychological distress

In predicting the likelihood of SPD, Model 2 provides support for H2, but only the use of SNSs is significantly related to the risk of SPD. Individual SNS use reduces the likelihood of experiencing SPD over time (e^b =0.614). No other ICT are associated with increased risk of experiencing SPD. However, as anticipated by H4, the addition of variables in Model 4, which account for SNS use by extended family and any change they experience in PD, attenuates the relationship between SNSs and risk of SPD (e^b =1.051). As with general PD, the relationship between the likelihood of SPD and a change in a family member's PD exists only for those with an extended family member who also uses SNSs (e^b =0.989, $p>.05$).

The influence of SNSs use on the risk of SPD appears substantive. Through individual use alone, an SNS user is 1.63 times more likely to avoid SPD. This is modestly lower than the effect of in-person social contact, which reduces the likelihood of experiencing SPD by 1.84 times (e^b =.542). Compare this to someone who was one point higher on the K6 in the previous year, he/she is 1.18 times more likely to be identified subsequently as having SPD. Or, in another nod to the role of social conditions, compared to other races, someone who is black or African American is 1.63 times more at risk of experiencing SPD. For most people, the additional risk of SPD when having a family member also on SNSs who experiences a change in PD is very small. It increases or decreases the risk of SPD by 1.05 times for a change of 1 point by a tie on the K6. In the case of a family member on SNSs with exceptionally improved mental health, a decrease of 10 points on the K6 (a change of +/-10 points on the K6 is so rare it was experienced by less than one-half of one percent of the sample), would roughly double the protective influence of SNSs. Inversely, a family member who experienced a sharp decline in mental health, a 10-point increase on the K6, would completely erase the additional protection of SNSs. In most social conditions, SNSs substantively reduce the risk of SPD; in rare situations with dramatically worsening social conditions, SNSs provide a trivial increase to the risk of SPD.

Discussion

There has been growing speculation that a major, public health crisis is looming because of ICT use (Royal Society for Public Health, 2017). Such speculation has been heavily biased by a body of research that has strayed from established definitions and screening for mood and anxiety disorders. "New" mental health problems, such as "nomophobia," are problematic in their conceptualization and operationalization. Studies of ICT and mood disorders, including depressive and anxiety symptoms, mostly rely on samples, such as college students, that do not represent the experiences typical of most ICT users. There is a tendency to exaggerate the significance of small, nonspecific, short-term, and potentially easily reversible emotional changes in relation to everyday use of ICT. In addition, by focusing on the role of individual ICT use and PD—individual causation—researchers have largely ignored social causation—the role of social conditions within a person's networks. Thus, this body of work has failed to recognize how social conditions and social media interact to affect anxiety and depressive symptoms. With very rare exceptions, social media and other ICT substantively reduce the risk that an individual will experience SPD in the form of a mood and anxiety disorder as classified by the *DSM*.

Counter to wide-ranging reports, which have suggested that individual uses of ICT, including general Internet use and a range of specific uses such as frequency of email, mobile Internet use, texting, and use of SNSs increase PD, no such relationships were found in a longitudinal panel survey drawn from a representative sample of the U.S. adult population. A limited set of ICT reduce PD over time (H1), including higher frequency of individual, general home Internet use, and use of an SNS. Use of an SNS was the only ICT associated with risk of PD at a level associated with diagnoses of a mood or other anxiety disorder. SNS users were at lower risk over time for experiencing SPD (H2). However, social conditions can attenuate the magnitude of this relationship, i.e., having an extended family member who uses the Internet further reduces PD over time. In contrast to general Internet use, the influence of social media on PD is entirely dependent on social conditions; its relationship depends on change in the PD of extended family also on social media. In the absence of a model that recognizes these social conditions, findings would misattribute the magnitude, and in a non-representative sample, possibly the direction of the relationship between social media and PD. When a family member on an SNS experiences an increase in PD, there is a significant increase in a person's PD; a decrease in a family member's PD results in a decrease in a person's PD (H3). The same relationship extends to the risk of experiencing SPD (H4). In only the rarest of conditions, a massive decline in the mental health of an extended family member who is also on SNSs, does SNS use not reduce the risk of PD at the level associated with a possible diagnosis of depression, or another *DSM* mood and anxiety disorder. For most people, social media use is associated with a substantively lower risk for SPD. This is a unique affordance of social media. Individuals who are not using social media or do not have family using social media do not experience change in their PD or risk of SPD in response to changes in an extended family member's PD.

The precise mechanism through which social media afford the flow of PD remains unknown. Other studies have documented the flow of depressive symptoms (Rosenquist et al., 2011) and stress (Kessler et al., 1985) through social networks. However, in this work, because a person's PD did not change when social ties not on SNSs experienced a change in PD, the mechanism is specifically tied to use of social media. One possibility is that social media make relationships more persistent and pervasive. Social media users may be connected to ties that might otherwise have gone dormant; they may be more aware of the moods experienced by social ties. Change in PD is then more likely to be mimicked, or met with the delivery (or failure to deliver) of social support (Lu & Hampton, 2017).

The relationship between general Internet use and PD also exhibited aspects of social causation, but was independent of changes in the PD of family members. It is also not clear from the data presented here what aspect of general Internet use contributes to better mental health. Previous research suggests that the relationship between home Internet use and reduced PD may be tied to searching for health information, participating in online support groups, or communicating with health care professionals (Cotten et al., 2011). The unexpected finding of improved PD when a person has an extended family member who is also an Internet user suggests an additional channel(s) through which ICT provides social support, social sharing, and other communication activities that improve or protect mental health.

This study has a number of limitations and weaknesses. Survey research, even longitudinal work such as this, cannot control for all confounding variables and thus does not definitively demonstrate causation. The PSID is a large, omnibus survey, and, as such, those performing secondary data analysis lack input into survey design. Use of SNSs was the only variable related to social media, which includes a range of technologies with different affordances. ICT measures with more fidelity and range would help identify the affordances of Internet and social media use related to PD. For example, the PSID measures of SNS use are based on activities that took place only "yesterday." Although this approach has high reliability when compared with many alternative measures (Hampton, 2017) and is likely to capture the typical SNS user—someone who uses SNSs daily—it under-identifies those who use SNSs (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015). In a similar way, although the PSID identified family members who used the Internet and SNSs, the data do not clarify if family members are friends on those SNSs, how strong their relationship is, or how often they see information posted by each other. While more precise network data would be extremely difficult to collect from a representative sample, it might help specify the relationship. For example, if social media use contributes to awareness as a result of exposure to PD shared through status updates, comments, "liking" behavior, online messaging, or even offline behaviors that result from online activity, such as phone calls and in-person visits. Such data would also help determine if the relationship between social media and PD is more pronounced when multiple ties jointly share in an increase or decrease in PD. A larger number of snapshots of change in ICT use, at both shorter and longer intervals, would help identify the longevity of the effect of change in the PD of social ties (Bayer, Ellison, Schoenebeck, Brady, & Falk, 2018). Future data on a larger subset of people's social ties would make it possible to differentiate the influence of change in PD by role (e.g., siblings vs. cousins) and to test the generalizability of these findings beyond extended family (e.g. workmates, friends, etc.). Future research might also explore the role that algorithms play in differential exposure to social ties' PD on social media, and the way individuals might consciously interact with algorithms to make mental health issues more or less visible (Cotter, 2018).

Problematizing relatively mundane uses of ICT has contributed to a moral panic (Hampton & Wellman, 2018). The supposed cure—encouraging individuals to protect their well-being by limiting their Internet and social media use—may actually reduce a new protective influence on mental health. Overheated public and clinical concerns about problematic Internet, cell phone, and social media use risk demonizing technologies that have a positive impact on the mental health of most adults. Generally, the protective relationship between ICT and PD is only reduced due to social conditions beyond an individual's control. Instructing people to avoid others online who are experiencing distress, for fear of "catching" anxiety or depression, is antithetical to the goal of developing positive personality traits related to perspective taking and empathic concern (Konrath, O'Brien, & Hsing, 2011). Such instruction removes a new and increasingly important means for people to communicate their problems and become aware of the need to provide social support.

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Appendix

The standardization of variables is one approach to improve the interpretability of regression coefficients. While regression coefficients that have not been standardized, and their associated p-values provides some interpretability, standardization facilitates a comparison of the relative importance of predictors by comparing estimates rather than p-values. This is achieved by centering and standardizing all continuous predictor variables by calculating their z-scores (the score, minus the mean score, divided by the standard deviation) prior to running the analysis. Since it makes little sense to standardize dummy variables (they cannot be increased by a standard deviation), dummy variables are not transformed. This approach allows for a focus on the magnitude of the estimates, along with significance thresholds.

There is a variety of well-established approaches to measuring the relative importance of explanatory variables, including semi-partial correlation coefficients, partial correlation coefficients, and conditional standardized mean differences. Approaches that rely on a comparison of variance explained by each predictor, such as partial correlation coefficients, have not been widely adapted for HLM; there is no intrinsic R-squared measures equivalent to what can be found in traditional multiple regression that can be portioned in a similar fashion (Goldstein, Browne, & Rasbash, 2002), and within and between-level correlation matrix are not readily available as part of an HLM output (Liu, Zumbo, and Wu, 2014). An approach using stepwise/hierarchical regression to interpret the relative importance of each variable based on the change in R-square at each step is fraught with problems (in HLM and other techniques). Such an approach would require accurate R-squared estimates, and would assume that there is no correlation between predictors, producing estimates that would be misleading and that would vary depending on the order that IVs were entered.