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## Digital Media and Stress: The Cost of Caring 2.0

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### **Abstract**

This research explores the relationship between the use of digital media and stress. Based on the findings of a national, probability sample of adults in the United States, the use of digital media was not directly associated with higher levels of psychological stress. Some uses of digital media were associated with lower levels of perceived stress for women but not for men. However, the evidence suggests that, for men and women, digital media provides heightened awareness of network life events (AoNLE) in the lives of both close and more distant acquaintances. An awareness of undesirable, major life events in the lives of others can be a source of psychological stress; this is the cost of caring. Thus, the link between digital media and stress is indirect. We argue that the growth of digital media is related to changes in the structure of peoples' personal communities that contribute to this trend. There has been a shift toward networks that offer persistent contact and pervasive awareness. Findings suggest that different mobile technologies, Internet technologies, and social media afford AoNLE for men and women, but women tend to report greater psychological stress than men, and they experience psychological stress from a wider range of AoNLE. We discuss explanations for the negative relationship between technology use and stress for women, as well as the implications of our findings for research on the use of digital media and psychological well-being, such as the relationship to social support, narcissism and empathy.

**Keywords:** social stress, awareness, social networks, social media, cost of caring, life events, empathy, FOMO.

## Digital Media and Stress: The Cost of Caring 2.0

### Introduction

A growing literature on psychological well-being and the use of digital media, including the Internet, mobile phones, and social media has accompanied the increase in the use of these technologies. One prominent example is the relationship between stress and the use of information and communication technologies. This research fits into a long tradition that has associated technological change with stress, including the transition to urbanization and industrialization in medieval England (Lewis, 2002), the automation of industrial production (Levi, Frankenhaeuser, & Gardell, 1981), and television viewing (Propper, Stickgold, Keeley, & Christman, 2007). It is therefore no surprise that some researchers suggest that digital communication is associated with higher levels of psychological stress (Derks, van Mierlo, & Schmitz, 2014; Thomée, Härenstam, & Hagberg, 2011), which can lead to deleterious health outcomes (Cecchi, Liccardi, Pellegrino, & Sofia, 2012). However, existing scholarship has often ignored the established literature on stress, failing to engage with existing theories and methods, and relying heavily on self-selected samples. As a result, researchers have misattributed the source of stress as it pertains to the use of digital media.

Drawing on the findings of a national, probability sample of American adults, this research explores the relationship between the use of digital media and stress. For most people, the use of digital media is not directly associated with higher levels of psychological stress. However, the increase in the use of digital media has been associated with changes to the structure of a person's personal community. There has been a shift in the nature of personal networks of supportive relationships that contributes to exposure to major stressful life events in

the lives of close and more distant acquaintances. This shift towards community that provides persistent contact and pervasive awareness (Hampton, 2016) comes with a “cost of caring” (Kessler & McLeod, 1984) that is associated with higher levels of psychological stress.

### **Digital Media and Stress**

The stress literature identifies a number of independent, external sources of stress, including traumatic events (e.g., a major earthquake), chronic stressors (e.g., ongoing financial issues), daily hassles (e.g., a work deadline or commuter traffic), stressful life events (e.g., losing a job or getting married), and ambient stressors (e.g., pollution) (Campbell, 1983; Turner, Wheaton, & Lloyd, 1995). When individuals lack the ability or the resources to adapt or cope with these demands, they perceive stress – psychological stress – that contributes to negative affective states, such as anxiety and depression (Cohen & Janicki-Deverts, 2012; Lazarus, 1966). Personal variables, such as age, sex, and marital status can also play a role in that they contribute to unequal exposure to stressful events, the availability of resources, and ability to cope. Psychological stress is a contributing factor to, amongst other health problems, cardiovascular disease (Steptoe & Kivimaki, 2012), asthma and allergy (Nagata, Irie, & Mishima, 1999), peptic ulcers (Levenstein, Rosenstock, Jacobsen, & Jorgensen, 2015), premature labor (Newton, Webster, Binu, Maskrey, & Phillips, 1979), the progression of immune-based diseases, such as HIV (Evans et al., 1997), and mortality (Jeong, Aldwin, Igarashi, & Spiro, 2015).

Previous research on the relationship between digital media and stress has provided no consistent theoretical argument for how the use of these technologies fits into the existing stress paradigm. On the surface, the use of digital media would seem to be unrelated to the exposure to, or intensity of traumatic events. Yet, in the context of television viewing, it has been argued that people living far from a traumatic event, such as the terrorist attacks in the United States on

September 11, 2001, experience higher levels of stress based on their media exposure (Propper, et al., 2007). This argument has recently been extended to the use of technologies, such as social media (Holman, Garfin, & Silver, 2014), although the persistence of this stress seems limited. In another approach, some have suggested that for those with lower technological competency, the use of digital media could be a daily hassle, and, over time, could become a source of chronic stress (Huang, Robinson, & Cotten, 2015). The pressure to use digital media to keep in contact, such as with a mobile phone, could become a source of fatigue and a chronic stressor (Ikeda & Nakamura, 2013). Yet, the most consistent argument for a relationship between digital media use and stress in the general population is that these technologies displace time that would otherwise be spent in social situations, or on leisure, and that this introduces stress (Stepanikova, Nie, & He, 2010; Turkle, 2015).

Despite the ubiquity of the time displacement hypothesis, much of the empirical evidence supports the finding that the use of digital communication technologies supplements rather than displaces contact with social ties (Wellman, Quan-Haase, Witte, & Hampton, 2001). Heavy users of these technologies tend to have a larger networks of core, close social ties (Hampton, Sessions, & Ja Her, 2011c), a more diverse overall network (Hampton, Lee, & Her, 2011b), and higher levels of social support (Lu & Hampton, in press). Although concerns about work life balance and the use of digital technologies cannot be ignored (Robinson et al., 2015), time-use data support the conclusion that people, and Internet users in particular, have more, not less social and leisure time than they did in the past (Robinson & Martin, 2010).

Existing scholarship has largely been based on measures that focus on qualitative responses to what people “like least” about technology (Baron, 2011), and subjective responses to questions about specific stressors. For example, the literature on “technostress” (Brod, 1984;

Bucher, Fieseler, & Suphan, 2013), is heavily based on measures that ask participants to rate how strongly they think a specific technology causes stress, or is responsible for other negative feelings (Lutz, Ranzini, & Meckel, 2014). Such measurement approaches have poor reliability in assessing the source of stress (Schachter & Singer, 1962; Schwarz, 1999). Internal experiences from unknown sources, or sources that are difficult to identify, can easily be misattributed to external sources as primed by the researcher. “By using items that simultaneously assess stressor and distress, the investigator abdicates to the subject the role of testing hypotheses concerning what constitutes morale- or health-damaging stressors” (Schonfeld, 1990, p. 322). Researchers need to separate a person’s use of a technology from their assessment of overall, or global, psychological stress. Further, the negative health outcomes attributed to stress are affected by a person’s global level of perceived stress, not their response to a particular event or technology (Cohen, Kamarck, & Mermelstein, 1983). This deficit in available research has the potential to dramatically bias understanding of how the everyday use of these technologies is related to stress.

There is little evidence of a generalizable trend related to digital media use and higher levels of stress. Studies of the general, adult population are relatively nonexistent. Extant research has relied heavily on studies of college students (Deatherage, Servaty-Seib, & Aksoz, 2014), individuals undergoing major life course transitions (Bartholomew, Schoppe-Sullivan, Glassman, Kamp Dush, & Sullivan, 2012), samples with pre-identified problematic uses of digital technology (Chiu, 2014), and periods of unique technological use, such as early Internet adoption (Kraut et al., 1998). In addition, few studies have considered how digital media may reduce stress. For example, when these technologies are used as source of entertainment, for relational maintenance (Leung, 2007), or as a means to access social support (Lu & Hampton, in

press), they may buffer stress (Cohen & Wills, 1985). Counter to the displacement hypothesis, digital media may even help people reorganize time to better cope with daily hassles and competing demands.

The existing evidence does not support the expectation that there is a direct relationship between the use of digital media and higher levels of psychological stress. While not excluding situational exceptions, or the possibility that some digital technologies may contribute to lower levels of psychological stress, we expect that, in the general adult population:

H1: There is no direct relationship between digital media use and higher levels of perceived stress.

### **Network Life Events as Ambient Stressors**

An alternative explanation for the relationship between digital media and perceived stress relates to the ambient and social nature of many digital media. Chronic, ubiquitous conditions of the physical environment, such as noise, temperature, and air pollution are typically viewed as ambient stressors (Campbell, 1983). “Ambient” in this context describes a condition, which, although perceptible, is typically in the background of a person’s awareness. At times, ambient stressors can become more salient, such as when a noisy environment increases in intensity. In such a situation, the stressor may become less ambient and resemble a chronic stressor or even a daily hassle. For some, digital media may be a source of ambient stress in their environment, for example, as a result of routine exposure to mobile phone use in public spaces (Monk, Carroll, Parker, & Blythe, 2004), or a source of office background noise (Evans & Johnson, 2000). Ambient information can also be a source of perceived stress.

Awareness of stressful, major, life events in the lives of others is one type of information that can be a source of psychological stress. The personal experience of a major life event is a

common source of stress – it is a type of social stress (Turner, et al., 1995). While it seems unlikely that those who use digital media experience more stressful major life events than other people, digital media can make information about other people’s social stress ambient. The specific process through which *awareness of network life events* (AoNLE) becomes a source of stress has not been well established, but has been called the “cost of caring” (Kessler, McLeod, & Wethington, 1985). Presumably, as part of everyday life and through multiple media, including greeting cards, invitations, phone calls, and face-to-face contact, there is an ambient level of exposure to the major life events of others. AoNLE could be driven through a process of social comparison (search) (Festinger, 1954), or serendipity (diffusion) (de Bruijn & Spence, 2001). AoNLE may lead to the provision of social support (Mikal, Rice, Abeyta, & DeVilbiss, 2013), which creates time demands that become daily hassles. It could also cue a psychological process related to empathy, guilt, or anger, which triggers psychological stress. Some research suggests that positive life events, such as getting married or having a child, as opposed to undesirable events, such as losing a job, are associated with lower psychological stress (Cohen & Hoberman, 1983), and this may extend to AoNLE. Some network life events are presumably more salient than others, and awareness may vary, based on the individual attributes and closeness of the acquaintance.

Considerable evidence suggests that women experience stress differently than men. A woman’s biological response to stress tends to differ from a man’s (Wang et al., 2007). Women experience psychological stress differently; they identify more chronic sources of stress, experience more daily hassles, and, although they do not experience a greater number of life events, a large number of events tend to be salient. As a result, they report higher levels of perceived stress (Matud, 2004). Women experience social stress differently. They tend to be



more aware of undesirable life events in the lives of close friends and family (Kessler, et al., 1985). This might be a result of the key role women tend to play in the provision of support (Wellman & Wortley, 1990), or the differences in the structure of women's core networks, including a larger number of close ties (Moore, 1990).

Existing research on AoNLE suggests that it is events in the lives of close others – strong ties – rather than the network of more extensive, primarily weak ties, that are associated with a cost of caring (Kessler & McLeod, 1984). However, the lack of research to support a relationship between AoNLE and stress from relationships that are not especially close may result from of a reading of the literature that discounts the role of more extensive ties (Burt, 2001). Although most people tend to have few close ties (Hampton, et al., 2011c; Marsden, 1987), their more extensive network of acquaintances, weak ties, and daily contacts is a significant source of information and support (Granovetter, 1973; Lu & Hampton, in press; Wellman & Wortley, 1990). Digital media may also augment the structure of a person's personal communities so that networks of more extensive, not-especially-close, ties become more persistent and exert additional social pressures.

The advent of social media and some other digital technologies has afforded *persistent contact* with ties that previously would have dissolved or become dormant (Hampton, 2016). These technologies allow people to articulate a connection and maintain contact with that connection over time. This contrasts with the traditional view of how technological change has influenced the structure of community. Traditionally, technologies, such as the automobile, airplane, telephone, and even early Internet technologies, afforded mobility (Rainie & Wellman, 2012; Urry, 2007). As such, over the life course, as the individual moved from one neighborhood, job, school, or voluntary group, to another, he or she abandoned social ties that

originated from these settings, often replacing them with new relationships in new neighborhoods, jobs, etc. (Coleman, 1988). Because digital media allow persistent contact, extensive networks of ties may communicate a greater volume of events.

The literature suggests that ambient stressors are generally negative in tone (Campbell, 1983). However, some researchers have suggested that social media users may be more susceptible to a negative psychological response to positive events in the lives of others – a “fear of missing out” (Przybylski, Murayama, DeHaan, & Gladwell, 2013). Given the finding that positive life events are associated with lower psychological stress (Cohen & Hoberman, 1983), we find it unlikely that the introduction of a new medium would fundamentally undermine existing trends. Awareness of positive events are likely to be neutral or even mitigate some of the negative psychological effects of awareness of undesirable events. Therefore, we hypothesize that:

H2: Awareness of undesirable network life events in the lives of a) close ties, and b) other ties is associated with higher levels of perceived stress.

### **Digital Media and AoNLE**

Digital media may also increase awareness of network life events. Unlike face-to-face communication, which is often context specific and directed to a small, narrow audience, many digital media – especially social media – allow content to be broadcast to a wide network of close and more extensive ties (Marwick & boyd, 2010; Wesch, 2009). Whereas the content of these messages can sometimes appear trivial, e.g., a photograph of a meal, it can also include political, health, financial, and relationship information (Wang, Burke, & Kraut, 2013). Such disclosures provide ambient – *pervasive awareness* – of the interests, places, opinions, and activities of one’s social ties (Hampton, 2016). Prior research has found that social media, and

other digital media are often used to document, record and both directly and indirectly disclose both positive and negative major life events (Bevan et al., 2015; Bevan, Gomez, & Sparks, 2014; Suler, 2004). As suggested by the evidence that digital communication tends to complement or supplement communication in-person and through other means (Wellman, et al., 2001), online interaction may also increase the opportunity for offline disclosure. Consistent with the theory of persistent contact and pervasive awareness (Hampton, 2016), we hypothesize that:

H3. Digital media use is associated with AoNLE in a person's a) network of close ties and b) more extensive networks.

We do not offer specific hypotheses as to which digital media are associated with AoNLE. Although we suspect that the persistent-pervasive qualities of digital media are responsible for awareness, the relationship to awareness is complex. This complexity is driven by a range of factors, including individual affordances of the technology (Norman, 1988), self-selection for the use of specific technologies (Hampton, Goulet, Rainie, & Purcell, 2011a), and network externalities that lead to the inclusion and exclusion of social ties from digital communication platforms (Lu & Hampton, in press). For example, women are far more likely than men to use the social bookmarking site Pinterest (Hampton, et al., 2011a). As such, this medium may be more important for sharing life events among women. Other technologies may specialize in one domain of major life event, such as the site LinkedIn, which is more specific to job-related information. The ubiquity of some technologies, such as Facebook, the only social media platform the majority of adult Internet users have adopted (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015), may also make them a more likely source for network life events. Different uses of these technologies, for example, status updates vs. commenting on others' content, may be a more salient source of network life events. To complicate matters further,

given that online contact is likely to lead to offline contact and offline disclosure, it may be difficult to tie awareness to the use of a specific medium. At this early stage, an exploratory approach to the relationship between AoNLE and digital media is most appropriate.

### **Methods**

In collaboration with the Pew Research Center, from August to September 2013, we conducted a random-digit dial survey of 1,801 adults, age 18 and older, Internet and non-Internet users, living in households in the United States. To maximize population coverage, telephone interviews were conducted in English and Spanish over landline and mobile phone (Kohut, Keeter, Doherty, Dimock, & Christian, 2012). A two-stage weighting procedure was used to weight the sample; the first stage was used to account for the inclusion of dual-users (landline and mobile phone) in both sample frames, and the second stage balanced sample demographics to population parameters. The sample was balanced to match national population parameters for sex, age, education, race, Hispanic origin, region, population density, and telephone usage. The response rate, as a product of contact rate (64.2%), cooperation rate (14.7%), and completion rate (95.9%), was 9.0%. Thirty cases were omitted from the analyses for missing data on one or more variables.

### **Perceived Stress**

We measured psychological stress using the Perceived Stress Scale (PSS) (Cohen, et al., 1983). Participants were asked a series of ten questions, such as, “In the last 30 days, how often have you been upset because of something that happened unexpectedly?” Participants responded

on a 4-point Likert scale (0-3).<sup>1</sup> The PSS-10 is among the most widely used measures of stress; it has undergone extensive validity testing and has previously been used in telephone surveys (Cohen & Janicki-Deverts, 2012; Lee, 2012; Roberti, Harrington, & Storch, 2006). The final PSS score ( $M=10.18$ ,  $SD=5.48$ ) was calculated by combining the ten items, so that a higher score indicates more psychological stress (0-30).

### **Awareness of Network Life Events (AoNLE)**

There is no established measure of AoNLE. Our measure of AoNLE was adapted from preexisting batteries of stressful life events (Holmes & Rahe, 1967; Turner, et al., 1995). In an attempt to capture the population of life events, these scales can include up to 118 events (Tausig, 1982); far too many items for a telephone survey. Our parsimonious twelve-item AoNLE life event index was designed to include a balance of events previously evaluated as desirable (e.g., becoming engaged or married) or undesirable (e.g., experiencing the death of a child) (Tausig, 1982), and to range from relatively frequently occurring (e.g., starting a new job) to those that we expected to be rarer (e.g., being the victim of a robbery or assault). The inclusion of a range of events – the mundane to the exceptional – allowed us to explore the possibility that only awareness of infrequent events is associated with stress. This design also allowed us to test the relationship between awareness of positive/negative events and psychological stress, to capture a measure of overall awareness, and to identify variation by tie strength. Participants were asked:

Please tell me if you know someone – other than yourself – who has experienced any of the following in the past 12 months. Do you know someone who has...

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<sup>1</sup> The PSS-10 was modified for consistency with other questions in the survey. The response categories were changed from a five- to a four-item Likert scale.

- Started a new job (close 46%; other 14%; both 57%)
- Moved or changed homes (close 43%; other 15%; both 55%)
- Become pregnant, given birth, or adopted a child (close 37%; other 18%; both 54%)
- Been hospitalized or experienced a serious accident or injury (close 38%; other 13%; both 50%)
- Become engaged or married (close 33%; other 18%; both 50%)
- Been fired or laid off (close 27%; other 18%; both 42%)
- Experienced the death of a child, partner, or spouse (close 24%; other 14%; both 36%)
- Had a child move out of the house or move back into the house (close 28%; other 9%; both 36%)
- Gone through a marital separation or divorce (close 19%; other 13%; both 31%)
- Experienced a demotion or pay cut at work (close 18%; other 9%; both 26%)
- Been accused of or arrested for a crime (close 11%; other 12%; both 22%)
- Been the victim of a robbery or physical assault (close 14%; other 9%; both 22%)

If a participant responded “Yes” to any of the twelve items, he or she was then given a probe to clarify if the event happened “to someone close”, or to someone “not very close” or both. For our analyses, each event was coded as a dichotomy and was also combined into two indexes.

AoNLE-C, awareness of events in the lives of close ties, was calculated as the sum of event items that participants reported as having happened to someone close to them, or both someone close and someone else that they know (0-12) ( $M=3.37$ ,  $SD=2.67$ ). AoNLE-E, awareness of

events in the lives of more extensive ties, was calculated as the sum of events that happened to nonclose ties, or both a close tie and someone else (0-12) ( $M=1.62$ ,  $SD=1.75$ ).

### **Digital Media Use**

Participants provided self-reported information on their use of a range of technologies, including mobile phones, general Internet activities, social media platforms, and the most popular social media platform, Facebook.

**Mobile phone use** measures included the average daily number of text messages sent ( $M=28.96$ ,  $SD=75.90$ ), number of text messages sent with pictures ( $M=1.97$ ,  $SD=11.46$ ), and number of unique people to whom messages were sent ( $M=3.47$ ,  $SD=5.38$ ).

**General Internet activities** included a measure of whether the participant was an Internet user (80% of participants) and the number of pictures shared online in an average week ( $M=3.16$ ,  $SD=8.77$ ). It also measured the number of emails sent and received per day ( $M=19.64$ ,  $SD=44.76$ ) and the number of unique people with whom participants exchanged emails on an average day ( $M=7.22$ ,  $SD=12.18$ ).

**Social media use** was based on participation in a range of social media platforms. Using a six-point scale, participants reported how often they visit or use various social media sites. Results were recoded into a scale of frequency of monthly visits (0-90) to Twitter ( $M=4.75$ ,  $SD=18.26$ ), Instagram ( $M=5.72$ ,  $SD=19.99$ ), Pinterest ( $M=2.77$ ,  $SD=12.57$ ), LinkedIn ( $M=2.00$ ,  $SD=9.63$ ), and Facebook ( $M=25.80$ ,  $SD=36.11$ ). Because of the dominance of Facebook use and existing research focused on the role of different Facebook activities in predicting different outcomes, we asked participants to differentiate their monthly Facebook use activities. We asked for the number of status updates ( $M=4.55$ ,  $SD=14.55$ ), number of 'likes' ( $M=19.14$ ,  $SD=32.82$ ), number of comments on other people's photos or status updates ( $M=12.33$ ,  $SD=25.80$ ), number

of private messages ( $M=8.30$ ,  $SD=21.56$ ), and number of Facebook friends ( $M=187.33$ ,  $SD=475.56$ ). Previous studies that have compared self-reported measures of these Facebook activities to log data of actual activities as provided by Facebook suggest a high level of validity (Goulet, 2012; Hampton, Goulet, Marlow, & Rainie, 2012).

**Demographic control variables** were included in the analysis for demographic characteristics established elsewhere in the literature as predictive of stress: age ( $M=46.38$ ,  $SD=17.93$ ), race (13% Black or African American), sex (50% female), years of education ( $M=13.48$ ,  $SD=2.42$ ), living with a spouse or partner (56%), and employment status (59% employed for pay) (Cohen & Janicki-Deverts, 2012).

### **Analysis**

Ordinary least squares (OLS) regression was used to model the relationships between psychological stress and predictors pertaining to digital media use and AoNLE. In this analysis, we do not combine the AoNLE measure into an index, but examine the relationship between perceived stress and each of the twelve major life events for close and more extensive social ties. We retain each event as a dichotomy, as prior research suggests that combining desirable and undesirable events into a combined index for use as an independent variable could neutralize the relationship to stress (Yen et al., 2005).

When controlling for AoNLE, we hypothesize that the use of digital media is not associated with higher levels of psychological stress. However, we do not exclude the possibility that there is a direct relationship between the use of some technologies and *lower* levels of psychological stress. We do not explicitly hypothesize which technological uses are associated with lower stress, but we do expect variation by sex. We base this expectation on the empirical evidence that suggests that men and women tend to experience stress differently. Therefore, we



take an exploratory approach that splits our sample into separate unconstrained models for men and women. The alternative approach – a partially constrained model with interaction effects to test if the variance is different between males and females – likely assumes more shared variance across sexes when predicting psychological stress than actually exists.

We used a stepwise forward selection procedure, because of the large number of independent variables used in our model and the exploratory nature of the analysis. We entered demographic variables into the model as a block and retained them throughout the analysis. We entered digital media variables and individual measures of AoNLE as two separate blocks, and dropped any variables that were not significant.<sup>2</sup> This approach preserves degrees of freedom and minimizes issues related to multicollinearity.

We used additional sets of OLS regressions to model the relationship between the use of digital media and AoNLE. In this analysis, AoNLE was modeled as a series of indexes. As a measure of awareness, a dependent variable, the combined positive and negative events in the AoNLE indexes do not present the same problems as they would have in the first analysis. As with the first analysis, separate, stepwise OLS regressions were run for men and for women for each of AoNLE-C and AoNLE-E.

## **Results**

### **Digital Media and Psychological Stress**

Table 1 presents the result of OLS regression predicting perceived psychological stress from technology use, controlling for AoNLE. An ANOVA ( $p < .01$ , two-tailed) confirms the

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<sup>2</sup> Variables were removed if their probability of F (p-value) became larger than .10 due to the inclusion of another variable.

expectation that women tend to perceive higher levels of stress ( $M=10.5$ ,  $SD=5.5$ ) than men ( $M=9.8$ ,  $SD=5.5$ ). Women's perceived stress was associated with a larger number of variables, and our model for women's perceived stress accounted for nearly twice as much variation ( $R^2 = .16$ ) as our model for men ( $R^2 = .08$ ). In terms of demographic variables, women who were older, had more years of formal education, lived with spouse or partner, and those who were employed, tended to perceive less psychological stress. Men reported lower levels of perceived stress in relation to more years of formal education and living with a spouse or partner. For women, employment was the strongest predictor of lower stress levels ( $\beta = -.158$ ) (followed closely by education;  $\beta = -.146$ ), whereas for men it was education ( $\beta = -.168$ ).

[Table 1]

As anticipated in H1, we did not identify a positive relationship between the use of digital media and perceived stress for either men or women. However, the use of some digital media was associated with lower stress for women. Frequent use of text messages with pictures ( $\beta = -.099$ ), emails ( $\beta = -.083$ ), and Twitter ( $\beta = -.116$ ) was associated with lower scores on the PSS. All things being equal, a woman who used Twitter daily, compared with a woman who did not use it at all, scored 1.1 units lower on the PSS. This effect is equivalent to the lower levels of stress reported by women who had approximately three additional years of formal education. While significant, the effect of email use and exchanging pictures through a mobile phone were less substantive, although comparable to a demographic variable such as living with a spouse/partner ( $\beta = -.087$ ). Exchanging twenty-five additional emails per day (the total sent and received) was associated with scoring .25 units lower on the PSS. Sending three pictures by text message on the average day was associated with a score that was .12 lower on the PSS.

## Awareness of Network Life Events and Stress

In H2, we hypothesize that awareness of undesirable life events in the lives of a) close ties and b) other, more extensive ties would be associated with higher levels of perceived stress. For men and women, awareness that a close social tie had experienced either a “demotion or pay cut at work” (women  $\beta = .110$ ; men  $\beta = .134$ ) or been “accused of or arrested for a crime” (women  $\beta = .074$ ; men  $\beta = .133$ ) was associated with higher levels of perceived stress. Women, but not men, also reported higher levels of perceived stress when they were aware that a close relation had “been hospitalized or experienced a serious accident or injury” ( $\beta = .071$ ) or “experienced the death of a child, partner, or spouse” ( $\beta = .126$ ). Fewer events in the lives of more extensive ties were related to perceived stress. Women reported higher levels of stress when a weaker tie had been accused or arrested for a crime ( $\beta = .097$ ). Men reported higher stress when a more distant acquaintance experienced a demotion or cut in pay ( $\beta = .069$ ).<sup>3</sup> This is consistent with previous research that found that women report family and health-related events more frequently than the men, whereas men tend to find work-related events more salient

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<sup>3</sup> Using this data, a report on the relationship between perceived stress and AoNLE by Hampton, Rainie, Lu, Shin, and Purcell (2015) did not identify as many events in the lives of close ties as being significantly related to perceived stress as we report here. Hampton et al (2015) also identified, for women, a relationship between perceived stress and two additional life events related to “weak ties”. The analysis by Hampton et al. (2015) was based on an operationalization of weak ties that was closer to a measure of overall network awareness; it included awareness of life events that happened to those whom participants described as “close” or “not close.” As described in the Methods section, the analysis in this paper operationalizes awareness of events in the lives of “other ties” as an event that happened to someone “not close” or an event that happened to “both someone close and someone not very close.” We believe that the operationalization presented here is a more valid interpretation of the distinction between “close” and a person’s more extensive network of ties.

(Matud, 2004). None of the events associated with higher stress were those identified in the literature as desirable (Tausig, 1982), casting doubt on the suggestion that awareness of desirable events results in negative well-being, or a “fear of missing out.” With the exception of “hospitalization or a serious accident,” all events associated with stress were relatively rare events.

The relationship between AoNLE and stress is substantive; the standardized coefficients for some events approach the magnitude of the strongest demographic predictors. Other things being equal, for women, the effect of awareness of even one of the handful of significant events we identified was associated with a score that was between .79 and 1.76 higher on the PSS. This compares to the average .96 lower PSS score reported by women who are married or living with a partner, or the 1.74 lower score reported by women engaged in paid employment. Although fewer events mattered, awareness had a similar relationship to men’s reported perceived stress. For men, awareness of even one event was associated with being 1.24 and 2.32 points higher on the PSS. This was equal to the protective benefits of between three and six years of formal education.

We note that prior to adding AoNLE to the regression, the frequency at which women send private messages on Facebook was a significant variable for predicting perceived stress. With the addition of AoNLE, through stepwise regression, frequency of Facebook messaging no longer made a significant contribution when predicting perceived stress. The loss of significance of a variable, which otherwise would have demonstrated a positive relationship between the use of digital media and stress, highlights the risk of identifying spurious relationships between media use and perceived stress, when AoNLE is not considered.

## Digital Media and AoNLE

Table 2 presents the results of a series of OLS regressions that predict awareness of network life events, AoNLE-C and AoNLE-E, based on use of digital media. ANOVA ( $p < .01$ , two-tailed) verifies that women ( $M=3.5$ ,  $SD=2.6$ ) are more aware than men of more major life events in the lives of close ties ( $M=3.2$ ,  $SD=2.7$ ), but not in the lives of other, more extensive acquaintances. Years of education is the only variable that consistently predicts awareness of both close and more extensive social ties for both men and women. More years of formal education is consistently associated with awareness of a large number of events in the lives of close and more distant acquaintances. Age is negatively associated with AoNLE-C for men and women, and, whereas age predicts lower AoNLE-E for women, age is unrelated to AoNLE-E for men. For women, the only other demographic variable that predicts awareness of network life events is employment, which is related to higher levels of AoNLE-E. Age is the strongest demographic predictor of AoNLE-C for men ( $\beta = .158$ ) and women ( $\beta = .172$ ). While education is the strongest predictor of AoNLE-E for both men ( $\beta = .159$ ) and women ( $\beta = .139$ ).

[Table 2]

Despite the relative consistency in demographic predictors of network life events, there is considerable divergence between men and women in terms of how technology affords awareness. Consistent with H3a and H3b, the use of digital media predicts higher levels of both AoNLE-C and AoNLE-E. However, the total number of digital media that predict awareness is considerably fewer when predicting AoNLE-E.

For women, the number of pictures shared online ( $\beta = .122$ ), the frequency of visits to Pinterest ( $\beta = .067$ ), and the number of Facebook friends ( $\beta = .115$ ) were positively associated with AoNLE-C. For men, higher levels of AoNLE-C were associated with the number of people

to whom they sent text messages through their mobile phones ( $\beta = .167$ ), the frequency of Pinterest ( $\beta = .069$ ) and LinkedIn use ( $\beta = .080$ ), and the frequency of comments on content contributed by other people on Facebook ( $\beta = .070$ ). For women, the standardized coefficient for picture sharing and number of Facebook friends were nearly equal to the magnitude of the coefficient for education ( $\beta = .120$ ). A woman who had a mean level of media use, who shared four pictures online per week, who used Pinterest six times per month, and had 245 Facebook friends, scored 0.48 point higher on AoNLE-C. This higher level of awareness is equivalent to 3.6 years of education, or nearly the difference in awareness between those who finished high school and those who completed a university degree. The effect of the use of digital technologies is even greater for men. The standardized coefficient for text messages suggests that it was the largest contributor, of all variables in our analysis, to AoNLE-C. At mean levels of use, a man who texts five people per day, who visits Pinterest once per month and LinkedIn four times per month, and who comments on Facebook thirteen times per month, scores 0.59 points higher on the AoNLE-C, which is equivalent to 4.3 years of education.

In predicting AoNLE-E, for women, the only use of technology associated with higher levels of awareness was basic Internet use ( $\beta = .110$ ). For men, the only use of digital media associated with AoNLE-E was frequency of email use ( $\beta = .133$ ). All other things being equal, basic Internet use was associated with women scoring .48 points higher on the AoNLE-E. Average male use of email, sending/receiving 24 emails/day, was associated with .12 more points on the AoNLE-E. For women, Internet use was a substantive predictor of awareness of life events in the lives of acquaintances, equivalent to more than four years of education. For men, email use was roughly equivalent to a year of education.

## Discussion

The results of this study do not support the argument that digital media use is directly related to higher levels of psychological stress in the general, adult population. In fact, we find evidence that, for women, the use of some digital information and communication technologies is related to lower levels of perceived stress. We find evidence to support a relationship between the use of some digital media and higher awareness of stressful events in the lives of close, as well as more extensive social ties. Failing to control for awareness of network life events can lead to spurious conclusions about the relationship between the use of digital media and stress. For example, we found that a relationship between psychological stress and Facebook use disappeared after controlling for network life events. Findings revealed that ambient exposure to some undesirable network life events contributed to higher levels of psychological stress. Although we have no evidence of a direct relationship between frequency of use of these technologies and higher levels of reported stress, our evidence suggests an indirect link.

Our data do not provide a conclusive explanation for why the use of some digital media by women is related to lower levels of perceived stress. These technologies – photo sharing through mobile devices, email exchanges, and Twitter – likely share technological affordances that help women cope with external sources of stress. The activities that take place through these media may provide an escape or a source of entertainment that buffers stressful events. Or, consistent with the relationship between the use of some digital media and higher levels of perceived social support (Lu & Hampton, in press), the use of these technologies may provide access to support, which in turn buffers stress (Cohen & Wills, 1985). These technologies may also provide the ability to share emotional experiences, which may help one to cope with stressful events and reduce psychological distress. Women tend to share emotional experiences

more frequently and with a wider range of people than do men (Pennebaker, Zech, & Rimé, 2001). While preexisting arguments suggest that digital media displace activities associated with stress reduction or create new, competing demands, it is also possible that these technologies help women cope with competing time demands of home, work, and “net work” (the network maintenance disproportionately experienced by women (Wellman, 1999)).

The role that AoNLE plays in reported levels of psychological stress is consistent with the theory of the “cost of caring” (Kessler, et al., 1985). Recent changes to the structure of community suggest that digital media are making relationships more persistent and pervasive (Hampton, 2016). As a result, network life events may become more visible and more salient as sources of social stress. Indeed, we found evidence that AoNLE in the lives of close ties is a significant source of psychological stress, especially for women. We found similar evidence, although more modest, for more extensive ties. With no relationship between awareness of positive life events and psychological stress, a fear of missing out, our evidence suggests that it is only an awareness of undesirable or negative events that predicts stress.

The use of digital media is related to higher levels of AoNLE. Although, the specific technologies that afford awareness of life events varied for men and women and for close and more extensive ties. The reason some digital media were related to AoNLE and not others is likely a result of the affordances of specific technologies, network externalities, and self-selection. For example, in a previous study, digital photo sharing was found to be associated with awareness of political diversity among core discussion members (Hampton, et al., 2011c). Our data suggest a similar affordance for sharing life events through photos. Previous studies found that communication with strong ties was more common through some digital communication channels than others, such as the mobile phone (Ling, 2008), and we find this extends to



variation in the awareness of life events. Technologies that are more likely to be used with an extensive range of ties, such as email, provide awareness of life events for more extensive ties. Digital media also specialize in their domains of life events. An ad-hoc analysis – an ANOVA between LinkedIn users and non-users – confirmed that users of this platform were more likely to be aware of work related events. Such events included starting a new job ( $p < 0.001$ ), being fired or laid off ( $p < 0.001$ ), experiencing a demotion or pay cut at work ( $p < 0.01$ ), and moving or changing homes ( $p < 0.001$ ). Some activities, such as “commenting” on Facebook, may also make awareness of life events more salient for more men than for women. There is preliminary evidence to suggest that men are aware of more network life events as a result of digital media. It may also be, as suggested by the finding that online contact supplements offline contact (Wellman, et al., 2001), that people do not encounter all event information online, but through subsequent communication.

Taken together, our hypotheses suggest that AoNLE may mediate the relationship between the use of some digital media and psychological stress. Future research should include a formal test of this relationship. However, the current twelve-item AoNLE measure is not suitable for a formal test of this relationship using an approach such as structural equation modeling (path analysis). Short, stressful life events scales, such as our AoNLE indexes do not cover a sufficiently wide range of possible events (Tausig, 1982). As such, our version of the AoNLE indexes likely underestimates the relationship between awareness of stressful life events and psychological stress. Not only is the range of the AoNLE limited, but the inclusion of a small number of relatively rare undesirable events (which turned out to be the most likely source of stress), truncates the range of possible scores for most people on our AoNLE indexes. Further, when operationalized as a single index and used as a mediating variable, rather than as a

dependent variable as in our analyses, including positive events along with the negative events could neutralize the relationship to stress (Yen, et al., 2005). AoNLE indexes suitable for a formal test of an indirect relationship must include a larger range of events. An AoNLE measure that included less ubiquitous desirable events might also identify a set of positive events associated with lower levels of stress (Cohen & Hoberman, 1983). This would support the need for separate undesirable and desirable indexes. Further work is also required to separate sources of awareness based on the use of digital media for social comparison (search) from those based on more serendipitous uses of technology (diffusion). Additional digital and traditional media, such as the use of voice over mobile and landline phones, should also be explored for their role in providing AoNLE. The use of algorithms in social media systems may further confound the processes we observed (Hamilton, Karahalios, Sandvig, & Eslami, 2014). Algorithms may exploit preexisting tendencies, such as the tendency for women to be more aware or interested in life events, with the aim to maximize interactions on a digital medium, with the unintended consequence of increasing social stress amongst a segment of the population that already feels a disproportionate cost of caring.

Consistent with other findings that suggest digital media can serve as a channel for the contagion of emotion (Coviello et al., 2014; Gruzd, Doiron, & Mai, 2011), through AoNLE, digital media serve as a channel for the spread of stress. The cost of caring is not a new phenomenon, but it may be increasingly felt because of changes to the nature of community that favor persistent contact and pervasive awareness. These findings present a challenge to those who are concerned about the relationship between digital communication and negative psychological outcomes. Although psychological stress can be a risk factor for health problems, it is difficult to problematize the cost of caring. Awareness of the problems and hurdles faced by

others is a form of social interest (Adler, 1938) and may ultimately facilitate the provision of social support. These social goods may outweigh the negative effect of stress. They may also counter concerns that digital media are associated with related constructs like narcissism, excessive interest in oneself, and lower levels of empathy, failing to place oneself in another's shoes and to feel what they are feeling (Konrath, O'Brien, & Hsing, 2011).

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Table 1. OLS regression on Perceived Stress Scale (PSS)

	Women (N=889)		Men (N=882)	
	Coefficient	(beta)	Coefficient	(beta)
Constant	17.132		15.135	
<b>Demographics</b>				
Age	-.035	(.118)	-.001	(.003)
Years of education (7-18)	-.334	(.146)	-.376	(.168)
Black/African-American	.478	(.031)	.616	(.036)
Living with spouse or partner	-.960	(.087)	-.852	(.078)
Employed	-1.739	(.158)	-.759	(.067)
<b>Mobile Phone Use</b>				
Number of text messages sent per day	-	-	-	-
Number of pictures sent per day	-.039	(.099)	-	-
Number of people text per day	-	-	-	-
<b>General Internet Use</b>				
Uses Internet	-	-	-	-
Number of pictures shared online per week	-	-	-	-
Number of emails sent/received per day	-.010	(.083)	-	-
Number of people email per day	-	-	-	-
<b>Social Media Use</b>				
Twitter visits per month (0-90)	-.035	(.116)	-	-
Instagram visits per month (0-90)	-	-	-	-
Pinterest visits per month (0-90)	-	-	-	-
LinkedIn visits per month (0-90)	-	-	-	-
<b>Facebook Use</b>				
Facebook visits per month (0-90)	-	-	-	-
Number of Facebook friends	-	-	-	-
Status updates per month (0-90)	-	-	-	-
Likes per month (0-90)	-	-	-	-
Comments per month (0-90)	-	-	-	-
Private messaging per month (0-90)	.013	(.050)	-	-
<b>AoLNE Close Ties</b>				
Started a new job	-	-	-	-
Moved or changed homes	-	-	-	-
Pregnant, given birth, or adopted a child	-	-	-	-
Hospitalized or a serious accident or injury	.788	(.071)	-	-
Engaged or married	-	-	-	-
Fired or laid off	-	-	-	-
Death of a child, partner, or spouse	1.614	(.126)	-	-
Child move out of or move back into the house	-	-	-	-
Gone through separation or divorce	-	-	-	-
Demotion or pay cut at work	1.563	(.110)	1.894	(.134)
Accused of or arrested for a crime	1.286	(.074)	2.325	(.133)
Victim of a robbery or physical assault	-	-	-	-
<b>AoLNE Other Ties</b>				
Started a new job	-	-	-	-
Moved or changed homes	-	-	-	-
Pregnant, given birth, or adopted a child	-	-	-	-
Hospitalized or a serious accident or injury	-	-	-	-
Engaged or married	-	-	-	-
Fired or laid off	-	-	-	-
Death of a child, partner, or spouse	-	-	-	-
Child move out of or move back into the house	-	-	-	-
Gone through separation or divorce	-	-	-	-
Demotion or pay cut at work	-	-	1.242	(.069)
Accused of or arrested for a crime	1.760	(.097)	-	-
Victim of a robbery or physical assault	-	-	-	-
<b>Adjusted R<sup>2</sup></b>		.156		.082

\*p&lt;.05 \*\*p&lt;.01 \*\*\*p&lt;.001

Note: used stepwise forward selection, excluded variable indicated by a dash "-".

Table 2. OLS regression on awareness of total number of major life events

	AoNLE-C		AoNLE-E	
	Women (N=889) Coefficient(beta)	Men (N=872) Coefficient(beta)	Women (N=889) Coefficient(beta)	Men (N=872) Coefficient(beta)
<b>Constant</b>	2.385 ***	1.888 ***	.016	.079
<b>Demographics</b>				
Age	-.025(.172)***	-.024(.158)***	-.010(.105)**	-.004(.040)
Years of education (7-18)	.132(.120)***	.136(.125)***	.101(.139)***	.113(.159)***
Black/African-American	-.149(.020)	-.041(.005)	-.309(.063)	-.153(.028)
Living with spouse or partner	.302(.057)	.053(.010)	.148(.042)	.088(.025)
Employed	.186(.035)	.210(.038)	.399(.113)**	.210(.058)
<b>Mobile Phone Use</b>				
Number of text messages sent per day	-	-	-	-
Number of pictures texted per day	-	-	-	-
Number of people text per day	-	.076(.167)***	-	-
<b>Internet Use</b>				
Is Internet user	-	-	.480(.110)**	-
Number of pictures shared / week	.041(.122)***	-	-	-
Number of emails sent/received / day	-	-	-	.005(.133)***
Number of people email / day	-	-	-	-
<b>Social Media Use</b>				
Twitter visits per month (0-90)	-	-	-	-
Instagram visits per month (0-90)	-	-	-	-
Pinterest visits per month (0-90)	.011(.067)*	.030(.069)*	-	-
LinkedIn visits per month (0-90)	-	.018(.080)*	-	-
<b>Facebook Use</b>				
Facebook visits per month (0-90)	-	-	-	-
Number of Facebook friends	.001(.115)***	-	-	-
Status updates per month (0-90)	-	-	-	-
Likes per month (0-90)	-	-	-	-
Comments per month (0-90)	-	.008(.070)*	-	-
Private messaging per month (0-90)	-	-	-	-
<b>Adjusted R<sup>2</sup></b>	.131***	.136***	.106***	.068 ***

\*p&lt;.05 \*\*p&lt;.01 \*\*\*p&lt;.001

Note: used stepwise forward selection, excluded variables indicated by a dash "-".