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User characteristics, social media use, and fatigue during the coronavirus pandemic: A stressor–strain–outcome framework

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ABSTRACT

Social networking platforms allow people to connect and socialize online, but the extant research suggests that increased social media (SM) use also leads to fatigue, affecting individual well-being. During the coronavirus (COVID-19) pandemic when millions of people were confined to their homes, SM use surged, posing questions about changes in individual SM use behaviors and effects. Guided by the stressor–strain–outcome framework and SM use research, this study examined the relationship among personal factors (gender, caregiving, income), two stressors (SM use intensity and risk concern about COVID-19), and the strain of SM fatigue. Survey data of 192 U. S. adult SM users were collected in late March of 2020. Our quantitative data analysis shows that SM fatigue increased significantly as individual concern about COVID-19 increased. Meanwhile, gender and caregiving responsibilities significantly impacted SM use intensity. Surprisingly, the predicted effect of SM use intensity on SM fatigue was not supported. Additional factor analysis revealed three motives of SM use (entertainment, networking, and collaboration) and quantitative analysis revealed that only the networking use of SM increased SM fatigue significantly. The results highlight the importance of considering individual risk concern and SM use motives when studying individual SM fatigue during crises.

1. Introduction

In recent world history, the year 2020 has brought millions of people worldwide personal and professional challenges due to the world's biggest health crisis to date—the coronavirus (COVID-19) pandemic. On March 11, 2020, the World Health Organization officially declared COVID-19 a worldwide pandemic (WHO, 2020). Just one month later, over 95% of the US population was instructed to remain home and practice social distancing, that is, maintaining a distance of at least 2 m or six feet to others (Mervosh et al., 2020). By the end of 2020, over 87 million people worldwide had contracted the virus, and more than 1.8 million people had lost their lives to it.¹ This unprecedented global health crisis has disrupted our everyday work and lives: non-essential work facilities and offices closed, with employees working remotely from home and students moving to virtual classrooms. Since spring of 2020, most people have found themselves in unprecedented social territory, relying mostly on online channels for their communication to the outside world.

During the COVID-19 pandemic, individual use of social media (SM)

platforms surged. Based on a survey of more than 25,000 consumers across 30 global markets, SM consumption increased by 61% over normal usage rates, as the pandemic caused many countries to impose lockdowns and various restrictions (Kantar, 2020). According to the Facebook vice presidents for analytics and engineering, total messaging increased to more than 50%, while voice and video calling more than doubled on both Messenger and WhatsApp over the month of February 2020 in the countries hit hardest by the coronavirus (Schultz & Parikh, 2020). While SM consumption surged, user behavior demonstrated some new patterns. According to an eMarketer report, the coronavirus spurred the development and popularity of new live streaming, video chat, and gaming features on SM networks (Williamson, 2020). As individuals use SM for entertainment, social interaction, and information sharing (Khan, 2017), these platforms can play a positive role in virtually strengthening socialization among citizens confined to their homes during the COVID-19 crisis. One recent study on online neighborhood social networks argued that online networks represent a viable solution for enhancing a community's resistance to disruptions imposed by the global pandemic, further demonstrating that community members' use

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¹ See the dashboard from Johns Hopkins University at <https://coronavirus.jhu.edu/map.html>.

of such networks fosters their social resilience, that is, the capability to recover from or respond positively to crises (Vogel et al., 2021).

However, prior studies have also shown that increased SM use may have a negative effect on users, resulting in SM fatigue. The term “SM fatigue” refers to users’ tendency to withdraw from SM usage as a result of feeling overwhelmed by too much content and too many sites, friends, and contacts, as well as too much time spent keeping up with these connections (Technopedia, 2011). This type of fatigue is associated with users’ emotional exhaustion and diminished personal accomplishment (Lee et al., 2014). Thus, the surge in SM use during the COVID-19 pandemic poses questions about changes in individual SM engagement behaviors and effects. Studies on individual SM use during COVID-19 have provided anecdotal evidence of new usage patterns (Williamson, 2020; Zhao & Zhou, 2020). However, they have also called for further investigations into the SM use behaviors of individuals from different demographic backgrounds. Therefore, it is important for us to better understand home-based, contextualized SM use during COVID-19 and to investigate whether the surge in SM use causes SM fatigue.

Thus, in this study, we sought to answer the following research questions:

- (1) What demographic factors affect SM use intensity during the COVID-19 pandemic?
- (2) Does SM use intensity lead to SM fatigue during the COVID-19 pandemic?
- (3) Do individual concerns about the COVID-19 pandemic lead to SM fatigue?

The objective of this research was to examine individual responses in terms of changed SM practices in times of the global coronavirus pandemic. Guided by the stressor–strain–outcome (SSO) framework and informed by SM use research, this study examined the relationship between two main stressors—SM use intensity and COVID-19 concern—and the strain of SM fatigue. It also examined whether three personal factors, namely, gender, caregiving responsibility, and household income, are associated with the stressors.

We drew upon uses and gratifications theory (UGT) to explore individual behaviors in SM use. Informed by the SM use literature, we predicted the relationships among personal factors, SM use intensity, COVID-19 concerns, and SM fatigue. We collected survey data from 206 adult SM users aged 18–59 years from an economically and ethnically diverse population in a metropolitan area on the US West Coast in late March of 2020 and used 192 completed responses for the study. Our quantitative data analysis using structural equation modeling (SEM) shows that both gender and caregiving responsibilities are significantly associated with SM use intensity and COVID-19 concerns. In addition, individual concerns about COVID-19 have a significant, positive effect on SM fatigue, while SM use intensity does not. Furthermore, a factor analysis of individual SM use purposes revealed three motives: entertainment, networking, and collaboration. Our supplemental quantitative data analysis indicates that the networking use of SM has a significant, positive effect on SM fatigue, while entertainment and collaboration use do not impact SM fatigue. This further analysis shows that not all SM use leads to SM fatigue and that the effect depends on the specific motives of individual SM use.

The remaining parts of the paper are organized as follows. In Section 2, we review the relevant literature and develop our hypotheses. Section 3 describes our research methodology, while Section 4 presents our main findings. Sections 5 discusses the findings, while Sections 6 and 7 conclude the paper by presenting the implications and directions for future research, respectively.

2. Theoretical background and hypothesis development

SM has become an integral part of our daily lives. “Social media” is defined as a group of Internet-based platforms and applications that

build on the technological foundations of Web 2.0 to allow the creation and exchange of user-generated content (Kaplan & Haenlein, 2010). SM not only allows users to obtain information instantly, but also enables them to view, comment on, and share content with others within large networks of users. According to Kaplan and Haenlein (2010), SM can be distinguished by six overarching categories: Wikipedia, blogs, content communities, virtual game worlds, virtual social worlds, and social networking sites (SNSs). In this paper, we focus on one type of SM, namely, SNSs such as Facebook, Twitter, Instagram, Snapchat, and LinkedIn. We view SM as consisting of interactive platforms that make it possible for individual users not only to create profiles, build social networks, and create and share various types of content, such as texts, pictures, video, and audio (Ellison & Boyd, 2013; Kim & Jung, 2017), but also to search for in-depth information (Riffe et al., 2008). To inform the development of our conceptual model of SM use and fatigue, we drew upon UGT and adopted the SSO framework, which we discuss below.

2.1. SM use gratification, stressor, and strain

As mentioned previously, this study drew upon UGT to explore individual behaviors in SM usage and the gratifications they sought in their SM consumption during the COVID-19 pandemic. UGT argues that individuals actively seek out and use specific media to satisfy their specific needs (Katz & Foulkes, 1962). Thus, their needs (motives) may influence their behaviors while engaging with different media platforms. One frequent motive is the need for information (i.e., people’s desire to increase their knowledge of oneself, others, and the world), which drives individuals to seek information from their media use (Shao, 2009). Another common motive is entertainment, through which people seek enjoyment, anxiety relief, and relaxation (McQuail, 2005). According to a study of online media using the user gratification lens, consumers’ choices of SM are motivated by four major needs: entertainment, information seeking, information sharing, and desire for remuneration (Dolan et al., 2016). SM platforms have been used as effective channels for people to satisfy their needs, such as those for information and entertainment. In other words, user motives influence user behaviors that consequently affect individual outcomes. Fatigue resulting from SM use is one such negative outcome on individual users.

This study adopted the SSO framework to guide our conceptual model development. The framework is a generic model originally developed to examine the relationships between mental conditions and professional performance in organizations (Koeske et al., 1993). It consists of three components: stressor(s), strain, and outcome(s). The SSO framework has been adopted by SM researchers to analyze the antecedents and consequences of SM use intensity and fatigue (Dhir et al., 2019; Lee et al., 2016). In those studies, the “stressor(s)” referred to emotional and behavioral stimulants, such as compulsive media use (Lee et al., 2016) and privacy concerns (Dhir et al., 2019). When employees experience stress in the workplace, they are likely to be exposed to strain (e.g., fatigue), which leads to deteriorated job performance (Koeske et al., 1993). Similarly, when students increase their use of WhatsApp, a popular instant messaging app, they experience fatigue from SM use, which leads to a decrease in their academic performance (Malik et al., 2020). In the context of SM use in our daily lives, users who experience stressors (e.g., compulsive use of technology, concerns about privacy) are likely to suffer from SM fatigue, which may negatively affect their well-being. In addition, prior research has found relationships between individual background variables and SM use (Riffe et al., 2008), which we present below.

2.2. User characteristics and SM use

Understanding user characteristics is important for SM studies. According to Riffe et al. (2008), 31%–50% of their respondents reported SM as a valued source of in-depth information for understanding issues

and topics related to health, science, and business. Consistent with prior research, the current study further suggests that individual background variables are good predictors of SM use behaviors.

Gender is one key factor to consider: Users of different genders have shown different motivations for and levels of participation in SM platforms. For example, prior studies (e.g., Hughes et al., 2012; Ruleman, 2012) have examined the differences in SM use behaviors between male and female users and found that the latter use SM more for communication purposes, while the former use them for observations. Moreover, according to a Pew Research report (Anderson & Jiang, 2018), more women (39%) are using Instagram than men (30%). As online users, women are also more likely to use Facebook and Instagram than men, as shown in 77% and 66% of the online sample uses, respectively. Similarly, we predict that, in the context of the COVID-19 pandemic, females are more likely to use SM than males. Therefore, we present the following:

Hypothesis 1a. (H1a): Gender is significantly associated with SM use intensity during the COVID-19 pandemic, with females showing greater SM use than males.

Caregiving responsibility is another important characteristic in the study of individual SM use behaviors. In this study, we define “caregiving responsibility” as the provision of home care or assistance to a family member in need. Prior research on employee work-life balance has shown that employees experience challenges in balancing their paid work and caregiving responsibilities at home (Duxbury et al., 2009). One common challenge reported by employees is that dealing with caregiving issues depleted their time and energy, which reduced their time for work or personal relaxation. During the COVID-19 crisis, many individuals found themselves assuming more family caregiving responsibilities, such as taking care of elderly parents or grandparents, babysitting, and homeschooling young children. As a result, they are less likely to have time to navigate SM platforms. Thus, we predict:

Hypothesis 1b. (H1b): Caregiving responsibility is significantly associated with SM use intensity during the COVID-19 pandemic, such that, as caregiving responsibility increases, SM use decreases.

Finally, **household income** is considered another important characteristic in the study of individual SM use behaviors during the coronavirus pandemic crisis. Income is an important factor because the resulting digital divide reflects socioeconomic inequality in terms of access to computers and the Internet (Gunkel, 2003). Low-income households not only have fewer technology resources but also show less frequent use of technologies, such as the Internet and its social networking platforms. For example, a study has shown that those from disadvantaged groups do not fully engage in online opportunities even if they have Internet access (Eynon & Helsper, 2011). According to the 2015 Pew Research Center Report, 78% of those living in the highest-income (US\$75k+) households use SM, compared to 56% of those in the lowest-income (less than US\$30k) households, representing a 22-point difference (Perrin, 2015, pp. 52-68). Based on the above reasoning and information, we propose:

Hypothesis 1c. (H1c): Household income is significantly associated with SM use intensity during the COVID-19 pandemic, such that as income increases, SM use increases.

2.3. User characteristics and risk perceptions regarding the COVID-19 pandemic

In this study, user characteristics, such as gender, caregiving responsibility, and household income, were expected to be associated with individual risk concerns. A study by Teladoc Health highlighted the widespread negative impact of COVID-19 on employees' mental health (Teladoc Health, 2020). The study revealed that this impact was more prevalent in women and young Americans: 52% of women experienced a negative impact compared to 42% of men. Similarly, research on gender

and mental health during COVID-19 has shown that the female gender is significantly associated with higher levels of stress, anxiety, and depression, thus suggesting a greater psychological impact of the coronavirus outbreak on females than males (Wang et al., 2020). Based on the abovementioned information, we propose:

Hypothesis 2a. (H2a): Gender is significantly associated with individual concerns about COVID-19, such that females show higher levels of risk concern than males.

Moreover, the coronavirus pandemic has demonstrated a significant effect on individuals with more family caregiving responsibilities. As the caregiving demand (i.e., the number of hours of care provided) increases, caregivers are likely to feel more physical and emotional strain that negatively affects their quality of life. In fact, high-strain caregivers reported more problems with emotional distress, worse physical functioning, and fewer social contacts than non-caregivers (Roth et al., 2009). The impact of family caregiving responsibilities on individuals further intensified during the COVID-19 pandemic because the coronavirus caused death at an alarming rate. Since February 1, 2020, the Centers for Disease Control and Prevention (CDC) has estimated a total of 942,431 excess deaths (associated with COVID-19 directly or indirectly) in the US (Ali, 2022). Worldwide, millions of people have also died from COVID-19, according to government records, with research suggesting that the actual number of COVID-19-related deaths could be much higher (Kobilov et al., 2021). In times of public health crises during which individual caregiving responsibilities increase at home, individual risk concerns about COVID-19 are also likely to increase without a definite ending date in sight. Therefore, compared to their counterparts, users with more caregiving responsibilities are likely to express higher risk concerns. Related to this, we predict the following:

Hypothesis 2b. (H2b): Caregiving responsibility is significantly associated with individual concern about COVID-19, such that the risk concern level increases as caregiving responsibility increases.

Finally, the coronavirus pandemic has demonstrated a significant effect on low-income households. For example, African American and Hispanic/Latino minority communities experienced disproportionately high health risks from COVID-19, according to a CDC report (2020). These communities also suffered from higher levels of unemployment (16.6% for African Americans and 18.2% for Hispanics/Latinos) compared to 12.8% for Whites and 13.7% for Asian Americans in April 2020 (Couch et al., 2020). As a result of high health risks and unemployment rates, people from ethnic minority backgrounds have been subject to higher risks of income loss and fatalities during the COVID-19 pandemic. Therefore, compared to their counterparts, SM users from low-income households are likely to express higher risk concerns. Based on this information, we predict:

Hypothesis 2c. (H2c): Household income is significantly associated with individual concerns about COVID-19, such that the risk concern level decreases as household income increases.

2.4. SM fatigue

Although SM provides users with the convenience of connecting with other users anywhere and anytime, while also offering various benefits (e.g., enjoyment, information access), SM has also been found to cause user fatigue. Fatigue is a multidimensional phenomenon that represents a subjective and unpleasant feeling, as suggested in medical research (Piper et al., 1987). This subjective, unpleasant feeling arises when individuals encounter a situation wherein demands for human attention and cognition are high, but individuals lack the required ability to meet them (Hardy et al., 1997). The concept of fatigue has been well-examined in disciplines such as clinical and occupational studies. Based on the conceptualization of fatigue in those studies, Ravindran et al. (2014) explored the concept of SM fatigue in the SM usage context, and defined it as “a subjective, multidimensional user experience

comprising feelings, such as tiredness, annoyance, anger, disappointment, guardedness, loss of interest, or reduced need/motivation associated with various aspects of social media use and interactions” (p. 2317). This definition has been widely adopted by studies examining SM fatigue (Xiao & Mou, 2019). Similarly, we adopted this definition of SM fatigue in our study.

The literature suggests that increased SM use results in individual fatigue associated with SM. For example, technology overload in terms of communication, features, and information will likely cause a condition referred to as “technostress,” or the stress or psychosomatic illness caused by working with computer technology on a daily basis (Lee et al., 2016; Shin & Shin, 2016). Focusing on mobile messenger services and interpersonal communication, an empirical study of Korean mobile users provided evidence showing that being connected too much anywhere and anytime via mobile messenger services has caused an increasing number of people to feel fatigue (Shin & Shin, 2016). A study of young adult students (aged 18–27 years) using the WhatsApp instant messaging app revealed that the intensity of SM use was the strongest predictor of SM fatigue (Malik et al., 2020). One study reported that, as users spent more time on social networking sites (SNSs), the overwhelming volume of social demands from these sites caused SNS fatigue, which led to physical and psychological strain (Lee et al., 2016). Thus, we propose:

Hypothesis 3. (H3): SM use intensity has a significant, positive relationship with SM fatigue during the COVID-19 pandemic.

Another predictor of fatigue is related to individual concerns and perceptions. Privacy and risk concerns in the context of SM use have been reported in prior studies. For example, one study revealed that users’ online privacy concerns served as the greatest predictive value for SM fatigue (Bright et al., 2015). More recently, Dhir et al. (2019) conducted a cross-sectional survey with 1552 users and found that individual concerns about risk and privacy significantly and positively correlated with the fatigue associated with their use of SNSs. Based on these findings, we predict that risk concerns about COVID-19 will lead to increased levels of SM fatigue. Thus, the following hypothesis is proposed:

Hypothesis 4. (H4): Individual concerns about COVID-19 have a significant, positive relationship with SM fatigue.

The research model with all the hypotheses is presented in Fig. 1.

3. Methodology

3.1. Data collection and sample

The study respondents consisted of adult SM users in a four-year public university on the US West Coast. The university chosen for this study is an ethnically and economically diverse academic institution that serves mostly commuting, nontraditional college students. The majority of the students were employed either part-time or full-time. Given the diversity of the students’ backgrounds, this university was an ideal research site for us to study SM use and SM fatigue during the COVID-19 pandemic.

Students from the university were invited to complete an online questionnaire during the two weeks from late March to early April 2020. The survey included open-ended questions about their SM use behaviors, structured questions on SM fatigue, and questions about their demographic background. On average, each survey took about 12 min to complete.

We received a total of 206 responses, 14 of which were removed due to incomplete/missing data. The respondents had a wide variety of majors, including business, accounting, marketing, biology, and sociology. About 83% of them were juniors and seniors. The final sample of 192 respondents varied in ages from 18 to 59 years (mean = 26, standard deviation = 7) and about 65% of the respondents were single.

3.2. Measurement

3.2.1. Strain measure

SM fatigue was measured by using three items adopted from Bright et al. (2015): “I am likely to receive too much information when I am searching on social media,” “I am frequently overwhelmed by the amount of information available on social media,” and “the amount of information available on social media makes me tense and overwhelmed.” Participants were asked to respond to these items on a 5-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree).

3.2.2. Stressor measures

There are two stressor measures: SM use and COVID concern. SM use was based on individual response regarding the total amount of time he/she spent on all SM accounts in a typical day (denoted as *USE* in our model). We asked our study participants the question: “On a typical day, how much time (minutes) in total do you spend on all the social media accounts you have (e.g., Facebook, Instagram, Snapchat, Twitter, Pinterest, LinkedIn)?” Participants were asked to choose one answer from the four choices: “less than or equal to 1 h,” “more than 1 h to 2 h,”

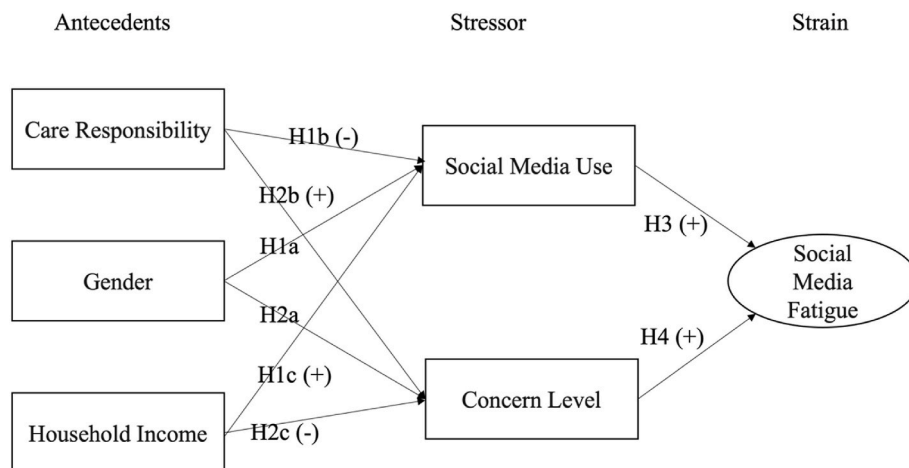


Fig. 1. Research model.

“more than 2 h–3 h,” and “more than 4 h” Based the participants’ responses, we coded the variable *USE* with four values, ranging from “1” (the lowest) to “4” (the highest) for the four corresponding answer categories. Our analysis was based on high use (when the use is more than 2 h) versus low use (when the use is less than or equal to 2 h).

COVID concern was measured by individual response to the question “How concerned are you about the coronavirus (COVID-19) spread in the US right now?” The responses are categorized in four ways: very much concerned, concerned, somewhat concerned, and not concerned at all. In our analysis, we used the variable *CONCERN* to capture the two levels of concern: high concern (e.g., very much concerned and concerned) and low concern (e.g., somewhat concerned and not concerned at all).

3.2.3. Antecedent measures

The antecedent variables are *CARE*, *GENDER*, and *INCOME*. *CARE* captures whether the respondent had the responsibility to take care of children, parents, or grandparents. Three questions were asked, “Do you need to take care of your children?” “Do you need to take care of your elderly parent(s)?” and “Do you need to take care of your grandparent (s)?” The variable *CARE* was coded 1 when the respondent had the responsibility to take care of children, parents or grandparents and 0 otherwise.

GENDER refers to the respondent’s gender, which is either female or male. Female was coded as 1 while male was coded as 0.

INCOME reflects the respondent’s total household income level. We asked participants to indicate their household income (1 = less than US \$20,000, 2 = US\$20,000–34,999, 3 = US\$35,000–49,999, 4 = US \$50,000–74,999, 5 = US\$75,000–\$99,999, 6 = US\$100,000–149,999, and 7 = US\$150,000 or higher).

3.3. Data analysis

We conducted covariance-based structural equation modeling (SEM) using Stata 17 to estimate our model and test our hypotheses. SEM is commonly used in different research contexts (Ringle & Sarstedt, 2012; Schumacker & Lomax, 2004). Based on the theoretical background and our hypotheses, we set up a path diagram, which was estimated with maximum likelihood and robust standard error.

In addition to the tests based on our hypotheses, we performed two robustness tests to further validate our findings. First, instead of using the SM usage level, we used the number of SM accounts as a proxy for the SM usage level. Second, we considered different settings for the directions of the relationships between concern level and usage because how SM usage and concern levels affected each other remained unclear. An individual may increase his/her usage due to the concern level, or a higher usage level may increase an individual risk concern.

4. Results

4.1. Descriptive statistics, factor analysis, and correlations

In this subsection, we present the descriptive statistics, factor analysis, and correlations for the measures we discussed earlier.

For the strain measure, SM fatigue, we adopted three validated items in Bright et al. (2015) as mentioned earlier. The average responses (standard deviation) for these three questions were 3.08 (1.19), 2.99 (1.33), and 2.71 (1.39), respectively, as presented in Table 1. We performed a confirmatory factory analysis (CFA) and formed only one factor (*FATIGUE*) with factor loadings 0.801, 0.924, and 0.851. The Cronbach’s α is 0.82, which shows a satisfying level of reliability. We also calculated the following validity metrics for *FATIGUE*, namely, average variance extracted (AVE) = 0.74, and composite reliability (CR) = 0.89, which are all at the acceptable level (Hair et al., 2010, 2017; Taber, 2018), as shown in Table 1.

For stressors, the two measures were SM use and COVID concern. For

Table 1
Social media fatigue.

Questions	Mean	Std Dev	Factor Loading		Mean	Std Dev
Q1: I am likely to receive too much information when I am searching on social media	3.084	1.188	0.801	<i>FATIGUE</i>	2.928	1.117
Q2: I am frequently overwhelmed by the amount of information available on social media	2.989	1.325	0.924			
Q3: the amount of information available on social media makes me tense and overwhelmed	2.711	1.382	0.851			

Cronbach’s α : 0.82.

Average variance extracted (AVE): 0.74.

Composite reliability (CR): 0.89.

usage level, most of them were in Category 1: less than or equal to 1 h (35.94%) and Category 2: more than 1 h but less than or equal to 2 h (28.12%), followed by Category 4: more than 3 h (21.35%) and Category 3: more than 2 h but less than or equal to 3 h (14.58%). The most popular SM platform was Instagram (81.6%²; n = 192). The distribution of other popular SM platforms is Snapchat (62.6%), Facebook (61.1%), LinkedIn (52.1%), Twitter (33.7%), Pinterest (30.0%), and others (3.7%).

For COVID concern, most of our participants stated that they were very much concerned (41.36%) or concerned (34.55%). About 23% of them were somewhat concerned. In our analysis, high concern level was about 76% while low concern level was about 24%.

For the antecedents, in terms of care responsibility, about 45% of our respondents reported some responsibilities to take care of their children or (grand)parents; about 53% of the respondents were female. For income level, 20.5% of the respondents had a household income less than US\$20,000. The distribution of the remaining categories was: between US\$20,000 and 34,999 (18.35%); between US\$35,000 and 49,999 (18.71%); between US\$50,000 and 74,999 (19.78%); between US \$75,000 and 99,999 (11.51%); between US\$100,000 and 149,999 (7.19%); and US\$150,000 or higher (3.96%). The correlations are presented in Table 2.

Overall, the SEM model fitness statistics (CFI = 0.826, RMSEA = 0.104, SRMR = 0.045) suggested an acceptable level of fitness of the model.

4.2. Main findings

Our main findings are shown in Fig. 2. First, in terms of the three antecedents (*CARE*, *GENDER*, and *INCOME*) and the stressors (*USE* and *CONCERN*), gender has a significant effect on social media use and COVID-19 concern levels; compared to males, female respondents (i.e., when *GENDER* is 1) had a higher level of social media usage (0.480, $p < 0.01$) and a higher level of concerns (0.187, $p < 0.01$) during the pandemic, which support H1a and H2a that predict the significant role of gender on social media use and COVID-19 concern. In addition, having the care responsibility (*CARE*) has a negative effect on social media usage level (−0.514, $p < 0.01$), but a positive effect on the COVID-19 concern level (0.136, $p < 0.05$), which are consistent with our expectations in H1b and H2b. These results suggest that, in times of the

² Note that an individual may use multiple social media sites. The percentage here is calculated based on a total of 192 responses to this question.

Table 2
Spearman correlations.

	FATIGUE	USE	CONCERN	CARE	GENDER	INCOME
<i>FATIGUE</i>	1.000					
<i>USE</i>	-0.026	1.000				
<i>CONCERN</i>	0.163*	0.028	1.000			
<i>CARE</i>	0.046	-0.169*	0.188*	1.000		
<i>GENDER</i>	0.215*	0.207*	0.209*	0.127	1.000	
<i>INCOME</i>	-0.028	0.121	-0.027	0.091	-0.162*	1.000

* $p < 0.05$.

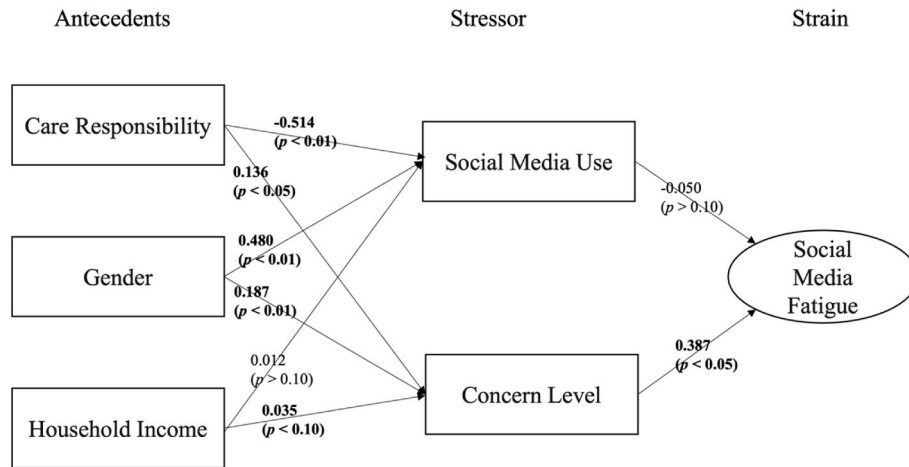


Fig. 2. SEM results.

global health crisis, the responsibility of taking care of children or the elderly increased individuals' concerns about the pandemic and reduced their social media usage level, which was possibly due to the time and efforts spent on those caregiving responsibilities. Income level (*INCOME*) also affects the concern level positively (0.035, $p < 0.10$), indicating that respondents with higher income level have a higher level of concerns, although the effect is only marginal.

We next turn our attention to stressors (*USE* and *CONCERN*) and the strain (*FATIGUE*). The results show that individuals' COVID-19 concern levels are significantly and positively related to *SM FATIGUE* (0.387, $p < 0.05$), which provides evidence to support H4: those who expressed a high level of concern were more likely to report SM fatigue than those at a low concern level. However, different from our expectation and prior literature, we did not find a significant relationship between the other stressor, SM use, and SM fatigue (-0.050 , *n.s.*), as we predicted in H3. To further investigate this insignificant association, we performed an additional analysis as detailed in Section 4.2.

4.2. Additional analysis

To explain the unsupported hypothesis H3, we conducted a further analysis to investigate individual motives for SM use. In particular, we investigated whether the insignificant relationship between SM use and SM fatigue is due to differences in use purposes. The model is shown in Fig. 3.³ In our survey, the respondents were asked to use the 5-point Likert scale (ranging from 1 = "strongly disagree" to 5 = "strongly agree") to rate the nine items related to the purposes of using SM: (1) to get to know people I would otherwise not meet at college, (2) to get acquainted with people who share my interests, (3) to do something fun (e.g., watch funny videos, read jokes), (4) to share information about the college campus with friends and classmates, (5) to maintain close social relationships with friends and classmates at college, (6) to collaborate with friends and classmates to create content for academic work (e.g., build presentations, write project reports), (7) to seek entertainment, (8) to take a break from study and academic work, and (9) to access content created by my friends and classmates at college (e.g., search and/or gather information from others about course assignments, projects).

We performed CFA and formed three factors (*ENTERTAINMENT*, *COLLABORATION*, and *NETWORKING*), with factor loadings mostly larger than 0.8 (see Table 3 for details). We also calculated the validity metrics, which are mostly at the acceptable level (Hair et al., 2010; 2017; Taber, 2018), also as shown in Table 3. Our results, shown in Fig. 4, indicate that the networking use of SM has a significant, positive effect on SM fatigue (0.818, $p < 0.05$), while entertainment (0.093, *n.s.*) and collaboration (0.207, *n.s.*) use does not impact SM fatigue.

The finding helps us explain the insignificant result between social media use and social media fatigue in our main model. Specifically, the



Fig. 3. Additional analysis: Social media use purposes and social media fatigue.

³ Note that we have also performed the full model with all other stressors and antecedents. However, instead of repeating other parts of the model, Fig. 3 only focuses on the additional analysis.

Table 3
Purposes (ENTERTAINMENT, COLLABORATION, and NETWORKING).

Questions	Factor Loading	Mean	Std Dev		Mean	Std Dev	Cronbach's α	AVE	CR
Q3: to do something fun (e.g., watch funny videos, read jokes)	0.861	4.042	1.111	ENTERTAINMENT	4.155	1.060	0.86	0.82	0.93
Q7: to seek entertainment	0.934	4.234	1.014						
Q8: to take a break from study and academic work	0.928	4.188	1.049						
Q4: to share information about the college campus with friends and classmates	0.661	2.209	1.272	COLLABORATION	2.651	1.383	0.76	0.54	0.82
Q5: to maintain close social relationships with friends and classmates at college	0.576	3.319	1.337						
Q6: to collaborate with friends and classmates to create content for academic work (e.g., build presentations, write project reports)	0.800	2.393	1.345						
Q9: to access content created by my friends and classmates at college (e.g., search and/or gather information from others about course assignments, projects)	0.861	2.682	1.326	NETWORKING	2.710	1.360	0.78	0.77	0.87
Q1: to get to know people I would otherwise not meet at college	0.897	2.432	1.309						
Q2: to get acquainted with people who share my interests	0.859	2.990	1.357						

AVE: average variance extracted; CR: composite reliability.

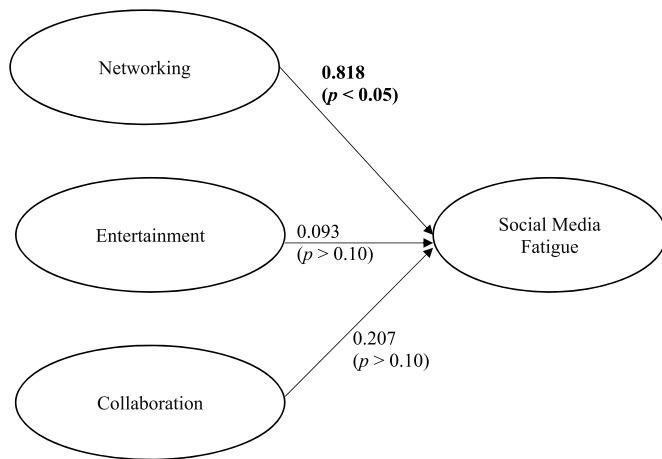


Fig. 4. Results for the additional analysis.

insignificant result may be due to differential effects of social media use purposes. That is, when the purpose for SM use is different, it may have different effect on users' SM fatigue. In our context of the COVID-19 pandemic, only the networking use of SM is related to SM fatigue but not entertainment and collaboration use. In the next section, we further use the responses from the open-ended questions to provide further insights and provide explanations to the insignificant result of H3 in the original model.

5. Discussion

The aim of this study was to examine the effects of two stressors - SM use intensity and COVID-19 concern level—on the strain of SM fatigue during the ongoing COVID-19 pandemic. Our hypothesis testing shows that individual risk concern during the pandemic has a significant positive effect on SM fatigue. As the risk perceptions of COVID-19 increased, users became more anxious and worried about the coronavirus threat to their family members' health and life, as well as the financial burdens arising from unemployment or underemployment in the time of crisis. These anxieties and worries may even cause users to have a mental breakdown during the lockdown, leading to SM fatigue. When SM becomes a viable and convenient channel for obtaining news and developments regarding the pandemic, the fear of missing out leads to further SM fatigue during the lockdown (Ashiru et al., 2022). Our study confirms the positive association between personal and situational factors, such as gender and caregiving responsibility, and COVID-19 risk perceptions, thus extending prior research on the feature of missing out

on SM platforms (Ashiru et al., 2022; Bright & Logan, 2018; Dhir et al., 2018).

The results show that social use and entertainment use have different effects on social media addiction and subjective well-being (Zhao, 2021).

However, our data analysis does not provide sufficient evidence to demonstrate the predicted positive, significant effect of SM use intensity on SM use fatigue. During global crises, such as COVID-19, it is possible that user fatigue is not caused by the length of time that users spend on SM platforms but by how they are using SM. As shown in a recent study on the role of SM during the COVID-19 pandemic, different SM use purposes (social use and entertainment use) have different effects on social media addiction and subjective well-being: entertainment use leads to social media addiction while social use tends to improve subjective well-being (Zhao, 2021). To deepen our data analysis, we performed a factor analysis of individual SM use purposes, which revealed three motives: entertainment, networking, and collaboration. Our supplemental quantitative data analysis showed that using SM for networking has a significant, positive effect on SM fatigue, while entertainment and collaboration use do not impact SM fatigue.

Moreover, our supplemental analysis of user narratives revealed that users' SM behaviors during the COVID-19 pandemic changed to some extent. For example, those who previously browsed information from various sources before the pandemic became more focused and more purposeful, as they used SM to search for quality information and keep track of the pandemic trajectory. This is reflected in the user remark below:

I now spend more time on social media during the pandemic. I take things seriously as regards the posts I see on my social media [accounts]. There's [sic] many messages regarding information about the pandemic, and I go on to research the information from a reliable source.

Those SM users who went on SM platforms occasionally for entertainment may find themselves engaging with SM platforms and consuming more online entertainment (movie, music, video, etc.) during the COVID-19 pandemic. As one user explained:

I now use social media more because there are fewer things to do. I make and watch more videos to see how other people are coping with everything or how many people are panicking/ panic buying, etc.

The above discussion and quotations suggest that both SM use content (e.g., information, entertainment) and environmental turmoil (i.e., COVID-19) are key factors to consider in studying SM fatigue. Individuals may use SNSs for obtaining and consuming different content or for collaborating on a task. Information systems (IS) research has provided evidence of the effects of SNS use for social interaction and

entertainment, apart from informational needs. As suggested by a study on compulsive SM use (Panda & Jain, 2018), individuals have social needs and engage in compulsive use behaviors online once they realize that they can satisfy their needs through online platforms. Prior studies have also identified three major types of user motivations, namely, social, hedonic, and cognitive: hedonic motivations refer to happiness, enjoyment, or fantasy; cognitive motivations relate to goal-oriented or information-seeking tasks; and social motivations describe connectiveness and a sense of belonging (Ali-Hassan et al., 2015; Salehan et al., 2017).

As reflected in the user remarks above, individual SM use behaviors have changed to adapt to the environment—in this case, the global pandemic. Since social distancing and “staying-at-home” are the critical practices to contain the spread of the deadly and infectious virus, the technological means of SM have allowed people to fill in the void of socialization amid emergency situations. However, it is important to note that different SM use purposes introduce different consequences, and some are problematic, such as SM addiction caused by increased entertainment use (Zhao, 2021), which may intensify users’ stress levels. How people changed their SM use behaviors during the COVID-19 pandemic may be conditioned by other factors (e.g., contextual and technical) and may differ based on their demographical backgrounds. For example, SNSs is suggested as a potential means to help preserve personal social capital and well-being of older adults from 50 years to 93 years old (Simons et al., 2021). Thus, the changing practices of social networking communication technologies by people from different demographical backgrounds would require further research.

6. Contributions and implications

The surprisingly mixed results in our study demonstrate the importance of considering user motives for SM engagement and the role of external environments. This further analysis of SM use purposes demonstrates that not all SM use leads to SM fatigue; rather, the effect is dependent on the specific motives of individual SM use. Our study participants indicated in their narratives that they mostly relied on SM channels for information, collaboration, and entertainment during the COVID-19 pandemic, which helped them mitigate the uncertainty and stress caused by the economic turmoil and health risks imposed by the coronavirus.

The contributions of this study are twofold. Theoretically, we extend SM research by applying the SSO framework and examining the effects of two stressors: SM use intensity and COVID-19 concerns. Our results showed that increased SM use for networking during the pandemic led to user fatigue but not in the other two types of SM use (entertainment and collaboration). This finding suggests that we should consider user motives in studying the role of information and communication technologies, such as SM platforms, during crises.

Practically, this study offers examples of how to use SM purposefully to gain valuable, trustworthy information and to provide individuals under lockdown with relief and relaxation. The shift in individual SM use has been echoed in an article on the development and popularity of new live streaming, video chat, and gaming features on SNSs during the COVID-19 pandemic (Williamson, 2020).

7. Concluding remarks: limitations and directions for future research

The unprecedented global crisis brought about by COVID-19 has imposed a widespread negative effect on individual well-being. If SM fatigue persists, it may cause mental health concerns. A recent study on psychological well-being during the COVID-19 pandemic suggested that a higher level of SM use was associated with poorer mental health (Zhao & Zhou, 2020). In this regard, our data analysis suggests that user fatigue due to excessive SM use may be one factor that leads to poorer mental health. To mitigate the negative effects of SM use, scholars have

investigated antecedents to SM fatigue, including privacy concerns and consumers’ conscious decisions (Logan et al., 2018), confidence and privacy concerns (Bright et al., 2015), and users’ personality traits (Lee et al., 2014). All of these studies suggest that users remain involved in SM if they believe that continued use provides positive outcomes and values, such as customized services to meet their needs. Related to this, our supplemental analysis of SM use behaviors revealed the positive values and outcomes perceived by users from their SM use during the COVID-19 crisis.

At this point, we would like to acknowledge three limitations of this study. First, we used self-reported data on SM use and focused on SM users from low socioeconomic status communities that were hit the hardest during the pandemic. These suggest that the findings of the current study may not be easily generalized. However, as our study sought to understand changes in individual SM use behaviors during the COVID-19 crisis, we found self-reported SM fatigue and risk concern level helpful in our empirical investigation. Future research on using both objective measure of SM use and self-reported measures of individual perceptions would generate further insights. The second limitation is related to our use of convenience sampling. As a result, the findings of the study should be applied to other contexts with caution. Finally, it is important to note that the study was conducted in March 2020 when the pandemic was in its early stage and individual users of SM rushed to the SNSs for their urgent needs for information and socialization. Although COVID-19 is far from being completely tamed today, it is conceivable that individuals’ abilities to cope with the pandemic-induced stress have changed over time. The results of our study suggest that individuals’ concern level about COVID-19 significantly increased their SM fatigue in the spring of 2020. As the levels of COVID-19 related concerns and stress have changed over the two years of the pandemic thus far, it’s possible that the effects of COVID-19 concern and the purposes of SM use on SM fatigue may have changed. For example, the largest US airlines dropped the mask-wearing requirement on airplanes on April 18, 2022 (Savage & Murphy, 2022) and Americans are now mostly concerned about inflation and war in Ukraine over the spiking of COVID-19 cases (NPR, 2022). Further research comparing SM fatigue during different phases of COVID-19 pandemic and on other stress factors would provide us with new insights into SM use and fatigue in times of crises.

Limitations notwithstanding, we believe this study has enhanced our understanding about individuals’ SM use and its effect on their personal experiences and feelings in times of global health crisis. According to a McKinsey COVID-19 National Consumer Survey conducted from March 27–29, 2020, 80% of the total 1062 respondents reported medium or high levels of stress and such widespread distress was exacerbated among those who suffered from reduced income or job loss due to COVID-19 (Coe & Enomoto, 2020). Yet, what we do not see or hear is how individual citizens cope with the anxiety and stress caused by lockdowns, especially in situations wherein digital channels and SM platforms serve as major outlets for them to connect to the outside world and keep their spirits high. We hope our study has made an initial effort to understand the role of social technology on people’s daily lives during pandemics. According to a consumer survey in the third quarter of 2019, users (15+ years) are more likely to use different SM platforms for different purposes, such as Facebook, WhatsApp, Snapchat, and Instagram for keeping in contact with friends and family; YouTube and Reddit for entertainment; Twitter or Reddit for news; and LinkedIn for strengthening their professional networks (AudienceProject, 2020). Further research on understanding platform-specific features and the associated effects on individuals’ mental health and well-being could generate new insights into the mental and psychological impacts of digital and social media during and after the COVID-19 pandemic.

Declaration of competing interest

The authors do not have any conflict interests to report.

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Appendix. Variable Definitions

Variables	Definitions	Questions in the Survey
<i>CARE</i>	Care responsibility of the subject, i.e., does the subject have care responsibilities for children, parents, or grandparents?	Do you need to take care of your children? Do you need to take care of your elderly parent(s)? Do you need to take care of your grandparent(s)?
<i>GENDER</i>	Gender of the subject	What is your gender? Male Female
<i>INCOME</i>	Income level of the subject	What is your total household income? less than US\$20,000 US\$20,000–34,999 US\$35,000–49,999 US\$50,000–74,999 US\$75,000–99,999 US\$100,000–149,999 US\$150,000 or higher
<i>CONCERN</i>	Concern level of the subject regarding COVID-19; equals one if the subject is very much concerned or concerned and zero otherwise	How concerned are you about the coronavirus (COVID-19) spread in the US right now? <ul style="list-style-type: none"> • Not concerned at all • Somewhat concerned • Concerned • Very much concerned
<i>USE</i>	The amount of time spent by a subject on any social media account, which is equal to one when the time spent is less than or equal to 1 h, two when the time spent is more than 1 h but less than or equal to 2 h, three when the time spent is more than 2 h but less than or equal to 3 h, and four when more than 3 h. In our analysis, this is equal to one when the usage level is larger than 2 h and zero otherwise.	On a typical day, how much time (minutes) in total do you spend on all the social media accounts you have (e.g., Facebook, Instagram, Snapchat, Twitter, Pinterest, LinkedIn)?
<i>FATIGUE</i>	Social media fatigue level of a subject. The three questions form one single factor. We used the factor scores of these three questions in the survey. (Items adopted from Bright et al., 2015).	Please rate your degree of agreement with the following statements regarding the amount of information available on social media (1 = strongly disagree, 5 = strongly agree). <ul style="list-style-type: none"> • I am likely to receive too much information when I am searching on social media. • I am frequently overwhelmed by the amount of information available on social media. • The amount of information available on social media makes me tense and overwhelmed.
<i>ENTERTAINMENT, NETWORKING, COLLABORATION</i>	Social media usage purposes of a subject. The nine questions form three factors. We labeled these factors as follows: <i>ENTERTAINMENT</i> , <i>NETWORKING</i> , and <i>COLLABORATION</i> , respectively. We used the factor score of these nine questions in the survey.	Please rate your degree of agreement with the following statements regarding the purpose of using social media (1 = strongly disagree, 5 = strongly agree). <ol style="list-style-type: none"> (1) to get to know people I would otherwise not meet at college. (2) to get acquainted with people who share my interests. (3) to do something fun (e.g., watch funny videos, read jokes) (4) to share information about the college campus with friends and classmates (5) to maintain close social relationships with friends and classmates at college (6) to collaborate with friends and classmates to create content for academic work (e.g., build presentations, write project reports) (7) to seek entertainment (8) to take a break from study and academic work (9) to access contents created by my friends and classmates at college (e.g., search and/or gather information from others about course assignments, projects)

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