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Can Mediated Communication Moderate the Relationship Between Being in Isolation and Quarantine for COVID-19 and Loneliness?

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Abstract

An online survey examined if and how aspects of mediated communication were associated with less loneliness while in isolation and quarantine for COVID-19. A national sample of 490 US participants who were either in isolation, quarantine, or in neither, answered questions regarding their use of mediated communication, the people with whom they communicated, perceived social presence, active and passive social media use, and perceived loneliness. SPSS software was used to run a multivariate regression model to test these potential moderators using a Hochberg (1988) correction for familywise error. For people in isolation and quarantine, relative to neither, the more they used mediated communication with a high degree of social presence, such as voice calls and video calls, the more loneliness they reported. The data also indicate that for those who are not in quarantine or isolation in a pandemic, using mediated communication with a high degree of social presence is related to less loneliness.

Keywords: mediated communication; social presence; strong ties; loneliness; COVID-19

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Introduction

Quarantine and isolation have been used in response to the COVID-19 pandemic that was first reported in Wuhan, China, in December 2019, and is affecting many countries globally (World Health Organization; WHO, 2021). Quarantine refers to the separation and restriction of people's movement who might have been exposed to a contagious disease to prevent them from infecting others, and isolation refers to separating people who have been infected with a contagious disease from others for the same purpose (CDC, 2020). As of July 2022, there have been over 551 million global cases of COVID-19, with the US leading the world in total cases (Johns Hopkins University and Medicine, 2022).

Being in quarantine or in isolation can be unpleasant and is believed to put people's psychological well-being at risk (Brooks et al., 2020). People experience stressors, such as financial loss, separation from loved ones, difficulty getting supplies, and uncertainty regarding health. Research has begun to examine the influence of being in quarantine and isolation on loneliness, as both, by definition, involve separating oneself from others to prevent contagion. This separation is in tension with individuals' need for connection to prevent feelings of loneliness (Hawkey & Cacioppo, 2010). Research has shown that individuals report significant increases in loneliness before and after being quarantined (Ruggieri et al., 2021), and after being ordered to isolate for COVID-19 (Groarke et al., 2020).

Mediated communication, or communication that takes place using an intervening medium, such as voice calls, texting, social media, and video calls, makes social connection possible when people are physically separated in the case of isolation and quarantine. Mediated communication has been viewed as a way to connect with others while apart to mitigate loneliness (Anderson & Vogels, 2020). Even so, limited studies have rigorously examined this issue by assessing if and how mediated communication can moderate the impact of being in quarantine and isolation, in comparison to the pandemic in general, on loneliness, despite its widespread use (Schaeffer, 2019).

As a result, we lack a solid knowledge base for informing the management of quarantine and isolation during a pandemic. This problem is serious as quarantine and isolation are critical public health measures that reduce the spread of a contagious disease in the absence of a vaccine, or before widespread immunity. Without understanding the implications of these public health measures on psychological well-being, it is unclear how successful these measures are among all populations, and how to address any adverse effects associated with them. This study addresses this problem by assessing the associations between mediated communication and loneliness among those in quarantine, isolation, or in neither, guided by prominent communication and technology theory.

Quarantine, Isolation, and Well-Being

Being in quarantine or in isolation can put people's psychological well-being at risk. For instance, individuals who were isolated or quarantined during the Middle East respiratory syndrome (MERS) outbreak in Korea reported anxiety and anger during and months after isolation (Jeong et al., 2016). Parents and their children who were quarantined or isolated during the H1N1 pandemic in the US reported greater risk for post-traumatic stress syndrome than those who were not quarantined or isolated (Sprang & Silman, 2013). And healthcare workers who quarantined during the severe acute respiratory syndrome (SARS) outbreak in China reported depressive symptoms three years later (Liu et al., 2012).

This research focuses on loneliness, or the “distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or especially the quality of one's social relationships” (Hawkey & Cacioppo, 2010, p. 218). A related but distinct construct is social isolation. Loneliness is synonymous with perceived social isolation, not with objective social isolation. Social isolation refers to the objective characteristics of one's social environment or the absence of relationships (de Jong Gierveld et al., 2006; Hwang et al., 2020). Both social isolation and perceived loneliness are relevant during the pandemic, as being in isolation and quarantine puts people at risk of social isolation, as they are required to physically separate from others to prevent contagion. Loneliness is one of the possible outcomes of social isolation.

Loneliness is important to study as it is a critical factor for well-being. People who are lonely are at a greater risk for depression, poorer health, impaired executive function, poor sleep quality (Hawkey & Capitanio, 2015), mortality (Holt-Lunstad et al., 2010), and chronic disease (Valtorta et al., 2016), among other well-being outcomes. People's loneliness is believed to be at risk during a pandemic as being in isolation and quarantine, or being physically separated from others, is in tension with individuals' need to connect with others to prevent loneliness. Studies about COVID-19 have shown that individuals placed in quarantine (Ruggieri et al., 2021; Sibley et al., 2020) and isolation (Groarke et al., 2020) report increases in loneliness and mental distress, though Groarke et al.'s measure for isolation included people who were not officially diagnosed with COVID-19. Taken together, the above empirical evidence suggests that people in quarantine and isolation are at risk for increased perceptions of loneliness. Less understood are potential moderators to mitigate this effect. The following baseline questions are asked to establish the relationship between being in quarantine and isolation on loneliness:

RQ1: What is the relationship between being in isolation, quarantine, or in neither on loneliness?

RQ2: Are there differences in loneliness among those in isolation, quarantine, or in neither?

Moderators for the Relationship Between Being in Quarantine and Isolation on Loneliness

According to the loneliness literature, social connection is a basic need. Hawkey and Cacioppo (2010) compare loneliness to the social equivalent of physical pain, hunger, and thirst that motivates people to connect with others to lessen or eliminate feelings of social isolation. Mediated communication makes social connection possible when people are physically separated in the case of isolation and quarantine. It is possible that the more people communicate with others the less loneliness they will report. A systematic review has shown that technology-

mediated interventions (Ibarra et al., 2020) and increasing mediated communication (Chopik, 2016) can decrease loneliness. Thus, the following baseline hypothesis is proposed:

H1: Mediated communication will moderate the relationship between being in isolation or in quarantine and loneliness such that the more individuals use mediated communication the less loneliness they will report.

Strong-Tie Communication as a Moderator of COVID-19 and Loneliness

Who people communicate with in isolation and quarantine might be more important than simply communicating to lessen the impact of being in isolation or quarantine on loneliness. The strength of weak ties theory (Granovetter, 1973) describes two types of relationships: weak ties, or acquaintances, and strong ties, or close others. Granovetter defines tie strength as a combination of four dimensions: the amount of time people spend together; the emotional intensity or closeness of the relationship; the degree of intimacy or mutual self-disclosure people engage in; and the reciprocal services, or support, that characterize the tie. Because strong tie relationships are characterized by social support, it is possible that mediated communication with strong ties might buffer against the negative impact of being in quarantine or isolation on loneliness, in line with the buffering effect model of social support (Cobb, 1976). The buffering effect model says that social support is related to well-being when people are stressed in that effective social support buffers, or protects, people from stress. Indeed, research about COVID-19 has shown that perceived social support weakens the positive relationship between COVID-19 anxiety and loneliness (Xu et al., 2020), and that individuals in a government mandated quarantine (high stress), in comparison to before a government mandated quarantine (low stress), report less loneliness when they have greater social support (Macdonald & Hülür, 2021). It is possible that people in isolation and quarantine who use mediated communication with strong ties will report less loneliness. Therefore:

H2: Mediated communication with strong ties will moderate the relationship between being in isolation or in quarantine and loneliness such that the more individuals use mediated communication with strong ties the less loneliness they will report.

Social Presence as a Moderator of COVID-19 and Loneliness

The degree of social presence while using mediated communication might also serve as an important moderator for the relationship between being in isolation or in quarantine on loneliness. Theory and empirical precedent indicate that not all mediated communication might facilitate the same relational outcomes. Social presence theory (Short et al., 1976) argues that various communication media differ in their capacity to transmit nonverbal and verbal content. The less cues (e.g., gestures, smiles, eye contact) a medium can transmit, the less warmth and involvement communicators experience with one another. For example, research has shown that people perceive media with less cues, such as texting, to have less social presence than media with more cues, such as voice, video (Sallnäs, 2005), avatar-mediated (Bente et al., 2008), and face-to-face (FtF) communication (Zhan & Mei, 2013).

Despite these origins, people's understanding of social presence has shifted from being dependent on the objective characteristics of media to the subjectively experienced characteristics of media. Research has shown that media with less cues, such as tweets (Kim & Song, 2016) and texting, can facilitate social presence (Kahlow et al., 2020), and that social presence can facilitate decreases in loneliness (Kim et al., 2019). Moreover, systematic reviews suggest that people who are socially isolated who use technology that facilitates social presence, can experience greater feelings of social connectedness, and decreases in loneliness (Henkel et al., 2020; Robinson et al., 2014). The above research suggests that social presence might moderate the relationship between being in isolation or in quarantine on loneliness such that the more social presence people experience, the more connected they might feel, and the less loneliness they would report. Thus:

H3: Social presence will moderate the relationship between being in isolation or in quarantine and loneliness such that the more mediated communication with high social presence individuals use the less loneliness they will report.

Social Media Use as a Moderator of COVID-19 and Loneliness

An abundance of research has shown that actively using social media, relative to passively using social media, can facilitate increases in psychological well-being (Liu et al., 2019). Per the model of social media use and well-being,

this is because active social media use (commenting, posting, gaming) has been shown to increase perceptions of social connectedness and reduce loneliness, whereas passive social media use (browsing, searching, monitoring) has been shown to increase perceptions of envy and social comparison (Verduyn et al., 2017). Meta-analytic evidence has shown that active social networking site (SNS) use (commenting, reacting, posting, gaming, entertainment) is related to improvements in psychological well-being; however, passive SNS use (browsing, searching, monitoring) is related to decreases in psychological well-being (Liu et al., 2019). Moreover, a subsequent meta-analysis has shown that there is a small positive correlation between time spent on SNSs and depression, but that negative and upward social comparison are more strongly related to depression than time spent on SNSs, corroborating the idea that how you use SNSs (e.g., actively or passively) impacts well-being more so than time spent on SNSs (Yoon et al., 2019). Applied to this study, it is possible that active and passive social media use will moderate the relationship between being in isolation or in quarantine on loneliness. Hence:

H4: Active social media use will moderate the relationship between being in isolation or in quarantine and loneliness such that the more active social media individuals use the less loneliness they will report.

H5: Passive social media use will moderate the relationship between being in isolation or in quarantine and loneliness such that the more passive social media individuals use the more loneliness they will report.

An online survey was used to collect data regarding naturally occurring variation in COVID-19 conditions that would otherwise be difficult to recreate in a laboratory. This design allowed the researcher to safely compare individuals' loneliness in quarantine and in isolation to understand if and how mediated communication moderates the relationship between being in quarantine and isolation and loneliness.

Method

Inclusion and Exclusion Criteria

The survey included adults who were aged 18 and over in the US. Quota sampling was used to recruit equivalent sizes of the target population groups (people who were in isolation, in quarantine, or in neither for COVID-19). Once data were obtained from about 150 respondents in each group, participants in the groups whose quotas had been reached, were excluded from the study.

Participant Characteristics

Of the 490 participants used in the final analysis, most identified as male (64%) with a mean age of 36.16 ($SD = 11.02$). Ages ranged from 20 to 78. For race, many identified as White (81.3%), then Black or African American (8.6%), Hispanic, Latin, or Spanish (4%), Asian (3.4%), American Indian or Alaskan Native (2.2%), and Mixed (0.2%). Most reported earning a 4-year college degree (53.6%), then a master's degree (26.3%), some college (8.4%), a 2-year college degree (5.4%), high school/GED (3.8%), a professional degree (JD, MD; 1.8%), and a PhD (0.4%). The majority were married (68.3%), then never married (25.4%), divorced (3.7%), separated (2.2%), and widowed (0.4%). For household size, 44.8% reported they lived with a spouse, 41% with child(ren), 35.3% with parents, 15.3% with a domestic partner, 13.7% with other family, 7.2% with non-related individuals, and 9.6% lived alone¹. For employment, 80.3% reported full-time employment, 11.2% part-time employment, 5.6% were not employed, 1.2% were students, and 1.4% were retired.

Sampling Procedures

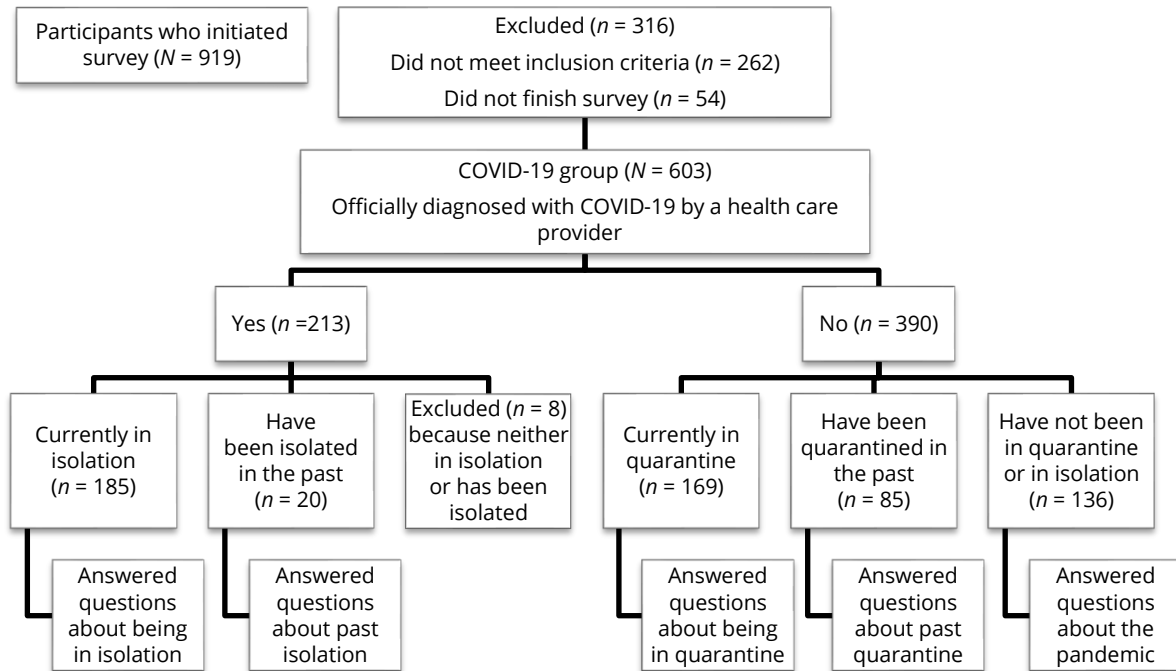
After receiving IRB Exemption #: IRB-20-0267 from a University in the US, quota sampling was used to recruit equal groups of the target populations: people in quarantine, isolation, or in neither for COVID-19. Once data were obtained from about 150 respondents in each group, participants in the groups whose quotas had been reached, were excluded from the study. In total, 919 people initiated the online survey, 54 participants did not finish the survey, 262 participants were excluded from the survey, and 603 participants finished the survey for a response rate of 65.61%.

As shown in Figure 1, of the 603 participants who finished the survey, they reported that they were either in quarantine ($n = 169$), in isolation ($n = 185$), had been quarantined ($n = 85$), had been isolated ($n = 20$), or were in neither ($n = 144$). To reduce memory bias, only participants who reported they were currently in quarantine,

currently in isolation, or in neither were used in the final analysis ($N = 498$) (Sudman & Bradburn, 1973). Additionally, eight participants who reported that they were diagnosed with COVID-19 but did not follow Centers for Disease Control and Prevention (CDC) guidelines regarding isolation were removed from the analysis for a final sample size of 490 participants who were currently in quarantine ($n = 169$, 34.5%), in isolation ($n = 185$, 37.8%), or in neither ($n = 136$, 27.8%).

Data were collected from June 16–29, 2020, and August 6–7, 2020. Daily case counts ranged from 24,786–47,167 during the June collection and 54,806–62,246 during the August collection (CDC, 2021). Participants were recruited from Amazon’s Mechanical Turk, an Internet data source that is comparable to professional market research panels and to student samples (Kees et al., 2017), and were paid \$1.85 upon completion of the survey.

Figure 1. Flowchart of Participants.



COVID-19 Group

To determine whether participants were in isolation, in quarantine, or in neither (control group), the first question of the survey asked participants if they had been officially diagnosed as having COVID-19 by a health care provider. Participants who said yes were asked if they were currently in isolation for coronavirus disease (COVID-19). Isolation was defined as the separation of people who have been diagnosed with COVID-19 from people who are not sick (CDC, 2020). Participants who said yes, were then branched to answer questions regarding their current isolation. Participants who said that they were not currently in isolation were asked if they had been isolated for the coronavirus disease (COVID-19). Participants who said that they had been isolated in the past, but were not currently in isolation, were branched to answer questions regarding their past isolation.

Participants who said that they had not been officially diagnosed as having COVID-19 by a health care provider, were asked if they were currently in quarantine for coronavirus disease (COVID-19). Quarantine was defined as the separation and restriction of movement of people who have potentially been exposed to COVID-19 to see if they become unwell (CDC, 2020). Moreover, it was explained that people in quarantine have not been diagnosed with COVID-19. Participants who said that they were currently in quarantine were then branched to answer questions regarding their current quarantine.

Participants who said that they were not currently in quarantine were asked if they had been quarantined for the coronavirus disease (COVID-19). Participants who said that they had been quarantined were branched to answer questions regarding their past quarantine. Participants who said that they had not been quarantined were branched to answer questions regarding the coronavirus pandemic in general as part of the control group.

Only participants who reported that they were currently in quarantine, in isolation, or in neither were used in the final analysis to reduce memory bias (Sudman & Bradburn, 1973) and capture people’s real-time experience of being in quarantine and isolation, the aim of the study.

Measures and Covariates

Loneliness

Three items from Russell et al.'s (1978) UCLA Loneliness Scale were used to measure loneliness, or the perception that one's social needs are not being met by the quantity or the quality of one's social relationships. Items include: *How often do you feel that you have nobody to talk to?*, *How often do you feel there is no one you can turn to?*, *And how often do you feel alone?*. Scale responses ranged from 1 = *never* to 4 = *always* ($M = 2.61$, $SD = 0.86$, $\alpha = .84$).

Mediated Communication

To assess the extent to which participants used mediated communication, participants were asked how often they have been communicating with others using a list of commonly used media, including voice call, video call, mobile text messaging, desktop instant messaging, email, private messages on social media, and public messages on social media on a scale from 1 = *never* to 7 = *daily*. The maximum score across media was used to compute a variable for degree of mediated communication; the average score would have undervalued mediated communication if individuals used one channel daily and other channels less often ($M = 5.59$, $SD = 1.76$, $\alpha = .76$).

Strong Tie Mediated Communication

To assess the degree to which participants were using mediated communication with strong and weak ties, participants were asked how often they have been communicating with a common list of relational types, including strangers, acquaintances, work colleagues, work supervisors, primary care physicians or other medical professionals, friends, best friends, family, and romantic partners on a scale from 1 = *never* to 7 = *daily*.

To determine the factor structure for strong tie mediated communication, half of the sample data were randomly selected ($n = 255$) and submitted to an exploratory factor analysis using principal axis extraction method and promax rotation in SPSS. Another half of the sample would be used to test the full measurement model with a confirmatory factor analysis. Two factors were extracted, accounting for 52.97% of the variance. Mediated communication with colleagues, supervisors, and romantic partners had strong cross-loadings. After dropping these items and rerunning the analysis, two factors accounted for 58.37% of the variance. Factor loadings ranged from .49 to .88. Following Granovetter's (1973) definition of strong and weak ties, three items assessed strong tie mediated communication with friends, best friends, and family ($M = 4.12$, $SD = 2.15$, $\alpha = .91$), and three items measured weak tie mediated communication with strangers, acquaintances, and primary care physicians or other medical professionals ($M = 2.07$, $SD = 1.55$, $\alpha = .71$). Weak tie communication was used as a covariate.

Social Presence

Three items from De Greef and Ijsselstein's (2001) Social Presence Questionnaire measured the degree of social presence, or the sense of being together on a scale of 1 = *strongly disagree* to 5 = *strongly agree*. The items included: *When using [channel selected] I get a real impression of personal contact*, *I can easily assess other's reactions to what has been said*, and *I get a good feel for others* ($M = 3.74$, $SD = 0.75$, $\alpha = .85$).

To assess if media with more cues produced different effects with respect to social presence, social presence was regressed on the media participants used, $F(8, 457) = 6.04$, $p < .001$, adj. $R^2 = .08$. Participants perceived greater social presence when using voice calls ($\beta = .19$) and video calls ($\beta = .16$), and less social presence when using email ($\beta = -.15$) and mobile text messaging ($\beta = -.15$). Desktop instant messaging, private messages on social media, and public messages on social media did not predict social presence.

Active and Passive Social Media Use

Frison and Eggermont's (2015) Multidimensional Scale of Facebook Use measured active and passive social media use. Three items assessed active use: *I posted status updates*, *I shared other people's posts*, and *I reacted and commented on posts* ($M = 3.54$, $SD = 1.01$, $\alpha = .78$). Two items measured passive use: *I browsed my news feed*, and *I looked at other people's posts, pictures, and/or profiles* ($M = 3.94$, $SD = 0.80$, $\alpha = .48$). Response scales ranged from

1 = *strongly disagree* to 5 = *strongly agree*. Given the low internal consistency of the passive social media use scale, passive social media use was not used in the final analysis.

Covariates

Questions about age, household size, gender, vulnerability to COVID-19, financial loss, history of mental illness, marital status, education, employment status, race, and days in quarantine or isolation were asked and controlled if these variables explained significant variation in loneliness. These covariates were chosen based on earlier research that showed these factors are associated with psychological well-being in contagious disease outbreaks (Blendon et al., 2004; Hawryluck et al., 2004; Jeong et al., 2016; Keeter, 2020; Liu et al., 2012; Sprang & Silman, 2013).

Analytic Strategy

To prepare the data for analysis, the continuous predictor variables were grand-mean centered to aid interpretation and the categorical variable for the COVID-19 group (isolation, quarantine, and control) was simple effect coded with the control group as the reference group (Cohen et al., 2003). Covariates that explained variance in loneliness (health vulnerability, financial loss, history of mental illness, education, and employment) were controlled; some categorical covariates were reduced for analysis. Notes of explanation are in Table 1. To control for family-wise error rate, or the probability of rejecting one or more of the hypotheses erroneously when performing multiple hypothesis tests, Hochberg's (1988) correction was used. Both the uncorrected p levels and the corrected alpha levels were reported in Table 1 (Streiner, 2015).

Results

Confirmatory Factor Analysis

To cross-validate the measurement model, another half of the sample data were randomly selected ($n = 248$; $n = 223$ used in the CFA) and submitted to a confirmatory factor analysis using Lavaan v0.6-10 (Rosseel, 2012) for R with ML estimation to test the five-factor measurement model (social presence, active social media use, passive social media use, strong-tie mediated communication, weak-tie mediated communication, and loneliness). The output indicated good fit of the model $RMSEA = .07$, $CFI = .92$, $SRMR = .06$. Due to the low reliability for passive social media use ($\alpha = .48$), passive social media use was removed from the model and the model was rerun. The output slightly improved $RMSEA = .06$, $CFI = .93$, $SRMR = .05$.

Data Analysis

One multiple regression model assessed the RQs and hypotheses regarding loneliness. RQ1 and RQ2 asked about the loneliness outcomes among those who were in isolation, quarantine, or in neither (control), and if there were differences in outcomes among those groups. The overall model was significant, $F(22, 410) = 14.43$, $p < .001$, adj. $R^2 = .41$. Detailed results for all RQs and hypotheses are in Table 1. As shown in Table 1, being in isolation or quarantine, relative to control, was not significantly related to loneliness.

H1 predicted that mediated communication would moderate the relationship between being in the COVID-19 group (isolation, quarantine, control) and loneliness such that the more mediated communication individuals used in isolation and quarantine, the less loneliness they would report. Face-to-face communication ($M = 2.32$, $SD = 2.16$) was added as a covariate to isolate the influence of mediated communication. There was not a significant interaction between isolation (vs. control) or quarantine (vs. control) and mediated communication on loneliness. The data were not consistent with H1.

H2 predicted using mediated communication with strong ties would moderate the relationship between the COVID-19 group (isolation, quarantine, control) and loneliness such that the more individuals used mediated communication with strong ties in isolation and quarantine, the less loneliness they would report. There was a significant interaction between isolation (vs. control) x mediated communication with strong ties ($p = .009$).

However, when the Hochberg (1988) correction was applied the interaction was no longer significant ($\alpha = .003$). The data were not consistent with H2.

Table 1. Multiple Regression Results for Loneliness.

Variable	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	Corrected α	Adj. R^2
Intercept	1.82	0.14		12.87	< .001	.003	.41
Health vulnerability	0.10	0.08	.06	1.24	.217	.010	
Financial loss	0.32	0.09	.16	3.65	< .001	.003	
History mental illness	0.14	0.07	.08	1.91	.057	.004	
Education 1	0.22	0.10	.13	2.32	.021	.003	
Education 2	0.22	0.11	.11	2.00	.047	.004	
Employed	0.30	0.12	.10	2.54	.011	.003	
Quarantine effect	0.22	0.16	.09	1.41	.160	.006	
Isolation effect	0.21	0.17	.09	1.29	.199	.008	
Face-to-face communication	-0.03	0.02	-.08	-1.87	.062	.004	
Mediated communication	-0.04	0.04	-.06	-1.23	.220	.013	
Quar x mediated communication	0.05	0.12	.03	0.41	.684	.017	
Isol x mediated communication	0.16	0.12	.08	1.33	.183	.007	
Strong-tie mediated communication	-0.07	0.02	-.16	-2.85	.005	.003	
Weak-tie mediated communication	0.04	0.02	.07	1.53	.128	.005	
Quar x strong-tie communication	0.14	0.08	.13	1.66	.097	.005	
Isol x strong-tie communication	0.20	0.08	.18	2.62	.009	.003	
Social presence	0.28	0.06	.25	4.86	< .001	.003	
Quar x social presence	0.53	0.15	.17	3.43	< .001	.003	
Isol x social presence	0.65	0.19	.18	3.40	< .001	.003	
Active social media	0.06	0.04	.07	1.37	.173	.006	
Quar x active social	-0.03	0.11	-.01	-0.29	.773	.025	
Isol x active social	-0.02	0.15	-.01	-0.16	.877	.050	

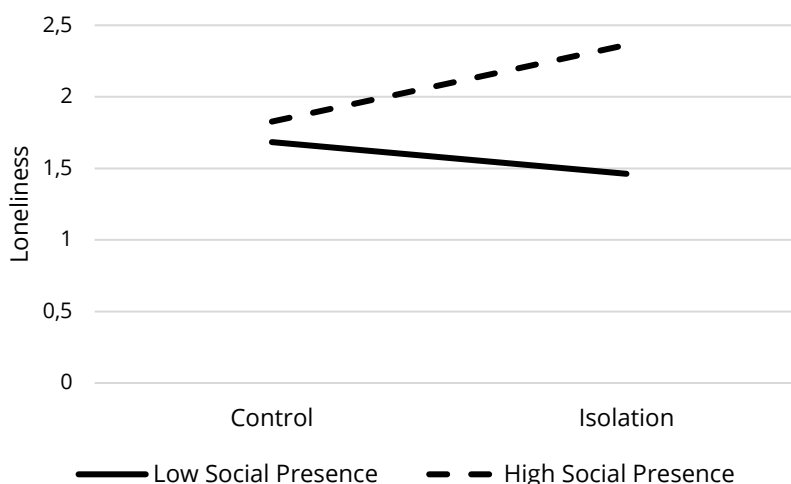
Note. Education 1 includes participants who completed a 4-year college degree. Education 2 includes participants who completed an advanced degree such as a PhD, MD, or a JD. The reference group includes participants who completed a 2-year college degree, some college, or high school/GED. Additional nominal variables, health vulnerability (yes/no), financial loss (yes/no), history of mental illness (yes/no), and employed (yes/no) were dummy coded with a no response as the reference group. The variance inflation factor (VIF) for the predictors ranged from 1.07 to 4.34, which are lower than 10 as the traditional rule-of-thumb threshold value (Cohen et al., 2003, p. 424). Thus, multicollinearity does not pose a serious threat. Corrected α is the revised α level using the Hochberg (1988) correction for family-wise error.

H3 predicted that social presence would moderate the relationship of the COVID-19 group (isolation, quarantine, control) and loneliness such that the more mediated communication with high social presence individuals used in isolation and quarantine the less loneliness they would report. There was a significant interaction between isolation (vs. control) and high social presence on loneliness ($p < .001$) with the Hochberg (1988) correction ($\alpha = .003$). However, the pattern of the data was opposite of the prediction. The conditional effect of isolation on loneliness was not significant when media with high social presence was in its 16th ($b = -0.26$) percentile, or its 50th percentile ($b = 0.31$), but it was in its 84th percentile ($b = 0.66$). As shown in Figure 2, the more media with social presence people used in isolation (vs. control) the more loneliness they reported. The data were not consistent with H3.

There was also a significant interaction between quarantine (vs. control) and social presence on loneliness ($p < .001$) with the Hochberg (1988) correction ($\alpha = .003$). Still, the pattern of the data was opposite of the prediction. The conditional effect of isolation on loneliness was not significant when media with low social presence was in its 16th ($b = -0.16$) percentile, or its 50th ($b = 0.30$) but it was in its 84th percentile ($b = 0.58$). As shown in Figure 3, the more media with social presence people used in quarantine (vs. control) the more loneliness they reported. The data were not consistent with H3.

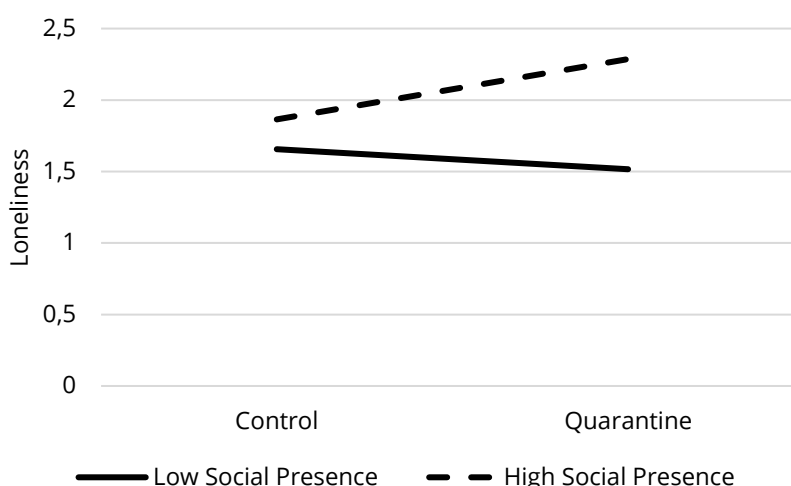
H4 predicted that active social media use would moderate the relationship between the COVID-19 group (isolation, quarantine, control) and loneliness such that the more individuals used social media actively in isolation and quarantine the less loneliness they would report. There was not an isolation (vs. control) x active social media use interaction or a quarantine (vs. control) x active social media use interaction on loneliness. The data were not consistent with H4.

Figure 2. *Isolation (vs. Control) x Social Presence on Loneliness (H3).*



Note. This figure demonstrates the low (16th percentile) and high (84th percentile) values of social presence as a moderator.

Figure 3. *Quarantine (vs. Control) x Social Presence on Loneliness (H3).*



Note. This figure demonstrates the low (16th percentile) and high (84th percentile) values of social presence as a moderator.

Discussion

This research examined if and how aspects of mediated communication, such as using mediated communication in general, with strong ties, with a high degree of social presence, and active social media use, were associated with loneliness while in isolation and quarantine for COVID-19. The results revealed that for people in isolation and quarantine, relative to neither, the more they used mediated communication with a high degree of social presence, such as voice calls and video calls, the more loneliness they reported. The data also indicate that for those who are not in quarantine or isolation in a pandemic, using mediated communication with a high degree of social presence is related to less loneliness. Because the data are correlational, the results also suggest that lonely individuals might be using mediated communication differently in isolation and quarantine.

This study contributes to our understanding of loneliness in a global pandemic in three ways. First, the results reveal how people's media use during the pandemic in isolation and quarantine is associated with their feelings of loneliness. The literature regarding the COVID-19 pandemic has until recently largely focused on people's media

use and experience of loneliness during the pandemic in general, while social distancing, or under stay-at-home orders with promising results (e.g., Choi & Choung, 2021; Pennington, 2021). Yet it is also important to consider people's experiences in isolation and quarantine who have been officially diagnosed with COVID-19 or exposed to COVID-19, a potentially fatal disease, as they report comparatively greater decrements in psychological well-being (e.g., Ruggieri et al., 2021; Sprang & Silman, 2013). This study joins other recent efforts to understand people's experiences in isolation and quarantine on psychological well-being (e.g., Groarke et al., 2020; Sibley et al., 2020), and extends this literature to examine potential moderators for this relationship. Second, this study comprehensively tests in one multivariate model which of several theoretically driven factors of mediated communication intersect with being in quarantine or isolation to predict outcomes in loneliness. And finally, this study rigorously tests these potential communication moderators by using a Hochberg (1988) correction for familywise error and carefully chosen covariates to eliminate potential spurious relationships to evoke confidence in the results.

The data provide insight regarding how media use in isolation and quarantine is associated with feelings of loneliness. The results suggest that the more people use media with a high degree of social presence, such as voice and video calls, relative to media with a low degree of social presence like text and email, in isolation and quarantine, relative to neither, the more loneliness they experience (H3). This result was surprising as the opposite was predicted. Because social presence theory says that media with a high degree of social presence facilitates warmth and involvement among communicators (Short et al., 1976), it was expected that the more people used media with a high degree of social presence, in isolation and quarantine, relative to neither, the less loneliness they would report. Given that previous research has shown that social presence is associated with less loneliness (Kim et al., 2019) and people who were not in quarantine or isolation reported less loneliness when they used media with a high degree of social presence, it is possible that being in quarantine and isolation represents a severity threshold that when crossed, makes social presence less effective at alleviating the feeling that people's social needs are not being met. People in isolation and quarantine not only have to contend with being socially isolated from others but also the fact that they have been officially diagnosed with COVID-19 or exposed to COVID-19, a potentially fatal disease. Research has shown that people report greater perceived stress when they must self-isolate or self-quarantine for COVID-19 (Nkire et al., 2021) and general psychiatric disorders, such as depression and anxiety, when they have COVID-19-related symptoms (Li & Wang, 2020).

It is possible that communicating with others while in quarantine and isolation reminds individuals of their uncertain health condition, separation from others, and is associated with increased feelings of loneliness. A large-scale analysis of representative data from the United Kingdom has shown that people with current or past symptoms of COVID-19 are more likely to feel lonely (Li & Wang, 2020), possibly as a result of quarantine or isolation from family and friends. Another large-scale analysis of data from the US has shown that increases in mediated communication with family and friends in the pandemic using high presence media, such as voice calls and video calls, does not improve people's feelings of loneliness while controlling for FtF communication (Hawkley et al., 2021). The data suggest that it is not only important to prepare people for potential feelings of loneliness that are associated with being in isolation and quarantine so that they can best cope with their situations, but also propose evidence-based interventions that can lessen these potential decrements in loneliness.

Some research suggests that finding a way to spend time with people safely in-person might improve people's perceptions of loneliness when they are in isolation or quarantine for COVID-19. A study of adults experiencing extreme loneliness and health problems who received two to six home visits by a health care professional over three months reported significant improvements in loneliness (Weiss et al., 2020). Elsewhere, research has shown that decreases in in-person contact during the COVID-19 pandemic is the strongest predictor of loneliness, even when taking increases in mediated communication into account, among older adults who are at greater risk for social isolation and health problems (Hawkley et al., 2021). Along these lines, research regarding patients' perceptions of remote monitoring for chronic diseases, which is like treating the coronavirus disease from a distance, has shown that they view it as jeopardizing interpersonal connections with their providers, and perceive FtF communication as a significantly more sufficient, advantageous, and favorable medium than mediated communication (e.g., Gorst et al., 2016; Mirzaei & Kashian, 2020; Walker et al., 2019). Visiting people who are in isolation or quarantine safely in-person might improve people's perceptions of loneliness in quarantine and isolation.

Notably, the results also demonstrate that for people who are not in isolation or quarantine, increasing their use of mediated communication with a high degree of social presence, such as voice and video calls, is associated with less loneliness. This encouraging result coheres with the diverse and creative ways that families and neighbors

have sought to maintain social connection during the pandemic. Nationally representative survey research in the US has shown that most adults report that since the beginning of the pandemic, mediated communication, such as voice (65%) and video calls (59%), has helped them stay connected with family and friends, and many feel just as close to close family (53%) and friends (47%) during the pandemic than they did before the pandemic (McClain et al., 2021). Likewise, other research has shown that using mediated communication to connect with others such as phone calling and video chatting, is associated with less loneliness (e.g., Choi & Choun, 2021).

A systematic review of interventions to reduce loneliness when in-person interaction is limited offers additional guidance for improving loneliness in a pandemic in general (Williams et al., 2021). The review indicates that video calling friends and family weekly can reduce loneliness, as well as giving people laptops with access to social contacts and community resources (e.g., Czaja, 2018; Saito, 2012). Other research has shown that playing online games, such as Wii, for an hour a week can decrease loneliness (e.g., Kahlbaugh, 2011). Additionally taking care of a plant (Tse, 2010), learning how to be mindful (e.g., Zhang et al., 2018), taking weekly Tai Chi Qigong meditation (Chan et al., 2017) or yoga classes that involve games and laughing (Kuru et al., 2018) can also lessen loneliness. Lastly, educational programs about how to develop and maintain relationships, and spend time alone can also reduce loneliness (e.g., Bouwman et al., 2017; Cohen et al., 2018).

Because this study relies on a cross-sectional analysis, which is not suited to answer questions beyond association, it would be equally likely that those individuals who are already feeling lonelier are using mediated communication differently. For example, longitudinal research suggests a potential bidirectional, curvilinear relationship between loneliness and active social media use (Wang et al., 2018). This study showed a slight U-shaped curvilinear relationship between emotional loneliness at T1 and active Facebook use at T2, and active Facebook use at T1 and social loneliness at T2, among adolescents, suggesting that people who report a high degree of loneliness are using social media differently as are people who report a high degree of social media use. At the same time, daily diary research has shown that previous day loneliness and mean loneliness is not associated with increases or decreases in daily text messaging or telephone use (Ruppel et al., 2018), indicating that loneliness on the previous day is not related to a change in daily text messaging and telephone communication the next day. Elsewhere, a review of three longitudinal studies about problematic internet use and loneliness, which includes activities such as social networking and gaming, has shown that problematic internet use appears to be a predictor for loneliness, rather than loneliness predicting problematic internet use (Moretta & Buodo, 2020). The data regarding loneliness and mediated communication use are mixed, and hard to untangle as most research has been cross-sectional. Future research would benefit from longitudinally designed studies to improve causal inference.

This study is not without limitations. One limitation is that participants could not be randomly assigned to COVID-19 groups. As such, there is a risk that the COVID-19 groups are not equivalent. To minimize this risk, carefully chosen covariates were included in the analysis to control for confounds to increase the validity of the results. Another limitation concerns the online method of data collection and this study's focus on mediated communication. Because data were collected using an online platform, it is possible that people in this sample have greater familiarity with and/or positive affect towards mediated communication such as social media than if the data were not collected using an online platform. In this case, the results would generalize only to people who use online platforms such as MTurk. At the same time, about 93% of people in the US use the internet and 72% of people use some type of social media (Pew Internet Research, 2021) so many people in the US are familiar with online communication. Future research would benefit from collecting data from online and offline sources to examine if there are systematic differences between these two groups. Relatedly, another limitation concerns the nonprobability sample, which introduces potential bias in the results and limits external validity due to potential sampling error. To improve the generalizability of the results, the hypotheses and research questions were derived from theory that can be applied across populations, settings, and times (Shapiro, 2002). Still, future research would benefit from collecting data using probability sampling that represents the target population to reduce sample bias and increase the generalizability of the results.

One might also be concerned about the sample size and the power of this study. A post hoc power analysis using G*Power v3.1 (Faul et al., 2009) for a linear multiple regression F test with 22 predictors, revealed a power level of $(1-\beta) = 1.00$. The likelihood that R^2 is not 0 is high. Because this study's regression model included 22 predictors, six of which were covariates, the power for each predicted interaction effect was lowered. For H1, the power level was $(1-\beta) = .10$ for the quarantine x mediated communication interaction and $(1-\beta) = .39$ for the isolation x mediated communication interaction on loneliness. For H2, the power level was $(1-\beta) = .52$ for the quarantine x strong-tie mediated communication interaction and $(1-\beta) = .85$ for the isolation x strong-tie mediated communication interaction on loneliness. For H3, the power level was $(1-\beta) = .96$ for the quarantine x social

presence interaction and the isolation x social presence interaction on loneliness. And for H4, the power analysis was $(1-\beta) = .08$ for the quarantine x active social media use interaction and $(1-\beta) = .06$ for the isolation x active social media use interaction on loneliness. Future research would benefit from collecting data from a larger sample size to increase the likelihood of detecting an effect if there is one.

In conclusion, quarantine and isolation are critical public health measures that reduce the spread of a contagious disease in the absence of a vaccine or widespread immunity. It is important to understand the implications of these public health measures for their effective use and mitigation of adverse effects. Given the findings, it is important to prepare people for potential increased feelings of loneliness when they are in isolation or quarantine so people can best cope with their situations, and to provide people in quarantine, isolation, and the pandemic in general with evidence-based solutions to improve loneliness from scientific interventions.

Footnotes

¹ Response about current household amount to over 100% because people were able to select more than one response.

Conflict of Interest

The author has no conflicts of interest to declare.

Author's Contribution

This study was devised and conducted by Nicole Kashian.

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