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Predictors and consequences of loneliness during the COVID-19 Pandemic

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A B S T R A C T

The COVID-19 pandemic has created a global context in which social isolation has become normative in order to reduce the risk of COVID-19 transmission. As a result of social distancing policies, the risk for loneliness and associated decline in quality of life has increased. The current study examined factors associated with loneliness and quality of life during the COVID-19 pandemic cross-sectionally ($n = 797$) and longitudinally ($n = 395$). Older age and larger social network size were associated with less loneliness, whereas having multiple physical or mental health diagnoses was associated with greater loneliness. Greater virtual social contact was also associated with increased loneliness. Greater loneliness was associated with all domains of quality of life both cross-sectionally and longitudinally. Understanding factors associated with loneliness is critical to developing effective strategies at reducing loneliness and improving quality of life during the pandemic. Contrary to popular perceptions, older age was associated with *less* loneliness and more virtual social contact was associated with *more* loneliness. Thus, it may be prudent to deemphasize virtual social contact in public campaigns and to emphasize safe methods of interacting in person.

1. Introduction

On March 11, 2020 the World Health Organization (WHO) declared the novel coronavirus (COVID-19) a global pandemic (World Health Organization, 2020). Governments worldwide have implemented social distancing measures to prevent transmission of the virus, including prohibition of public gatherings and closure of non-essential services. Similar measures have been implemented during previous pandemics, such as the SARS outbreak of 2003, however, the current global extent of social restrictions has not been seen for over a century (Centers for Disease Control and Prevention, 2018). While social distancing measures undoubtedly mitigate the spread of infectious disease and minimize the burden on health systems, the negative psychological effects of social distancing may contribute to the ongoing development of a secondary mental health crisis (Moreno et al., 2020; Pfefferbaum and North, 2020).

With mandated decreases in social contact as a result of the pandemic, the risk of loneliness has increased (Killgore et al., 2020; Tull et al., 2020). Loneliness can be defined as the feeling of distress when one's social relationships are perceived to be either qualitatively or quantitatively inadequate (Perlman and Peplau, 1981), and represents a significant risk factor for both physical and mental health complications.

Meta-analytic evidence suggests that individuals who live alone or are socially isolated are approximately 30% more likely to have died during an average 7-year follow up period (Holt-Lunstad et al., 2015), at a rate greater than obesity and comparable to cigarette abuse (Holt-Lunstad et al., 2010). Loneliness is also associated with hazardous lifestyle choices such as alcohol and substance abuse (Åkerlind and Hörnquist, 1992; Hosseinbor et al., 2014), mental health disorders such as depression and anxiety (Leary, 1990), and physical health conditions such as suppressed immune function (Jaremka et al., 2013), poor sleep quality (Hawkley et al., 2010), and Alzheimer's disease (Wilson et al., 2007). Even prior to the COVID-19 pandemic, loneliness levels were cited to be at epidemic levels (Neill-Hall, 2013; Cacioppo and Cacioppo, 2018), with over half of Americans reporting feelings of loneliness and social isolation (Cigna et al., 2020).

The WHO defines quality of life as an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (WHOQOL Group, 1998). Quality of life can be examined in the context of multiple domains of an individual's lived experience, including their physical wellbeing, psychological wellbeing, social relationships, and their environment. Negative perceptions of one's quality of life are associated with a host of negative health outcomes,

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such as stress-related symptomatology, risk of psychiatric illness, and shorter life expectancy (Phyo et al., 2020). During the COVID-19 pandemic, quality of life has decreased substantially from pre-pandemic levels in countries which have implemented strict lockdowns and other restrictive measures, particularly in young, female, low income, and unemployed adults, and those with pre-existing health conditions. (Pieh et al., 2020; Epifanio et al., 2021; Horesh et al., 2020). Importantly, loneliness is also associated with poorer quality of life in all domains (Arslantaş et al., 2015; Gerino et al., 2017) and accounts for up to 35% of the variance in quality of life (Borge et al., 1999).

Given the potential for increased loneliness as a result of COVID-19 social restrictions, it is important to examine factors associated with loneliness during the pandemic. Size of social networks, frequency of social contact, and the nature of social contact are all factors that have potentially changed as a result of the pandemic. Social network size (Nicolaisen and Thorsen, 2016) refers to the number of individuals with whom a person has regular social contact and is comfortable confiding in (Lubben, 1988). Smaller social networks have been linked to a variety of physical and mental health outcomes such as suppressed immune response (Pressman et al., 2005), increased depression (Goldberg et al., 1985; Domènech-Abella et al., 2017), and increased mortality (Shye et al., 1995). Gender differences in social networks are also important to consider. Men have smaller social networks than women (McLaughlin et al., 2010), and in older men (but not older women) smaller social networks are associated with increased risk of mortality (Shye et al., 1995).

Distinct from social network size, social contact refers to the frequency of social interaction with others (Shor and Roelfs, 2015). Less social contact is also associated with negative physical and mental health outcomes including increased risk of mortality (Shor and Roelfs, 2015), depression (Elmer and Stadtfeld, 2020), and dementia (Kuiper et al., 2015). Conversely, greater social contact is associated with better cardiovascular health (Lepore et al., 1993; Roy et al., 1998), quality of life, and cognitive functioning (Datta et al., 2015; Cohn-Schwartz, 2020).

The format of social contact is also important to consider now that much contact is occurring virtually rather than in person as a result of the pandemic. The positive effects of in-person social interactions have been well-established however, the effects of virtual social contact have been less extensively studied and some evidence suggests that virtual contact does not have the same positive effects as in-person contact (Lee et al., 2011). Virtual contact consisting of one-click feedback (i.e. "likes" or other reactions) are associated with reduced wellbeing (Burke and Kraut, 2016) and passive social media usage, such as watching videos and reading posts, was associated with a 33% increase in depressive symptoms (Escobar-Viera et al., 2018). Thus, virtual social contact is not always positive, however, it is unclear whether virtual social contact is helpful during the pandemic when in-person contact is less available.

In addition to social network size, frequency of contact, and nature of contact, differences in loneliness based on gender and age have been reported, however, the relationships appear to be complex. Some meta-analyses have suggested that men are more likely to be lonely than women (Mahon et al., 2006) while others suggest that there is no effect of gender (Maes et al., 2019). In a recent meta-analysis (Maes et al., al., 2019), a small effect of gender was found with men reporting greater loneliness than women, but this effect disappeared when samples with less than 100 men and 100 women were excluded. The effect of age on loneliness is similarly complex with the most likely explanation being a nonlinear relationship (Lasgaard et al., 2016; Victor and Yang, 2012) with peaks in both young adults (Beutel et al., 2017; Shovestul et al., 2020) and older adults (Yang and Victor, 2011).

Although previous research has examined factors associated with loneliness, the COVID-19 pandemic presents a unique context in which different associations with loneliness may emerge. For example, although loneliness is typically higher in both young adults and older adults, it has been proposed that older adults may be at greater risk of loneliness due to greater isolation during the pandemic (Trad et al., 2020; Berg-Weger and Morley, 2020). The reasons why people are socially isolating are also important to consider, as isolation to protect one's self or others may be less detrimental than isolation that is enforced by governmental regulations. Additionally, although virtual social contact is typically associated with more loneliness and negative health outcomes, it is possible that virtual contact has become a more positive experience during the pandemic. Thus, examining factors associated with loneliness and quality of life within the current global context is critical.

The present study aimed to examine factors associated with increased loneliness and reduced quality of life during the COVID-19 pandemic. Factors of interest included social network size, frequency of social contact, format of social contact, beliefs about social distancing, risk for health complications from COVID-19, and demographic characteristics such as age and gender.

2. Method

2.1. Participants and procedure

Participants were recruited through Amazon Mechanical Turk (MTurk) for a study examining coping during the COVID-19 pandemic (Shamblaw et al., 2021; Leibovitz et al., 2021). MTurk has been validated for use in psychological research (Clifford et al., 2015), with evidence suggesting that data collected on MTurk is more representative of community-based demographics than other sampling techniques (Cheung et al., 2017). Participants could access the survey if they had a Canadian or U.S.-based Internet protocol (IP) address and a 99% approval rating from other requesters for prior MTurk tasks, indicating accurate completion of tasks. We recruited 1000 participants for the baseline survey to more closely approximate population characteristics with the intent of informing population recommendations. Based on past research, we expected to exclude 20–25% of responses due to failure of effort items, which would result in an analyzable baseline sample of 750 to 800 participants. Of this sample a 50% attrition rate was expected for the follow-up survey based on previous MTurk studies. This would result in a final longitudinal sample of approximately 400 participants, which is sufficient to detect small effects. The baseline survey was accessed between April 21st and 25th, 2020 and participants completed the follow-up survey approximately one month later between May 21st and 27th, 2020. Participants were compensated with $2 (USD) for each survey and participants that passed the effort questions on both surveys were provided with a bonus $2 (USD). Ethical approval was obtained by the Research Ethics Board at the University of Toronto. All participants provided written informed consent.

2.2. Materials

2.2.1. UCLA loneliness scale (Russell et al., 1978)
The UCLA Loneliness Scale is a 20-item self-report measure assessing feelings of loneliness and isolation. Items are rated on a 4-point Likert-type scale from "0" (I never feel this way) to "3" (I often feel this way), with higher responses indicating greater feelings of loneliness and isolation. In the current study, the internal consistency was $\alpha = 0.96$.

2.2.2. World health organization quality of life – BREF (WHOQOL-BREF; the WHOQOL group, 1998)
The WHOQOL-BREF is a 26-item self-report measure assessing quality of life across four domains: physical health (7 items), psychological state (6 items), social relationships (3 items), and environment (8 items). Items are rated on a 5-point Likert-type scale with higher scores indicating higher quality of life. Items within each domain are averaged and the mean score is multiplied by 4 so that the total score of each domain has a maximum value of 20. A total score out of 80 is created by summing the domain scores. In the current study, internal consistency

for the full scale was α = 0.91 at baseline and 0.93 at follow-up. Domain scores ranged from α = 0.66 to α = 0.83 at baseline and α = 0.75 to α = 0.86 at follow-up.

2.2.3. Social distancing beliefs items

Beliefs about social distancing were measured with five items: (1) Social distancing is a way I can help people; (2) I am social distancing to protect my family; (3): Social distancing is useful in stopping the spread of COVID-19; (4) I am social distancing because the government tells me to; (5) I am social distancing because everything is closed. The items were rated across a 5-point Likert-type scale ranging from "0" (Disagree) to "4" (Agree).

2.2.4. Lubben social network scale-6 (LSNS-6; Lubben et al., 2006)

The LSNS-6 is a 6-item self-report measure assessing social interaction with both family and friends. Items are rated on a 6-point Likert-type scale from "0" (none) to "5" (nine or more), with higher scores indicating larger social networks. In the current study, the internal consistency was α = 0.84.

2.2.5. Social contact items

Social contact was assessed using three items: how often participants (1) leave their place of residence; (2) have virtual contact with people outside of the household; and (3) have in-person contact with people outside of the household. Items were rated on a 7-point Likert type scale ranging from "0" (Never) to "6" (Several times per day).

2.2.6. Physical and mental health risk

Participants were presented with a list of 30 common physical health diagnoses and six common mental health diagnoses and asked to indicate whether they had been diagnosed with any of the conditions. Participants who indicated they had been diagnosed with two or more conditions in either category were considered at "high risk" for either physical health or mental health consequences from the pandemic. The same questions were asked regarding whether participants had a friend or family member who had been diagnosed with the listed conditions.

2.2.7. Effort items

We assessed the validity of responses with four embedded effort questions adapted from Huang et al. (2014): (1) I have never used a computer (valid responses: disagree, somewhat disagree); (2) I eat cement occasionally (valid responses: never, almost never); (3) Select the answer "very dissatisfied" (valid responses: very dissatisfied, dissatisfied); and (4) Select the answer "I never feel this way" (valid responses: I never feel this way, I rarely feel this way). Participants were required to pass at least three of the effort questions to be included in the final sample.

2.3. Data analysis

Differences between individuals who completed the follow-up survey and those who did not were examined using t-tests and chi-squared tests. Correlations between measures at baseline and follow-up were also examined to determine the correlation across timepoints.

Beliefs about social distancing were examined descriptively as the percentage of participants who indicated "Agree" or "Somewhat Agree" to each of the social distancing questions. Demographic, health risk, and social factors were examined as predictors of loneliness using simultaneous multiple regression analyses. Analyses were conducted independently for the cross-sectional data and longitudinal data. For the longitudinal analyses, predictors were entered at baseline, predicting loneliness at follow-up. The effects of loneliness, social factors, health factors, and demographic factors on quality of life were examined both cross-sectionally and longitudinally using simultaneous multiple regression analyses. Longitudinal analyses were examined with predictors at baseline and quality of life at follow-up. Quality of life

domains (physical health, psychological state, social relationships, environment) were examined in independent regression analyses.

3. Results

3.1. Participants

A total of 1000 participants completed the baseline survey. 203 (20.3%) participants were excluded for answering more than one effort question incorrectly, which resulted in a final sample size of 797. Of these, 408 participants (51%) completed the survey again one month later. At follow-up 13 individuals (3%) were excluded for incorrectly answering more than one effort question, which resulted in a final sample at follow-up of 395. Two participants were missing data on the WHO-QOL at baseline and thus were excluded from analyses pertaining to the WHO-QOL. Demographic characteristics of the baseline and follow-up samples are presented independently in Table 1. State and provincial residential demographics are included in Supplementary Table 1.

Participants who completed the follow-up survey were significantly older ($M = 33.72$, $SD = 12.63$) than participants who did not complete the follow-up survey ($M = 30.80$, $SD = 10.09$), $t(795) = 3.60$, $p < .001$. A greater proportion of the non-completer sample was American (96.7%) compared to completers (92.6%), $\chi^2(1) = 6.97$, $p = .01$. Further, a greater proportion of the completer sample had at least a bachelor's degree (65.3%) compared to non-completers (57.7%), $\chi^2(1) = 4.87$, $p = .027$. Completers had significantly higher baseline scores than non-completers on WHO-QOL Social Relationships ($M = 14.46$, $SD = 3.33$; $M = 13.92$, $SD = 3.35$, respectively), $t(793) = 2.27$, $p = .024$, and WHO-QOL Environment ($M = 14.98$, $SD = 2.53$; $M = 14.46$, $SD = 2.57$, respectively), $t(793) = 2.88$, $p = .004$. There were no significant differences between completers and non-completers on gender (female vs. male), ethnicity (white vs. non-white), income, or baseline UCLA Loneliness, WHO-QOL Physical Health or WHO-QOL Psychological State, $ps > 0.052$.

There was a significant increase in Physical Health QOL and Environment QOL from baseline to follow-up, however there were no significant changes in loneliness, Social Relationship QOL or Psychological QOL (Table 2). There were significant correlations between baseline and follow-up scores on all primary outcome variables: Loneliness, $r(393) = 0.785$, $p < .001$, WHO-QOL Physical Health, $r(393) = 0.767$, $p < .001$, WHO-QOL Psychological State, $r(393) = 0.814$, $p < .001$, WHO-QOL Social Relationships, $r(393) = 0.691$, $p < .001$ and WHO-QOL Environment, $r(393) = 0.768$, $p < .001$. Given the strength of these correlations, we ran the primary analysis without controlling for baseline values in the longitudinal models, due to the fact that this would dramatically reduce the overall variance in the outcome measure. However, we also ran the longitudinal models with baseline values included to examine whether any relationships changed when baseline was included.

3.2. Beliefs about social distancing

See Table 3 for descriptive statistics of beliefs about social distancing. Overall, the majority of participants endorsed positive beliefs towards social distancing. Specifically, 94% of participants reported believing that social distancing was a way they could help people, 90% that social distancing was a way they could protect their family, and 93% that social distancing is useful in stopping the spread of COVID-19. Given the substantial endorsement of positive beliefs about social distancing, and thus skew in this variable, we did not include social distancing beliefs in the regression analyses for loneliness or quality of life.

3.3. Loneliness

Results of the cross-sectional and longitudinal regression analyses

Table 1
Demographic characteristics of the baseline and longitudinal sample.

	Baseline (N = 797)	Longitudinal (n = 395)
Age, M years (SD)	32.2 (11.5)	33.7 (12.6)
Country of residence, n(%)		
USA	755 (94.7)	366 (92.7)
Canada	42 (5.3)	29 (7.3)
Gender, n(%)		
Male	357 (44.8)	173 (43.8)
Female	435 (54.6)	220 (55.7)
Non-binary	3 (0.4)	2 (0.5)
Two-spirit	2 (0.3)	0 (0.0)
Race/ethnicity, n(%)		
White	538 (67.5)	274 (69.4)
Black	66 (8.3)	28 (7.1)
Multiracial	52 (6.5)	26 (6.6)
Latin American	49 (6.1)	21 (5.3)
South Asian	36 (4.5)	20 (5.1)
Chinese	22 (2.8)	11 (2.8)
Southeast Asian	11 (1.4)	7 (1.8)
Filipino	8 (1.0)	3 (0.8)
Korean	4 (0.5)	1 (0.3)
West Asian	3 (0.4)	1 (0.3)
Indigenous	2 (0.3)	1 (0.3)
Arab	2 (0.3)	1 (0.3)
Japanese	2 (0.3)	1 (0.3)
Other	2 (0.3)	0 (0.0)
Current relationship status, n(%)		
Single	304 (38.1)	150 (38.0)
Partnered	158 (19.8)	75 (19.0)
Married	297 (37.3)	149 (37.7)
Separated/divorced	33 (4.1)	20 (5.1)
Widowed	5 (0.6)	1 (0.3)
Currently living alone	98 (12.3)	51 (12.9)
Yearly household income, n(%)		
$0 - $10,000	65 (8.2)	30 (7.6)
$10,001 - $20,000	56 (7.0)	25 (6.3)
$20, 001 - $30,000	92 (11.5)	42 (10.6)
$30,001 - $50,000	139 (17.4)	69 (17.5)
$50,001 - $70,000	150 (18.8)	72 (18.2)
$70,001 - $100,000	134 (16.8)	79 (20.0)
$100,001 - $150,000	111 (13.9)	51 (12.9)
$150,001 +	50 (6.3)	27 (6.8)
Highest level of education, n(%)		
Less than high school	9 (1.1)	3 (0.8)
High school graduate	204 (25.6)	87 (22.0)
College certificate or diploma	94 (11.8)	47 (11.9)
Bachelor's degree	350 (43.9)	182 (46.1)
Master's degree	116 (14.6)	61 (15.4)
Doctorate	24 (3.0)	15 (3.8)
Currently working, n(%)	495 (62.1)	254 (64.3)
Physical Health Diagnoses, n(%)		
0	490 (61.5)	239 (60.5)
1	185 (23.2)	85 (21.5)
2+	122 (15.3)	71 (18)
Mental Health Diagnoses, n(%)		
0	548 (68.8)	282 (71.4)
1	132 (16.6)	60 (15.2)
2+	117 (14.7)	53 (13.4)

Table 2
Loneliness and quality of life at baseline and follow-up.

	Baseline		Follow-up		t
	M	SD	M	SD	
UCLA Total Score	17.82	14.33	17.93	14.83	−0.23
WHO-QOL Physical Health Score	15.46	2.67	15.76	2.70	−3.18**
WHO-QOL Psychological Score	14.05	3.23	14.21	3.23	−1.64
WHO-QOL Social Relationship Score	14.46	3.33	14.54	3.54	−0.56
WHO-QOL Environment Score	14.99	2.53	15.22	2.60	−2.63**

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

examining factors associated with loneliness are presented in Table 4. Older age and a larger social network size were significantly associated with lower loneliness both cross-sectionally and longitudinally. Further, having two or more physical health diagnoses and two or more self-reported mental health diagnoses were each related to greater loneliness both cross-sectionally and longitudinally. Longitudinally, greater frequency of virtual contact at baseline was related to higher loneliness at follow-up. There was no relationship between in-person contact and loneliness. When baseline loneliness was included in the longitudinal regression model only the presence of two or more self-reported mental health diagnoses remained a significant predictor.

3.4. Quality of life

Results of the cross-sectional and longitudinal regression analyses examining correlates of quality of life are presented in Tables 5 and 6 respectively.

In the cross-sectional analyses, higher income and larger social network size were associated with higher physical health QOL, whereas being in a relationship, having one or more physical health disorders, having one or more mental health disorders, greater loneliness, and greater frequency of virtual contact were associated with lower physical health QOL. Older age, higher income, larger social network, and in-person contact with people outside of one's household were associated with better psychological QOL, whereas having at least one mental health disorder and greater loneliness were associated with lower psychological QOL. Being in a relationship and larger social network were associated with better social QOL, whereas greater loneliness was associated with lower social QOL. Finally, higher income, higher education, and larger social network were associated with better environmental QOL, whereas greater loneliness and greater frequency of virtual contact were associated with lower environmental QOL.

In the longitudinal analyses, higher income, larger social network size, and greater frequency of leaving one's place of residence were associated with better physical health QOL, whereas having two or more physical health disorders (compared to none) and greater self-reported loneliness were associated with lower physical health QOL. Higher income was associated with better psychological QOL, whereas having two or more physical health disorders, having at two or more mental health disorders, and greater loneliness were associated with lower psychological QOL. Being in a relationship and having a larger social network were associated with better social QOL, whereas greater loneliness was associated with lower social QOL. Finally, higher income and larger social network were associated with better environmental QOL, whereas greater loneliness and in-person contact with people outside of one's household were associated with lower environmental QOL. When baseline QOL score was included in the longitudinal analyses only the relationships between loneliness with social relationship QOL and psychological QOL remained significant.

4. Discussion

To our knowledge, this is the first longitudinal study to explore factors associated with loneliness during the COVID-19 pandemic. Over 90% of participants endorsed positive beliefs about social distancing and over 70% reported leaving their place of residence a few times per week or less. 70% of participants also reported having in-person contact with people outside their household less than once per week. Thus, the current results suggest that most people view social distancing positively and were abiding by social distancing guidelines at the time of the study. Although most participants had limited in-person contact with people outside their household, the majority of participants (86.1%) reported engaging in virtual contact with people outside of their household multiple times per week. This is consistent with the reported rise in social media outlets and video chatting services during the pandemic (Koeze and Popper, 2020).

Table 3

Descriptive statistics of social distancing beliefs and social contact.

Social Distancing Beliefs:	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
Social distancing is a way I can help people, n(%)	602 (76)	138 (17.4)	37 (4.7)	8 (1)	7 (0.9)
I am social distancing to protect my family, n(%)	555 (70.1)	155 (19.6)	43 (5.4)	14 (1.8)	25 (3.2)
Social distancing is useful in stopping the spread of COVID-19, n(%)	594 (75)	144 (18.2)	30 (3.8)	15 (1.9)	9 (1.1)
I am social distancing because the government tells me to, n(%)	271 (34.2)	261 (33)	92 (11.6)	98 (12.4)	70 (8.8)
I am social distancing because everything is closed, n(%)	80 (10.1)	207 (26.1)	93 (11.7)	158 (19.9)	254 (32.1)
Social Contact:	Never	Less than weekly	Once per week	A few times per week	Once per day	A few times daily	Several times per day
Leaving place of residence, n(%)	58 (7.3)	167 (21.1)	177 (22.3)	210 (26.5)	124 (15.7)	48 (6.1)	8 (1.0)
Virtual contact with people outside of household, n(%)	22 (2.8)	38 (4.8)	50 (6.3)	225 (28.4)	98 (12.4)	186 (23.5)	173 (21.8)
In person contact with people outside of household, n(%)	302 (38.1)	252 (31.8)	90 (11.4)	87 (11)	23 (2.9)	23 (2.9)	15 (1.9)

Table 4

Factors associated with loneliness at baseline and follow-up.

	Model 1		Model 2	
	β	T	β	t
Age	−0.15	−4.02***	−0.18	−3.33**
Gender	−0.02	−0.65	0.04	0.88
Ethnicity	−0.02	−0.61	−0.01	−0.27
Income	−0.02	−0.56	−0.02	−0.43
Education	0.00	0.01	0.03	0.61
Partner status	−0.02	−0.59	−0.04	−0.79
Physical health[1]				
No physical health disorder	–	–	–	–
One physical health disorder	0.02	0.72	0.02	0.36
Two or more physical health disorders	0.08	2.26*	0.12	2.32*
Mental health[1]				
No mental health disorder	–	–	–	–
One mental health disorder	0.04	1.23	0.05	1.11
Two or more mental health disorders	0.18	5.13***	0.18	3.54***
LSNS-6 score	−0.38	−11.09***	−0.40	−7.81***
Currently living alone	0.04	1.03	0.01	0.13
Frequency of virtual contact	0.05	1.49	0.14	2.77**
Frequency of in person contact outside of household[1]				
No in person contact	–	–	–	–
In person contact less than weekly	0.04	1.04	0.01	0.10
In person contact more than weekly	0.05	1.21	0.03	0.60
Frequency of leaving place of residence	−0.05	−1.47	0.05	0.96

Note. Model 1 = Baseline model predicting loneliness at baseline (N = 792); Model 2 = Longitudinal model predicting loneliness at follow-up (n = 393). All predictors were measured at baseline. LSNS-6 = Lubben Social Network Scale-6.

[1] Dummy coded variable.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Loneliness was a major problem before the pandemic (Cigna et al., 2020) and represents a significant mental and physical health risk. The decreased social contact due to pandemic-associated social restrictions created an environment with the potential to foster loneliness. There is some evidence that rates of loneliness have not increased during the pandemic (Luchetti et al., 2020), however, this may be due to high levels of loneliness even prior to the pandemic. The current results suggest that older adults and people with larger social networks are less lonely. This is consistent with previous research suggesting that young adults and individuals with fewer friends are at greater risk of loneliness (Beutel et al., 2017; Shovestul et al., 2020), however, is contrary to suggestions in the popular media that older adults are at risk for increased loneliness as a result of the pandemic. The current results also suggested that individuals with two or more self-reported mental health diagnoses or physical health diagnoses had higher levels of loneliness. Individuals with multiple diagnoses can be considered to be in the at-risk group for complications from COVID-19 (Guan et al., 2020), and being in this at-risk group is associated with greater loneliness. This is consistent with previous research finding that loneliness is associated with poorer mental (Heinrich and Gullone, 2006) and physical health (Holt-Lunstad et al., 2015). Thus, individuals who are in an at-risk group for COVID-19 are more likely to experience loneliness and it may be important to target this group for interventions that increase social connection and decrease loneliness. It may be more challenging for at-risk individuals to have social contact during the pandemic due to the inherent risk of infection that social contact poses. Thus, development of novel methods of engaging in social contact may be warranted. Given the current results indicating that increased virtual social contact is associated with greater loneliness and decreased quality of life across physical and environmental domains while larger social network size is associated with decreased loneliness and increased quality of life across all domains, it is possible that frequency of contact is not as important in determining loneliness and quality of life as breadth of social contact. It may be important to identify people who have small social networks or who have pre-existing physical or mental health conditions, which increased risk of loneliness and decreased quality of life in the current sample. Expanding social networks to include more people, especially outside of the household, may be beneficial. It may also be helpful for people who are at-risk for loneliness to seek out physically-distanced social contact that is in person, instead of relying only on virtual contact.

Finally, even after controlling for demographic and social factors, loneliness was significantly associated with reduced quality of life in all domains both cross-sectionally and longitudinally. Thus, not only is loneliness itself an important treatment target during the pandemic, but it is also critical due to the strength of its relationship with quality of life. Across almost all domains of quality of life having a larger social network was also consistently associated with higher QOL, suggesting that larger social networks have been protective against loneliness during the pandemic. It is important to note that as the situation surrounding the pandemic evolves, so too do the implications of our findings. The current study was conducted in April of 2020, and the relevance of certain factors must be considered with respect to these changes. Rates of infection and lockdowns across states and provinces have fluctuated since the initial wave of COVID-19, and individuals hailing from states and provinces with the strictest lockdown measures across the entire pandemic may be most prudent to target in interventions. Social network size, rates of virtual social contact, and incidence of loneliness may need to be further examined as it is possible that rates have changed significantly over the course of the pandemic.

Given the negative effects of loneliness, it is critical to develop interventions to reduce loneliness. Popular press recommendations have typically focused on the importance of maintaining virtual contact during the pandemic when it is not possible to have in-person contact. However, the present results actually suggest that higher levels of virtual

Table 5

Cross-sectional regression analyses predicting quality of life (N = 790).

	Physical Health		Psychological State		Social Relationships		Environment	
	β	t	β	t	β	T	β	t
Age	0.03	0.88	0.07	2.20*	−0.05	−1.32	−0.05	−1.32
Gender	0.00	−0.11	−0.05	−1.74	0.03	1.02	−0.02	−0.45
Ethnicity	0.03	0.82	0.01	0.19	0.01	−0.41	0.06	1.76
Income	0.14	4.06***	0.07	2.11*	−0.02	−0.56	0.20	5.84***
Education	0.03	0.92	0.04	1.18	0.03	0.96	0.08	2.32*
Partner status	−0.08	−2.24*	0.06	1.77	0.18	5.17***	−0.02	−0.48
Physical health								
No physical health disorder	–	–	–	–	–	–	–	–
One physical health disorder	−0.08	−2.46*	−0.04	−1.19	0.01	0.44	−0.01	−0.22
Two or more physical health disorders	−0.20	−5.74***	−0.06	−1.88	0.02	0.51	−0.03	−0.75
Mental health								
No mental health disorder	–	–	–	–	–	–	–	–
One mental health disorder	−0.09	−2.88**	−0.12	−4.07***	−0.03	−0.95	−0.03	−0.98
Two or more mental health disorders	−0.07	−2.08*	−0.14	−4.37***	−0.03	−0.76	−0.03	−0.78
UCLA Loneliness Scale	−0.32	−9.30***	−0.42	−12.77***	−0.41	−11.69***	−0.22	−6.30***
LSNS-6 score	0.14	3.90***	0.11	3.35**	0.15	4.23***	0.24	6.57***
Currently living alone	0.02	0.45	−0.02	−0.53	0.01	0.34	0.02	0.54
Frequency of virtual contact	−0.08	−2.48*	−0.05	−1.69	−0.02	−0.57	−0.09	−2.67**
Frequency of in person contact outside of household								
No in-person contact	–	–	–	–	–	–	–	–
In person contact less than weekly	0.00	0.03	0.08	2.45*	0.05	1.43	−0.02	−0.41
In person contact more than weekly	−0.03	−0.71	0.10	2.86**	0.01	0.23	−0.01	−0.34
Frequency of leaving place of residence	0.05	1.39	0.00	0.04	−0.05	−1.48	0.02	0.52

Note.

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

Table 6

Longitudinal regression analyses predicting quality of life (n = 392).

	Physical Health		Psychological State		Social Relationships		Environment	
	β	t	β	t	β	t	β	t
Age	0.10	1.80	0.03	0.68	0.03	0.48	0.02	0.29
Gender	−0.03	−0.58	−0.05	−1.23	0.02	0.37	0.00	0.03
Ethnicity	0.03	0.70	0.03	0.63	0.03	0.68	0.05	0.92
Income	0.13	2.49*	0.11	2.45*	−0.02	−0.38	0.20	3.75***
Education	0.04	0.92	0.06	1.47	0.04	0.89	0.07	1.40
Partner status	−0.09	−1.83	0.03	0.64	0.14	2.78**	0.00	0.07
Physical health								
No physical health disorder	–	–	–	–	–	–	–	–
One physical health disorder	−0.04	−0.88	−0.04	−0.91	0.06	1.34	0.00	0.04
Two or more physical health disorders	−0.25	−4.72***	−0.10	−2.10*	−0.04	−0.76	−0.06	−1.01
Mental health								
No mental health disorder	–	–	–	–	–	–	–	–
One mental health disorder	−0.08	−1.64	−0.05	−1.23	−0.06	−1.36	0.00	−0.08
Two or more mental health disorders	−0.09	−1.86	−0.14	−3.14**	0.01	0.20	0.01	0.20
UCLA Loneliness Scale	−0.22	−4.15***	−0.45	−9.39***	−0.40	−7.58***	−0.18	−3.28**
LSNS-6 score	0.11	1.99*	0.07	1.29	0.12	2.10*	0.15	2.53*
Currently living alone	0.00	0.03	0.02	0.52	−0.02	−0.37	−0.03	−0.51
Frequency of virtual contact	−0.01	−0.19	−0.05	−1.01	−0.01	−0.26	0.02	0.35
Frequency of in person contact outside of household								
No in-person contact	–	–	–	–	–	–	–	–
In person contact less than weekly	−0.07	−1.41	−0.01	−0.13	−0.05	−0.97	−0.14	−2.65**
In person contact more than weekly	−0.08	−1.53	0.04	0.76	−0.06	−1.21	−0.13	−2.28*
Frequency of leaving place of residence	0.10	2.02*	−0.02	−0.37	−0.08	−1.74	0.06	1.25

Note. Predictors are at baseline and WHO-QOL outcome variables are at follow-up.

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

social contact are related to greater loneliness and lower quality of life. This was also a sample that regularly engaged in virtual social contact, and yet this virtual contact was associated with greater loneliness. Thus, while it seems that many people are heeding social distancing guidelines and opting for virtual contact over in-person contact, this same form of virtual contact is associated with lower QOL. It is unclear whether the specific type of virtual contact may play a role in the effect it has on loneliness, since previous research has found that active social contact in the form of having virtual conversations enhances wellbeing while passive social contact through observing social media outlets, does not (Burke and Kraut, 2016). Future research could examine more specific forms of virtual contact during the pandemic and associations with loneliness. However, in light of the current findings, it may be prudent to be cautious in recommending virtual social contact exclusively and further research on the effects of virtual social contact during the pandemic are needed. Future research could experimentally examine

the effects of prescribing socially distanced in-person contact compared to virtual contact to further determine effective methods of combatting loneliness during periods of prescribed social distancing.

The current results should be interpreted with consideration of several limitations. The study was conducted on Amazon Mechanical Turk to facilitate rapid data collection. The use of MTurk may limit the generalizability of the sample since participants must be proficient with using the MTurk platform, however, MTurk samples are actually more representative of community-based demographics than other sampling techniques (Clifford et al., 2015; Cheung et al., 2017). There were also several significant differences between the study sample that completed the survey at baseline and follow-up, which may have impacted our longitudinal findings. This included completers of the study being more likely to be significantly older and to have greater education. Completers also had significantly higher baseline scores on WHO-QOL domains of Social Relationships and Environment. The present study also used self-report measures to assess loneliness and QOL. Although these are well-validated scales, interview-based measures are the gold standard for mental health assessment and results may have differed if these measures had been used. Future studies should consider using more objective interview-based measures to assess loneliness. Lastly, all of the reported analyses are correlational in nature and thus causal inference is challenging.

4.1. Conclusion

With social distancing being used as the primary strategy to limit the spread of COVID-19, people are significantly more socially isolated than before the pandemic. The majority of participants in the current study reported having positive beliefs about social distancing and preferred engaging in more virtual forms of social contact, over in-person contact during the pandemic. Older age and a greater social network were found to be associated with lower levels of loneliness, while the presence of multiple physical and/or mental disorders were found to be associated with increased loneliness. Greater loneliness was consistently associated with lower QOL across all domains. However, increasing virtual contact may not be an effective method of reducing loneliness, since more virtual contact was linked to greater loneliness and lower QOL.

Author statement

All authors contributed to conceptualization and design of the study. RR managed data collection and wrote the first draft of the manuscript. MB, AS, and RR conducted statistical analyses and all authors contributed to writing the manuscript. All authors approved the final version of the manuscript.

Declaration of Competing Interest

No authors have any conflicts of interest to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2021.113934.

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