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# Reduced social contact and attachment insecurity as predictors of loneliness during COVID-19: A two-month experience sampling study

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## ABSTRACT

The impact of reduced social contact on mental health during the COVID-19 pandemic has been identified as a major public health concern. While personality factors such as attachment style have been associated with psychological distress during the pandemic, the longitudinal relevance of these factors and the role of daily social contact in mitigating distress remains poorly understood. This study evaluated the impact of social contact and attachment style on changes in loneliness over an 8-week experience sampling period during the COVID-19 pandemic. A general adult sample ( $n = 184$ ) recruited online completed measures of psychological distress, attachment, and loneliness via smartphone. Loneliness and daily social contact were assessed twice per week for eight weeks, yielding 1124 unique observations. During the experience sampling period, proximal increases in loneliness were associated with decreased daily in-person contact. In contrast, participants who described themselves as having fewer interactions via text, phone, or videoconferencing, as well as those with higher anxious and avoidant attachment traits, reported greater experiences of loneliness over time. These findings suggest the relevance of both enduring personality characteristics and daily social behaviors as risk factors for loneliness during the pandemic, pointing to potential targets for clinical intervention and future empirical study.

## 1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has led to dramatic changes in daily social behavior and routines; understanding the long-term impact of these changes on mental health has been identified as an important priority for empirical study (Holmes et al., 2020). While cross-sectional surveys have shown elevations in mood and anxiety symptoms since the start of the pandemic (APA, 2020; Liu et al., 2020; McQuaid et al., 2021; Wang et al., 2020), longitudinal studies have yielded less consistent findings. Studies assessing psychiatric symptoms at the daily or weekly level during the pandemic have shown relatively stable rates of stress, anxiety, and depression, in some cases even revealing decreases in negative affect and symptom severity over time (Fried et al., 2020; Stieger et al., 2021; Rosenstreich et al., 2020).

Given the necessity of reducing non-essential social contact, escalations in rates of loneliness in particular have been viewed as a significant public health concern (Holmes et al., 2020). Greater loneliness has been associated with several negative health outcomes, including

greater psychological stress and negative affect, reduced sleep efficiency and quality, and increased physiological stress (Cacioppo & Hawkley, 2009; Heinrich & Gullone, 2006; Pressman et al., 2005). Chronic feelings of loneliness have been associated with impaired immune response, with one study finding connections between high levels of loneliness, smaller social networks, and an inhibited antibody response to seasonal influenza vaccines (Pressman et al., 2005). Loneliness as a construct is typically differentiated from objective measures of social connection (such as frequency of social contact), with greater emphasis on subjective experiences of aloneness or emotional isolation that persist regardless of the availability of others (Peplau & Perlman, 1982). As such, while concerns about rising rates of loneliness during the pandemic are worth consideration, reductions in social contact alone may be insufficient in accounting for these changes.

Longitudinal studies of loneliness during the pandemic have thus far yielded inconsistent findings. Several studies have found experiences of loneliness to remain stable over the course of 2–3 weeks during the early stages of the pandemic (Fried et al., 2020; Stieger et al., 2021).

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Rosenstreich et al. (2020) found increased loneliness over a two-week period in individuals reporting a high degree of loneliness at baseline, while those who reported lower loneliness showed stable or decreasing rates over time. In contrast, longer-term assessments of changes in loneliness (e.g., over the course of months) have found significant increases in specific demographic groups, including millennials and parents of school-aged children (APA, 2020). Overall, despite general evidence that psychological distress has increased during the pandemic, the specific factors affecting changes in loneliness remain poorly understood.

Individual personality-based factors may influence vulnerability to loneliness in certain individuals. For example, loneliness has long been associated with early attachment disruptions (Weiss, 1987). Attachment theory posits that emotional bonds with caregivers interact with infant temperament to influence the development of emotion regulation capacities, personality traits, and social behaviors. Childhood experiences with caregivers who are inconsistently available or who are in other ways problematically engaged may lead to the development of insecure attachment (Bowlby, 1980), which may manifest behaviorally through excessive reassurance-seeking or overreliance on relationships (i.e. anxious attachment) or through disinterest or disavowal of emotional intimacy (i.e. avoidant attachment; Mikulincer & Shaver, 2007). Traumatic life situations are believed to activate the attachment system as a means of supporting emotional functioning and sense of safety (Mikulincer et al., 2002). Like loneliness, insecure attachment has been associated with a range of negative mental and physical health outcomes (Maunder & Hunter, 2008), including compromised immune functioning and proinflammatory phenotype (Ehrlich, 2019; Sbarra & Hazan, 2008). Adult attachment has further been investigated as both an individual difference (Moccia et al., 2020) and culture-level factor in predicting health outcomes during the COVID-19 pandemic: a large cross-sectional survey study of Italian adults conducted in April 2020 found for example that anxious attachment was associated with higher levels of psychological distress (Moccia et al., 2020). A large multinational study conducted by Kafetsios (2021) found that attachment orientations assessed at the culture level predicted differential growth curves of infection and mortality rates due to COVID-19. The findings of these studies provide evidence supporting the broad relevance of attachment theory in understanding psychological responses to stress and other health outcomes during the COVID-19 pandemic.

Questions remain however about the role of attachment in longitudinal adaptation and mental health. Given that both insecure attachment and loneliness contribute to compromised health functioning and greater psychological impairment, understanding the connections between these factors remains an important objective for informing behavioral health interventions during and following the end of pandemic conditions. Since loneliness is hypothesized to function as distinct from more objective measures of social connection, considerations of attachment style and daily social behaviors together may offer complementary explanations for changes in loneliness over time. For example, prior studies have shown that anxious and avoidant attachment styles are associated with different perceptions of the impact of daily social contact on emotional functioning (Campbell et al., 2005; Mikulincer & Shaver, 2007) and different preferences for social network size and engagement in general (Fiori et al., 2011), which together may suggest that attachment traits and daily social contact patterns are important to consider in conjunction with one another in predicting emotional resilience during periods of adversity and stress. Given that anxious attachment has been associated with greater dependency on others for emotional support and stability (Campbell et al., 2005), it is possible that anxious attachment traits will be associated more strongly with loneliness in the context of reduced social contact than avoidant attachment traits.

The present study aims to understand the interpersonal and behavioral factors affecting loneliness during the pandemic. Specifically, we sought to evaluate associations between attachment insecurity, the form

and frequency of social contact, and experiences of loneliness in a sample of adults over a two-month period. To account for the potential influence of increased stress, depression, and anxiety symptoms that were evident following the initial onset of the pandemic (e.g., van der Velden et al., 2021), we included a measure of psychological distress as a covariate in our analyses, to ensure that increases in loneliness were not attributable solely to escalations in distress during this period. We predicted that anxious attachment would be associated with greater reports of loneliness upon entry to the study (baseline), and that both reduced social contact and anxious attachment would prospectively predict higher ratings of loneliness over a two-month experience sampling period.

## 2. Materials and methods

### 2.1. Participants and procedures

Participants were recruited through social media posts and email listservs. Individuals were eligible if they were 18 years of age or older, residing in the United States, and if they had access to a smartphone or tablet. Enrollment occurred between April and June 2020, with 78% of the sample enrolling by May 1st. The final sample included 184 participants, of which  $n = 112$  provided at least two experience sampling entries. Participants who completed baseline measures were primarily of Eastern/Western European descent (78.7%), with a mean age of 44.01 ( $SD = 16.19$ , median = 40, range 18 to 88). Most participants reported their current residence as being in the Northeast of the United States (57.0%), followed by the West (17.7%), South (14%), and Midwest (11.3%). Most identified as female (78.20%), with smaller proportions identifying as male (15.40%), transgender (2.70%), nonbinary (3.20%), or not sure (0.50%).<sup>1</sup> All but three participants reported that social distancing guidelines were being implemented in their local community. All study procedures were approved by the Institutional Review Board of the Austen Riggs Center.

### 2.2. Data collection

Surveys were anonymous and responses were collected using a secure smartphone app hosted by LifeData ([www.LifeDataCorp.com](http://www.LifeDataCorp.com)). Participants provided informed consent prior to participating. After completing baseline measures, participants were sent automated prompts twice per week (occurring on consistent days but randomized times) for a target of sixteen responses over eight weeks ( $M = 10.45$ ,  $SD = 5.84$ ). These responses were collected between April and September 2020, and participants were given the option of entering a gift card raffle after completing the baseline (\$10) and experience sampling (\$20) portions of the study. The average length of time spent in the experience sampling period for participants was 46 days ( $SD = 27$  days).

### 2.3. Psychometric assessment

A demographic form was used to collect information about age, gender, marital status, ethnicity, state of residence, and current employment status. Participants were also asked about social distancing requirements in their community.

The Mental Health Inventory-5 (MHI-5; Berwick et al., 1991), a five item self-report measure assessing psychiatric symptom severity, was used at baseline to evaluate psychological distress. A transformed total score ranging from 0 to 100 was calculated, with higher scores representing greater psychological distress.

<sup>1</sup> There were no differences in the demographic characteristics of the baseline sample ( $n = 184$ ) compared to subsample who completed the experience sampling protocol ( $n = 112$ ).

The Experiences in Close Relationships Scale – Short Form (ECR-SF; Wei et al., 2007), a 12-item self-report measure, was used at baseline to evaluate anxious and avoidant attachment traits, with higher ratings representing greater attachment insecurity on each dimension.

The UCLA Loneliness Scale – 6 item version (ULS-6; Neto, 2014) was used to assess loneliness both at baseline and during the experience sampling period, with higher scores representing greater loneliness.

During the experience sampling period, participants were asked how many people they interacted with “on average each day since [their] last entry,” with separate categories for in-person interactions, interactions via text, or interactions via phone/videoconferencing. The text and phone/videoconference categories were combined into a “remote contact” category.

### 3. Results

Internal consistency for baseline measures ranged from  $\alpha = 0.75$  (ECR-SF Attachment Avoidance) to  $\alpha = 0.86$  (MHI-5). The intraclass correlation coefficient (ICC) for the ULS-6 experience sampling data was 0.80 (with  $\alpha$  values of 0.62 and .92 for level-1 and level-2 ULS-6 data, respectively). Zero-order associations between study variables are reported in Table A1. Preliminary analyses examined differences in loneliness at baseline related to demographic variables. A small but significant negative association was found between age and loneliness,  $r = -0.15, p < .05$ . There were no other significant differences in loneliness at baseline based on demographic factors (i.e. gender, race).

#### 3.1. Psychological distress and insecure attachment predicting loneliness at baseline

Multiple regression analyses were used to examine associations between psychological distress, attachment anxiety and avoidance, and loneliness assessed at baseline. Age was initially included as a covariate but was removed after emerging as non-significant when psychological distress was added to the model. A two-stage regression was conducted with loneliness as the dependent variable (see Table A2). Psychological distress was entered in Model 1, followed by the two attachment variables in Model 2. In Model 1, psychological distress contributed significantly to the regression model,  $F(1,182) = 42.40, p < .001$ , accounting for 18.5% of the variation in loneliness. The two attachment variables in Model 2 explained an additional 17.6% of variation in loneliness, and the corresponding change in  $R^2$  was significant,  $F(2,180) = 34.44, p < .001$ .

#### 3.2. Predictors of loneliness during the two-month experience sampling period

We employed a multilevel model to account for dependencies found within nested data (timepoints nested within participants) while obtaining proper standard errors (Snijders & Bosker, 2011). The random intercept and slope model was defined as:

$$\text{Lonely}_{it} = \beta_{0i} + \beta_{1i}(\text{Daily\_In\_Person}_{it}) + \beta_{2i}(\text{Daily\_Remote}_{it}) + e_{it}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{Overall\_In\_Person}_i) + \gamma_{02}(\text{Overall\_Remote}_i) + \gamma_{03}(\text{AttAnx}_i) + \gamma_{04}(\text{AttAv}_i) + \gamma_{05}(\text{Distress}_i) + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + u_{1i}$$

$$\beta_{2i} = \gamma_{20} + u_{2i}$$

where Lonely refers to the outcome which varied across each person (i) and each timepoint (t). Daily in-person and daily remote contact were person centered at level-1, so a positive score represented a day with higher social contact relative to that person's average day in the study. These associations were modeled including random effects, meaning

that (for instance) the association between daily in-person contact and loneliness ( $\beta_{1i}$ ) was represented through a sample-wide association ( $\gamma_{10}$ ) representing the typical participant's level-1 association and individual differences ( $u_{1i}$ ) around that association.

Overall, in-person and remote contact were calculated by taking a within-person mean for each participant (i). These scores were then sample centered so that a positive score represented a person with greater social contact relative to others in the sample. This centering approach let us examine how loneliness related to within-person changes in social contact, as well as between-person differences in social contact. Distress, attachment anxiety, and attachment avoidance scores for each participant at baseline were also included (i).<sup>2</sup> Multilevel modeling was completed in SAS 9.4 (Littell et al., 1996) using SAS' PROC MIXED with missing data treated as missing at random.

Table A3 displays the results of the multilevel model. Loneliness decreased on days where participants received more in-person contact relative to their average day in the study. Examining between-person effects, individuals with greater loneliness relative to others in the study endorsed higher levels of both attachment anxiety and avoidance, higher levels of distress, and lower levels of remote social contact.<sup>3</sup>

### 4. Discussion

The COVID-19 pandemic has altered the everyday social behaviors of individuals around the world, in many cases creating barriers to accessing social support. While social distancing has been a necessary and effective public health measure, corresponding concerns about increases in loneliness have led to efforts to understand the negative effects of reduced social contact on emotional functioning over time. The findings of the present study offer one illustration of the importance of both behavioral and personality-based factors in understanding vulnerability to loneliness during the COVID-19 pandemic, suggesting possible pathways for future intervention and study.

To our knowledge, this is the first study to examine the differential impact of in-person versus remote social contact on experiences of loneliness during the COVID-19 pandemic. Our results indicate that both the timescale and type of social contact are relevant in explaining loneliness during the pandemic. For the average participant, daily increases in in-person contact were associated with decreased loneliness, while increased remote contact was unrelated to loneliness on a daily basis. However, participants who engaged in more remote contact overall (relative to others in the study) reported lower loneliness compared to others in general. This may indicate that remote social contact has an aggregate effect of reducing loneliness, without necessarily leading to abrupt (daily) shifts, as was the case for in-person contact. Alternately, individuals who experienced few feelings of loneliness during this stage of the pandemic may have maintained more frequent contact with friends and family using remote means, which would suggest instead that higher aggregated remote contact is better interpreted as an indicator of lower proneness to loneliness rather than as a behavioral factor exerting a direct effect.

Our prediction that anxious attachment would be associated with

<sup>2</sup> We also examined associations between when a participant completed the study (since some participants started at different dates, and loneliness may have been related to the duration into the pandemic when data was collected), region of residence, and whether increased time in the study was associated with loneliness (e.g., whether participants became lonelier over time). In all cases, findings were not significant, so we did not control for these variables in our final model. We ran a preliminary model with all predictors except attachment styles, and then a final model where attachment styles were included. Both models produced identical interpretations of the results, so for parsimony we only present the final model.

<sup>3</sup> As an exploratory analysis, we also examined whether there were any significant interactions between social contact variables and baseline attachment and distress variables in association with loneliness. None were significant.

Loneliness was supported both at baseline and during the experience sampling period. However, contrary to our expectations, attachment avoidance was also found to be positively associated with loneliness, though with a slightly lower magnitude of effect compared to attachment anxiety. While avoidant attachment is often viewed as relating to lower dependency on relational support, avoidant individuals have been found to differ from anxious individuals primarily in their withdrawal from emotional engagement in the face of attachment-related threats (e.g., divorce or separation) rather than general threats (e.g., failure; Mikulincer et al., 2002). Since the pandemic has created conditions of adversity across several (not just interpersonal) domains, it may be that differences in responses to loss of daily social contact is less differentiated between individuals with attachment anxiety and avoidance than might be expected. While age was not found to be associated with loneliness in our baseline analyses, prior studies have found differences in the associations between attachment avoidance and anxiety and experiences of loneliness and well-being in different age groups, with perceptions of social support playing a larger role in mitigating experiences of loneliness in older adults with avoidant attachment compared to other attachment and age groups (Kafetsios & Sideridis, 2006). In the present study, the relationship between both insecure attachment dimensions and loneliness was significant even when accounting for current levels of psychological distress and social contact (both across days and overall). Thus, loneliness was driven not only by reduced social contact and greater distress, but also more globally by enduring personality-based patterns.

Among the many mental health factors that have been studied during the COVID-19 pandemic, loneliness has emerged as a leading concern due to its association with other adverse health outcomes as well as its persistence over time. In many studies, loneliness has been found to persist at an elevated degree of severity long after other symptoms have remitted to pre-pandemic levels (e.g., Siflinger et al., 2021; van der Velden et al., 2021). Achieving a better understanding of factors affecting loneliness over time may be particularly important for addressing mental and physical health outcomes that persist beyond the pandemic. Insecure attachment is believed to elevate risk for poor physical health through its contribution to the development of a proinflammatory phenotype, in which exposure to early stress and adversity influences the development of chronic low-grade inflammation which inflicts a higher burden of physiological distress and acceleration of age-related physical decline (Ehrlich, 2019).

Loneliness involves interpersonal and affective factors, with attachment being among the earliest interpersonal templates that sets a developmental course associated with various health outcomes in adulthood. Our study confirms that individuals identified as having an

insecure attachment style are more vulnerable to experiences of loneliness, even when distress and reduced social contact are included in the model. Those with an insecure attachment style have a pre-pandemic developmental vulnerability to loneliness that the conditions of the pandemic exacerbated. This is an important finding because it suggests targets for psychological intervention and education after the pandemic to reduce ongoing and future vulnerability to loneliness, even when social distancing is no longer required. Loneliness was a risk factor for adverse health outcomes before the pandemic (Cacioppo & Hawkley, 2009; Heinrich & Gullone, 2006; Pressman et al., 2005), and the increased social isolation and associated increased loneliness during the pandemic may have long-term effects that will take years to understand and address. One recommendation is to prospectively and longitudinally include attachment style, loneliness, distress, and frequency/mode of social contact in studies that assess the trajectory of recovery as we emerge from the social restrictions of the pandemic.

Our study had several limitations. Given the timing of data collection, we were unable to estimate changes in study variables with reference to participants' pre-pandemic functioning. Similarly, although nearly all participants described themselves as living under social distancing requirements, we were unable to assess the degree to which daily in-person contact was reduced during the study period compared to earlier social behaviors. Further, our manner of assessing frequency of interpersonal contact during the eight week study period relied on self-reported estimates of general behavior rather than more objective tracking of specific contact events. Finally, our sample was comprised of individuals with limited racial and ethnic diversity and included only those with access to smartphones or tablets, limiting the generalizability of our findings to more diverse populations.

Despite these limitations, the present study is the first to our knowledge to evaluate the effects of social behavior and attachment style as sources of influence on loneliness during the COVID-19 pandemic. Our findings offer opportunities for clinical translation and application and contribute to the growing knowledge base of the impact of the pandemic on mental health.

**CRedit authorship contribution statement**

Katie C. Lewis: Conceptualization; project administration; methodology; investigation; data curation; formal analysis; software; visualization; writing - original draft; writing - review & editing. Michael J. Roche: Conceptualization; data curation; software; formal analysis; visualization; writing - original draft. Fiona Brown: Data curation; project administration; writing - review & editing. Jane G. Tillman: Conceptualization; writing - review & editing.

**Appendix A**

**Table A1**  
Zero-order correlations among variables in the study.

Variable	Age	Gender	Distress	Attachment anxiety	Attachment avoidance	In person	Remote	Total contact	Loneliness
Age	1								
Gender	0.11	1							
Distress	-0.26*	0.05	1						
Attachment anxiety	-0.35*	0.09	0.39*	1					
Attachment avoidance	0.04	0.18*	0.07	0.11	1				
In person	-0.04	0.28*	0.05	-0.05	0.08	0.38	0.17*	0.72*	-0.01
Remote	0.14	0.10	-0.21*	-0.16	0.05	0.29*	0.70	0.81*	-0.30*
Total contact	0.10	0.19*	-0.16	-0.14	0.09	0.66*	0.89*	0.63	-0.21*
Loneliness	-0.20*	0.12	0.46*	0.46*	0.26*	0.02	-0.37*	-0.27*	0.80

Note. *N* = 186 for baseline variables, *n* = 112 for variables including experience sampling (in person and remote), *n* smaller for gender which was coded as a binary (female = 0, male = 1) variable, with other genders listed treated as missing data. Distress = MHI-5 transformed total score. Attachment anxiety = ECR-SF anxious attachment. Attachment avoidance = ECR-SF avoidant attachment. Bottom diagonal indicates between-person effects. Top diagonal indicates within-person effects. Within-person effects based on observation sample size around 1140, using uncentered variables. Diagonal values indicate ICC score (for baseline variables containing no within-person variance, 1 indicates 100% between-person variability).

\* *p* < .05.

**Table A2**  
Anxious and avoidant attachment predicting loneliness at baseline.

Variable	$\beta$	$T$	$R$	$R^2$	$\Delta R^2$
Step 1			0.44	0.19	0.19
Distress	0.44	6.51**			
Step 2			0.60	0.37	0.18
Distress	0.27	4.12**			
Attachment anxiety	0.40	6.22**			
Attachment avoidance	0.17	2.78**			

Note.  $N = 184$ . Distress = MHI-5 transformed total score. Attachment anxiety = ECR-SF anxious attachment. Attachment avoidance = ECR-SF avoidant attachment.

\*\*  $p < .01$ .

**Table A3**  
Longitudinal associations between loneliness, social contact, and attachment.

Variable	Est	SE
Intercept	11.45*	1.70
Within-person effects		
Daily in-person contact	-0.08*	0.04
Daily remote contact	-0.05	0.03
Between-person effects		
Overall in-person contact	0.13	0.11
Overall remote contact	-0.29*	0.07
Attachment anxiety	0.16*	0.04
Attachment avoidance	0.15*	0.05
Distress	0.07*	0.02
Random effects		
Intercept	8.76*	1.28
In-person contact	0.02	0.02
Remote contact	0.02*	0.01
Residual error	3.48*	0.16

Note. Based on 1124 experience sampling ratings across  $n = 112$  participants. Daily variables were person-centered, and overall variables were sample-centered. Attachment anxiety = ECR-SF anxious attachment. Attachment avoidance = ECR-SF avoidant attachment. Distress = MHI-5 transformed total score.

\*  $p < .05$ .

**Table A4**  
(Supplemental) Longitudinal associations between loneliness and social contact.

Variable	Est	SE
Intercept	13.69*	0.35
Within-person effects		
Daily in-person contact	-0.09*	0.04
Daily remote contact	-0.05	0.03
Between-person effects		
Overall in-person contact	0.20	0.13
Overall remote contact	-0.38*	0.08
Random effects		
Intercept	12.98*	1.84
In-person contact	0.02	0.02
Remote contact	0.02*	0.01
Residual error	3.49*	0.16

Note. Based on 1124 experience sampling ratings across  $n = 112$  participants. Daily variables were person-centered, and overall variables were sample-centered.

\*  $p < .05$ .

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