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Younger people and people with higher subjective SES experienced more negative effects of the pandemic on their friendships

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ABSTRACT

Friendships provide social support and mental health benefits, yet the COVID-19 pandemic has limited interactions with friends. In August 2020, we asked participants ($N = 634$) about their friendships during the pandemic as part of a larger study. We found that younger people and people with higher subjective SES reported more negative effects on their friendships, including feeling more isolated and lonelier. We also found that stress, isolation, and guilt were associated with greater COVID-related social risk-taking, such as making and visiting new friends in person. Our results suggest the pandemic is affecting friendships differently across demographic groups and these negative effects might motivate social risk-taking.

1. Introduction

COVID-19 was declared a pandemic on March 11, 2020 (World Health Organization, 2020), causing governments to recommend quarantining, self-isolation, and social distancing to limit the spread of the disease (Pew Research, 2020). While these practices reduced infection risk, they also lead to feelings of isolation and lack of social connectedness (Pantell & Shields-Zeeman, 2020), which are associated with adverse health outcomes (Elmer, Mepham, & Stadtfeld, 2020) and increased risk of premature death (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015).

Friendships help protect against these outcomes — good friendships are associated with faster recovery, increased well-being, and protection against illnesses (Perlman & Peplau, 1981; Reblin & Uchino, 2008; Smith & Christakis, 2008). However, the pandemic has created challenges for friendships, making it harder to make new (Bieltz, 2020) and maintain existing friendships (University College London, 2020). Since the pandemic has caused new risks, stresses, and anxieties for many (Bäuerle et al., 2020; Dryhurst et al., 2020; Fofana et al., 2020), it is possible that these factors have also influenced friendships.

1.1. People employ various strategies to manage risks

One underexplored benefit of friendship is the extent to which friends help us manage our risks. Dorfman (2007) proposed four strategies for managing risk: individuals can manage their risks and deal with consequences by themselves (risk retention), avoid situations with potentially large risks (risk avoidance), reduce the probability or size of potential losses (risk reduction), or transfer their risk to others (risk transfer). McCleskey and Gruda (2021) documented that less resilient, risk-tolerant, and younger individuals experienced more anxiety early in the pandemic compared to their more resilient, risk-tolerant, and older counterparts. However, this study did not assess the strategies their sample used to manage their risks.

During times of unforeseeable challenges, such as pandemics, friendships may be one of the most valuable resources for managing risk and providing support (Aktipis et al., 2016; Aktipis, Cronk, & de Aguiar, 2011; Gurven & Hill, 2009; Tooby & Cosmides, 1996). However, these benefits may have unintended costs. In the current pandemic, social connectedness predicts the spread of COVID-19 more accurately than geographical and physical proximity (Kuchler, Russel, & Stroebel, 2020). This implies that one is more likely to catch COVID-19 from

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friends than strangers.

1.2. Friendships vary across demographic groups

Prior research documents that friendships form between similar individuals (Verbrugge, 1977). But individual differences, such as age, sex, education, and socioeconomic status (SES), influence formation and maintenance. For example, women's friendships are described as less tolerant compared to men's (Benenson et al., 2009), but this difference decreases with age (Fox, Gibbs, & Auerbach, 1985). High SES individuals generally prefer to spend time alone but are more likely to spend time with friends when they spend time with others (Bianchi & Vohs, 2016). However, most friendship research focuses on friendships in childhood and early adulthood. As a result, less is known about how friendships change across time (Blieszner, Ogletree, & Adams, 2019), though research suggests friendships are important for maintaining emotional well-being in later life (Miche, Huxhold, & Stevens, 2013).

1.3. The present work

In this study, we take an initial look at how friendships were impacted during the pandemic. As one of the first empirical investigations of friendships during the pandemic, we took an exploratory approach to test a range of competing predictions. One possibility is that the pandemic did not influence friendships, leading to no differences between demographic groups in perceptions of friendships. Another prediction is that some groups (particularly younger, female, less educated, or lower SES) are more likely to experience negative friendship outcomes, as previous research suggests their friendships are more temporary and unstable (Antonucci, Lansford, & Akiyama, 2001). However, it is also possible that these groups deal with friendship conflict more effectively and, therefore, experienced fewer negative friendship outcomes during the pandemic. Finally, given the effects of risk-taking during the pandemic (McCleskey & Gruda, 2021), we tested predictions about risk management strategies and friendship outcomes. Risk transfer inherently requires social interaction (Cronk et al., 2019), so those who use risk transfers may report more negative effects as their opportunities for social contact are limited. However, it is also possible that those who use non-social forms of risk management perceive more negative effects due to having to manage risk during the pandemic by themselves.

2. Method

2.1. Participants

We recruited an international sample through Prolific as part of a longitudinal study assessing cooperation and behavior during the pandemic (Ayers et al., 2020). Friendships were not the focus of that project, so a priori power analysis was not possible. However, sensitivity analyses with our predictors, alpha = 0.05, and power = 0.95 suggest we are powered to detect effects as small as $R^2 = 0.039$.

Participants took the initial demographic survey on March 24, 2020 ($N = 902$) and were invited to return approximately every two weeks. On August 8, 2020 ($N = 634$, $M_{age} = 29.61$, $SD_{age} = 11.03$, 50.70% male) participants answered questions regarding friendship. Most participants resided in continental Europe ($N = 365$), had a bachelor's/4-year college degree (30.20%) or some college education (26.20%), average subjective SES ($M = 5.64$, $SD = 1.46$, on a 1 = *lowest subjective SES* to 10 = *highest subjective SES* scale; (Adler et al., 2000)), and identified as White (82.30%).

2.2. Materials, measures, and procedures

On March 24, participants reported demographics, perceived risk of COVID-19 infection, and their likelihood of using different risk-management strategies: *I am likely to ask parents or friends for help preparing for the COVID-19 pandemic* (risk transfer), *I have been stocking up on food and supplies so that I am prepared for the COVID-19 pandemic* (risk retention), *I try to reduce my risk of getting COVID-19 by doing things like washing my hands often* (risk reduction), and *I completely avoid situations that could put me at risk of contracting COVID-19, like going to the grocery store when it is crowded* (risk avoidance). These items were created to investigate risk management strategies during the pandemic. Participants also reported COVID-induced changes in their stress, anxiety, and perceived risk of contracting COVID-19 (1 = Not at all stressed/anxious/likely, 7 = Extremely stressed/anxious/likely).

On August 8, participants reported on their friendships (Table 1). All friendship variables were assessed via single items except for two: the preference for having a wide network of friends and the motivation to befriend others (Ayers et al., 2020). To construct these composites, items were generated to assess the tradeoff between having many friends and investing heavily in friends. Across five studies ($N_1 = 1684$, $N_2 = 104$, $N_3 = 767$, $N_4 = 634$ (current sample), $N_5 = 1066$), two factors emerged as the most parsimonious explanation of this tradeoff, yielding the two composite measures. Validation of the friendship preference scale is described at https://osf.io/e9pxy/, and the McDonald's ω reliabilities in this sample (Dunn, Baguley, & Brunsden, 2014) are in Table 1.

3. Results

A multivariate multiple regression was used to predict our friendship variables from COVID-19 related variables, risk management variables, and demographic information entered as simultaneous predictors. Correlations between variables are presented in the supplemental materials

Table 1
Means, standard deviations, and friendship item wordings.

Friendship variables collected on August 8, 2020	Response scale	M	SD
Contact How often have you been in contact with friends (not including family members, in-laws, children) since the pandemic started?	1 = less than once a month 5 = every day	3.12	1.29
Impact of pandemic How has the pandemic impacted your existing friendships?	1 = made them worse 7 = made them better	3.91	1.11
Do you feel guilty because you are not able to check-in on your friends in person as much as you used to?	1 = not at all 7 = very much	3.06	1.84
How satisfied are you with your friendships currently during the pandemic?	1 = not at all 7 = completely	4.73	1.64
Isolation How isolated from your social circle have you felt during the pandemic?	1 = not at all 7 = completely	4.09	1.71
How lonely have you felt during the pandemic?	1 = not at all 7 = completely	3.77	1.84
Friendship behavior Have you made any new friendships since the pandemic began? If so, how many?	Free response Min = 0, Max = 10	0.80	1.77
A friend of yours is hosting a party indoors at his house next weekend that will have about 50 guests. Some of the guests are mutual friends of yours; other guests you do not know. Considering you have no other obligations, how likely are you to attend this party?	1 = not at all 7 = very likely	2.54	1.82
Preference to have a wide network of friends composite (ω = 0.92)	1 = strongly disagree 7 = strongly agree	3.16	1.18
Motivation to befriend new friends composite (ω = 0.85)	1 = strongly disagree 7 = strongly agree	3.58	1.64

(Tables S1–S3) and standardized regression coefficients are presented in Table 2.

3.1. Omnibus multivariate regression

Overall, the multivariate model predicted participant perceptions of their friendships, $F(11, 468) = 3341.49$, $p < 0.001$, Pillai's = 0.99. When we investigated the univariate effects, all predictors significantly contributed to the model (p's < 0.001). Since multivariate regressions predict the linear combination of dependent variables (Dattalo, 2013), we also performed multiple regressions to investigate our friendship variables separately with simultaneous predictors. We include hierarchical regression analyses in the supplemental materials (Table S2). We present all significant results here but focus our discussion on results that survive Bonferroni correction for multiple tests ($p < 0.005$).

3.2. Contact with friends

We predicted how often people contacted their friends during the pandemic, $F(11, 468) = 2.33$, $p = 0.009$, adjusted $R^2 = 0.03$. Older adults had less contact with friends during the pandemic ($\beta = -0.13$, $SE = 0.005$, $p = 0.007$) but did not survive corrections.

3.3. How were friendships impacted?

We did not predict whether friendships were positively or negatively impacted by the pandemic, $F(11, 468) = 1.40$, $p = 0.17$, adjusted $R^2 = 0.009$.

3.4. New friends

Demographics predicted the number of new friends made during the pandemic ($F(11, 468) = 3.56$, $p < 0.001$, adjusted $R^2 = 0.06$). Younger ($\beta = -0.19$, $SE = 0.007$, $p < 0.001$), less educated ($\beta = -0.10$, $SE = 0.05$, $p = 0.03$), and higher subjective SES ($\beta = 0.13$, $SE = 0.06$, $p = 0.007$) participants made more new friends during the pandemic. Only the age effect survived corrections.

3.5. Satisfaction with friends during the pandemic

We predicted satisfaction with friends during the pandemic, $F(11, 468) = 2.40$, $p = 0.007$, adjusted $R^2 = 0.03$. Participants who used risk reduction strategies more ($\beta = 0.13$, SE = 0.09, $p = 0.01$) and were higher in subjective SES ($\beta = 0.12$, SE = 0.05, $p = 0.01$) were more satisfied with their friendships, but these effects did not survive corrections.

3.6. Isolation from friends

COVID-related demographics predicted how isolated participants felt from their friends during the pandemic, $F(11, 468) = 3.89$, $p < 0.001$, adjusted $R^2 = 0.06$. Participants who reported feeling more stressed felt more isolated ($\beta = 0.23$, SE = 0.07, $p < 0.001$; Fig. 1).

3.7. Loneliness

Demographics predicted how lonely participants felt during the pandemic, $F(11, 468) = 7.06$, $p < 0.001$, adjusted $R^2 = 0.12$. Participants who reported feeling more stressed reported feeling lonelier ($\beta = 0.23$, $SE = 0.07$, $p = 0.0004$; Fig. 2A) and younger participants felt lonelier ($\beta = -0.18$, $SE = 0.001$, $p = 0.001$; Fig. 2B).

3.8. Guilt

We predicted how guilty participants felt about not being able to check-in on their friends in person during the pandemic, $F(11, 468) = 4.30$, $p < 0.001$, adjusted $R^2 = 0.07$. Participants who reported feeling more stressed ($\beta = 0.16$, SE = 0.08, $p = 0.02$) and participants who used more risk transfer strategies ($\beta = 0.11$, SE = 0.05, $p = 0.02$) reported feeling more guilty, but neither effect survived corrections.

3.9. Attending an indoor party with people you don't know

Risk management strategies predicted how likely participants were to attend an indoor party with 50 people during the pandemic, $F(11, 468) = 3.77$, $p < 0.001$, adjusted $R^2 = 0.06$. Participants who used more risk avoidance strategies ($\beta = -0.18$, SE = 0.06, $p = 0.0006$) and women ($\beta = -0.10$, SE = 0.17, $p = 0.04$) were less likely to go to the indoor party, but the sex effect did not survive corrections.

3.10. Wide friendship network

We predicted participant preferences for having a wide network of friends during the pandemic, $F(11, 468) = 4.05$, $p < 0.001$, adjusted $R^2 = 0.07$. Participants who used risk transfer strategies more ($\beta = 0.15$, SE = 0.03, $p = 0.002$) and were higher in subjective SES ($\beta = 0.16$, SE = 0.04, $p = 0.001$) were more likely to want a wide network.

3.11. Wanting to befriend

Finally, demographics predicted how much participants wanted to befriend new people during the pandemic, $F(11, 468) = 8.61$, $p < 0.001$, adjusted $R^2 = 0.15$. Participants who reported greater anxiety ($\beta = 0.15$, SE = 0.07, $p = 0.02$), used risk transfer strategies more ($\beta = 0.16$, SE = 0.04, $p = 0.001$; Fig. 3A), and were male ($\beta = -0.10$, SE = 0.15, $p = 0.02$) reported a greater desire to befriend, but younger participants ($\beta = -0.20$, SE = 0.006, $p < 0.001$; Fig. 3B) reported a greater desire to befriend. The effects of anxiety and sex did not survive corrections.

4. Discussion

The COVID-19 pandemic has drastically changed how people conduct their lives. Guidelines aimed at slowing the spread of COVID-19 have led to unintended negative mental health outcomes (Elmer, Mepham, & Stadtfeld, 2020) and interfered with many benefits afforded by friendships (Dunbar, 2018; Perlman & Peplau, 1981; Reblin & Uchino, 2008; Smith & Christakis, 2008).

4.1. Factors that predicted negative friendship outcomes

Participants who were younger, less educated, male, and had higher subjective SES reported more negative impacts on their friendships. However, only the age and SES effects survived corrections for multiple tests. As some of our participants indicated they were likely to engage in risky social behaviors (i.e., younger people wanting to befriend others during the pandemic) and previous research shows that social proximity predicts COVID-19 outbreaks (Kuchler, Russel, & Stroebel, 2020), knowing who is likely to seek social contact during a pandemic may help public health efforts to reduce disease transmission.

We found evidence that pandemic-related stress predicted some friendship outcomes, specifically feelings of isolation and loneliness. This relationship has important implications as pandemic-induced stress may cause increased in-person interactions to mitigate these effects, ultimately increasing transmission of COVID-19. Our data supports this, as pandemic induced stress was correlated with both the desire to have a wide friendship network ($r = 0.17$, $p < 0.001$) and desire to befriend new people ($r = 0.21$, $p < 0.001$).

We also found that the use of various risk management strategies was differentially associated with friendship-related outcomes. Participants who used risk transfers, which require social interactions (Cronk et al., 2019), wanted to befriend others and have a wider network of friends. Thus, our findings suggest that risk transfers might motivate in-person

Table 2
Regression coefficients for demographics, risk management variables, and COVID-19 variables predicting friendship outcomes.

		Predictors										
		Stress B [95% CI]	Anxiety B [95% CI]	Perception of risk B [95% CI]	Risk transfer B [95% CI]	Risk retention B [95% CI]	Risk reduction B [95% CI]	Risk avoidance B [95% CI]	Age B [95% CI]	Sex[+] B [95% CI]	Education B [95% CI]	Subjective SES B [95% CI]
Multivariate multiple regression		**4.51 [4.36, 4.65]** ***	**5.00 [4.83, 5.10]** ***	**3.89 [3.75, 4.02]** ***	**3.93 [3.76, 4.09]** ***	**3.61 [3.45, 3.77]** ***	**6.38 [6.30, 6.46]** ***	**5.59 [5.45, 5.73]** ***	**29.57 [28.59, 30.56]** ***	**0.48 [0.44, 0.53]** ***	**4.09 [3.94, 4.23]** ***	**5.67 [5.54, 5.80]** ***
		β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]	β [95% CI]
Multiple regressions	Contact with friends	0.10 [−0.01, 0.21]	−0.09 [−0.20, 0.03]	0.09 [0.01, 0.17]	0.01 [−0.05, 0.08]	−0.01 [−0.08, 0.06]	0.10 [−0.05, 0.24]	−0.08 [−0.16, 0.01]	**−0.13 [−0.14, −0.12]** **	0.05 [−0.19, 0.29]	−0.10 [−0.17, −0.02]	0.08 [−0.006, 0.16]
	Impact on existing friendships	0.01 [−0.08, 0.11]	−0.05 [−0.15, 0.05]	0.05 [−0.20, 0.12]	−0.02 [−0.08, 0.04]	−0.01 [−0.07, 0.05]	0.10 [−0.02, 0.23]	−0.03 [−0.10, 0.05]	−0.06 [−0.07, −0.05]	−0.06 [−0.13, 0.29]	0.03 [−0.04, 0.09]	0.10 [0.03, 0.17]*
	Number of new friends	−0.07 [−0.22, 0.08]	0.08 [−0.07, 0.25]	−0.03 [−0.14, 0.08]	−0.03 [−0.13, 0.06]	−0.03 [−0.13, 0.08]	−0.04 [−0.24, 0.16]	−0.03 [−0.15, 0.09]	**−0.19 [−0.21, −0.18]** ***	−0.0006 [−0.33, 0.33]	−0.11 [−0.21, 0.001]*	0.13 [0.01, 0.24]**
	Satisfied with friends	−0.11 [−0.24, 0.03]	−0.08 [−0.21, 0.07]	−0.02 [−0.11, 0.08]	0.01 [−0.07, 0.10]	−0.01 [−0.10, 0.08]	0.13 [−0.05, 0.31]**	−0.01 [−0.12, 0.09]	0.04 [0.03, 0.05]	0.09 [−0.20, 0.39]	−0.02 [−0.12, 0.07]	0.12 [0.02, 0.22]**
	Isolated from friends	**0.23 [0.09, 0.38]** **	0.04 [−0.11, 0.20]	0.03 [−0.08, 0.13]	0.09 [−0.001, 0.18]	−0.05 [−0.15, 0.04]	−0.07 [−0.26, 0.12]	0.001 [−0.11, 0.12]	−0.02 [−0.04, −0.01]	−0.09 [−0.40, 0.23]	0.07 [−0.04, 0.17]	0.02 [−0.09, 0.13]
	Loneliness	**0.23 [0.08, 0.38]** ***	0.04 [−0.11, 0.20]	0.01 [−0.10, 0.12]	0.01 [−0.08, 0.10]	0.08 [−0.20, 0.18]	−0.05 [−0.25, 0.14]	0.04 [−0.07, 0.16]	**−0.18 [−0.19, −0.16]** ***	0.01 [−0.31, 0.34]	−0.08 [−0.18, 0.03]	−0.06 [−0.18, 0.05]
	Guilt for not checking-in in person	0.16 [0.01, 0.31]*	0.09 [−0.08, 0.25]	0.001 [−0.11, 0.11]	0.11 [0.02, 0.21]*	0.006 [−0.10, 0.11]	−0.002 [−0.20, 0.20]	−0.02 [−0.14, 0.10]	−0.03 [−0.05, −0.02]	0.07 [−0.27, 0.40]	−0.04 [−0.15, 0.07]	0.06 [−0.06, 0.17]
	Likelihood of going to an indoor party	−0.01 [−0.17, 0.14]	−0.03 [−0.20, 0.13]	−0.05 [−0.16, 0.07]	0.05 [−0.05, 0.15]	0.08 [−0.03, 0.18]	−0.04 [−0.24, 0.17]	**−0.18 [−0.30, −0.05]** ***	−0.07 [−0.09, −0.06]	−0.10 [−0.44, 0.25]*	−0.09 [−0.20, 0.03]	0.09 [−0.03, 0.20]
	Wide friendship network	0.12 [0.02, 0.22]	0.04 [−0.06, 0.15]	0.02 [−0.05, 0.10]	**0.15 [0.09, 0.21]** **	−0.01 [−0.08, 0.05]	−0.005 [−0.14, 0.13]	−0.01 [−0.09, 0.07]	−0.06 [−0.07, −0.05]	−0.02 [−0.24, 0.20]	−0.03 [−0.10, 0.04]	**0.16 [0.08, 0.23]** ***
	Wanting to make new friends	0.09 [−0.04, 0.23]	0.16 [0.01, 0.30]*	0.02 [−0.08, 0.12]	**0.16 [0.07, 0.24]** ***	0.06 [−0.03, 0.15]	−0.08 [−0.26, 0.10]	−0.02 [−0.13, 0.08]	**−0.20 [−0.21, −0.19]** ***	−0.10 [−0.40, 0.19]*	−0.02 [−0.12, 0.07]	0.05 [−0.06, 0.15]

Bold indicates significant after Bonferroni correction ($p < 0.005$ cutoff).
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
[+] 0 = male, 1 = female.

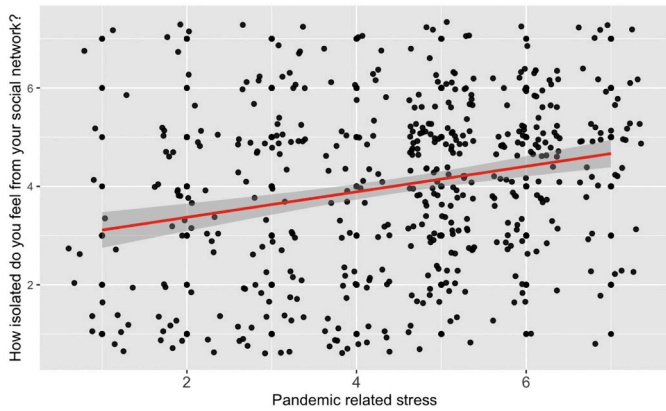

Fig. 1. The model predicted feeling isolated from one's social network during the pandemic ($p < 0.001$, adjusted $R^2 = 0.06$), such that those who felt more stressed (*How stressed do you currently feel dealing with changes caused by COVID19?*; $\beta = 0.23$, SE = 0.07, $p < 0.001$) felt more isolated from their social network. Red lines represent simple linear regression equations with 95% confidence intervals. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

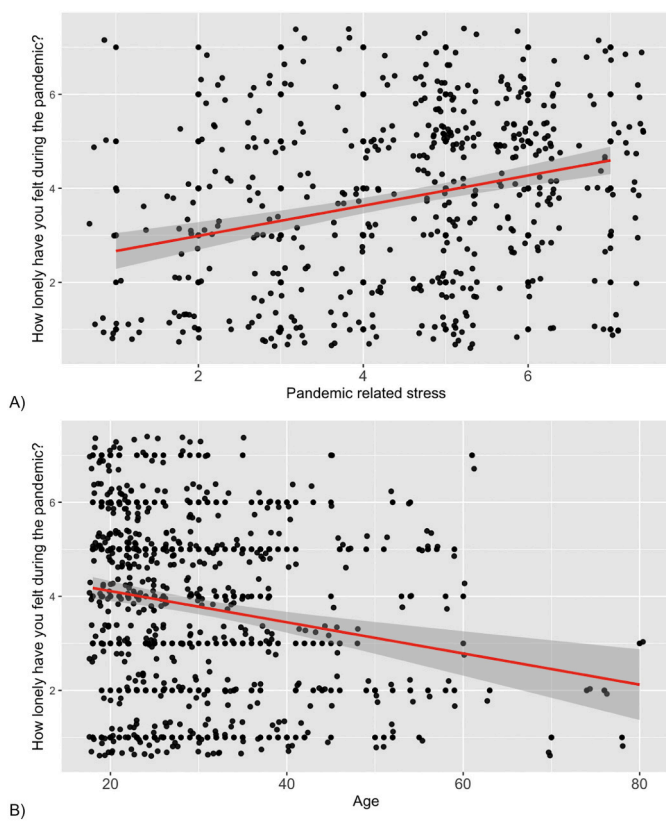

Fig. 2. The model significantly predicted feeling lonely during the pandemic, and age was a negative predictor of feeling lonely during the pandemic ($p < 0.001$, adjusted $R^2 = 0.12$). A) Those with more stress (*How stressed do you currently feel dealing with changes caused by COVID19?*; $\beta = 0.23$, $SE = 0.07$, $p = 0.0004$) felt lonelier during the pandemic. B) Younger participants felt lonelier during the pandemic ($\beta = -0.18$, $SE = 0.001$, $p = 0.001$). Red lines represent simple linear regression equations with 95% confidence intervals. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

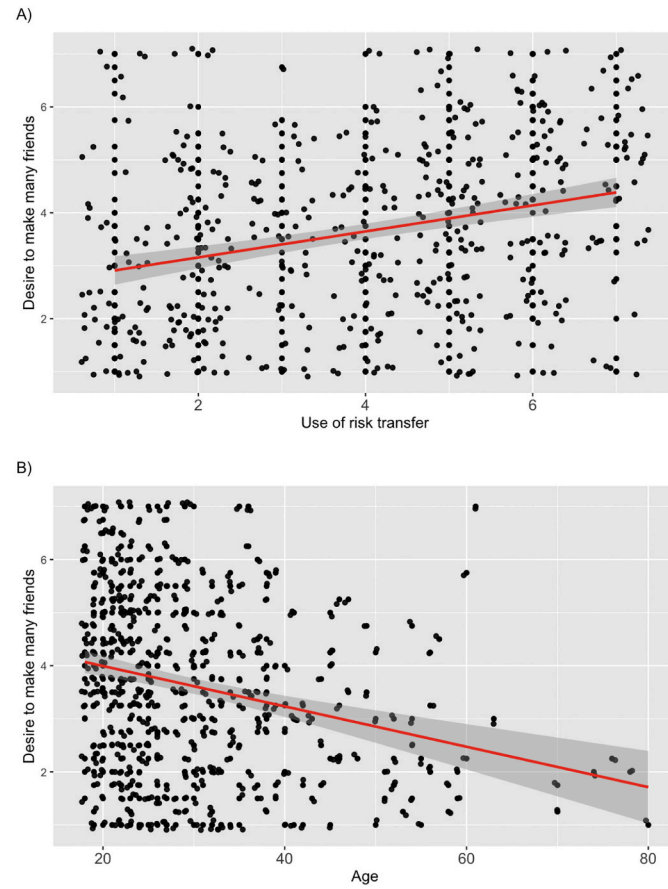

Fig. 3. The model predicted participants wanting to make more friends during the pandemic ($p < 0.001$, adjusted $R^2 = 0.15$). A) Participants who were more likely to use risk transfer strategies (*I am likely to ask parents or friends for help preparing for the COVID19 pandemic*; $\beta = 0.16$, SE = 0.04, $p = 0.001$) were more likely to indicate that they wanted to make more friends during the pandemic. B) Older participants ($\beta = -0.20$, SE = 0.006, $p < 0.001$) were less likely to indicate that they wanted to make more friends during the pandemic. Red lines represent simple linear regression equations with 95% confidence intervals. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

interactions to maintain existing, or gain new, relationships that help to manage one's risks.

4.2. Friendships might protect against pandemic-related challenges

While our results suggest that some individuals experienced negative friendship outcomes, pandemic-related anxiety and perceived risk of infection did not influence our friendship items. One interpretation is that, while the pandemic has resulted in some negative effects, friendships may have had a protective influence for some. While pandemic-related anxiety is not associated with the number of new friends participants made, it is associated with wanting a wide network of friends and motivation to befriend others. This could mean that those who experienced less pandemic-related anxiety did so because their friendships buffered negative effects.

4.3. Why do subjective SES and education predict outcomes in opposite directions?

An unexpected finding was that higher subjective SES individuals reported making more friends during the pandemic, while more educated individuals reported making fewer friends (before Bonferroni correction). This is somewhat puzzling as these variables are positively

correlated in the literature (Aikens & Barbarin, 2008; McLaughlin & Sheridan, 2016) and our data ($r = 0.27$, $p < 0.001$). Our predictors were entered simultaneously, so it is likely that education and subjective SES predicted unique variances in our friendship variables similar to the literature on body mass index (BMI) — weight and height are positively correlated, but predict BMI in opposite directions (Sperrin, Marshall, Higgins, Renehan, & Buchan, 2016; Strauss, 1999).

Our findings are also consistent with research showing that more educated people have greater COVID-19 literacy (Okan et al., 2020) while entitlement, which is associated with subjective SES (Côté et al., 2021), leads to less preventative behavior (Zitek & Schlund, 2020). In our data, participants who reported higher subjective SES were more likely to say they would go to an indoor party (before corrections). The increased likelihood of risky activities could be due to participants *feeling* less vulnerable to (or better able to deal with) pandemic-specific risks, regardless of whether this is objectively true.

4.4. Limitations

Because we measured general friendship items, we are not able to differentiate between the effects of emotionally close and distant friends/acquaintances. Friends and acquaintances have different demands (Dunbar, 2018) and benefits (Shah & Jehn, 1993), suggesting that these relationships contribute differently to pandemic-related mental health and well-being. Future research can address this limitation by asking about different types of friends (e.g., best friends, close friends, acquaintances).

Another limitation is that our analyses did not allow us to examine causality. For example, we found that COVID-related stress was positively associated with feeling isolated and lonely. One interpretation is that friendships affected mental health (e.g., more isolation from friends increased stress) during the pandemic, but another possibility is that mental health affected friendships (e.g., more stress increased isolation from friends). Future studies could assess causality by conducting time series analyses.

We assessed several attitudes and preferences about friendships. Changes in friendship-related behaviors (like social contact, new friends made, and risk strategies used) during the pandemic may be more important, as behavioral changes are more indicative of risk-taking. For example, knowing which individuals *actually* go to crowded indoor parties during a pandemic would enable interventions that specifically target these individuals to prevent unnecessary risk and disease transmission.

5. Conclusion

The COVID-19 pandemic has caused changes in friendship, though not as many as we may have expected. Our study found that participants who reported more pandemic-related stress, were younger, had higher subjective SES, and used risk transfers reported more negative friendship outcomes. While this study does not establish causation, it is a first step in exploring changes in friendship caused by the COVID-19 pandemic and their implications for health-related risk taking.

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CRediT authorship contribution statement

Jessica D. Ayers: Conceptualization, Formal analysis, Methodology, Writing – original draft. **Diego Guevara Beltran:** Data curation, Methodology, Writing – review & editing. **Andrew Van Horn:** Data curation, Methodology, Writing – review & editing. **Lee Cronk:** Methodology, Writing – review & editing. **Peter M. Todd:** Methodology, Funding acquisition, Supervision, Writing – review & editing. **Athena Aktipis:** Methodology, Funding acquisition, Supervision, Writing – review & editing.

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Appendix A. Supplementary materials

Supplementary analyses for this article can be found online at https://doi.org/10.1016/j.paid.2021.111246.

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