Prepandemic relationship satisfaction is related to postpandemic COVID-19 anxiety: A four-wave study in China

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Abstract

The COVID-19 pandemic has had lasting impacts on people’s interpersonal relationship and mental health. Using four-wave data in China (N = 222, 54.50% female, Median = 31.53, SD = 8.17), the current study examined whether prepandemic relationship satisfaction was related to postpandemic COVID-19 anxiety through midpandemic perceived social support and/or gratitude. The results showed that people’s COVID-19 anxiety decreased from the peak to the trough stage of the pandemic; perceived social support increased markedly from prepandemic to the peak and remained stable subsequently, while relationship satisfaction remained unchanged throughout. Further, it was midpandemic perceived social support, not gratitude, that mediated the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety, indicating that perceived social support played a crucial role in this process. Finally, it is suggested that

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perceived social support should be distinguished from gratitude as two different components of social interactions.

**Keywords**
Relationship satisfaction, COVID-19 anxiety, perceived social support, gratitude, longitudinal design

The coronavirus disease-2019 (COVID-19) outbreak in January 2020 has become a global pandemic. As of January 2021, there were more than 94,000,000 confirmed cases and 2,000,000 deaths worldwide (World Health Organization, 2021). To prevent the virus from spreading, the World Health Organization (2020) recommended implementing social distancing policies to limit close face-to-face contact with others and reduce the spread of COVID-19 (Centers for Disease Control and Prevention, 2020). In China, the authorities restricted travel from 24 January 2020 and shut down most businesses (Bureau of Disease Prevention and Control, 2020). As the global pandemic intensified, many other countries, such as the United Kingdom, have successfully introduced social distancing measures (British Government, 2020). Billions of people have been distanced from social activities to avoid virus infection and transmission (Banerjee & Rai, 2020).

Although the social distancing policies led to the number of confirmed cases in China to decline below 1000 cases by the end of April 2020, the policies have resulted in a lack of physical contact, face-to-face communication, and social activities, thus reducing relationship intimacy and posing threats to individuals’ mental health (Brooks et al., 2020; Galea et al., 2020). Accordingly, studies have shown that people who have been distanced from social activities because of probable COVID-19 infection during the pandemic have reported higher levels of anxiety and depression than those who have not been distanced (Zhao et al., 2020) and have had more post-traumatic stress symptoms and some long-lasting effects (Brooks et al., 2020).

However, it remains unknown whether and how individuals’ pre-existing relationship quality would influence their psychological distress following the disaster. Inspired by the social convoy model (Antonucci & Akiyama, 1987; Antonucci et al., 2014), we propose in the current study that midpandemic perceived social support and/or gratitude might mediate the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety.

**Relationship satisfaction is related to COVID-19 anxiety**

It has been found that individuals with positive relationships reported less mental health distress than those with a poor-quality relationship during the pandemic (Pieh et al., 2020). When people’s lives were being threatened, interpersonal relationship quality can negatively relate to their anxiety symptoms during COVID-19 (Magson et al., 2021; Wang et al., 2020). However, due to the cross-sectional nature of previous studies, it is unclear how relationship satisfaction, perceived social support, and COVID-19 anxiety
would change with the rise and fall of the COVID-19 pandemic and whether prepandemic (T0) relationship satisfaction was related to COVID-19 anxiety across the pandemic. From the perspective of the social convoy model (Kahn & Antonucci, 1980), social relationships can provide a protective base which can help people deal with pressure and stress. In line with the principles of the social convoy model, extant studies have found that relationship satisfaction is a strong protective factor for people’s mental health (Freedman et al., 2015; Till et al., 2017). Therefore, we predicted that prepandemic (T0) relationship satisfaction would be negatively related to COVID-19 anxiety during the pandemic? (Hypothesis 1).

Furthermore, given the emphasis of the social convoy model on the importance of social relationships and reciprocity (Antonucci et al., 2014), satisfying relationships may provide individuals with relational contexts for the perception of social support and grateful emotions (Reis & Franks, 1994). Therefore, both the individual’s perceived social support from others and appreciation for the benevolence of others, namely, gratitude, during the pandemic were likely to mediate the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety.

**Perceived social support might mediate the association between relationship satisfaction and COVID-19 anxiety**

According to the social convoy model, the quality of social relationships as one of the most important dimensions of social relationships affects the total amount of social support within the social circle (Antonucci et al., 2014). Perceived social support refers to the perception of the support from others available to a person (Demaray & Malecki, 2002). It plays a key role in people’s adaptation to crisis events in their lives, thus having a positive effect on personal adaptation and mental health (Thoits, 2011). Numerous studies have shown that relationship satisfaction is positively correlated with perceived support in social relationships (Kaul & Lakey, 2003; McCleachern et al., 2013; Sommantico et al., 2020). For example, interpersonal relationships can predict social support; people with higher-quality relationships might have more opportunities to perceive support from others (Luo et al., 2017; Zhang et al., 2015).

Actually, relationship satisfaction might reflect psychological capital that could facilitate people’s perceived social support. In the perspective of the theory of resilience and relational load (Afifi et al., 2016), if relational partners have maintained their relationships better over time, they are more likely to perceive each other in a positive way and uplift each other against the stressor. Accordingly, perceived social support has been found to be negatively correlated with anxiety during the COVID-19 crisis (Cao et al., 2020; Zhao et al., 2020). According to the “stress-buffering” framework of social support (Schwarzer & Leppin, 1991; Thoits, 1995), perceived social support can provide the experience of positive affect and help individuals build the psychosocial resources needed to cope with stress and adversity. A large number of studies have supported the stress-buffering model, indicating that the function of perceived social support in mitigating subsequent psychological distress in high-stress situations (Fried & Tiegs, 1993; Cheng, 1997). Perceived social support can play a mediator role between interpersonal relationships and
depressive symptoms (Luo et al., 2017) and loneliness (Zhang et al., 2015). Moreover, it was shown that family social support plays a mediating role between intergenerational relationship satisfaction and mental health (Li et al., 2019).

All in all, considering the improvement of relationship satisfaction may provide more social support to people during the pandemic, we hypothesized that midpandemic social support might mediate the relationship between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety (Hypothesis 2a).

Gratitude might mediate the association between relationship satisfaction and COVID-19 anxiety

In addition to perceived social support, positive relationship is found to be related to gratitude (Algoe, 2012; Wood et al., 2008). By definition, gratitude refers to a generalized tendency to respond with emotional appreciation to the roles of favors from other people in their positive experiences and outcomes (McCullough et al., 2002). Furthermore, evidence has shown that gratitude is negatively associated with anxiety (Rosmarin et al., 2010), and this correlation has also been confirmed during the COVID-19 pandemic (Biber et al., 2020). Therefore, greater midpandemic gratitude might mediate the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety.

Although both perceived social support and gratitude might mediate the effects of relationship satisfaction on COVID-19 anxiety, we noticed that there are crucial differences in the concept and mechanism of action between the two. In definition, perceived social support reflects how much individuals realize the tangible material (e.g., time, money, or supplies) and spiritual support from others (e.g., care, concern, and love) (Norris et al., 2005). Thus, perceived social support is more focused on a cognitive appraisal of being reliably connected to others (Neria et al., 2009) and is affected by the ecological contexts of stressful encounters and the types of social support assessed (Cohen & Wills, 1985; Cutrona & Russell, 1990). By contrast, gratitude more embodies a tendency to respond with emotional appreciation to the benevolence of others (Emmons & McCullough, 2004). Hence, perceived social support and gratitude appear to have different dominant components of positive interpersonal interactions. Thus, we predicted that perceived social support and/or gratitude might mediate the relationship between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety (Hypothesis 2b).

By identifying the plausible mediation variables of perceived social support and/or gratitude in the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety, the current study will deepen our understanding of the psychological mechanism underlying social relationship and mental health and, meanwhile, provide insight on what would really help to resume a healthy life in the postpandemic period. Using longitudinal design and natural experiment method, the current study would reveal whether people’s relationship satisfaction would change with the development of the COVID-19 pandemic and whether prepandemic relationship satisfaction would reduce postpandemic COVID-19 anxiety. These results would ultimately
facilitate to perfecting the theoretical framework of the social convoy model with revealing the constant and variable functions of relationship satisfaction in reducing anxiety.

Present study

As mentioned previously, owing to the strong social distancing measures adopted by the Chinese government in January 2020, the COVID-19 pandemic has been controlled since the end of April 2020 in China. The number of confirmed cases in China has dropped significantly, which provides us an opportunity to examine how pre-existing relationship quality is related to individuals’ postpandemic COVID-19 anxiety. Accordingly, we collected longitudinal data at four key nodes of the COVID-19 pandemic in China: the prepandemic (T0; 12 January 2020), the peak (T1; 15 February 2020), the decline (T2; 15 March 2020), and the trough (T3; 10 April 2020) stages, as shown in Figure 1 (see Xu et al., 2020). The longitudinal data were from a longitudinal project concerning individuals’ mental health (e.g., anxiety), positive psychological resources (e.g., perceived social support), and interpersonal relationship quality (e.g., interpersonal relationship satisfaction). We measured the participants’ relationship satisfaction, perceived social support, and trait anxiety before the COVID-19 pandemic had been declared an emergent public health event. Using longitudinal data, we could explore how prepandemic relationship satisfaction was related to postpandemic COVID-19 anxiety through midpandemic mediation factors.

Using data before the pandemic and subsequent three-wave data through the peak and trough of COVID-19, the aims of our study were to examine (1) how relationship satisfaction, COVID-19 anxiety, and perceived social support changed with the rise and

![Figure 1. The trajectory of current confirmed cases of COVID-19 in China.](image-url)
fall of the COVID-19 pandemic; (2) whether prepandemic relationship satisfaction (T0) was related to postpandemic COVID-19 anxiety (T3); and (3) if so, whether midpandemic perceived social support (T2) and/or gratitude (T2) would mediate the association between prepandemic relationship satisfaction (T0) and postpandemic COVID-19 anxiety (T3).

Method

Participants and procedure

The current sample size was determined by the availability of potential participants over a 4-month period. Via a survey website (www.wjx.cn), 266 Chinese adults took part in our survey, with 222 (83.46%) valid cases who have filled all the questionnaires and passed the attention check questions. The final participants (54.50% female, $M_{age} = 31.53$, $SD = 8.17$) were 222 Chinese adults from 26 provinces. To reduce the influence of common method bias, we had randomized the presentation order of items during each test, transformed some items in reverse, emphasized that the data was only used for research purposes, and ensured the anonymity of participants. After completing an online informed consent form, the participants filled out the questionnaire and were compensated with 12 yuan (approximately $2) each time. Of all the participants, 164 (73.87%), 123 (54.41%), and 161 (72.52%) participated in the online surveys at T1, T2, and T3, respectively. In total, 114 subjects (51.4%) completed in all four stages. The protocol was approved by the ethics board at the Faculty of Psychology, Beijing Normal University.

We conducted Little’s (1998) missing completely at random (MCAR) test to deal with missing data (Little, 1988). The result for Little’s MCAR test of all the variables was significant, $\chi^2 (37) = 73.37, p < .001$. Thus, we used full information maximum likelihood estimation (FIML) in our study (Enders & Bandalos, 2001). All 222 participants were included in the analyses.

Measures

General Relationship Satisfaction from T0 to T3: Drawing on a previous study (Kwan et al., 1997), we used one item to assess participants’ level of general relationship satisfaction (“How satisfied are you with your interpersonal relationships in the past month?”). A seven-point scoring system was used, with 1 representing “very dissatisfied” and 7 representing “very satisfied.”

Perceived Social Support from T0 to T3: Perceived social support was assessed using the 12-item Chinese version of the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988). The participants reported their perceived levels of family support, friend support, and social support in the past month (e.g., “There is a special person who is around when I am in need”). Items were rated on a 7-point scale from 1 = strongly disagree to 7 = strongly agree. Total scores were computed and used in analyses, with higher scores indicating higher levels of perceived social support. The Cronbach’s alpha values were .90, .89, .90, and .92 at T0, T1, T2, and T3, respectively.
**Trait Anxiety at T0:** Trait anxiety was assessed via the 20-item Trait Anxiety Subscale from the Chinese version of the State-Trait Anxiety Inventory (Spielberger et al., 1983; Li & Qian, 1995). The participants rated their levels of trait anxiety (e.g., “I feel nervous.”) on a 4-point scale from 1 = “not at all” to 4 = “very much so.” This scale has been well validated in Chinese adults (Chen et al., 2014). The total score was computed, with higher scores indicating higher levels of trait anxiety. The Cronbach’s alpha in this study was .89.

**COVID-19 Anxiety from T1 to T3:** COVID-19 anxiety was assessed using the 10-item Self-check and Self-inspect Scale for COVID-19 Anxiety (Chinese Psychological Society, 2020, February 9). The participants were asked about their anxious behaviors and mood after the outbreak of COVID-19 in the past month (e.g., “I feel more irritable, dissatisfied, or angry than usual.”). Items were rated on a 5-point scale from 1 = almost never to 5 = almost always. We computed the total scores by summing all items, with higher scores representing higher levels of COVID-19 anxiety. The Cronbach’s alphas were .87, .86, and .87 at T1, T2, and T3, respectively.

**Gratitude at T2:** Gratitude was assessed using the 6-item Gratitude Questionnaire (McCullough et al., 2002). The participants reported their levels of gratitude in general (e.g., “If I had to list everything that I felt grateful for, it would be a very long list”). Items were rated on a 6-point scale from 1 = strongly disagree to 6 = strongly agree. Total scores were computed and used in analyses, with higher scores indicating higher levels of gratitude. The Cronbach’s alpha was .71 in the current study.

**Demographic variables at T0:** The participants reported their age, sex (1 = male, 2 = female), the city they live in, and monthly income (from 1 = “less than 5000 yuan” to 7 = “higher than 35,000 yuan.”) The level of the monthly income was “between 5000 and 10,000 yuan” for 97 adults, 43.69%) at T0. We used Amap to obtain the actual distance from the city of each participant to Wuhan, Hubei, and we assigned four grades base on the following distance criterions: 1 less than 735 km for 61 individuals (27.5%); 2 between 735 km and 904 km for 56 individuals (25.2%); 3 between 904 km and 1134 km for 52 individuals (23.45); and 4 more than 1134 km for 53 individuals (23.9%). The distance criteria were determined by the whole sample quartiles. The variables were considered covariates in the model due to their significant correlations with anxiety and well-being in previous studies (Lofors et al., 2006; Merikangas et al., 2003; Steptoe et al., 2015).

**Planned analysis**

We first used SPSS 24.0 for basic descriptive statistics and correlation analysis. Then repeated-measures ANOVA was used to evaluate how relationship satisfaction (T0 to T3), perceived social support (T0 to T3), and COVID-19 anxiety (T1 to T3) changed along with the rising and falling COVID-19 case numbers using the nlme package in R 4.0.2 (Pinheiro et al., 2014). To deal with potentially high variability between subjects, we used the mixed effect model to consider both within-subject and between-subject variability in the models. In the mixed effect model, we assumed each participant’s experience would have various effects in their measurement. To control these differences, participants’ differences were counted into random effects. That is, there would be distinct regression expressions with different intercepts (participants’ difference) but the same slope (time).
Second, to test whether prepandemic relationship satisfaction was related to COVID-19 anxiety, as well as whether perceived social support (T2) and gratitude (T2) were correlated with postpandemic COVID-19 anxiety (T3), we conducted regression analysis using the lavaan package in R (Rosseel, 2012).

Third, to examine whether perceived social support (T2) and gratitude (T2) would mediate the association between relationship satisfaction (T0) and COVID-19 anxiety (T3), we fit several structural equation models with the lavaan package, with sex, age, and monthly income (T0) as control variables. Considering existing evidence shows that trait anxiety is significantly related to social support and coronavirus anxiety (Ao et al., 2020; Jungmann & Witthöft, 2020; Özmete & Pak, 2020), we also controlled for trait anxiety (T0) in mediation analysis. Furthermore, we controlled for COVID-19 anxiety measured at T1 and perceived social support at T0 to eliminate the impact of the initial response.

Finally, we used bootstrapping with 5000 resamples, thus generating a bootstrap distribution of all indirect effects (Montoya & Hayes, 2015). The chi-square goodness-of-fit test, robust confirmatory fit index (CFI) and root mean square error of approximation (RMSEA) are reported to indicate the fit of the primary model.

Moreover, we would use the following fit indices to evaluate the models’ goodness of fit: $\chi^2$ could be accepted when the $p$-value is greater than .05 or when the ratio of $\chi^2/df$ is less than 5, CFI with okay fit when being more than .90, RMSEA close to or less than .08, and SRMR indicating good fit when it is less than .08 (Kenny, 2015). However, $\chi^2$ would usually be less weighted when evaluating the model due to its sensitivity to sample size (Bentler, 1990).

Results

Research question 1: How did relationship satisfaction, COVID-19 anxiety, and perceived social support change with the rise and fall of the COVID-19 pandemic?

Descriptive statistics for the measures are displayed in Table 1. The trajectories of perceived social support, relationship satisfaction, and COVID-19 anxiety are presented in Figure 2. As can be seen in Table 1, the participants experienced the highest COVID-19 anxiety ($M = 24.76$, $SD = 6.42$) at T1. They also reported the highest level of perceived social support ($M = 66.79$, $SD = 8.78$) and a moderate level of relationship satisfaction ($M = 5.13$, $SD = 1.38$) at this time. At T2 and T3, as the prevalence of COVID-19 declined in China, the COVID-19 anxiety of the participants also showed a downtrend ($M_{COVA2} = 23.14$, $SD_{COVA2} = 6.19$; $M_{COVA3} = 22.34$, $SD_{COVA3} = 6.38$) while they experienced relatively stable relationship satisfaction ($M_{satisfaction2} = 5.27$, $SD_{satisfaction2} = 1.35$; $M_{satisfaction3} = 5.37$, $SD_{satisfaction3} = 1.50$) and perceived social support ($M_{support2} = 66.67$, $SD_{support2} = 8.98$; $M_{support3} = 66.26$, $SD_{support3} = 10.09$). Gratitude was measured at T2 ($M = 27.54$, $SD = 3.97$).

Correlation analysis revealed that relationship satisfaction at each time point positively correlated with one another ($r = .48 - .71$, $p < .001$). Also, perceived social support showed a moderate to high correlation at each time points. ($r = .33 - .81$, $p < .001$).
| Variable                             | M    | SD   | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|-------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1. Relationship satisfaction T0     | 4.99 | 1.55 | —    |      |      |      |      |      |      |      |      |      |      |      |
| 2. Relationship satisfaction T1     | 5.13 | 1.38 | .53*** | —   |      |      |      |      |      |      |      |      |      |      |
| 3. Relationship satisfaction T2     | 5.27 | 1.35 | .47*** | .57*** | —   |      |      |      |      |      |      |      |      |      |
| 4. Relationship satisfaction T3     | 5.37 | 1.50 | .48*** | .71*** | .66*** | —   |      |      |      |      |      |      |      |      |
| 5. COVID-19 anxiety T1              | 24.79 | 6.42 | —14  | —24  | —22  | —30*** | —   |      |      |      |      |      |      |      |
| 6. COVID-19 anxiety T2              | 23.14 | 6.19 | —18* | —33*** | —36*** | —34*** | .75*** | —   |      |      |      |      |      |      |
| 7. COVID-19 anxiety T3              | 22.34 | 6.38 | —19* | —39*** | —20* | —40*** | .66*** | .69*** | —   |      |      |      |      |      |
| 8. Perceived social support T0      | 63.51 | 10.61 | .49*** | .43*** | .45*** | .50*** | —.04 | —.08 | —.08 | —   |      |      |      |      |
| 9. Perceived social support T1      | 66.79 | 8.78 | .39*** | .40*** | .46*** | .49*** | .01  | —.15 | —.02 | .72*** | —   |      |      |      |
| 10. Perceived social support T2     | 66.67 | 8.98 | .46*** | .44*** | .53*** | .50*** | —.10 | —.28*** | —.21* | .65*** | .78*** | —   |      |      |
| 11. Perceived social support T3     | 66.26 | 10.09 | .44*** | .39*** | .41*** | .59*** | .02  | —.08 | —.10 | .70*** | .79*** | .81*** | —   |      |
| 12. Gratitude T2                    | 27.54 | 3.97 | .21* | .29** | .50*** | .34*** | —.18* | —.28*** | —.07 | .33*** | .44*** | .49*** | .32** | —   |

(continued)
### Table 1. (continued)

| Variable       | M  | SD  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
|----------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gender         | 1.55| —   | −.08| .05 | .09 | −.03| −.01| −.02| −.02| −.05| −.08| .01 | −.06| −.04|
| Age            | 31.53| 8.17| .06 | .05 | .11 | .09 | .04 | −.03| .08 | .01 | −.01| −.09| −.08|
| Income         | 2.47| —   | .14*| .20*| .14 | .20*| .07 | .03 | −.08| .17*| .14 | .09 | .13 | .04 |
| Distance       | 2.44| —   | −.07| −.03| −.03| −.13| .16*| .10 | .15 | .03 | .08 | −.03| −.08| .05 |
| Trait anxiety  | 39.76| 9.57| −.59***| −.38***| −.39***| −.55***| .20*| .30**| .23**| −.47***| −.45***| −.45***| −.51***| −.31***|

Note. M = means, SD = standard deviations. * p < .05, ** p < .01, *** p < .001.
Moreover, COVID-19 anxiety showed a moderately high stability at the peak, downtrend, and postpandemic stages ($r = .66 - .75$, $p < .001$). The results of mixed effect modeling revealed that relationship satisfaction remained relatively stable from T0 to T3 ($F(3, 445) = 2.01$, $p = .111$). Meanwhile, perceived social support increased significantly from Time 0 to T1 ($M_{support1-0} = 2.59$, $p < .001$) and remained relatively stable from T1 to T2 ($M_{support2-1} = -1.114$, $p = .257$) as well as from T2 to T3 ($M_{support3-2} = .441$, $p = .891$). Furthermore, COVID-19 anxiety decreased significantly from T1 to T2 ($M_{COVA2-1} = -1.346$, $p = .005$), and the decrease in COVID-19 anxiety from T2 to T3 approached significance ($M_{COVA3-2} = -.988$, $p = .063$).

**Research question 2: Was prepandemic (T0) relationship satisfaction related to COVID-19 anxiety during the pandemic?**

We found that relationship satisfaction (T0) was not related to COVID-19 anxiety when COVID-19 was at its peak (T1, $\beta = -.141$, $p = .072$, $DR^2 = .02$) but was negatively related to COVID-19 anxiety during the decline (T2, $\beta = -.184$, $p = .042$, $DR^2 = .034$) and trough stages (T3, $\beta = -.194$, $p = .014$, $DR^2 = .038$), which partially supported our Hypothesis 1. Furthermore, social support (T2) was negatively related to T3 COVID-19 anxiety ($\beta = -.208$, $p = .026$, $DR^2 = .043$). By contrast, gratitude was not correlated with T3 COVID-19 anxiety ($\beta = -.073$, $p = .436$, $DR^2 = .005$).

**Research question 3: Did midpandemic (T2) perceived social support and/or gratitude mediate the association between prepandemic (T0) relationship satisfaction and postpandemic (T3) COVID-19 anxiety?**

Using the same lavaan package in R, we set up a multiple mediation model controlling for sex, age, income, perceived social support (T0), and COVID-19 anxiety (T1). The multiple mediation model ($\chi^2 (21) = 221.81$, $p < .001$, CFI = 1.00, RMSEA <.001, SRMR <.001) showed that relationship satisfaction at T0 ($\beta = .223$, $p = .002$, $DR^2 = .050$) was positively related to perceived social support at T2 (see Figure 3). Moreover,
perceived social support at T2 ($\beta = -0.263$, $p = .010$, $DR^2 = .069$) negatively predicted COVID-19 anxiety at T3. However, neither gratitude ($\beta = 0.137$, $p = .189$) nor relationship satisfaction at T0 ($\beta = -0.058$, $p = .458$) was related to COVID-19 anxiety at T3, respectively.

Furthermore, the bootstrapping results revealed a significant, negative indirect effect of perceived social support at T2 on the association between relationship satisfaction at T0 and COVID-19 anxiety at T3 ($effect = -0.273$; 95% CI = [-0.635, -0.065]), which was consistent with our Hypothesis 2a. Specifically, there was no significant direct effect of prepandemic relationship satisfaction on postpandemic COVID-19 anxiety ($effect = -0.271$, $p = .460$), when perceived social support (T2) was controlled. Additionally, the indirect effect of gratitude between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety was not significant ($effect = 0.045$; 95% CI = [-0.067, 0.358]). Taken together, these findings suggested that it was perceived social support, not gratitude, that played a mediating role in the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety. After controlling for baseline trait anxiety (T0), the model ($\chi^2 (24) = 232.603$, $p < .001$, CFI = 1.00, RMSEA <.001, SRMR <.001) remained statistically valid, and there was no evidence showing that trait anxiety had significant influence on COVID-19 anxiety at T3 ($\beta = .012$, $p = .893$).

To explore whether prepandemic relationship satisfaction was related to COVID-19 anxiety at T2 through perceived social support at T1, we set up a multiple mediation model controlling for gender, age, income, perceived social support (T0), and COVID-19 anxiety (T1). The fitness of the model was not good ($\chi^2 (16) = 144.970$, $p < .001$, CFI = .667, RMSEA = .222, SRMR = .170), and relationship satisfaction at T0 ($\beta = .102$, $p = .091$) was not correlated with perceived social support at T1. Moreover, perceived social support at T1 was negatively related to COVID-19 anxiety at T2 ($\beta = -0.225$, $p = .008$, $DR^2 = .051$), but relationship satisfaction at T1 was not related to COVID-19 anxiety at T2 ($\beta = .118$, $p = .075$).

Finally, we conducted two supplemental analyses. The fitness of the mediation model to test whether perceived social support at T1 might mediate the relationship between T0
relationship satisfaction and T3 COVID-19 Anxiety was not good ($\chi^2 (30) = 403.642, p < .001, \text{CFI = .641, RMSEA = .226, SRMR = .165}$). And relationship satisfaction at T0 had no significant effect on perceived social support at T1 ($\beta = .102, p = .091$) as well as COVID-19 Anxiety at T3 ($\beta = -.106, p = .130$). Moreover, perceived social support at T1 had no significant effect on COVID-19 Anxiety at T3 ($\beta = -.013, p = .843$). The results indicated that T1 perceived social support did not mediate the relationship between T0 relationship satisfaction and T3 COVID-19 anxiety. Additional multiple mediation analysis showed that T0 perceived social support ($\beta = -.011, p = .891$) might not predict T3 COVID-19 anxiety through T2 relationship satisfaction ($\beta = -.033, p = .702$) and gratitude ($\beta = .071, p = .464$). It indicated that pre-pandemic perceived social support might not predict post-pandemic COVID-19 anxiety through mid-pandemic relationship satisfaction and gratitude.

**General discussion**

The current study tested whether and how pre-pandemic relationship satisfaction was related to post-pandemic COVID-19 anxiety using four-wave longitudinal data in China. The results showed that participants’ reported relationship satisfaction remained unchanged throughout the pandemic; their COVID-19 anxiety decreased from the peak to the decline to the trough stage; and their perceived social support increased markedly from the prepandemic to the peak COVID-19 stage and subsequently remained stable. Further, mid-pandemic perceived social support, not gratitude, could mediate the association between pre-pandemic relationship satisfaction and post-pandemic COVID-19 anxiety.

First, we found that COVID-19 anxiety, perceived social support, and relationship satisfaction in people showed different patterns of changes with the development of the COVID-19 pandemic. Specifically, people’s COVID-19 anxiety decreased from the peak to the decline of COVID-19. Owing to the forceful social distancing measures implemented by the Chinese government at the end of January 2020, the COVID-19 pandemic had been well controlled by the end of April, which in turn effectively reduced people’s COVID-19 anxiety.

Relationship satisfaction, however, remained unchanged from the prepandemic to the trough point. Antonucci and Akiyama (1987) supposed that social convoys are generally stable across time and situations, which might explain the finding. Similar tendencies were also observed in another research (Folk et al., 2020; Li et al., 2020; Williamson, 2020). Researchers explained that individuals did not perceive significant changes in social connectiveness, probably because they were able to seek alternative ways through the Internet to stay connected to others (Folk et al., 2020; Li et al., 2020). More efforts are needed to reveal the stability and fluctuation of relationship satisfaction in future research, which will facilitate to perfecting the theoretical framework of the social convoy model.

Of note, people’s perception of social support sharply increased from the prepandemic stage to the peak COVID-19 stage and remained relatively stable from the peak to the decline and to the trough stage of COVID-19. These results were in line with those of previous studies, which have found that participants tended to report increased support from others when they faced the pandemic (El-Zoghby et al., 2020) and seek more social
connection (Goodwin et al., 2020). In addition, due to the COVID-19 lockdown, people might have more time to connect with others and feel a greater need for connection and appreciation for relationship. This might explain why perceived social support remained even higher when the virus was generally controlled than in the pre-pandemic period.

Furthermore, pre-pandemic relationship satisfaction was negatively related to T2 and T3 COVID-19 anxiety, indicating that relationship satisfaction may help individuals lowering COVID-19 anxiety, which provides evidence for the social convoy model (Antonucci et al., 2011; De Leon et al., 2001). On the other side, no association between pre-pandemic relationship satisfaction and T1 COVID-19 anxiety revealed the benefits of interpersonal social relationships might be conditional. At the peak of the COVID-19 pandemic, people’s extreme fears of disease and death anxiety might have masked the positive effects of high-quality relationships, or only very high quality of relationships might enact support under extreme high level of stress. With uncovering the boundary condition for the buffering effects of relationship satisfaction at different stages of the pandemic, our finding would contribute to both confirming and extending the social convoy model.

Perceived social support was found to be negatively correlated with COVID-19 anxiety, which is consistent with recent studies (Grey et al., 2020). More importantly, we found that mid-pandemic perceived social support played a mediating role between pre-pandemic relationship satisfaction and post-pandemic COVID-19 anxiety. This result supports the prediction by the social convoy model that support stemming from social bonds can offer interpersonal resources to deal with the threat of a stressor and improve adaptability, thus alleviating anxiety caused by the pandemic (Antonucci et al., 2009).

By contrast, gratitude did not mediate the relationship between pre-pandemic relationship satisfaction and post-pandemic COVID-19 anxiety. This result is consistent with the finding that daily state gratitude is not associated with negative affect, including anxiety, on either the concurrent day or the following day during the COVID-19 outbreak (Jiang, 2020). More importantly, the current finding confirms our bold assumption that there might be crucial differences between perceived social support and gratitude. Based on the current research findings and previous studies, we suggest that perceived social support and gratitude may have different dominant components of positive interpersonal interactions, that is, the cognitive and emotional components, respectively.

According to social convoy theory, social relations are multidimensional, including the structure, type, quality, and reciprocity dimensions (Antonucci et al., 2014). In fact, perceived social support is associated with the amount of tangible material and spiritual encouragement from others (Norris et al., 2005), which represents more cognitive components of social interaction. By contrast, gratitude reflects the individual’s tendency of being thankful for benevolence of others, representing more emotional components of positive interpersonal relationships. Based on the present findings, cognitive components of social interactions seem to take precedence over emotional components in alleviating anxiety in the face of the COVID-19 pandemic. Moreover, the main effect model and the stress-buffering model also provide more support for the more powerful effects of perceived social support during the pandemic compared with those of gratitude (Cohen & Wills, 1985; Thoits, 1995). By revealing differences between perceived social support and
gratitude in the prediction of COVID-19 anxiety, the current study enriches and extends the framework of the social convoy theory which may contribute to unfolding the underlying mechanism between interpersonal relationship satisfaction and anxiety. Although our data was collected in 2020 and nowadays people have acquired more knowledge about COVID-19 and developed some strategies to deal with quarantine, the pandemic rebound would still threaten people’s interpersonal relationship and mental health in the long run (Pietromonaco & Overall, 2022). Future studies are necessary to explore the interpretability and generalizability of current model in different pandemic periods.

Moreover, it was T2, but not T1, perceived social support mediated the relationship between T0 relationship satisfaction and T3 COVID-19 anxiety. One potential reason is that T2 perceived social support is closer to T3 than T1, which might show more timely and crucial effects on lowering T3 COVID-19 anxiety. Furthermore, due to the strict social distancing policies at the peak COVID-19 stage (T1), the major source of social support (T1) might be mainly from social platforms or family members in the living places (Li et al., 2020; Xu et al., 2020), which were finite in space and time. Contrastingly, at the decline and postpandemic stage when the social distancing policies were loose, people could gain practical social support (T2) through face-to-face interaction, which might be more efficient in reducing T3 COVID-19 anxiety.

Practical implications

Three practical implications can be suggested. First, individuals are suggested to establish and maintain high-quality social relationships, which may facilitate restoring good function after the pandemic. Second, during social distancing period, providing people with more practical assistances to ensure individuals to realize they are supported, such as masks or vaccines, might more effectively lower their COVID-19 anxiety. Third, because individuals’ psychological state may fluctuate at different stages of the pandemic, health departments are suggested to observe people’s mental health state from a dynamic perspective and design stage-specific interventions accordingly.

Limitations and future directions

The current research has several limitations. First, because of the longitudinal design, the relatively small sample size limits the external validity of the research results to a certain extent; therefore, data from larger samples are needed to verify the reproducibility of the current results. Second, although the one-term scale to assess relationship satisfaction has been validated in previous studies (Fülöp et al., 2020; Kwan et al., 1997; Wu et al., 2011), future research is still suggested to use multi-facet measurement to test whether different aspects of relationship quality might be related to mental health in various ways. Third, how the attachment style and household structure might influence people’s relationship satisfaction and perceived social support during the pandemic remains to be tested in future research. Fourth, in addition to perceived social support, other mechanisms by which social relationships affect health and the factors that promote or inhibit the
development and maintenance of social relationships remain to be explored. Fifth, given the complexity and dynamics of the variables, relationship satisfaction and perceived social support may affect each other mutually and cause one another in different ways under different circumstances. Future research is needed to investigate how they relate to each other and the underlying mechanisms in various situations. Sixth, the current study hadn’t taken some participants’ demographics (e.g., gender identity, disability, race, and sexual orientation) into consideration. Whether the current findings can be generalized to different groups awaits future research.

**Conclusion**

First, as COVID-19 case numbers have risen and fallen, people’s relationship satisfaction, COVID-19 anxiety, and perceived social support showed different patterns of change. Second, prepandemic relationship satisfaction was negatively related to postpandemic COVID-19 anxiety. Third, midpandemic perceived social support, but not gratitude, mediated the association between prepandemic relationship satisfaction and postpandemic COVID-19 anxiety.

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**Open research statement**

As part of IARR’s encouragement of open research practices, the authors have provided the following information: This research was not pre-registered. The data and materials used in the research cannot be publicly shared but are available upon request via email.

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**References**

Affifi, T. D., Merrill, A. F., & Davis, S. (2016). The theory of resilience and relational load. *Personal Relationships, 23*(4), 663–683. https://doi.org/10.1111/pere.12159

Algoe, S. B. (2012). Find, remind, and bind: The functions of gratitude in everyday relationships. *Social and Personality Psychology Compass, 6*(6), 455–469. https://doi.org/10.1111/j.1751-9004.2012.00439.x

Antonucci, T. C., Ajrouch, K. J., & Birditt, K. S. (2014). The convoy model: Explaining social relations from a multidisciplinary perspective. *The Gerontologist, 54*(1), 82–92. https://doi.org/10.1093/geront/gnt118
Antonucci, T. C., & Akiyama, H. (1987). Social Networks in adult life and a preliminary examination of the convoy model. *Journal of Gerontology, 42*(5), 519–527. https://doi.org/10.1093/geronj/42.5.519

Antonucci, T. C., Birditt, K. S., & Ajrouch, K. (2011). Convoys of social relations: Past, present, and future. In K. L. Fingerman, C. A. Berg, J. Smith, & T. C. Antonucci (Eds.), *Handbook of life-span development* (pp. 161–182). Springer Publishing Company.

Antonucci, T. C., Birditt, K. S., & Akiyama, H. (2009). Convoys of social relations: An interdisciplinary approach. In V. L. Bengston, D. Gans, N. M. Pulney, & M. Silverstein (Eds.), *Handbook of theories of aging* (pp. 247–260). Springer Publishing Company.

Ao, Y., Zhu, H., Meng, F., Wang, Y., Ye, G., Yang, L., & Martek, I. (2020). The impact of social support on public anxiety amidst the covid-19 pandemic in China. *International Journal of Environmental Research and Public Health, 17*(23), 1–14. https://doi.org/10.3390/ijerph17239097

Banerjee, D., & Rai, M. (2020). Social isolation in Covid-19: The impact of loneliness. *International Journal of Social Psychiatry, 66*(6), 525–527. https://doi.org/10.1177/0020764020922269

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246. https://doi.org/10.1037/0033-2909.107.2.238

Biber, D. D., Melton, B., & Czech, D. R. (2020). The impact of COVID-19 on college anxiety, optimism, gratitude, and course satisfaction. *Journal of American College Health*. Advance online publication. https://doi.org/10.1080/07448481.2020.1842424

British Government. (2020). *Prime Minister’s statement on coronavirus (COVID-19)*. GOV.UK. https://www.gov.uk/government/speeches/pm-address-to-the-nation-on-coronavirus-23-march-2020

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet, 395*(10227), 912–920. https://doi.org/10.1016/S0140-6736(20)30460-8

Bureau of Disease Prevention and Control. (2020). Notice on the strict prevention of pneumonia caused by the new coronavirus infection through transportation. http://www.nhc.gov.cn/jkj/s3577/202001/e5e8c983baba4c1589512e6c99fdaa4e.shtml

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 pandemic on college students in China. *Psychiatry Research, 287*(5), 112934. https://doi.org/10.1016/j.psychres.2020.112934

Centers for Disease Control and Prevention. (2020, February 11). *COVID-19 and your health*. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html

Cheng, C. (1997). Role of perceived social support on depression in Chinese adolescents: A prospective study examining the buffering model. *Journal of Applied Social Psychology, 27*(9), 800–820. https://doi.org/10.1111/j.1559-1816.1997.tb00660.x

Chen, X., Song, Y., & Sun, H. (2014). The relationship between general self-efficacy and state-trait anxiety of adolescents. *China Journal of Health Psychology, 22*(3), 418–419. https://doi.org/10.13342/j.cnki.cjhp.2014.03.0

Chinese Psychological Society. (2020). “Self-check and Self-inspect Scale of COVID-19 Anxiety” online, welcome to scan and fill in the answer. https://mp.weixin.qq.com/s/rtlu22EAwkEHd2PKgelXmg
Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310–357. https://doi.org/10.1037/0033-2909.98.2.310

Cutrona, C. E., & Russell, D. W. (1990). Type of social support and specific stress: Toward a theory of optimal matching. In B. R. Sarason, I. G. Sarason, & G. R. Pierce (Eds.), *Social support: An interactional View* (pp. 319–366). John Wiley & Sons.

De Leon, C. F. M., Gold, D. T., Glass, T. A., Kaplan, L., & George, L. K. (2001). Disability as a function of social networks and support in elderly African Americans and whites: The duke EPESE 1986–1992. *The Journals of Gerontology: Series B, 56*(3), S179–S190. https://doi.org/10.1093/geronb/56.3.S179

Demaray, M. K., & Malecki, C. K. (2002). The relationship between perceived social support and maladjustment for students at risk. *Psychology in the Schools, 39*(3), 305–316. https://doi.org/10.1002/pits.10018

El-Zoghby, S. M., Soltan, E. M., & Salama, H. M. (2020). Impact of the COVID-19 pandemic on mental health and social support among adult Egyptians. *Journal of Community Health, 45*(4), 689–695. https://doi.org/10.1007/s10900-020-00853-5

Emmons, R. A., & McCullough, M. E. (Eds.). (2004). *The psychology of gratitude*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195150100.001.0001

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal, 8*(3), 430–457. https://doi.org/10.1207/S15328007SEM0803_5

Folk, D., Okabe-Miyamoto, K., Dunn, E., & Lyubomirsky, S. (2020). Did social connection decline during the first wave of COVID-19: The role of extraversion. *Collabra: Psychology, 6*(1), 37. https://doi.org/10.1525/collabra.365

Freedman, S. A., Gilad, M., Ankri, Y., Roziner, I., & Shalev, A. Y. (2015). Social relationship satisfaction and PTSD: Which is the chicken and which is the egg? *European Journal of Psychotraumatology, 6*(1), 28864. https://doi.org/10.3402/ecpt.v6.28864

Fried, Y., & Tiegs, R. B. (1993). The main effect model versus buffering model of shop steward social support: A study of rank-and-file auto workers in the USA. *Journal of Organizational Behavior, 14*(5), 481–493. https://doi.org/10.1002/job.4030140509

Fülöp, F., Bóthe, B., Gál, É., Cachia, J. Y. A., Demetrovics, Z., & Orosz, G. (2020). A two-study validation of a single-item measure of relationship satisfaction: RAS-1. *Current Psychology, Advance online publication*. https://doi.org/10.1007/s12144-020-00727-y

Galea, S., Merchant, R. M., & Lurie, N. (2020). The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *JAMA Internal Medicine, 180*(6), 817–818. https://doi.org/10.1001/jamaformed.2020.1562

Goodwin, R., Hou, W. K., Sun, S., & Ben-Ezra, M. (2020). Quarantine, distress, and interpersonal relationships during COVID-19. *General Psychiatry, 33*(6), Article e100385. https://doi.org/10.1136/gpsych-2020-100385

Grey, I., Arora, T., Thomas, J., Saneh, A., Tohme, P., & Abi-Habib, R. (2020). The role of perceived social support on depression and sleep during the COVID-19 pandemic. *Psychiatry Research*, 293(11), 113452. https://doi.org/10.1016/j.psychres.2020.113452

Jiang, D. (2020). Feeling gratitude is associated with better well-being across the life span: A daily diary study during the COVID-19 outbreak. *The Journals of Gerontology: Series B, 77*(4), e36–e45. https://doi.org/10.1093/geronb/gbaa220
Jungmann, S. M., & Witthöft, M. (2020). Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety? *Journal of Anxiety Disorders, 73*(6), 102239. https://doi.org/10.1016/j.janxdis.2020.102239

Kahn, R. L., & Antonucci, T. (1980). Convoys over the life cycle: Attachment, roles and social support. In P. B. Baltes, & O. Brim (Eds.), *Lifespan development and behavior* (Vol. 3, pp. 253–286). Academic.

Kaul, M, & Lakey, B. (2003). Where is the support in perceived support? The role of generic relationship satisfaction and enacted support in perceived support’s relation to low distress. *Journal of Social and Clinical Psychology, 22*(1), 59–78. https://doi.org/10.1521/jscp.22.1.59.22761

Kenny, D. A. (2015). *Measuring model fit*. http://davidakenny.net/cm/fit.htm

Kwan, V. S., Bond, M. H., & Singelis, T. M. (1997). Panscultural explanations for life satisfaction: Adding relationship harmony to self-esteem. *Journal of Personality and Social Psychology, 73*(5), 1038–1051. https://doi.org/10.1037/0022-3514.73.5.1038

Li, C., Jiang, S., & Zhang, X. (2019). Intergenerational relationship, family social support, and depression among Chinese elderly: A structural equation modeling analysis. *Journal of Affective Disorders, 248*(4), 73–80. https://doi.org/10.1016/j.jad.2019.01.032

Li, W. L., & Qian, M. Y. (1995). Revision of Chinese college students’ norm of state trait anxiety scale. *Acta Scientiarum Naturalium Universitatis Pekinensis, 1995*(1), 108–112. https://doi.org/10.13209/j.0479-8023.1995.014

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198–1202. https://doi.org/10.1080/01621459.1988.10478722

Luo, Y., Xiang, Z., Zhang, H., & Wang, Z. (2017). Protective factors for depressive symptoms in adolescents: Interpersonal relationships and perceived social support. *Psychology in the Schools, 54*(8), 808–820. https://doi.org/10.1002/pits.22033

Magson, N. R., Freeman, J. Y. A., Rapee, R. M., Richardson, C. E., Oar, E. L., & Fardouly, J. (2021). Risk and protective factors for prospective changes in adolescent mental health during the COVID-19 pandemic. *Journal of Youth and Adolescence, 50*(1), 44–57. https://doi.org/10.1007/s10964-020-01332-9

McCullough, M. E., Emmons, R. A., & Tsang, J.-A. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82*(1), 112–127. https://doi.org/10.1037/0022-3514.82.1.112

McEachern, A. D., Fosco, G. M., Dishion, T. J., Shaw, D. S., Wilson, M. N., & Gardner, F. (2013). Collateral benefits of the family check-up in early childhood: Primary caregivers’ social support and relationship satisfaction. *Journal of Family Psychology, 27*(2), 271–281. https://doi.org/10.1037/a0031485
Merikangas, K. R., Zhang, H., Avenevoli, S., Acharyya, S., Neuenschwander, M., & Angst, J. (2003). Longitudinal trajectories of depression and anxiety in a prospective community study: The Zurich cohort study. *Archives of General Psychiatry, 60*(10), 993–1000. https://doi.org/10.1001/archpsyc.60.9.993

Montoya, A. K., & Hayes, A. F. (2015). Estimating and testing indirect effects in within-subject mediation analysis: A path-analytic framework. In: 27th Annual Convention of the Association for Psychological Science, New York, NY.

Neria, Y., Galea, S., & Norris, F. (2009). Disaster mental health research: Exposure, impact, and response. In Y. Neria, S. Galea, & F. H. Norris (Eds.), *Mental health and disasters* (pp. 1–12). Cambridge University Press. https://doi.org/10.1017/CBO9780511730030.001

Norris, F. H., Baker, C. K., Murphy, A. D., & Kaniasty, K. (2005). Social support mobilization and deterioration after Mexico’s 1999 flood: Effects of context, gender, and time. *American Journal of Community Psychology, 36*(1), 15–28. https://doi.org/10.1007/s10464-005-6230-9

Özmete, E., & Pak, M. (2020). The relationship between anxiety levels and perceived social support during the pandemic of COVID-19 in Turkey. *Social Work in Public Health, 35*(7), 603–616. https://doi.org/10.1080/19371918.2020.1808144

Pich, C., O’Rourke, T., Budimir, S., & Probst, T. (2020). Relationship quality and mental health during COVID-19 lockdown. *Plos One, 15*(9), Article e0238906. https://doi.org/10.1371/journal.pone.0238906

Pietromonaco, P. R., & Overall, N. C. (2022). Implications of social isolation, separation, and loss during the COVID-19 pandemic for couples’ relationships. *Current Opinion in Psychology, 43*(2), 189–194, https://doi.org/10.1017/19485506211001687

Pinheiro, J., Bates, D., DebRoy, S., & Sarkar, D., R Core Team. (2014). *nlme: Linear and nonlinear mixed effects models* (R package version 3.1-128). http://CRAN.R-project.org/package=nlme

Reis, H. T., & Franks, P. (1994). The role of intimacy and social support in health outcomes: Two processes or one? *Personal Relationships, 1*(2), 185–197. https://doi.org/10.1111/j.1475-6811.1994.tb00061.x

Rosmarin, D. H., Krumrei, E. J., & Pargament, K. I. (2010). Are gratitude and spirituality protective factors against psychopathology? *International Journal of Existential Psychology & Psychotherapy, 3*(1), 1–5.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1–36, https://doi.org/10.18637/jss.v048.i02

Schwarzer, R., & Leppin, A. (1991). Social support and health: A theoretical and empirical overview. *Journal of Social and Personal Relationships, 8*(1), 99–127. https://doi.org/10.1177/0265407591081005

Sommantico, M., Santa, P., & De Rosa, B. (2020). Lesbian and gay relationship satisfaction among Italians: Adult attachment, social support, and internalized stigma. *Archives of Sexual Behavior, 49*(5), 1811–1822. https://doi.org/10.1007/s10508-020-01736-5

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state-trait anxiety inventory (form Y)*. Mind Garden.

Steptoe, A., Deaton, A., & Stone, A. A. (2015). Subjective well-being, health, and ageing. *Lancet, 385*(9968), 640–648. https://doi.org/10.1016/S0140-6736(13)61489-0

Thoits, P.A. (1995). Stress, coping and social support processes: Where are we? What next? *Journal of Health and Social Behavior, 35*(53–59), 53–79. https://doi.org/10.2307/2626957
Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior, 52*(2), 145–161. https://doi.org/10.1177/0022146510395592

Till, B., Tran, U. S., & Niederkrotenthaler, T. (2017). Relationship satisfaction and risk factors for suicide. *Crisis, 38*(1), 7–16. https://doi.org/10.1027/0227-5910/a000407

Wang, Y., Duan, Z., Ma, Z., Mao, Y., Li, X., Wilson, A., Qin, H., Ou, J., Peng, K., Zhou, F., Li, C., Liu, Z., & Chen, R. (2020). Epidemiology of mental health problems among patients with cancer during COVID-19 pandemic. *Translational Psychiatry, 10*(1), 263. https://doi.org/10.1038/s41398-020-00950-y

Williamson, H. C. (2020). Early Effects of the COVID-19 Pandemic on relationship satisfaction and attributions. *Psychological Science, 31*(12), 1479–1487. https://doi.org/10.1177/0956797620972688

Wood, A. M., Maltby, J., Stewart, N., Linley, P. A., & Joseph, S. (2008). A social-cognitive model of trait and state levels of gratitude. *Emotion, 8*(2), 281. https://doi.org/10.1037/1528-3542.8.2.281

World Health Organization. (2020). Coronavirus disease (COVID-19) advice for the public. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

World Health Organization. (2021). WHO coronavirus disease (COVID-19) dashboard. https://covid19.who.int/?gclid=EAIaIQobChMIrHz4tH6YLK6QfIQVQdeWCh0VYApEcEAAAYASABEGlrVxD_BwE

Wu, Z., Qiu, H., & Gong, W. (2011). Correlations between self-acceptance, human trust and contentment of human relation of college students. *China Journal of Health Psychology, 19*(12), 1496–1498, https://doi.org/10.13342/j.cnki.cjhp.2011.12.015

Xu, J., Ou, J., Luo, S. S., Wang, Z., Chang, E., Novak, C., Shen, J., Zheng, S., & Wang, Y. (2020). Perceived social support protects lonely people against COVID-19 anxiety: A three-wave longitudinal study in China. *Frontiers in Psychology, 11*(11). https://doi.org/10.3389/fpsyg.2020.566965

Zhang, B., Gao, Q., Fokkema, M., Alterman, V., & Liu, Q. (2015). Adolescent interpersonal relationships, social support and loneliness in high schools: Mediation effect and gender differences. *Social Science Research, 53*(9), 104–117. https://doi.org/10.1016/j.ssresearch.2015.05.003

Zhao, H., He, X., Fan, G., Li, L., Huang, Q., Qiu, Q., Kang, Z., Du, T., Han, L., Ding, L., & Xu, H. (2020). COVID-19 infection outbreak increases anxiety level of general public in China: Involved mechanisms and influencing factors. *Journal of Affective Disorders, 276*(11), 446–452. https://doi.org/10.1016/j.jad.2020.07.085

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment, 52*(1), 30–41. https://doi.org/10.1207/s15327752jpa5201_2