Research article

How social support and resilience impact mental health: The moderating role of time in isolation during the COVID-19 pandemic

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ABSTRACT

During the COVID-19 pandemic, quarantines effectively prevented the spread of COVID-19 but also caused people to develop mental health problems. We thus aimed to verify the impact of social support and resilience on mental health and to uncover the moderating role played by time in isolation during the post-pandemic era. We administered a cross-sectional survey to 510 college students. The results found that social support directly and negatively predicted mental health problems, and this relationship was mediated by resilience. Through multigroup analysis, resilience partially mediated the relationship between social support and mental health during period of isolation 1 (PI1) and fully mediated this relationship during period of isolation 2 (PI2) and period of isolation 3 (PI3). Moreover, the path coefficient of resilience to mental health at T3 was significantly higher than that at T2. Thus, the effect of resilience on mental health increases with the duration of time in isolation.

1. Introduction

Since the COVID-19 outbreak in 2019, there have been more than 766 million confirmed cases, and more than 6.93 million confirmed deaths worldwide. Over the past 3 years, quarantines have become regular measures used to prevent the spread of COVID-19. However, quarantines have a negative impact on mental health; ramifications include psychological distress [1–3], anxiety, depression [4,5], and cognitive impairment [6]. As a vulnerable group, college students have experienced multiple challenges in terms of learning methods, social communication, and job hunting during the COVID-19 pandemic [7]. A study of 654 Western college students found that they reported more emotional issues (e.g., stress, depression, loneliness) and behavioral problems (e.g., a lack of motivation, difficulty focusing on schoolwork, and restless sleep) during the COVID-19 lockdown [8]. Therefore, the mental health of college students during the pandemic deserves more attention. In addition to examining the mental health of individuals during periods of isolation, some studies have focused on the protective factors of mental health, such as social support [9,10] and resilience [11]. However, few studies have examined how the relationships among social support, mental resilience, and mental health evolve over time in isolation.

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1.1. Social support and mental health

Social support refers to the actual support received from others in stressful situations [12]. Many studies have found a negative relationship between social support and mental illness, including stress [13], anxiety [14], depression [9,15,16], trouble sleeping [10], and vital exhaustion [16]. A meta-analysis of 64 studies found a moderate effect size between social support and mental health [17]. Furthermore, this study found that social support had a greater effect on college students' mental health. Moreover, perceived social support can alleviate psychological problems in college students during the COVID-19 pandemic because being connected to others creates a sense of belonging and thus helps individuals to maintain a good emotional state [18–20].

Hence, we developed Hypothesis 1 (H1): Social support negatively predicted college students' psychological problems during the COVID-19 pandemic.

1.2. Resilience as a mediator

Resilience is the ability to deal with adversity and enables individuals to recover from situations of stress, anxiety, and depression [21]. Several studies have demonstrated a significant association between resilience and mental health. Individuals with high levels of mental resilience are thought to be more adaptable and adept at dealing with stressful situations, greatly reducing their susceptibility to psychological problems [11]. Furthermore, resilience can mitigate the impact of COVID-19 on college students' psychological symptoms [20,22].

Beyond the direct link between resilience and mental health, a growing number of studies have explored the relationships among social support, resilience, and mental health during the COVID-19 pandemic [11,23–27]. Some studies have suggested that resilience plays a mediating role in the relationship between social support and mental health, including psychiatric symptoms [23], self-affirmation, depression, anxiety [28], school adaptation [27], and work-related stress [29].

A biopsychosocial model proposes that the effects of mental resilience on mental health are based on three approaches: (1) the harm reduction approach, which emphasizes resilience as the ability to help individuals return to their initial level of mental health after being affected by stressful events; (2) the protection approach, which describes resilience as a barrier that allows individuals to preserve their mental health during stressful events; and (3) the promotion approach, which refers to people building resilience through positive adaptive experiences and becoming flexible in coping with stressful events [30].

Based on the above mentioned literature, Hypothesis 2 (H2) was proposed: Resilience negatively predicts psychological problems and plays a mediating role between social support and psychological problems among college students.

1.3. Time in isolation as a moderator

Although the relationship linking social support, resilience, and mental health during COVID-19 has been explored by some studies, few studies have focused on the effect of time in isolation on these relationships. However, previous studies have found that a longer period of isolation is associated with higher levels of depression and anxiety [31], and that the level of resilience in the late stage of isolation is significantly higher than that in the early stage [32]. The above biopsychosocial model proposed that harm reduction, protection, and promotion approaches to resilience play different roles when individuals experience psychological distress [30]. This protective approach enables people to respond positively to stressful events and prevent psychological problems from developing. When psychological problems arise, the harm reduction approach allows individuals to gradually return to normal levels. After recovering from psychological stress, individuals adopt a promotional approach.

Based on these findings, we developed Hypothesis 3 (H3): Time in isolation moderates the relationship between resilience and mental health.

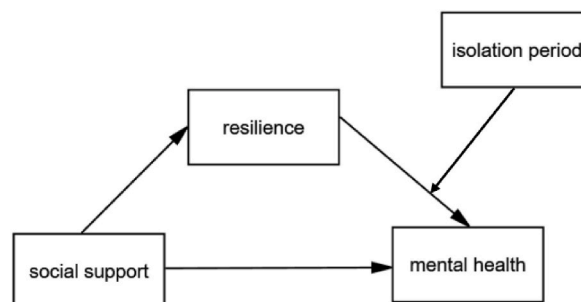Fig. 1 presents the theoretical model used in this study.

Fig. 1. The study model.

2. Methods

2.1. Participants

We collected the data online from December 1 to December 10, 2022 in China, where most cities were under sealed control. And the survey was conducted by using Questionnaire Star, an online questionnaire collection platform. Only when it was confirmed that the participants were in the lockdown stage could they continue to answer the questions; otherwise, the questionnaire was terminated immediately. Ultimately, a total of 510 college students was included in the follow-up analyses. The participants were from universities in 28 cities across China and ranged in age from 18 to 27 ($M_{age} = 21.03$, SD = 1.76). Most participants were male ($N = 279$, 54.7 %) and majored in science and engineering ($N = 300$, 58.8 %). Until the survey was completed, 152 college students reported having been in isolation for 1–2 weeks, 201 college students reported having been in isolation for 3–4 weeks; and 157 college students reported having been in isolation for more than four weeks.

2.2. Measures

Social support. The revised Chinese version of the Perceived Social Support Scale developed to assess individuals' levels of perceived social support [33]. The Chinese version contains 12 items divided into three dimensions: support from friends, support from family, and support from others. The participants provided their answers on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The reliability of the scale was high (Cronbach's α = 0.913). For the three dimensions, the Cronbach's alpha was 0.795 for support from friends, 0.807 for support from family, and 0.756 for support from others.

Mental resilience. The Chinese version of the Connor-Davidson Resilience Scale was used it to measure mental resilience [34]. This scale contains 25 items that address tenacity, self-reliance, and optimism. The questionnaire involves a 5-point scale ranging from 1 (*not true at all*) to 5 (*true nearly all of the time*). We calculated the overall score by summing up all items so that higher scores indicated better mental resilience. The Cronbach's α in this study was 0.916.

Stress. The Perceived Stress Scale was translated into Chinese to measure stress [35]. Seven of the 14 items were considered negative (e.g., "Are you unable to control important things in your life?") and the remaining seven were viewed as positive (e.g., "Have you dealt successfully with day-to-day problems and annoyances?"). The questionnaire involved a 5-point scale ranging from 1 (*never*) to 5 (*extraordinary frequency*). We calculated total scores after reversing the positive items and then summing up all the scores. Higher scores indicated greater stress. The short version of the scale was highly reliable (Cronbach's α = 0.817).

Anxiety. We used the Chinese version of the State Anxiety Inventory to assess anxiety [33]. This scale is based on self-report, with each response rated on a 4-point scale ranging from *never* to *always*. There were 20 items, with 10 items about rising anxiety levels (e.g., "I am nervous") and 10 items about decreasing anxiety levels (e.g., "I feel happy"). The Cronbach's α for this scale in the current study was 0.919.

Depression. We gauged depression using the Chinese version of the Center for Epidemiologic Studies Depression Scale [33]. This scale contains 20 items that measure the frequency of depressive feelings or moods in the past week. The participants provided their answers on a 4-point scale ranging from 1 (*never or occasionally*) to 4 (*most of the time*). We summed up the items to obtain a total score, with higher scores suggesting deeper levels of depression. The Cronbach's α in this study was 0.922.

Period of isolation. The participants were instructed to answer, "How long have you been in lockdown since the school strictly prohibited going out?" The answer was set to three options: period of isolation 1 (PI1, 1–2 weeks), period of isolation 2 (PI2, 3–4 weeks), and period of isolation 3 (PI3 > 4 weeks).

2.3. Statistical analyses

The mental health scores in the current study were the sum of the stress, anxiety, and depression scores. Thus, the higher the mental health score, the more negative the individual's mental state. We analyzed the data using SPSS 22.0 and AMOS 24.0. First, we performed a common method bias (CMB) test. Next, we expressed the descriptive and correlational data for social support, resilience, and mental health. We employed structural equation modeling (SEM) to explore the mediating role of resilience in the relationship between social support and mental health. Finally, we carried out a multigroup analysis to examine the moderating effect of time in isolation on the mediation model described above.

3. Results

3.1. Common method bias testing

We performed Harman's single-factor test to avoid the CMB caused by the single-survey technique. We used exploratory factor analysis for all items related to social support, resilience, and mental health. Unrotated factor analysis showed that the eigenvalues of the 15 factors were greater than 1, and the variance explained by the first factor was 30.49 %, which was less than 40 %. Thus, CMB in the current data was not significant.

3.2. Descriptive and correlational statistics of the variables

We conducted an analysis of variance (ANOVA; see Table 1) and found that participants' perceived social support in IP1 ($M = 62.57$, $SD = 12.15$) was higher than that in IP2 ($M = 59.18$, $SD = 12.34$), $F(2,507) = 3.36$, $p = 0.035$. Mental health in IP2 ($M = 123.98$, $SD = 29.11$) was higher than that in IP1 ($M = 115.51$, $SD = 32.53$), $F(2, 507) = 3.64$, $p = 0.027$. Correlation analysis indicated that social support and resilience were positively correlated ($r = 0.753$, $p < 0.001$), while social support ($r = -0.684$, $p < 0.001$) and resilience ($r = -0752$, $p < 0.001$) were negatively correlated with mental health separately.

3.3. The mediating role of resilience in the relationship between social support and mental health

We conducted SEM to test the proposed mediation model using AMOS 24.0. The indices employed to evaluate the model fit were the comparative fit index (CFI), the Tucker-Lewis index (TFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR) [36]. The results showed that the model was acceptable (Fig. 2): $\chi^2 (24) = 5.602$, p < 0.001, TLI = 0.958, CFI = 0.972, RMSEA = 0.095, and SRMR = 0.028. To further examine the mediation effect, 5000 bootstrap samples and 95 % bias-corrected confidence intervals (CIs), with significance indicated by CIs that did not include zero. The results revealed that social support positively predicted college students' resilience ($\beta = 0.833$, p < 0.001, 95 % CI = 0.967 to 1.198) and negatively predicted their mental health ($\beta = -0.175$, p = 0.009, 95 % CI = -1.009 to -0.006). Moreover, resilience negatively predicted college students' mental health ($\beta = -0.681$, p < 0.001, 95 % CI = -2.003 to -1.176). Thus, resilience mediates the relationship between social support and mental health.

3.4. Multi-group analysis of the influence of social support on mental health with different durations in isolation

Table 2 presents the fit indices for each model. The $\Delta\chi^2$/df was 4.07 between M1 and M2, $p < 0.001$; the $\Delta\chi^2$/df was 0.02 between M2 and M3, $p = 0.978$; the $\Delta\chi^2$/df was 3.16 between M3 and M4, $p = 0.01$; and the $\Delta\chi^2$/df was 2.43 between M4 and M5, $p < 0.001$. The difference in the fitting index (ΔTLI, ΔCFI, ΔRMSEA) between each of the models was <0.01, which meant that each equivalent model was established [37]. This indicates that the mediating model of resilience has the same significance and potential structure as TI1, TI2, and TI3.

Further comparing the three models with different times of isolation, we found that resilience partially mediated the relationship between social support and mental health problems during TI1, but fully mediated this relationship during TI2 and TI3 (see Fig. 3through 5). We then used the critical ratio value to analyze the differences between the path coefficients of the different models. When the absolute value of the critical ratio was greater than 1.96, the two path coefficients were significantly different [38]. The results only showed that the path coefficient of resilience to mental health of TI3 was significantly higher than the same path coefficients of TI2 (critical ratio = -2.104 > -1.96) (see Figs. 4 and 5).

4. Discussion

Although the COVID-19 pandemic is mostly behind us, its impact on people's mental health remains unclear. In the past three years, many studies have explored the status of individual mental health during the COVID-19 outbreak and its protective factors, such as social support and resilience. However, few studies have examined the effects of social support and resilience on mental health from a micro perspective. We therefore investigated the relationships between social support, resilience, and mental health among Chinese college students and explored how these relationships changed during isolation in the post-pandemic era. We found that social support had a direct effect on mental health and an indirect effect on mental resilience. Moreover, the duration of isolation moderated the relationship between social support, mental resilience, and mental health.

First, we found that social support negatively predicted mental health problems, thereby supporting H1. This result is consistent with those of previous studies on coronavirus outbreaks [18,20]. The Stress Buffering Model (SBM) also explains this relationship. According to the SBM, social support acts as a buffer when facing stressful events or circumstances. On the one hand, the perceptions of others help individuals reframe their understanding and evaluation of stressful events; on the other hand, others can provide specific solutions, actual material, or spiritual support for stressful events, which can reduce or even eliminate the negative impact of stress on one's mental health [12,35]. During the COVID quarantines, college students received support from parents, friends, and others to change their perceptions of COVID-19 or provide approaches to alleviate their psychological distress. The higher the perceived social support, the fewer psychological problems.

This study also found that resilience partially mediated the association between social support and mental health. This finding is

Table 1
ANOVA analysis of the variables on time in isolation.

Variables	TI1 N = 152	TI2 N = 201	TI3 N = 157	F	Post analysis (LSD)
Social support	62.57 ± 12.15	59.18 ± 12.34	60.94 ± 12.26	3.36*	TI1 > TI2
Resilience	89.15 ± 13.96	85.71 ± 15.86	87.93 ± 14.97	2.39	/
Mental health	115.51 ± 32.53	123.98 ± 29.11	119.27 ± 27.92	3.64*	TI2 > TI1
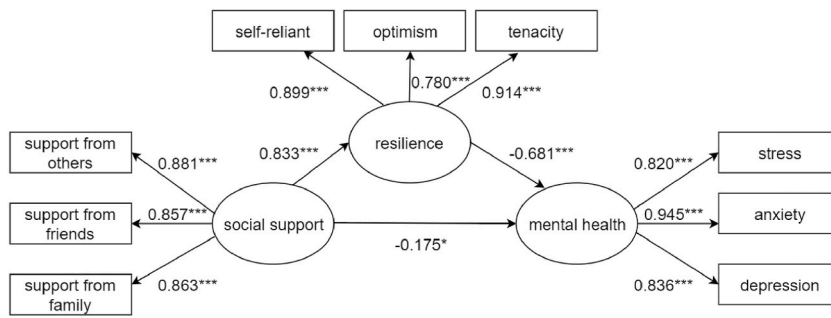
Fig. 2. Full model; ***$p < 0.001$, *$p < 0.05$.

Table 2
The fitting index of multi-group analysis model.

Model	χ^2	df	TLI	CFI	RMSEA
M1	259.47	84	0.944	0.956	0.064
M2	283.918	90	0.942	0.951	0.065
M3	283.962	92	0.944	0.952	0.064
M4	296.607	96	0.943	0.950	0.064
M5	340.376	114	0.946	0.943	0.063

Note: M1 is a measurement coefficient equality model; M2 is a structural weights equality model; M3 is a structural covariances equality model; M4 is a structural residuals equality model; M5 is a measurement residuals equality model.
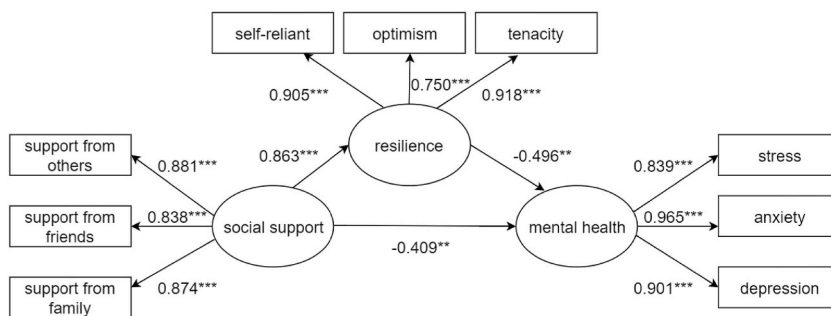

Fig. 3. The SEM model for time in isolation 1; ***$p < 0.001$, **$p < 0.01$.
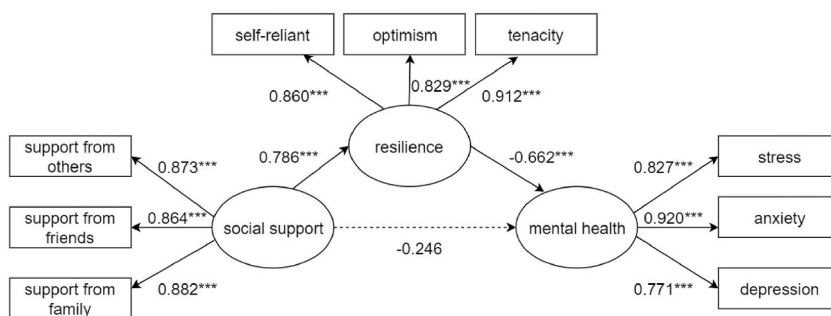

Fig. 4. The SEM model for time in isolation 2; ***$p < 0.001$, **$p < 0.01$.

consistent with those of previous studies [23,27]. Resilience can alleviate mental health problems through harm reduction, protection, and promotion [30]. What's more, the positive effects of resilience on mental health are associated with a range of behavioral factors, and social support is believed to be an external environmental factor in resilience when individuals are harmed by a stressful event [30]. Hence, support received from others, friends, and family increased college students' resilience and enabled it to play a role in protection and harm reduction efforts during COVID-19 lockdowns. At the start of a period of isolation, resilience helps college
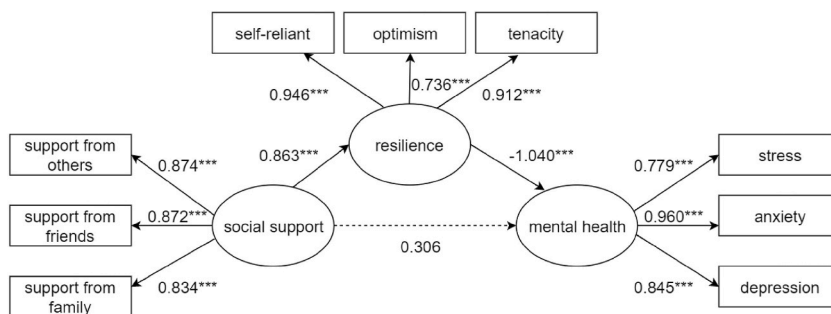
Fig. 5. The SEM model for time in isolation 3; ***$p < 0.001$.

students maintain normal mental health; when mental health is out of balance, resilience restores their mental state to a normal level by reducing harm.

However, we found that the effect of resilience on mental health problems differed according to the duration of isolation, with the path coefficient of resilience-mental health in TI3 being significantly higher than that in TI2. This outcome is consistent with H3. Specifically, the protective effect of resilience on mental health increased with longer periods in isolation. This difference can be explained by the promotion of resilience [30]. With increasing periods of time in isolation, college students have acquired some positive adaptation experiences that have shaped their resilience and made them more flexible in coping with mental health problems. In addition, we found that the direct effect of social support on mental health was significant in TI1 but became insignificant in TI2 and TI3. The decrease in perceived social support with the time in isolation was similar to that reported in previous studies [13]. This may be because the subjective perception of social support declines with a rise in time in isolation. Moreover, social support, as an external factor, still needs to play a role through individual internal factors such as resilience.

Implications

Although both social support and psychological resilience are thought to be protective factors for mental health, we found that the protective effect of people's psychological resilience on mental health gradually increased over time. Thus, future studies should consider exploring the protective factors and internal mechanisms of mental health from the dimension of time in order to identify the factors that have long-term stable effects on individual mental health.

Based on the current results, our study also suggests that college education should not only focus on improving students' knowledge and skills but also set up professional courses to enhance students' psychological resilience. It is important for university students to be able to sustainably combat adversity. A previous study involved a 4-week training program centered on resilience intervention that led to improved resilience levels among college students [39]. The program focused on the following four areas: (1) providing appropriate stress-coping strategies, (2) strengthening one's sense of responsibility in stressful situations, (3) changing students' attribution styles, and (4) enhancing students' bonds with friends and relatives. Another resilience intervention for college students focuses on improving cognitive and processing skills through role-playing and games, thereby boosting students' mental resilience and optimism [40]. The above initiatives can be considered for inclusion in the curricula taught to Chinese university students in order to reinforce their resilience levels and help more students successfully deal with difficulties.

Strengths and limitations of the study

This study is the first to explore the effects of time in isolation on the relationships among social support, psychological resilience, and mental health status among college students, highlighting the importance of increasing psychological resilience in college students to prevent future mental health problems caused by isolation to avoid similar infectious diseases. This study was based on a large sample size and included college students from multiple provinces and cities in China, making the findings more generalizable.

However, our study has some limitations. A major one is that the study is grounded in cross-sectional data, and we artificially divided the participants into three groups based on the length of isolation. Therefore, we noted significant heterogeneity among the groups. Moreover, the cross-sectional design prevented us from inferring causality.

Taken together, we found social support to be a protective factor against harm to college students' mental health and that resilience mediated the association between social support and mental health problems. Moreover, with an increase in time in isolation, the effect of resilience on mental health increased, and the impact of social support on mental health decreased.

Funding

Ethics approval

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Review Committee of Chongqing Normal University (CNU-EDU-2022-033). Informed verbal consent was obtained from all subjects involved in the study.

Data availability statement

The data that supports the findings of this study is available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

CRediT authorship contribution statement

Fang Xie: Writing – original draft, Investigation, Data curation, Conceptualization. **Xiaona Wu:** Writing – original draft, Data curation. **Chaoli Deng:** Writing – review & editing, Investigation. **Xiaoqian Li:** Investigation. **Ziyu Yi:** Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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