

# Perceived Control Buffers the Effects of the COVID-19 Pandemic on General Health and Life Satisfaction: The Mediating Role of Psychological Distance

Lei Zheng 

*School of Economics and Management, Fuzhou University, Fuzhou, China  
Center for China Social Trust Research, Fuzhou University, Fuzhou, China  
Institute of Psychological and Cognitive Sciences, Fuzhou University, Fuzhou, China*

Miao Miao\*

*Department of Medical Psychology, School of Health Humanities, Peking University, Peking, China  
School of Sociology, China University of Political Science and Law, Beijing, China*

Yiqun Gan 

*School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

**Background:** Ways to maintain good health during a pandemic are very important for the general population; however, little is known about the impact of the coronavirus disease 2019 (COVID-19) on individuals' life satisfaction and perceived general health. This study aimed to examine the effects of COVID-19 on life satisfaction and perceived general health and reveal the buffering effect of perceived control on coping with COVID-19. **Methods:** We collected 1,847 participants' data from 31 pandemic-affected provinces in China and obtained regional epidemic data of the same provinces. We employed a moderated mediation model with both individuals' self-report data and regional epidemic data to verify the hypotheses. **Results:** Psychological distance mediated the relationships of regional pandemic severity with perceived general health and life satisfaction. Perceived control moderated the detrimental effects of regional pandemic severity through the moderating effects of regional pandemic severity on psychological distance, as well as the moderating effects of psychological distance on life

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\*Address for correspondence: Miao Miao, Department of Medical Psychology, School of Health Humanities, Peking University, Beijing 100191, China. Email: miaomiao20061988@126.com

satisfaction. **Conclusions:** Our findings indicate that perceived control may act as a protective factor buffering the psychological impact of the pandemic on general health and life satisfaction. Psychological distance can serve as a mediator that explains how the COVID-19 pandemic impacts perceived general health and life satisfaction.

Keywords: COVID-19, health, life satisfaction, perceived control, psychological distance

## INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) has been rapidly spreading worldwide after it was first reported in Wuhan, China, in December 2019. In March 2020, the World Health Organization (WHO) declared the disease a pandemic and that it was in phase 6, suggesting that the pandemic is a widespread human infection. As COVID-19 spreads easily through ordinary human interactions, the pandemic is not only a serious threat to public health (Xu et al., 2020) but also causes psychological changes in individuals (Qiu et al., 2020). Thus, social-psychological assistance has been regarded as an important measure in the crisis governance of COVID-19 in China (Chen et al., 2020; Duan & Zhu, 2020). However, compared to mental problems, maintaining positive psychological status, such as in perceiving general health and life satisfaction, is critical for people during the pandemic. Surprisingly, it is unclear how the COVID-19 pandemic is impacting people's perception of general health and life satisfaction, as well as how social-psychological protection against the pandemic can be provided. Therefore, the present study aimed to address these issues by analysing integrated individual-level self-reported data and regional-level epidemic data in China.

## COVID-19 and Psychological Outcomes

The negative psychological outcomes of the COVID-19 pandemic have attracted considerable attention. One prominent aspect which has been widely studied is mental health (Chen et al., 2020; Duan & Zhu, 2020; Xu et al., 2020). In fact, a pandemic often causes feelings of distress and anxiety, according to previous studies (Bults et al., 2011; Wong, Gao, & Tam, 2007). In this pandemic, 35 per cent of respondents reported psychological distress in a Chinese national study (Qiu et al., 2020). Therefore, researchers highlighted the public's urgent psychological needs during the pandemic (Liu, Zhang, & Wang, 2019; Pfefferbaum & North, 2020).

In contrast to psychological problems caused by the pandemic, there is scant knowledge regarding the positive psychological outcomes, which contributes to the development of a good life and building a well-functioning society (Seligman, Steen, Park, & Peterson, 2005). For the general public, maintaining health

and life satisfaction during a pandemic is very important. Previous studies have revealed that the Severe Acute Respiratory Syndrome (SARS) outbreak had a considerable impact on individuals' perceived general health and life satisfaction (Lai, Bond, & Hui, 2007; Lau et al., 2008; Main, Zhou, Ma, Luecken, & Liu, 2011). In fact, considering the importance of psychological intervention in the prevention and control of COVID-19 (Chen et al., 2020; Duan & Zhu, 2020; Qiu et al., 2020), it is extremely important to help people—especially those living in areas where the pandemic has spread—to cope with psychological changes. However, as the existing research has mainly focused on mental health issues resulting from the pandemic, more research exploring the psychological effects of the COVID-19 pandemic on perceived general health and life satisfaction among residents of pandemic-hit regions is necessary.

## Psychological Distance

The psychological effects of a pandemic often vary across regions and the negative effects are stronger in regions that are severely affected than in those that are less affected. In particular, people residing in severely affected regions have reported high levels of anxiety and low levels of subjective well-being compared to individuals from more mildly affected regions (Kim, 2019; Lau et al., 2008; Wong et al., 2007). Therefore, given the detrimental effects of the COVID-19 pandemic on psychological outcomes, people may report less perceived general health and life satisfaction in more severe pandemic regions than that in milder pandemic regions.

Actually, people tend to feel closer to the virus in severely affected regions. This is in line with psychological distance, which refers to the subjective experience that something is close or far away from others, including other persons, events, time periods, and hypotheticality (Liberman & Trope, 2014). As the possibility is also a type of psychological distance (Liberman & Trope, 2014), it affects individuals' subjective perceptions as well as their responses to risks (Chandran & Menon, 2004; Jones, Hine, & Marks, 2017; Lerner, Streicher, Sachs, Raue, & Frey, 2016). As the number of confirmed cases indicates the pandemic's severity (Reed et al., 2013), an increase in the number in nearby places may be related to the perception of being infected. This will eventually result in decreasing the perceived psychological distance. As subjective distance from a disease has been reported to impact psychological reactions (Kim, 2019), a recent study found that people who perceived a small distance from death reported low levels of life satisfaction (Gerstorff, Ram, Röscke, Lindenberger, & Smith, 2008). Therefore, when people are residing close to infected places, they feel a closer psychological distance from the virus and thereby perceive low levels of positive psychological outcomes, such as life satisfaction and perceived general health.

## Perceived Control

Psychological factors are becoming increasingly important in alleviating the negative effects of pandemics and increasing the government's capacity to deal with disasters (Li, Yang, Dou, & Cheung, 2020; Pfefferbaum & North, 2020). Among these, perceived control was reported to moderate the relationship between the perceived severity of COVID-19 and mental health problems (Li, Yang, Dou, & Cheung, 2020; Li, Yang, Dou, Wang, et al., 2020). In particular, perceived control has been found to significantly affect both life satisfaction and perceived general health (Ferguson & Goodwin, 2010; Hofmann, Luhmann, Fisher, Vohs, & Baumeister, 2014).

According to the theory of perceived control, this term refers to an individual's perceived capacity to handle or prevent a certain incident, and the individual differences in sense of control are closely associated with successful coping during stressful situations (Lachman, 2006). According to prior studies, a sense of control can be a factor enhancing a person's capacity and competence in handling outcomes, thereby leading to effective techniques for coping with stressors and increased life satisfaction and health (Alonso-Ferres, Imami, & Slatcher, 2020; Drewelies et al., 2020; Hofmann et al., 2014; Lachman, 2006; Thompson & Prottas, 2006).

Additionally, a sense of control alters an individual's perception of their capacity to handle the environment, which changes their perception regarding a threat (Witt, Proffitt, & Epstein, 2005). In particular, people with high perceived control feel closer to positive targets and perceive greater distance from negative targets (Han, Gershoff, Kirmani, & Dalton, 2018). Therefore, a sense of control may lead to a further distance from negative objects such as the pandemic, which further results in a high level of perceived general health and life satisfaction.

## The Present Study

According to previous studies, the COVID-19 pandemic has negatively affected both physical and psychological health in regions where it has spread (Pfefferbaum & North, 2020; Qiu et al., 2020; Xu et al., 2020). In addition to mental problems, ways to maintain life satisfaction and perceived general health are equally important for the general population living in pandemic-affected regions. However, to the best of our knowledge, few studies have attempted to investigate the effects of the COVID-19 pandemic on life satisfaction and perceived general health. Considering the differences in pandemic severity across regions in China, we propose the following hypotheses.

*Hypothesis 1.* Regional pandemic severity negatively predicts perceived general health and life satisfaction among citizens in pandemic-affected regions.

Although some studies have examined the effects of the COVID-19 pandemic on psychological outcomes, little is known regarding the possible mechanisms underlying the above-mentioned process. According to the psychological distance theory, regional pandemic severity may alter the perceived psychological distance, thereby reducing perceived general health, and life satisfaction. Therefore,

*Hypothesis 2.* Psychological distance mediates the effects of regional pandemic severity on both perceived general health and life satisfaction.

Psychological factors have become increasingly important for controlling this pandemic (Duan & Zhu, 2020; Pfefferbaum & North, 2020). In particular, perceived control has been demonstrated to have a protective function for mental health during the COVID-19 pandemic (Li, Yang, Dou, & Cheung, 2020). Therefore, we propose the following:

*Hypothesis 3.* Perceived control moderates the psychological effects of regional pandemic severity on perceived general health and life satisfaction. Specifically, the impact of regional pandemic severity on perceived general health and life satisfaction is stronger for individuals with lower perceived control.

Lastly, given the protective function of perceived control in disasters (Pfefferbaum & North, 2020), a sense of perceived control not only alters individuals' perception regarding a threat (Han et al., 2018; Witt et al., 2005), but also helps individuals cope with the threat (Infurna & Gerstorf, 2014). According to the literature, high perceived control increases the psychological distance from a negative target (Han et al., 2018), which may in turn help individuals in coping with the COVID-19 pandemic and further lead to high levels of perceived general health and life satisfaction. In addition, many studies have reported that a sense of control is a key protective factor during adversity (Infurna & Gerstorf, 2014), suggesting that people with high perceived control tend to successfully cope with the threat, even when they perceive a close psychological distance from the disease. Therefore, perceived control may moderate the relationship either between regional pandemic severity and psychological distance or between psychological distance and the outcomes. Therefore, we proposed the following hypotheses:

*Hypothesis 4.* Perceived control moderates the psychological effects of regional pandemic severity on psychological distance from COVID-19. In particular, the impact of regional pandemic severity on psychological distance is stronger for individuals with low levels of perceived control, compared to those with high levels of perceived control.

*Hypothesis 5.* Perceived control moderates the effects of psychological distance on life satisfaction and perceived general health. In particular, the relationships between psychological distance and outcomes (i.e. life satisfaction and perceived

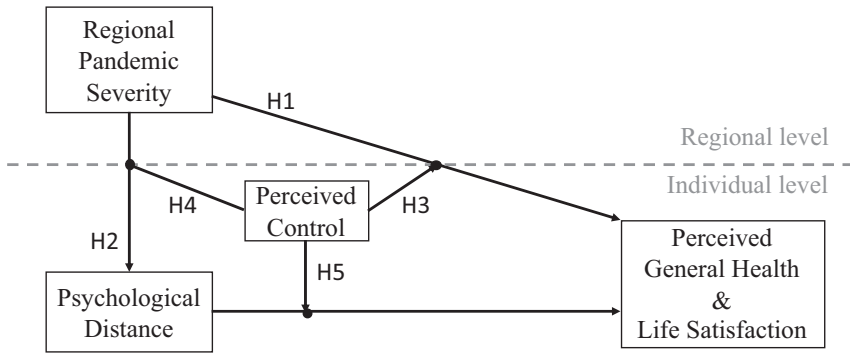


FIGURE 1. Conceptual model.

general health for individuals) are weaker for individuals with low levels of perceived control, compared to those with high levels of perceived control.

*Hypothesis 6.* Perceived control moderates the mediating effects of psychological distance on life satisfaction and perceived general health (Figure 1). In particular, the mediating effects of psychological distance are stronger for individuals with high levels of perceived control, compared to those with low levels of perceived control.

## METHOD

### Participants

This study recruited 1,847 participants from 31 provinces of China using an online survey platform. Their average age was  $30.64 \pm 9.19$  years. There were 767 men and 1,080 women respondents. None of them were confirmed cases, but nine of them reported that they were suspected cases. In addition, 257 participants had completed high school education, 465 had completed junior college education, 868 held bachelor's degrees, and 257 held master's or doctorate degrees. All participants provided informed online consent, and the study design was approved by the Ethics Committee of the first author's university. Only those participants who provided online consent were enrolled in this study; these participants were debriefed using an online page and were compensated with 6 RMB (0.75 Euro) after completing the survey.

## Measures

*Life Satisfaction.* This was assessed using a single item, similar to the methodology of a previous study (Kobau, Snizek, Zack, Lucas, & Burns, 2010). The participants were asked to indicate their levels of life satisfaction on a scale of 1 to 9, wherein 1 = extremely dissatisfied and 9 = extremely satisfied. The statement was: “Overall, how satisfied do you feel with your current life? 1 means extremely dissatisfied and 9 means extremely satisfied.”

*Perceived General Health.* This was also assessed using a single item, which was taken from a previous study (Main et al., 2011). The participants were asked to indicate their attitudes toward their recent health status on a scale of 1 to 5. The statement was, “Overall, your present health status is \_\_\_\_\_, where 1 means bad, 2 means normal, 3 means good, 4 means very good, and 5 means extremely good.”

*Psychological Distance.* This was measured using two items, which were adopted from the concept of psychological distance (Liberman & Trope, 2014). Individuals were required to report their perceived psychological distance from the pandemic on a scale ranging from 1 (extremely near) to 9 (extremely remote). The statements were: “How much distance do you perceive between yourself and COVID-19?” and “How much distance do you perceive between yourself and the people infected with COVID-19?” Pearson’s correlation between the two items was 0.81.

*Regional Pandemic Severity.* This is usually determined using two main factors: clinical severity and transmissibility (Reed et al., 2013). In this study, the regional number of confirmed COVID-19 cases was used as the regional pandemic severity index, as the number of confirmed cases has been linked to regional pandemic severity. These data were obtained from the website of the National Health Commission of the People’s Republic of China. This study used the data from the day on which the survey was conducted (7 February 2020).

*Perceived Control.* This was measured using the perceived control scale (Whitaker, Miller, & Clark, 2000). The scale comprises five inverse items: “I have little control over the things that happen to me”, “There is really no way for me to solve some of the problems I have”, “Sometimes I feel that I’m being pushed around in life”, “There is little that I can do to change many of the important things in my life”, and “I often feel helpless in dealing with life problems.” Each item was scored on a 7-point Likert scale (1 = “strongly disagree” to 7 = “strongly agree”). The responses were reverse recoded so that higher scores indicated high levels of perceived control. Cronbach’s alpha was .90 for this sample.

## Data Analysis

As people are residing (nested) in regions with different levels of pandemic severity, those in the same region are more similar in the perception of the pandemic than people residing in other regions. In other words, participants were intraclass correlated within their residing regions in this data. In such cases, the Hierarchical Linear Model (HLM) is commonly used for a nested data structure (Stephen & Anthony, 2002). Therefore, we conducted an HLM with the 31 regions of China as clusters; psychological distance, life satisfaction, and perceived general health as individual-level variables; and regional pandemic severity as the region-level variable.

First, to estimate the intraclass correlation, we analysed a null model in M-plus 7.0. Second, in Model 1, we performed HLM with the dependent variables (life satisfaction and perceived general health), and control variables (including age, sex, education level, suspected case, and group size). Third, regional pandemic severity and perceived control were entered as predictors with random intercepts in Model 2 to test the direct effects of regional pandemic severity. The effects of the random slope of perceived control were included in the latter model (i.e. Model 4) for testing the cross-level moderation. Fourth, in Model 3, we tested the mediation effect of psychological distance on the relationships between regional pandemic severity and outcomes with both random intercepts and random slopes. The random mediation effects were tested with the Monte Carlo approach in R 3.6.2 (Preacher & Selig, 2012). Fifth, a cross-level moderation model with random slopes was used to estimate the moderating effect of perceived control on the relationship between regional pandemic severity and psychological distance. Last, we tested the random moderating effect of perceived control on the relationships between psychological distance and outcomes in Model 6.

## RESULTS

### Descriptive Statistics

Table 1 shows the participants' demographic statistics and the correlation matrix of the variables in this study.

### Regional Pandemic Severity Affects General Health and Life Satisfaction via Psychological Distance

In the null model, the results indicated that the intraclass correlation coefficients were .03 for psychological distance, .01 for life satisfaction, and .01 for perceived general health, respectively. As shown in Table 2, after controlling for



TABLE 1  
Means, Standard Deviations, and Pearson Correlation Coefficients for All Variables (n = 1847)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9
1. Age	30.64	9.19									
2. Sex	1.58	0.49	-.15**								
3. Education	2.61	0.89	-.27**	.06*							
4. Suspected cases	<0.01	0.07	-.04	-.02	.02						
5. Group size	57.72	65.67	.13**	-.16**	-.11**	-.06*					
6. Life satisfaction	6.42	1.70	.13**	-.04	-.08**	-.01	.08**				
7. Perceived general health	3.08	0.93	.04	-.06*	-.06*	-.03	.06*	.40**			
8. Psychological distance	4.43	2.03	-.01	-.03	-.09**	.02	.01	.20**	.14**		
9. Perceived control	3.87	1.41	.03	.01	.06*	-.04	.06*	.22**	.20**	.02	
10. Regional pandemic severity	2.25	0.45	.08**	-.06*	-.02	.02	.16**	-.04 <sup>†</sup>	.03	-.12**	.01
	(1676.23)	(501.2.92)	(.09**)	(-.02)	(-.01)	(.02)	(-.07**)	(-.07**)	(.02)	(-.13**)	(-.01)

Note: †p < .10; \*p < .05; \*\*p < .01. Regional pandemic severity was measured by the number of confirmed cases at the province level—the number was transformed by logarithm with base 15, below the regional pandemic severity was the raw number of confirmed cases; Sex: 1 = men, 2 = women; Education: 1 = high school, 2 = college; 3 = bachelor; 4 = master or doctor; Suspected cases: 1 = Yes, 0 = No.

TABLE 2  
Effects of Regional Pandemic Severity, Perceived Control, and Psychological Distance on Perceived General Health and Life Satisfaction

	Model 1		Model 2		Model 3	
	Health	LS	Health	LS	Health	LS
Fixed effect						
Age	0.01 (0.01)	0.02 (0.01)**	0.001 (0.003)	0.02 (0.01)**	0.01 (0.01)	0.02 (0.01)**
Sex	-0.09 (0.05)*	-0.05 (0.08)	-0.09 (0.05)*	-0.05 (0.08)	-0.08 (0.04)	-0.03 (0.08)
Education	-0.05 (0.03)*	-0.09 (0.05)	-0.05 (0.03)*	-0.09 (0.05)	-0.04 (0.03)	-0.05 (0.05)
SC	0.01 (0.31)	0.001 (0.56)	0.01 (0.31)	0.001 (0.56)	0.02 (0.31)	0.001 (0.55)
Group size	0.001 (0.01)	0.01(0.01)	0.001 (0.01)	0.01 (0.01)*	0.001 (0.01)	0.01 (0.01)
RPS			0.04 (0.05)	-0.25 (0.09)**	0.07 (0.05)	-0.16 (0.12)
PC			0.13 (0.02)**	0.26 (0.03)**	0.12 (0.02)**	0.25 (0.03)**
Random effect						
PD					0.06 (0.01)**	0.15 (0.02)**
Mediation effect						
RPS → PD →					-0.03 (0.01)**	-0.08 (0.02)**
-2LL	12056.57		11888.94		19547.91	
Df	14		18		31	
R <sup>2</sup>	0.009	0.023	0.047	0.073	0.070	0.109
						0.029

Note: \* $p < .05$ , \*\* $p < .01$ . Sex: 1 = men, 2 = women; Education: 1 = high school, 2 = college; 3 = bachelor; 4 = master or doctor; SC = Suspected cases; RPS = Regional pandemic severity as measured by the number of confirmed cases at the province level—the number was transformed by logarithm with base 15; PC = Perceived control; RPS × PC = the interaction of regional pandemic severity and perceived control; Health = Perceived general health; LS = Life satisfaction; PD = Psychological distance; The random effects of psychological distance are the averaged random effects of psychological distance.

other covariables in Model 1, regional pandemic severity was negatively associated with life satisfaction ( $B = -0.25$ ,  $SE = 0.09$ ,  $p = .005$ ), but was insignificantly related to perceived general health ( $B = 0.04$ ,  $SE = 0.05$ ,  $p = .427$ ) in Model 2. Therefore, H1 was partially supported.

Next, the results of the mediation model showed that regional pandemic severity had a negative effect on the psychological distance from COVID-19 ( $B = -0.54$ ,  $SE = 0.12$ ,  $p < .001$ ), which subsequently led to low levels of perceived general health ( $B = 0.06$ ,  $SE = 0.01$ ,  $p < .001$ ) and life satisfaction ( $B = 0.15$ ,  $SE = 0.02$ ,  $p < .001$ ). According to H2, the mediating effects were both significant (perceived general health: effect size =  $-0.03$ ,  $SE = 0.01$ ,  $p = .001$ , 95% CI [ $-0.01$ ,  $-0.05$ ]; life satisfaction: effect size =  $-0.08$ ,  $SE = 0.02$ ,  $p < .001$ , 95% CI [ $-0.04$ ,  $-0.12$ ]), suggesting that regional pandemic severity affects individuals' life satisfaction and perceived general health through psychological distance.

## Moderating Effects of Perceived Control

To test the moderating effects of perceived control, the present researchers first tested whether perceived control directly moderates the effect of regional pandemic severity on outcomes. The results of Model 4 demonstrated that perceived control insignificantly moderated the effects of regional pandemic severity on perceived general health ( $B = 0.01$ ,  $SE = 0.02$ ,  $p = .795$ ) and life satisfaction ( $B = -0.02$ ,  $SE = 0.04$ ,  $p = .647$ ), which does not support H3.

Subsequently, according to H4, the results of Model 5 indicated that perceived control moderated the effects of regional pandemic severity on psychological distance ( $B = 0.20$ ,  $SE = 0.09$ ,  $p = .018$ ; Table 3). As shown in Figure 2A, the effect of regional pandemic severity on psychological distance was greater among individuals with low levels of perceived control ( $B = -0.76$ ,  $SE = 0.15$ ,  $p < .001$ ) than those with high levels of perceived control ( $B = -0.27$ ,  $SE = 0.15$ ,  $p = .077$ ).

Next, the results of Model 6 indicated that perceived control moderates the effects of psychological distance on life satisfaction ( $B = -0.08$ ,  $SE = 0.03$ ,  $p = .014$ ), but not for the effects of psychological distance on perceived general health ( $B = -0.01$ ,  $SE = 0.02$ ,  $p = .641$ ). Therefore, H5 was partially supported. In particular, regarding the effects of psychological distance on perceived general health, there were no significant differences found across the levels of perceived control (Figure 2B). However, the effects of psychological distance on life satisfaction were greater among individuals with low perceived control ( $B = 0.24$ ,  $SE = 0.04$ ,  $p < .001$ ) than among those with high perceived control ( $B = 0.08$ ,  $SE = 0.04$ ,  $p = .037$ ; Figure 2C).

Finally, this study examined whether perceived control moderates mediation effects of psychological distance. The results of the moderated mediation model showed that among people with low perceived control, the psychological

TABLE 3  
Mediating Effects of Psychological Distance and Moderating Effects of Perceived Control

	Model 4				Model 5				Model 6			
	Health	LS	Health	PD	Health	LS	Health	PD	Health	LS	Health	PD
Fixed effect												
Age	0.001 (0.003)	0.02 (0.01)**	0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)	0.02 (0.01)**	-0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)	0.02 (0.01)**	0.01 (0.01)	-0.01 (0.01)
Sex	-0.09 (0.05)*	-0.05 (0.08)	-0.08 (0.05)	-0.14 (0.10)	-0.08 (0.05)	-0.03 (0.08)	-0.14 (0.10)	-0.14 (0.10)	-0.08 (0.05)	-0.03 (0.08)	-0.08 (0.05)	-0.14 (0.10)
Education	-0.05 (0.03)*	-0.08 (0.04)	-0.05 (0.03)	-0.23 (0.06)**	-0.05 (0.03)	-0.08 (0.04)	-0.23 (0.06)**	-0.23 (0.06)**	-0.05 (0.03)	-0.08 (0.04)	-0.05 (0.03)	-0.23 (0.06)**
SC	0.01 (0.31)	-0.001 (0.55)	0.01 (0.31)	0.01 (0.67)	0.01 (0.31)	-0.02 (0.54)	0.01 (0.67)	0.01 (0.67)	0.02 (0.31)	0.001 (0.55)	0.02 (0.31)	-0.02 (0.67)
Group size	0.001 (0.01)	0.01 (0.01)*	0.001 (0.01)	0.01 (0.01)	0.001 (0.01)	0.01 (0.01)*	0.01 (0.01)	0.01 (0.01)	0.001 (0.01)	0.01 (0.01)*	0.001 (0.01)	0.01 (0.01)
PD												
RPS	0.05 (0.05)	-0.24 (0.09)**	0.07 (0.06)	-0.53 (0.12)**	0.07 (0.06)	-0.17 (0.11)	-0.53 (0.12)**	-0.53 (0.12)**	0.06 (0.01)**	0.16 (0.02)**	0.06 (0.01)**	-0.53 (0.12)**
PC			0.13 (0.02)**	0.25 (0.03)**	0.13 (0.02)**	0.25 (0.03)**	0.13 (0.02)**	0.13 (0.02)**	0.07 (0.06)	-0.17 (0.11)	0.13 (0.02)**	-0.17 (0.11)
PD × PC									0.13 (0.02)**	0.26 (0.03)**	0.13 (0.02)**	0.26 (0.03)**
Random effect									-0.01 (0.02)	-0.08 (0.03)*	-0.01 (0.02)	-0.08 (0.03)*
PD			0.07 (0.01)**	0.17 (0.02)**	0.07 (0.01)**	0.17 (0.02)**	0.07 (0.01)**	0.07 (0.01)**				
PC	0.13 (0.02)**	0.26 (0.03)**					0.04 (0.04)	0.04 (0.04)				0.04 (0.04)
RPS × PC	0.01 (0.02)	-0.02 (0.04)					0.20 (0.09)*	0.20 (0.09)*				0.20 (0.09)*
-2LL	11617.89		19865.45		19865.45				19533.69			
df	22		34		34				33			
R <sup>2</sup>	0.048	0.079	0.070	0.035	0.109	0.035	0.068	0.035	0.068	0.112	0.035	0.035

Note: \* $p < .05$ ; \*\* $p < .01$ . Sex: 1 = men, 2 = women; Education: 1 = high school, 2 = college; 3 = bachelor; 4 = master or doctor; SC = Suspected cases; RPS = Regional pandemic severity as measured by the number of confirmed cases at the province level—the number was transformed by logarithm with base 15; PC = Perceived control; RPS × PC = the interaction of regional pandemic severity and perceived control; Health = Perceived general health; LS = Life satisfaction; PD = Psychological distance.

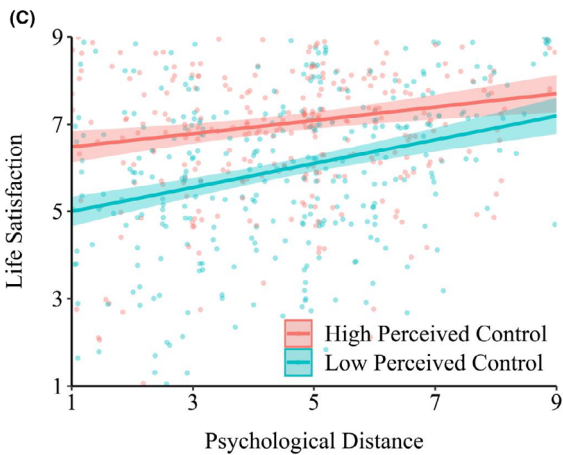
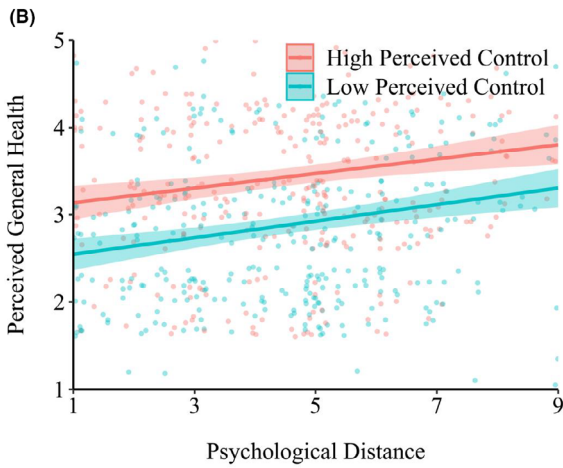
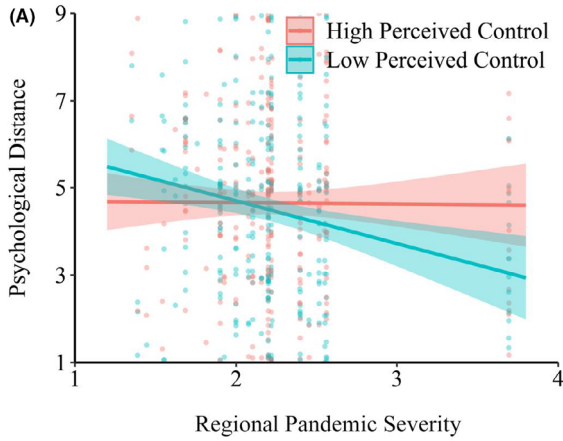


FIGURE 2. Perceived control moderates the effect of regional pandemic severity on psychological distance. *Note:* Regional pandemic severity was measured by the number of confirmed cases at the province level, and the number was transformed by logarithm with base 15; the moderating effects were significant for Figure 2A and Figure 2C but not for 2B. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

distance mediated relationships between regional pandemic severity and perceived general health (effect size =  $-0.05$ ,  $SE = 0.02$ ,  $p = .006$ , 95% CI [ $-0.02$ ,  $-0.09$ ]), and between regional pandemic severity and life satisfaction (effect size =  $-0.18$ ,  $SE = 0.05$ ,  $p < .001$ , 95% CI [ $-0.09$ ,  $-0.27$ ]). However, for people with high perceived control, the effects of psychological distance on both perceived general health (effect size =  $-0.01$ ,  $SE = 0.02$ ,  $p = .098$ , 95% CI [ $0.01$ ,  $-0.04$ ]) and life satisfaction (effect size =  $-0.03$ ,  $SE = 0.02$ ,  $p = .064$ , 95% CI [ $0.01$ ,  $-0.06$ ]) were insignificant. According to H6, perceived control buffers the psychological effects of regional pandemic severity by moderating the mediating effects of psychological distance in the relationship between regional pandemic severity and outcomes (i.e. perceived general health and life satisfaction).

## DISCUSSION

In the COVID-19 pandemic, it is quite important to maintain life satisfaction and the general health of the public. The results indicate that psychological distance can serve as a mediator in the relationship between regional pandemic severity and life satisfaction, and regional pandemic severity and perceived general health. In addition, perceived control can act as a protective factor against regional pandemic severity by moderating the mediating effects of psychological distance. In particular, the regional pandemic severity adversely affects psychological distance when people have low perceived control, which in turn can lead to low levels of both life satisfaction and perceived general health. This is consistent with the results of previous pandemic studies, which reported that pandemics led to considerable negative psychological outcomes (Main et al., 2011; Pfefferbaum & North, 2020), and perceived control promoted successful coping, which led to life satisfaction and perceived general health (Lachman, 2006; Prenda & Lachman, 2001).

It is noteworthy that this study recruited participants from 31 regions in China during the severe phase of the COVID-19 pandemic. The regions that our study sampled reported 99.85 per cent of the confirmed cases (34,567 people) of the total number in China and covered 97.53 per cent of the Chinese population (1,384 million people). Therefore, our results revealed the relationship between

environmental threat and psychological outcomes among people who resided mainly in the affected regions in China during the COVID-19 pandemic.

## Evidence of the Detrimental Effects of the COVID-19 Pandemic on Life Satisfaction and Perceived Health

The present study provides empirical evidence that COVID-19 pandemic severity at the regional level had a direct impact on individuals' life satisfaction after controlling the covariables. This result is consistent with the psychological effects of SARS on subjective life satisfaction (Lau et al., 2008; Maunder et al., 2006). The present study found that the COVID-19 pandemic can create psychosocial burdens for ordinary citizens, thus resulting in decreased subjective life satisfaction.

The present study did not find a direct association between regional pandemic severity and perceived general health. However, we found that the regional pandemic severity could affect individuals' perceived general health by shortening their psychological distance from the virus. In particular, people reported lower levels of perceived general health when they perceived a closer distance to COVID-19. Consequently, the regional pandemic can lead to psychological changes related to perceived general health. Our findings suggest that individuals who live in severely affected pandemic regions are more likely to perceive poorer general health, which indicates that more attention to this detrimental effect is needed in the future.

Our findings revealed the detrimental effects of the pandemic on people's positive psychological outcomes. Positive psychology—contrary to mental health problems—focuses more on individuals' health and well-being that not only enhance daily life for individuals but also contribute to well-being (Seligman et al., 2005). Therefore, it is necessary for the crisis management department to direct more attention toward positive psychological intervention programs for ordinary citizens living in pandemic-hit regions.

## Psychological Distance Explains How the COVID-19 Pandemic Affects Psychological Outcomes

It is noteworthy that this study found the mediating role of psychological distance in the relationship between the severity of the COVID-19 pandemic and psychological outcomes. In particular, people living in areas with a large number of confirmed COVID-19 cases perceived a closer psychological distance from the virus. This is in line with previous studies that the distance between self and SARS affected the level of anxiety (Lau et al., 2008; Wong et al., 2007).

Additionally, the present study found that people who perceived a close psychological distance from COVID-19 reported low levels of life satisfaction and perceived general health. This is consistent with previous studies wherein people

reported less life satisfaction when they perceived the threat at a close psychological distance (Gerstorff et al., 2008). Consequently, the regional threat (i.e. regional pandemic severity) alters the subjective distance from the virus, which can subsequently change people's life satisfaction and perceived general health. Our findings that psychological distance mediated the relationship between regional threat and mental outcomes can be further generalised to other highly infectious diseases.

Previous research has reported that environmental factors affect an individual's reactions through organismic variables (Luqman, Cao, Ali, Masood, & Yu, 2017). In this study, regional pandemic severity was measured from the regional epidemic data, and large numbers of confirmed cases represented higher environmental risks of infection. We believe that regional pandemic severity can be regarded as an environmental factor and can impact individuals' mental health through organismic variables such as psychological distance.

## Perceived Control Buffers the Effects of Regional Pandemic Severity via Psychological Distance

According to the present study's findings, perceived control can serve as a protective factor against the psychological effects of COVID-19. In particular, perceived control was found to enhance the participants' capacity to deal with stressors and alter the subjective experience of environmental stressors (Alonso-Ferres et al., 2020; Lachman, 2006; Li, Yang, Dou, & Cheung, 2020). This study found that perceived control could moderate the mediating effect of psychological distance, in which perceived control not only buffers the detrimental effects of regional pandemic severity on psychological distance, but also alleviates the negative impact of psychological distance from COVID-19 on perceived life satisfaction.

Our finding that perceived control can moderate the relationship between regional pandemic severity and psychological distance is consistent with previous studies. People with high levels of perceived control feel psychologically further from the disease (Han et al., 2018), which helps them successfully cope with the pandemic and improve their perceived general health and life satisfaction (Alonso-Ferres et al., 2020). Therefore, people with higher levels of perceived control are more likely to feel psychologically further from the current pandemic, which in turn increases their feelings of life satisfaction and general health.

Previous studies found the moderating role of perceived control in the associations between pandemic severity and mental health problems (Li, Yang, Dou, & Cheung, 2020; Li, Yang, Dou, Wang, et al., 2020). However, the present study provides the empirical evidence that perceived control can alter the relationship by moderating the relations between regional pandemic severity and positive psychological outcomes (e.g. life satisfaction). Given the adaptive function of perceived control in mental health (Lachman, 2006), the present study



demonstrated that perceived control can moderate the psychological impact of the COVID-19 pandemic by moderating the impact of the COVID-19 pandemic on psychological distance and moderating the impact of psychological distance on life satisfaction, thereby improving mental health outcomes.

Our overall findings not only support the main effects of perceived control on perceived health and life satisfaction but also demonstrate its buffering effect on adjusting psychological outcomes among people living in pandemic-affected regions (Alonso-Ferres et al., 2020; Lachman, 2006).

## Implications

COVID-19 continues to spread globally; ways to maintain good health are becoming important for the general public. Our finding revealed that psychological distance explained the relationship between regional pandemic severity and psychological outcomes. Programs for increasing psychological distance from the virus may help improve the general public's life satisfaction and health in pandemic-affected regions. For example, social distancing and isolating suspected people may be a way to promote increased psychological distance for the general public.

Our findings significantly contribute to understanding the adaptive function of perceived control against the psychological impact of the pandemic. Enhancing perceived control is a possible approach for helping individuals cope with the psychological effects of the COVID-19 pandemic (Li et al., 2020). Prior research has found that perceived control improves as uncertainty decreases (Zachariae et al., 2003). Therefore, in terms of crisis governance, public communication regarding uncertainty related to the pandemic will be important. An objective description of the pandemic transmission and severity will benefit regional stability as well as global pandemic prevention and control.

## Limitations

There are some limitations in this study. First, it employed a cross-sectional design, in which causal interpretations among self-report measures are impossible. However, we included an objective index, which is more convincing in determining a causal relationship. In addition, some correlations were low but reached significant levels due to the large sample size. Although a large sample size usually leads to more reliable results with greater precision and power, more solid evidence is needed to provide support for the relations among these variables. Further research should address these issues through longitudinal studies or experimental designs. Second, both perceived general health and life satisfaction were assessed using a single item, which may not have been sufficiently comprehensive. Additionally, although the measurement of perceived control has been used in previous studies (Whitaker et al., 2000), these items involve the

components of lack of control. To further clarify the impact of perceived and lack of control during pandemics, we recommend that future studies select a more comprehensive measurement that assesses both perceived control and lack of control. Third, COVID-19 has been declared a global pandemic by the WHO. However, our cohorts were restricted to majorly affected regions, especially eastern and central China. Given the cultural differences among regions in China, which may limit the generalisation of the study's findings, future studies should consider the cultural differences among populations when examining the psychological effects of the COVID-19 pandemic.

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