Self-efficacy and mental health problems during COVID-19 pandemic: A multiple mediation model based on the Health Belief Model

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A R T I C L E   I N F O

A B S T R A C T

Confronting COVID-19 pandemic, one's health belief and behavior are essential to mental well-being. Thus conceived, this study applied the Health Belief Model to test the mediating effect of risk perception and coping strategies on the relationship between self-efficacy and mental health problems. Six hundred and eighteen participants aged 17–52 (117 males and 501 females) completed our web-based survey from February 7 to April 10, 2020. 12.6–15.1% of participants were affected by COVID-19 outbreak in varying degrees. The mediating effects of risk perception and active coping were significant, so was the serial mediating effect of risk perception and passive coping. Individuals with higher general self-efficacy were more likely to have lower risk perception, less passive coping strategies, more active coping strategies, and subsequently had less mental health problems. In conclusion, application of the HBM would help understand how mental health problems happen during an infectious disease epidemic, and the relationships among the HBM constructs need further investigation.

1. Introduction

Public health emergencies often seriously affected public mental health (Tian et al., 2020). During the Severe Acute Respiratory Syndrome (SARS) pandemic, a survey in Hong Kong found that close to two-thirds of the respondents felt horrified, apprehensive, or helpless to SARS (Lau et al., 2006). A recent survey showed that 70% of participants in China reported moderate to severe mental health symptoms during COVID-19 pandemic (Tian et al., 2020). These symptoms could last longer time and have greater prevalence than the pandemic itself (Ornell et al., 2020). Thus, it is urgent to understand how mental health problems have happened during the COVD-19 pandemic.

Applying the Health Belief Model (HBM) to COVID-19 might help to reduce coping behaviors that might provoke anxiety and fear, and shape a person's risk perception through perceived self-efficacy (Mukhtar, 2020). The present study aims to provide a process explanation for the effect of general self-efficacy on adult mental health problems during the COVID-19 pandemic. Furthermore, based on the associations among

several constructs of the HBM, the present study examined the mediating effects of risk perception and coping strategies in this relation.

1.1. Self-efficacy and mental health problems

As a construct in the HBM, self-efficacy was considered to be an important determinant of health (Chao et al., 2019), since self-efficacy is a key factor for the initiation and execution of disease-coping behaviors (Bandura, 1977) . During the COVID-19 pandemic, several studies also reported that general self-efficacy was related to mental health problems in several populations (e.g., Bidzan et al., 2020; Mo et al., 2021). Moreover, higher self-efficacy was also reported to be associated with fewer mental health problems during the SARS pandemic (Mak et al., 2009).

1.2. Coping strategies as a mediator

The HBM is one of the most common models for explaining

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individual differences in coping behaviors related to health problems (Pearlman et al., 2020; Skinner et al., 2008). Coping was considered as thoughts and actions used to manage the external and internal demands of stressful situations (Folkman & Moskowitz, 2004), including active coping and passive coping (Main et al., 2011). Researchers believed that people tended to use active coping to manage daily stressors with controllable outcomes, while using passive coping to manage uncontrollable events (Cheng & Tang, 2004), such as the Wenchuan Earthquake in China (Yang et al., 2010) and SARS-related stress (Gan et al., 2004).

Self-efficacy allows individuals to seek efficient coping strategies on the encountered difficulties (Bidzan et al., 2020), such as the COVID-19 pandemic (Ezati et al., 2021). A meta-analysis study indicated that general self-efficacy was specified as the main predictor of health behaviors (Sheeran et al., 2016). Some studies found that self-efficacy was positively related to active coping (e.g., McBride & Ireland, 2016; Yang et al., 2010) and negatively related to passive coping (e.g., Chen et al., 2020; Ding et al., 2015). Furthermore, a recent study reported that coping style mediated the relationship between general self-efficacy and psychological stress in children with malignant tumor (Liu et al., 2020).

1.3. Risk perception as a mediator

Risk perception is central to the HBM (Rosenstock, 1974). Risk perception could be defined as "people's judgments about the likelihood of negative outcomes such as an illness, injury, disease and death", and psychometric assessment of risk perception might cover a wide range of features of a certain risk (Winters et al., 2020), including perceived susceptibility, likelihood and severity (Brewer et al., 2007), as well as perceived uncontrollability of potential fatal harm (Winters et al., 2020). Some studies showed that risk perceptions were positively related to mental health problems (Imai et al., 2020; Miura et al., 2017; Suzuki et al., 2015), especially during the SARS pandemic (Wu et al., 2009). A recent study also found that perceived susceptibility and severity were positively related to state anxiety during the COVID-19 pandemic (Lin et al., 2020). However, risk perceptions might not be always negative, since other studies found higher risk perceptions were associated with more protective behaviors to cope (Bruine de Bruin & Bennett, 2020; Chou et al., 2020).

Self-efficacy would influence how threats were perceived (McBride & Ireland, 2016). However, the relationship between self-efficacy and risk perception received little attention, and inconsistent conclusions were obtained on the relationship (Lemée et al., 2019; McBride & Ireland, 2016). An Italian study found that general self-efficacy was a significant predictor of perceived personal susceptibility for the COVID-19 pandemic (Commodari et al., 2020).

1.4. Risk perception and coping strategies as serial mediators

Previous studies have found that risk perception was related to coping strategies in clinical settings (e.g., Nilsson et al., 2013). According to a recent commentary on HBM, risk perception might also modify one's coping strategies for the prevention of COVID-19 (Mukhtar, 2020). Furthermore, a recent study found that coping strategies mediated the association between risk perception and mental health among Healthcare Personnel during COVID-19 epidemic (Krok & Zarzycka, 2020).

1.5. Research question and hypothesis

Based on previous studies, this study tried for the first time to apply the HBM to explain coping strategies and mental health in Chinese adults during COVID-19 pandemic. We aimed to test the mediating effects of risk perception and coping strategies between self-efficacy and mental health problems. Three hypotheses were proposed for this study:

Hypothesis 1. Risk perception mediates the relationship between self-efficacy and mental health problems.

Hypothesis 2. Coping strategies mediate the relationship between self-efficacy and mental health problems.

Hypothesis 3. Risk perception and coping strategies operate as serial mediators between self-efficacy and mental health problems.

2. Method

2.1. Participants

A total of 798 adults from 30 cities in China took part in our online survey from February 7 to April 10, 2020. Participants received invitation of the survey through their personal contacts in Wechat or the webpage of a massive opening online psychology course. Our sample consisted of 618 participants (501 females). The average age of the participants was 22.7 years (SD = 4.9).

2.2. Measures

2.2.1. Mental health problems

Mental health problems related to COVID-19 pandemic were measured by the Psychological Questionnaires for Emergent Events of Public Health (PQEEPH). The PQEEPH consists of 25 items of five subscales, depression, neurasthenia, fear, compulsion/anxiety, hypochondria (Gao et al., 2004). Each item was scored according to the degree of emotional response (0 = "none" to 3 = "severe") and frequency (0 = "seldom" to 3 = "always"). Average scores of items on each dimension were considered as low-risk, medium-risk, and high-risk based on mean plus one standard deviation or two standard deviations (Chen et al., 2020). Cronbach's α for the PQEEPH was 0.93 in this study. The content validity index (CVI) of the PQEEPH was 0.95 and the CVI of items ranged from 0.83–1.00.

2.2.2. Risk perception

Risk perception was measured by the Public Risk Perception Scale for Public Health Emergencies (PRPS) designed by Dai et al. (2020). The scale consists of 10 items, including four dimensions, severity of pandemic, uncontrollability, severity of health effects, likelihood. Each item was rated on a 5-point scale (1 = "completely not true" to 5 = "completely true"), with higher scores representing higher levels of risk perception. In this study, Cronbach's α for the scale was 0.76. The CVI of the PRPS was 0.97 and the CVI of items ranged from 0.83–1.00.

2.2.3. General self-efficacy

The Chinese version (Wang et al., 2001) of the General Self-Efficacy Scale (GSES, Jerusalem & Schwarzer, 1986) was used to measure people's perceived self-efficacy, which consists of 10 items. Items were rated on a 4-point Likert scale, ranging from "strongly disagree" (scored 1) to "strongly agree" (scored 4), with higher total scores representing the stronger ability and confidence to cope with stressful events. Cronbach's α calculated in this study was 0.92. The CVI of the GSES was 1.00 and the CVI of all items was 1.00.

2.2.4. Coping strategies

Individuals' coping strategies were measured by the Simplified Coping Style Questionnaire (SCSQ) developed by Xie (1998). It consists of 20 items with two subscales assessing an individual's active coping and passive coping. Each item was rated on a 4-point Likert scale (0 = "never" to 3 = "often"). In this study, Cronbach's α for active coping was 0.86 and passive coping was 0.73. The CVI of the SCSQ was 0.89 and the CVI of items was 0.67–1.00.

2.3. Data analysis

SPSS Statistic v26.0 and Mplus v7.0 were employed in our data analyses. Kolmogorov-Smirnov test showed that none of the variables was normally distributed (all $p < 0.001$). To evaluate the content validity of the questionnaires, six experts, including four psychologists, a mental health education specialist, and a public health physician, were asked to rate each item for relevance on a four-point Likert questionnaire. The CVI of each scale was calculated by averaging method according to Polit et al. (2007). Contingency table analyses and Mann-Whitney U tests were used to examine gender differences. Spearman correlation analyses were performed. Structural equation modeling (SEM) was performed in Mplus to test the hypotheses in a structural equation model. Self-efficacy, coping style, and the components of risk perception and mental health were used as manifest variables, and risk perception, mental health were used as latent variables. 95% bias-corrected confidence interval (CI) was used to estimate indirect effects with 5000 resample. Statistical significance is considered if the 95% CI does not contain zero.

3. Results

3.1. Preliminary analyses

The psychological impacts of COVID-19 pandemic are displayed in Table 1. Respectively, 8.6%, 7.9%, 10.4%, 8.9% and 7.9% of participants were at medium-risk for depression, neurasthenia, fear,

Table 1
Descriptive statistics and differences for all variables.

	Gender		χ2 or Z	p
	Male (N = 161)	Female (N = 457)		
Age (years)	23.36 ± 5.42	22.51 ± 4.71	−2.14	0.032
Survey time (no new cases, %)	11.8	5.7	6.59	0.010
Region (cumulative confirmed cases >500, %)	70.8	76.8	2.30	0.129
Identity (student, %)	73.9	74.6	0.03	0.860
Education (bachelor degree or above, %)	97.5	98.5	0.19	0.660
Risk perception				
Total scores	3.35 ± 0.57	3.49 ± 0.54	−2.77	0.006
Severity of pandemic	3.68 ± 0.62	3.78 ± 0.57	−2.24	0.025
Uncontrollability	3.64 ± 0.82	3.75 ± 0.78	−1.56	0.118
Severity of health effects	3.50 ± 0.95	3.70 ± 0.90	−2.32	0.020
Likelihood	2.29 ± 0.83	2.44 ± 0.78	−2.10	0.035
Mental health				
Depression	0.45 ± 0.64	0.38 ± 0.55	−0.66	0.510
Neurasthenia	0.45 ± 0.59	0.43 ± 0.58	−0.55	0.580
Fear	1.03 ± 0.57	1.15 ± 0.56	−2.46	0.014
Compulsion/anxiety	0.24 ± 0.43	0.22 ± 0.39	−0.10	0.920
Hypochondriasis	0.27 ± 0.44	0.30 ± 0.45	−0.47	0.636
Self-efficacy	2.74 ± 0.59	2.54 ± 0.56	−3.67	<0.001
Active coping	1.93 ± 0.53	2.04 ± 0.49	−2.10	0.036
Passive coping	1.34 ± 0.55	1.38 ± 0.51	−0.65	0.518

Note. N = 618 (except Age, because this variable has 81 missing values). Results are rendered M ± SD except for special notes.

compulsion/anxiety, and hypochondria, and 6.5%, 4.9%, 3.2%, 4.9% and 4.7% of participants were at high-risk for these problems respectively. Table 1 also displayed descriptive statistics and differences for variables. Gender difference was found only in fear ($p = 0.014$), i.e., male participants had lower fear than female participants.

3.2. Correlational analyses

Correlations among the variables are displayed in Table 2. Spearman correlation analyses showed that risk perception total scores were negatively related to self-efficacy ($p = 0.002$), and were positively related to passive coping as well as all dimensions of mental health problems (all $p < 0.001$). Self-efficacy was positively related to active coping ($p < 0.001$), and was negatively related to passive coping ($p = 0.025$) as well as all dimensions of mental health problems (all $p < 0.050$). Besides, active coping was negatively related to depression, neurasthenia, and compulsion/anxiety (all $p < 0.001$). Passive coping was positively related to all dimensions of mental health problems (all $p < 0.001$).

3.3. Testing multiple mediation models

As outlined by (Walker & Smith, 2017), the χ^2 test statistic was sensitive to both sample size and multivariate non-normality. Therefore, this statistic would not be taken into account in this study. The results of the initial model indicated that two indices of the initial model were not acceptable (CFI = 0.91, TLI = 0.87, SRMR = 0.07, RMSEA = 0.09, 90% CI = [0.080, 0.100]). However, considering significant correlations between depression and neurasthenia, fear and hypochondria in this study (all $p < 0.010$), three covariance pathways between the error terms respectively associated with active coping and passive coping, depression and neurasthenia, fear and hypochondria were added. The final model (Fig. 1) fit the data moderately well (CFI = 0.93, TLI = 0.90, SRMR = 0.07, RMSEA = 0.08, 90% CI = [0.068, 0.088]).

The direct and indirect effects among the variables are displayed in Table 3. A review of the indirect effects of self-efficacy on health mental problems showed that the mediating effects of risk perception ($b = −0.02$, 95% CI = [−0.045, −0.002]) and active coping ($b = −0.13$, 95% CI = [−0.171, −0.092]) were significant, providing whole support for H1 and partial support for H2. The serial mediating effect of risk perception and passive coping remained significant ($b = −0.01$, 95% CI = [−0.014, −0.001]), providing partial support for H3.

4. Discussion

Based on the HBM, the present study investigated multiple mediation models of mental health problems in a sample of the non-infected general Chinese public during COVID-19 pandemic. The main findings are: (1) 12.6–15.1% of participants were affected by COVID-19 outbreak in varying degrees; (2) risk perception mediated the relationship between self-efficacy and mental health problems; (3) active coping mediated the association between self-efficacy and mental health problems; (4) risk perception and passive coping operated as serial mediators between self-efficacy and mental health problems.

4.1. Public mental health during COVID-19 pandemic

In this study, 15.1% of participants were at medium-risk or high-risk for depression. This finding echoed three recent studies that 16.5–20.1% of the participants reported moderate or severe depressive symptoms (Choi et al., 2020; Huang & Zhao, 2020; Wang et al., 2020). Besides, 13.8% of participants were at risk for compulsion/anxiety, which is also consistent with an existing study reporting that 14% of the respondents had anxious symptoms (Choi et al., 2020). Moreover, 13.6% of participants were at risk for fear. Another similar study also showed that fear was present in 18.1% of the general population in Bosnia and

Table 2
Correlations for main variables and their dimensions.

		1	2	3	4	5	6	7	8
Risk perception	1	–							
Mental health problems									
Depression	2	0.16***	–						
Neurasthenia	3	0.22***	0.64***	–					
Fear	4	0.39***	0.41***	0.45***	–				
Compulsion/anxiety	5	0.20***	0.66***	0.64***	0.51***	–			
Hypochondriasis	6	0.20***	0.34***	0.36***	0.53***	0.42***	–		
Self-efficacy	7	−0.13**	−0.19***	−0.25***	−0.12**	−0.20***	−0.09*	–	
Active coping	8	−0.03	−0.21***	−0.25***	−0.06	−0.20***	−0.05	0.46***	–
Passive coping	9	0.18***	0.26***	0.27***	0.16***	0.33***	0.17***	−0.09*	0.12**

Note. N = 618.
* *p* < 0.05.
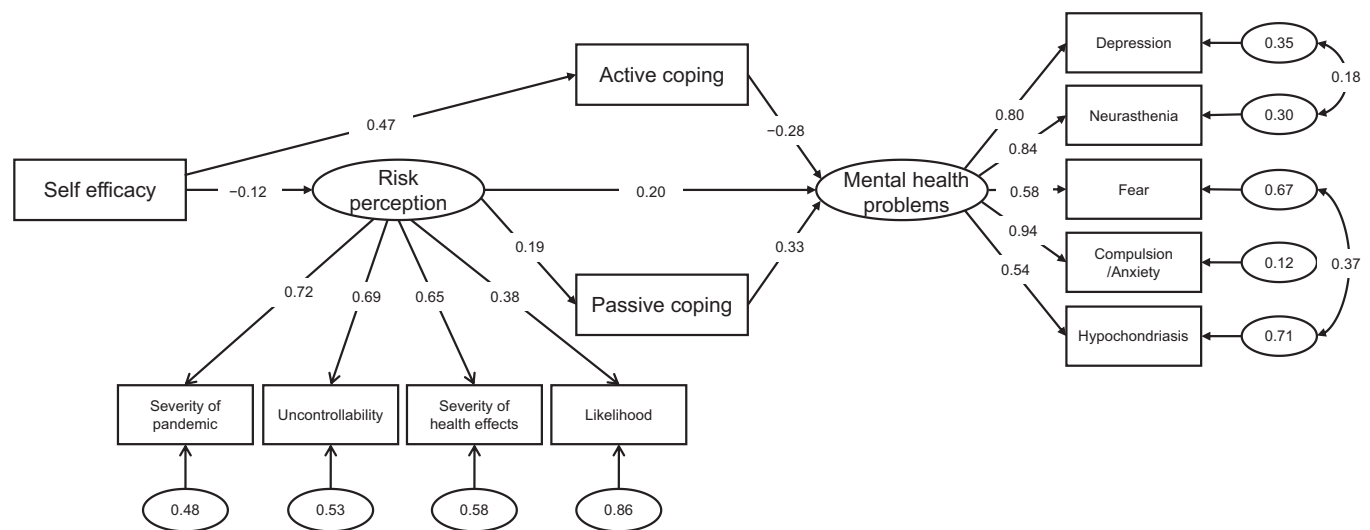** *p* < 0.01.
*** *p* < 0.001.

Fig. 1. The structural equation model of direct and indirect effects on mental health problems. *Note.* Statistically insignificant paths between variables are not presented.

Table 3
Testing the pathways of the multiple mediation models.

Effect	Estimate	95% CI	
		Lower	Upper
Direct effect			
Active coping → health mental problems	−0.28	−0.347	−0.181
Passive coping → health mental problems	0.33	0.229	0.371
Risk perception → active coping	0.05	−0.036	0.147
Risk perception → passive coping	0.19	0.127	0.363
Risk perception → health mental problems	0.20	0.111	0.342
Self-efficacy → risk perception	−0.12	−0.149	−0.022
Self-efficacy → active coping	0.47	0.359	0.464
Self-efficacy → passive coping	−0.07	−0.131	0.003
Self-efficacy → health mental problems	0.00	−0.068	0.070
Indirect effect			
Self-efficacy → risk perception → health mental problems	−0.02	−0.045	−0.002
Self-efficacy → active coping → health mental problems	−0.13	−0.171	−0.092
Self-efficacy → passive coping → health mental problems	−0.02	−0.048	0.002
Self-efficacy → risk perception → active coping → health mental problems	0.00	−0.001	0.005
Self-efficacy → risk perception → passive coping → health mental problems	−0.01	−0.014	−0.001

Note. N = 618. Standardized estimates are shown.

Herzegovina (Šljivo et al., 2020). By and large, the proportions of COVID-19-related mental health problems in this study seemed relatively low. The reason might be that most participants of this study were young and middle-aged adults, who might have fewer mental health problems than other age groups during the COVID-19 pandemic (Tian et al., 2020).

4.2. The mediating effect of risk perception

As predicted in Hypothesis 1, risk perception mediated the association between general self-efficacy and mental health problems. Risk perception was found to be positively related to mental health problems in our study, echoing findings of a recent Italian study (Germani et al., 2020). On the other hand, general self-efficacy was found to be negatively related to risk perception. This suggests that application of the HBM (higher general self-efficacy and possibly moderate risk perception) should receive more attention in a public health emergency, such as the COVID-19 pandemic.

4.3. The multiple mediating effects of active coping and passive coping

We found that active coping was negatively related to mental health problems, whereas passive coping was positively related to mental health problems. These results are consistent with prior findings (Cohen-Louck & Levy, 2020; Yang et al., 2010; Lemée et al., 2019). More

importantly, our results also indicated that active coping mediated the effect of self-efficacy on mental health problems, and risk perception and passive coping jointly mediated the effect of self-efficacy on mental health problems. This might be due to that information that increases confidence in behavioral activation, were more likely to motivate people to change health behaviors than information that increases perceived threat of diseases (Noar et al., 2007). Notably, a prior study indicated that individuals were more likely to use passive coping in dealing with pandemic-related stress (Gan et al., 2004).

4.4. Limitations

Several limitations should be noted in our study. First, this is a cross-sectional investigation, so further studies should be conducted to examine causal links among these variables. Second, the sample size is relatively small with an unbalanced gender proportion. Third, our data were collected by a self-report questionnaire through the Internet due to quarantine measures across the country; as such the indicated levels of mental health problems may not be in accord with the assessments of mental health professionals. The online questionnaire also limited the availability of the survey to elder adults.

5. Conclusions

From the perspective of the HBM, our study investigated mental health problems and underlying mechanisms among the non-infected people during COVID-19 pandemic. We found that risk perception and coping strategies were mediators in the association of self-efficacy and mental health problems. Our findings have important implications for understanding the mechanism of mental health during an infectious disease pandemic in view of health psychology. First, general self-efficacy may play a crucial role in coping behaviors and mental health during the infectious disease pandemic. Second, shaping adaptive risk perceptions through various media may benefit public mental health, and the assessment of risk perception needs more investigation in the future.

Ethical statement

All procedures performed in studies involving human participants were in accordance with the institutional and/or national research committee's ethical standards and with The 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Research Ethics Committee of the first corresponding author' university approved this study.

Informed consent

Informed consent was obtained from all individual participants in the study.

CRediT authorship contribution statement

Chenhao Zhou: Methodology, Software, Formal analysis, Data curation, Writing – original draft, Visualization, Writing – review & editing. **Xiao Dong Yue:** Visualization, Writing – review & editing. **Xingli Zhang:** Methodology, Writing – review & editing. **Fangfang Shangguan:** Conceptualization, Writing – original draft, Methodology, Project administration, Resources, Investigation, Validation, Writing – review & editing. **Xiang Yang Zhang:** Resources, Writing – review & editing.

Declaration of competing interest

All authors declared no conflicts of interest.

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