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The Relationship between Eexposure Level and Risk Propensity: A Chain Intermediary between Perceived Threat and Coping Effectiveness

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Abstract: *This study explored the relationship between the exposure level of COVID-19 and risk propensity and its potential mechanism. The DOSPERT-7 scale, perceived threat questionnaire and coping effectiveness questionnaire were used to investigate 3459 participants from 31 provincial administrative departments in China (2987 valid samples). The results showed that: (1) the exposure level of COVID-19 negatively predicted the risk behavior tendency, that is, the higher the exposure level, the lower the risk behavior tendency; (2) Perceived threat and coping effectiveness have intermediary effects on exposure level and risk propensity respectively; (3) Perceived threat and coping effectiveness play a chain intermediary role in exposure level and risk propensity.*

Keywords: *exposure level, risk propensity, perception threat, coping effectiveness, chain intermediary*

1. Introduction

Since December 2019, COVID-19 has swept the world. Due to the lack of vaccine methods and treatment experience at the beginning, COVID-19 has spread rapidly with its high transmission, causing the world to fall into epidemic panic. Based on this, all over the world have adopted strict prevention policies, such as wearing masks, maintaining social distance and isolation, to curb the outbreak of COVID-19. However, the severity of the epidemic has caused people to worry about its psychological, social, and economic impact (Cerami et al., 2020).[2] It can be said that COVID-19 poses an epoch-making economic, psychological, and life threatening to everyone.

The wide spread of COVID-19 around the world has caused people to have a strong fear of infection and death. Lu Lin, an academician of the Chinese Academy of Sciences, said that the impact of COVID-19 on human psychology would last for at least 20 years. Among them, the research on economic impact, social support, isolation, media broadcast, and other factors and mental health status has attracted extensive attention (Cao et al., 2020; Lai et al., 2020). [1][6]Among these factors, a common antecedent variable is the degree of correlation with the event, that is, the level of exposure. In general, the physical isolation and infection risk brought by the epidemic will increase the loneliness, anxiety, death anxiety, and depression symptoms of individuals (Pyszczynski, Lockett, Greenberg,&Solomon, 2020), [9]which will lead to unhealthy psychological states. The higher the level of exposure to the epidemic, the more serious the negative psychological problems, that is, the "ripple effect". However, some studies have found that being close to the epidemic center is negatively related to anxiety levels and epidemic-related safety and health problems. This phenomenon is called the "psychological typhoon eye effect" (Xie, Stone, Zheng,&Zhang, 2011),[13] which is used to describe the public's psychological resilience to major emergencies and disasters.

As for the psychological mechanism of the psychological typhoon eye effect, the anxiety buffer hypothesis believes that self-esteem, as a buffer of mental health, can protect oneself from the impact of loneliness and fear on anxiety and depression (Rossi et al., 2020).[10] The theory of psychological immunity believes that repeated exposure to stress events will numb the self (Lewis & Schwartz, 2009),[7] and improve the threshold of perception of stress events. The theory of cognitive dissonance regards the state of cognitive dissonance as the source of psychological abnormality. When individuals are at risk or in crisis, they will choose to change their cognition to eliminate the uncomfortable psychological state. The above theories can better explain the relationship between exposure level and mental health, but will the "psychological typhoon eye effect" be reflected in other fields? We have been inspired by ancient Chinese literature. Zuo Zhuan has a saying that "when the crisis comes, the

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trapped beasts will struggle and take risks, that is, they will show" ripple effect "in the risk behavior. Will there be" psychological typhoon eye effect "in the risk decision-making field? We want to verify its existence, so we assume:

H1: There is a "psychological typhoon eye effect" in the field of risk decision-making, that is, the higher the exposure level, the lower the risk propensity.

At the same time, behavior is often closely related to motivation. According to the theory of protective motivation, attitude and behavior depend on two key psychological factors of risk perception, including a person's perceived threat to risk and coping effectiveness of risk coping ability (Maddux & Rogers, 1983). [8]Perceived threats include estimates of the likelihood of infection and the severity of the disease. Coping effectiveness refers to the belief that the measures to deal with threats are effective, and whether people and groups can effectively deal with risks and protect themselves from harm. From the perspective of risk perception, the exposure level is closely related to the risk level risk perceived by individuals. In an early experimental study using Edward's gambling task, when participants were reminded of their death, they would make more dangerous decisions (Hart, Schwabach, & Solomon, 2010); [4]However, fear management theory believes that people have two different systems to manage death anxiety, namely, proximal defense and distal defense (Pyszczynski et al., 2020). When individuals focus on death-related thoughts, the proximal defense will be activated to suppress these thoughts, such as denying the severity of the death threat, or taking healthier behaviors to push death to the distant future; When death information is at the edge of consciousness rather than the focus, remote defense is used to maintain the existing state and take meaningful actions to prevent death. Therefore, we infer that when the epidemic exposure level is high, people will perceive a higher death threat, so they will adopt more effective coping methods and make more conservative behaviors to avoid risks, that is, assume H2 and H3.

H2: Perceived threat and coping effectiveness play an intermediary role in exposure level and risk behavior tendency respectively.

H3: Perceived threat and coping effectiveness play a chain mediating role in the relationship between exposure level and risk behavior tendency.

Due to the particularity of the epidemic period, this study used a cross-sectional method to collect data to investigate the potential mechanism of the impact of epidemic exposure level on risk behavior propensity. The theoretical path model of this study is shown in Figure 1.

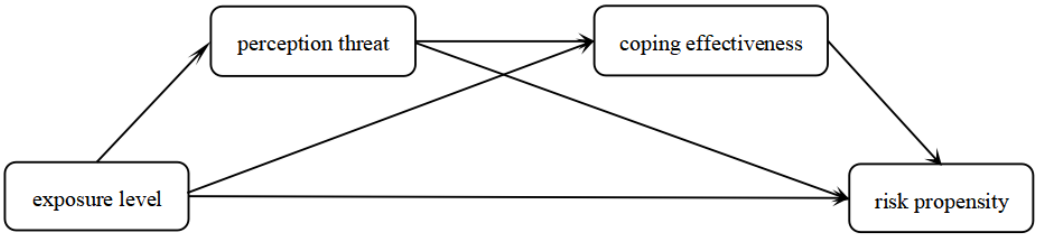

Figure 1 Chain mediation theory model of exposure level and risk propensity

2. Research Methods

2.1. Participants

During the epidemic period (March 3-13, 2020, 11 days in total), 3459 participants from 31 provincial administrative departments participated in the online survey using the questionnaire star platform, excluding 471 invalid questionnaires that did not answer carefully (the average answer time was less than 200ms or repeated selection of an option), and 2987 valid samples remained, with an effective rate of 86.3%. This study was approved by the Academic Committee of the School of Social and Psychological Science of the Central University of Finance and Economics. It took about 10 minutes to complete all the questions in the questionnaire. Each participant received 5 yuan after completing the questionnaire.

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2.2. Research materials

2.2.1. Exposure level

In this study, the cumulative number of confirmed cases was used as an indicator to evaluate the exposure level. To avoid changes in indicators caused by dynamic changes in data, all epidemic data are published on the official website of the National Health Commission on March 2, 2020. In this study, the variance of the number of original cases in 31 provinces and regions is large, which does not conform to the normal distribution. For example, on March 2, Hubei Province had 67217 cases of COVID - 19, and the other 30 provinces and regions had less than 1500 cases of COVID - 19. Therefore, the data will be logarithmically processed and will be normal distribution after processing.

2.2.2. Risk propensity

The DOSPERT-7 scale (the Domain Specific Risk Making scale) was prepared by Wang Xiaotian et al. All items in the scale are scored by Likert-7 points, with "1" representing "very unlikely" and "7" representing "very likely". The average score of each item option is the total risk propensity. Cronbach's α is 0.86. Cronbach's α of the DOSPERT-7 scale in this study was 0.945. The fitting index of confirmatory factor analysis was 2=3698.43, df=329, CFI=0.945, TLI=0.937, RMSEA=0.059. The scale had good structural validity.

2.2.3. Perceived threat

Based on the risk perception model proposed by predecessors (Slovic, 1987), [11]the perceived threat questionnaire was compiled. The questionnaire aims to reflect the perceived lethality and severity of the epidemic during the outbreak of COVID-19. The questionnaire adopts Likert-5 points for scoring, and 1-5 points, in turn, represent very disagree to very agree. At first, a total of 6 items were used to measure perceived threats, but one item "I often follow the official information issued by the National Health Commission" was deleted because its load was lower than 0.70. Therefore, in the final structural model, 5 items were used to represent perceived threats. Cronbach's α of the Perceived Threat Questionnaire in this study was 0.820, the fitting index of confirmatory factor analysis was 2=299.92, df=9, CFI=0.953, TLI=0.922, RMSEA=0.104, and the scale had good structural validity.

2.2.4. Coping effectiveness

The questionnaire is adapted from the perceived coping effectiveness questionnaire used by Kim, Sherman and Upgradoff (2016). [12]The questionnaire was originally used to reflect the participants' belief that they and their groups can effectively protect themselves from the threat of Ebola. Cronbach's α is 0.82 (Kim, Sherman, & Upgrade, 2016). [5]As the Ebola epidemic situation is very similar to COVID-19, the adjusted project has good scenario adaptability. Coping effectiveness involves self-efficacy and coping effectiveness in this study. The four topics are "I think the epidemic of pneumonia will be effectively controlled", "I am optimistic about the epidemic situation", "I believe I can effectively respond to the epidemic of pneumonia" and "I believe we can effectively respond to the epidemic of pneumonia". The first two items mainly reflect the sense of reaction efficacy, and the last two items mainly reflect the sense of self-efficacy. Likert-5 points are used for the four items, and 1-5 points in turn represent very disagreeable - very agreed. Cronbach's α of the Coping Effectiveness Questionnaire in this study was 0.907. The fitting index of confirmatory factor analysis was 2=13.07, df=2, CFI=0.999, TLI=0.996, RMSEA=0.043. The scale had good structural validity.

3. Research results

3.1. Common method deviation test

Since the research data are all from the self-report of participants during the epidemic, there is an unavoidable problem of common method bias. In this study, the Harman single-factor test was used for exploratory factor analysis. The results of non-rotated exploratory factor analysis extracted seven characteristic roots greater than 1. The variance interpretation rate of the first factor was 32.9% (less than 40%), so there was no serious common method bias in this study. At the same time, the study used confirmatory factor analysis to conduct a common method deviation test for all self-assessment scale items. The results showed that the model fit was very poor, 2=37518.21, df=665, CFI=0.531, TLI=0.504, RMSEA=0.136.

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3.2. Descriptive statistics and correlation analysis

The data results are shown in Table 1. Among them, gender and risk propensity, age and exposure level and perceived threat, income and exposure level and risk propensity, education level, and perceived threat and risk propensity are significantly correlated, and these variables will be used as control variables in the subsequent regression analysis process. There is a significant correlation among exposure level, perceived threat, coping effectiveness, and risk propensity, which provides preliminary support for regression analysis.

Table 1: Mean value, standard deviation, and correlation of each variable (N=2983)

variable	M	SD	1	2	3	4	5	6	7	8
1. gender	1.59	0.49	1							
2. age	3.13	1.21	0.02	1						
3. income	2.94	1.47	-0.19***	0.27***	1					
4. education	2.34	0.96	-0.06**	-0.29***	0.19***	1				
5. exposure level	2.96	0.81	0.02	-0.06**	-0.07***	0.02	1			
6. perceived threat	2.95	1.00	-0.01	-0.08***	0.00	0.12***	0.17***	1		
7. coping effectiveness	3.87	0.98	0.04	0.04*	0.01	0.03	0.12***	0.11***	1	
8. risk propensity	3.02	1.11	-0.17***	-0.03	0.12***	0.10***	-0.11***	0.27***	-0.16***	1

Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$, the same as below.

3.3. Statistical test

Hierarchical regression analysis was used to examine the relationship between exposure level, perceived threat and coping effectiveness, and risk propensity. Considering the possible interference of demographic variables in the model, the study takes gender, age, income, occupation, education level, etc. as control variables, and the results are shown in Table 2. Model 1 refers to the influence of control variables on risk propensity. Model 2 examines the influence of independent variables on risk propensity based on control variables. Among them, the fitting degree R^2 of model 1 is 0.053, that is, the explanatory power of control variables on risk propensity is 5.3%, and the fitting degree R^2 of model 2 is 0.172, that is, after controlling the interference variables, the explanatory power of independent variables on risk propensity is 17.2%.

Table 2: Results of hierarchical regression analysis model of risk propensity

variable	model 1	model 2
(constant)	3.341***	3.627***
gender	-0.305***	-0.291***
age	-0.009	0.004
income	0.082***	0.074***
education	0.048*	0.028
exposure level	/	-0.186***
perceived threat	/	0.338***
coping effectiveness	/	-0.195***
R^2	0.053	0.172
$\triangle R^2$	0.053	0.118
F	33.531***	141.475***

In this study, Bootstrapping repeated sampling method was adopted. The PROCESS v4 plug-in in SPSS 27.0 was used for the intermediary effect test. Model 6 was selected as the test model, with exposure level as the independent variable, risk propensity as the dependent variable, and perceived threat and coping effectiveness as the chain intermediary variables. The disturbance variables were controlled. Bootstrap was set to 5000 times, and non-standard path coefficients, standard deviations, and confidence intervals were output, The direct and intermediate effect tests are conducted, and the path coefficient results are shown in Figure 2.

The test results show that the path indirect effect mediated by perceived threat is 0.07 (95% CI=[0.05, 0.09]), the path indirect effect mediated by coping effectiveness is -0.02 (95% CI=[-0.04, -0.02]), and the path indirect effect mediated by a perceived threat and coping effectiveness is -0.004 (95% CI=[-0.006, -0.002]). The chain-mediated effect is tested.

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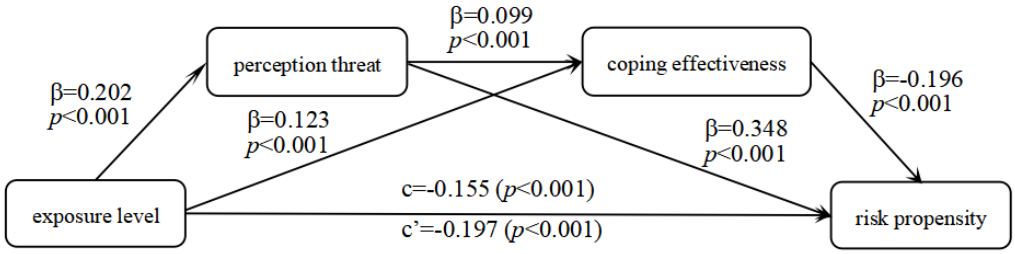

Figure 2 Chain mediation effect of the perceived threat and coping effectiveness in exposure level and risk propensity

4. Discussion

Based on the theory of protective motivation, this study explored the relationship between the level of exposure to COVID-19 and risk propensity and its potential psychological path. The results show that the COVID-19 life-threatening event does have a "psychological typhoon eye effect" in the field of risk behavior tendencies, that is, people at the center of the COVID-19 event will show more risk aversion. In addition, this study explored the potential path between the exposure level and risk propensity of COVID-19 through perceived threat and coping effectiveness, which is specifically reflected in the positive mediating effect of perceived threat on the relationship between exposure level and risk propensity, and the mediating effect of coping effectiveness on the negative correlation between exposure level and risk propensity. The reverse mediating effect between these two paths does not directly indicate the existence of the "psychological typhoon eye effect", Therefore, the study constructs a chain mediation model to test the hypothesis, and the results show that the path test results are significant, indicating that people's strong coping effectiveness can explain why people show a risk aversion tendency when they perceive life threats.

At the beginning of the outbreak of the COVID-19 epidemic, the death scare caused by unknown diseases cast a cloud on people's minds. Obviously, in the face of life threats, the signs of "fighting with trapped animals" are reflected in people's risk behaviors. The higher the perceived threat, the easier it is to show a high-risk preference; However, different from trapped animals, people have a "psychological protection network" when dealing with crises, that is, coping effectiveness. According to the psychological immune theory, groups with high epidemic exposure can have higher crisis-coping effectiveness. This sense of crisis coping effectiveness can effectively mitigate the negative impact of crisis events, which has been confirmed in many empirical studies. From the perspective of risk vulnerability theory (Gollier, 1996), [3]large-scale disasters can be regarded as "background risks", which will make vulnerable groups more risk averse; From the perspective of fear management theory (Pyszczynski et al., 2020), one of the ways to deal with the fear of disease is to use more psychological resources for meaningful behavior, which coincides with the conclusion of this study.

This study mainly discusses the chain intermediary effect between perceived threat and coping effectiveness in the level of exposure and risk propensity. Consistent with the research hypothesis, the study found the "psychological typhoon eye effect" in the field of risk preference. When the coping effectiveness is high enough, even if the perceived life threat, individuals can choose "not surprised or dangerous". Therefore, in the process of practical intervention, the government should focus on protecting the group trust of residents when formulating policies, and creating a stable and orderly living atmosphere and a positive social mentality; Psychological workers should also focus on the cultivation of psychological resilience and sense of efficacy in crisis intervention so that residents can have more support of psychological energy in the face of crisis.

In addition, although this study has expanded the research results of risk propensity in the crisis facing situation through empirical research, there are still several shortcomings and prospects: first, this study uses cross-sectional data during the epidemic, which cannot produce the effect of longitudinal data in verifying the relationship between the exposure level of COVID-19 and risk propensity, that is, it cannot explain the changes in the time dimension, nor can it verify the causal relationship between variables, In the future, more longitudinal design studies, such as follow-up design survey, should be carried out to expand the verification of causality between psychological variables; Second, the research data of this study are all in the form of subjective reports. In the future, data can be collected in the form of laboratory behavior observation or task tests to enhance the robustness of data results

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analysis; Third, the participants in this study are all residents with Chinese living backgrounds. At the beginning of the outbreak, China's epidemic prevention strategies are different from those of other countries, and China's cultural characteristics will also affect the external validity of the study. Therefore, whether the research results apply to other countries remains to be considered. Therefore, it is necessary to carry out cross-cultural research and comparison in the future to verify the applicability of the findings of this study in different countries.

5. Conclusion

The conclusions of this study are as follows: (1) The "psychological typhoon eye effect" is established in the field of risk behavior, that is, the higher the exposure level, the lower the risk behavior tendency; (2) Perceived threat and coping effectiveness have intermediary effects on exposure level and risk propensity respectively; (3) The chain intermediary effect of the perceived threat and coping effectiveness in exposure level and risk propensity is established.

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