

Uncertainty Tolerance and Information Overload in High-Risk Epidemic Areas: The Mediating Role of Sense of Control

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ABSTRACT

The rapid advancement of information technology has led to a notable rise in information overload, a critical factor impacting the mental well-being of individuals in modern society. This is particularly pronounced in high-risk epidemic zones, where individuals are inundated with a barrage of epidemic-related information. This study aims to investigate the influence of individuals' tolerance for uncertainty on information overload in these high-risk areas, while also examining the intermediary role played by the sense of control. Through a questionnaire survey involving 250 residents of Hubei Province, the data was analyzed using SPSS and PROCESS plug-ins. The findings reveal a significant negative correlation between uncertainty tolerance and information overload, with the sense of control acting as a statistically significant mediator between the two. This underscores the potential of enhancing individuals' uncertainty tolerance and sense of control in alleviating information overload. These insights offer novel perspectives on understanding the psychological mechanisms of information processing in epidemic-prone regions and provide valuable suggestions for optimizing information dissemination strategies by bolstering individuals' psychological resilience.

KEYWORDS

Uncertainty Tolerance; Information Overload; Sense of Control.

1. INTRODUCTION

1.1. Research Background

With the rapid development of digital information technology, the amount of information individuals are exposed to within a short period has dramatically increased. Particularly during public health emergencies such as the COVID-19 pandemic, the explosive growth of information through social media and news channels has led to unprecedented issues of information overload for the public. Information overload not only affects the quality of individual decision-making but also may result in psychological health problems such as information anxiety, increased stress, and decreased sleep quality (Zhang et al., 2023). Especially in high-risk epidemic areas, individuals may feel immense pressure due to their lack of ability to process large amounts of information, impacting not only their psychological well-being but also their ability to filter and absorb important information, thus affecting the effectiveness of epidemic prevention and individual quality of life (Chen et al., 2020). Under the leadership of the Party and the people's government, with the premise that individuals are responsible for their own health, we have largely overcome the impact of the COVID-19 pandemic. However, COVID-19 can still serve as a typical research example, analyzing the influence of major public health emergencies on the psychological health of individuals in the information age.

1.2. Theoretical Foundation

The concept of information overload was initially proposed by Alvin Toffler in his work "Future Shock," defining it as the situation where individuals receive more information than they can process, leading to difficulties in decision-making and a decrease in quality of life. Subsequent research further clarified the relationship between information overload and individual psychological health, such as anxiety, stress, and cognitive dysfunction. Uncertainty tolerance, as an important concept in psychology, describes individuals' psychological adaptability when facing uncertain situations (Li, 2020). Moreover, individuals who conform to social norms may experience higher social overload (Hong et al., 2015), with East Asians generally exhibiting higher levels of conformity. Additionally, research has shown that individuals with low uncertainty tolerance are more likely to feel anxious and stressed when confronted with large amounts of ambiguous information, exacerbating the negative effects of information overload (Liu, 2019). Furthermore, the sense of control, as the belief that individuals can control life events, is an important psychological mechanism for alleviating information overload (Burger, 1989). Individuals with a high sense of control demonstrate higher efficiency in information processing and lower stress responses; however, some scholars have pointed out that individuals often rely on external actions or material needs to satisfy their sense of control, even resorting to addictive substances in pursuit of control (Zheng, 2021). Additionally, researchers have indicated that individuals with low sense of control prefer to seek more comprehensive information (Sullivan, 2010), yet the amount of information they can process is far lower than the information received (Zhang et al., 2016). Therefore, the sense of control may play a mediating role between uncertainty tolerance and information overload.

1.3. Research Objectives

This study aims to explore how uncertainty tolerance among residents in high-risk epidemic areas during the COVID-19 pandemic affects information overload and attempts to reveal the potential mediating role of the sense of control. Specifically, this study will first analyze the relationship between uncertainty tolerance and information overload and then examine whether the sense of control mediates between uncertainty tolerance and information overload, as well as the specific manifestation of this mediation effect. Through this research, we hope to provide theoretical support and empirical data for understanding the information processing mechanisms of the public in extreme situations and to provide scientific evidence for relevant departments to formulate effective information dissemination and psychological intervention strategies during public health emergencies such as pandemics.

The theoretical value of this study lies in its enrichment of the research field of information overload and its deepening of our understanding of the relationship between uncertainty tolerance and information overload through exploring the mediating role of the sense of control. In terms of practical significance, the results of this study can help policymakers and health departments better recognize the importance of enhancing the uncertainty tolerance and sense of control among the public in high-risk situations to prevent information overload and improve public psychological health.

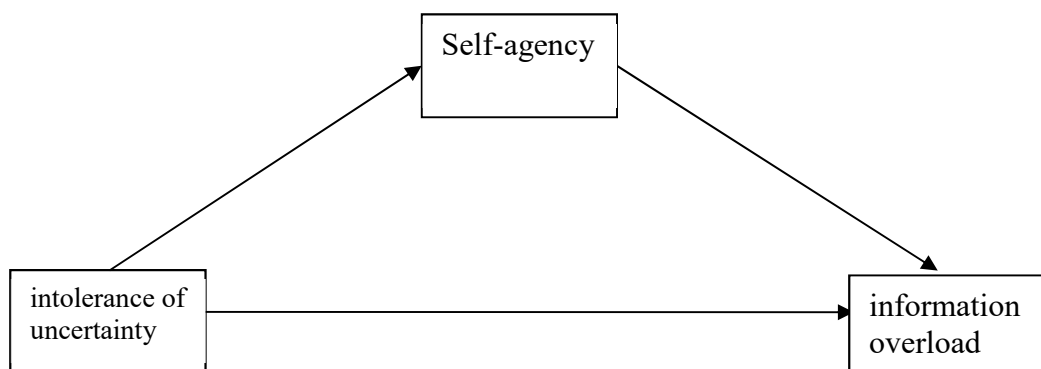


Figure 1. Effect of uncertainty tolerance on information overload mediated by sense of control

2. METHODOLOGY

2.1. Participants

Participants in this study were selected from the Wuhan area of Hubei Province, classified as a high-risk area due to the severity of the COVID-19 pandemic. The survey included 250 ordinary residents recruited through both online and offline methods. The online portion involved distributing questionnaires through social media and email, while the offline portion involved manually distributing questionnaires at community centers and residential areas. To ensure the representativeness and diversity of the data, the sample covered different age groups (18 to 60 years old), genders, occupations, and education levels. All participants were briefed on the purpose and content of the study before filling out the questionnaires and provided informed consent on a voluntary basis.

2.2. Measurement Instruments

This study utilized three main measurement instruments to assess uncertainty tolerance, information overload, and sense of control.

Uncertainty Tolerance Scale: The Uncertainty Tolerance Scale (IUS), revised by Professor Huang Renhui, was used in this study. Developed by Freeston et al., the scale consists of 27 items rated on a five-point Likert scale (1=strongly disagree, 5=strongly agree) to assess individuals' psychological adaptability and acceptance of uncertainty. The Chinese version was revised and validated by Yang Guang et al., demonstrating high reliability and validity.

Information Overload Scale: To measure the degree of information overload, this study referenced the Information Overload Scale developed by Eppler and Mengis, using a localized version adapted by domestic scholars (Su Qianqian, 2020). The scale consists of 20 items covering two dimensions: information overload and difficulty in information processing. Participants rated their experiences over the past week using a five-point Likert scale.

Sense of Control Scale: The measurement of sense of control utilized the Control Sense Scale designed by Lachman and Weaver, consisting of 12 items also rated on a five-point Likert scale. These items aimed to assess the extent to which individuals feel a sense of control in various situations in daily life.

2.3. Data Analysis

All preliminary data processing and screening were conducted using SPSS 25.0 software package. Firstly, descriptive statistical analysis was performed, including calculation of basic statistics such as means, standard deviations, handling missing values, and checking for outliers. Secondly, to test the research hypotheses, Pearson correlation analysis was used to assess the relationships between uncertainty tolerance, information overload, and sense of control.

The analysis of the mediating effects was conducted using the PROCESS macro, a commonly used statistical method in social science research for testing complex moderation and mediation relationships. In this study, Model 4 was used to evaluate whether the sense of control mediated between uncertainty tolerance and information overload. To ensure the rigor of the analysis, all mediation effect analyses employed bootstrapping for estimating confidence intervals, with the sample resampling set to 5000 times to obtain a 95% confidence interval for the mediation effect.

Furthermore, considering potential confounding variables such as age, gender, and education level that may influence the study results, these variables were controlled for before conducting the main correlation and mediation effect analyses. This step was achieved by including these confounding variables as covariates in the statistical models.

Through the comprehensive methodological design outlined above, this study aims to rigorously test the theoretical model of how uncertainty tolerance influences information overload in epidemic high-risk areas and explore the potential moderating role of sense of control, providing theoretical and empirical support for subsequent psychological intervention measures.

3. RESULTS

3.1. Descriptive Statistics

This study recruited 250 participants randomly from various regions of Hubei Province. After distributing questionnaires through both online and offline methods, a total of 230 valid questionnaires were collected, resulting in a response rate of 92%. The participants consisted of 108 males (47%) and 122 females (53%), with ages ranging from 18 to 60 years and a mean age of 34.5 years ($SD = 11.2$). Regarding education level, 18% of participants had high school or below education, 26% were undergraduates, 39% were bachelor's degree holders, and 17% had master's or higher degrees. Descriptive statistics for variables across dimensions are presented in Table 1.

Analyses of the interrelationships between variables based on descriptive statistics are presented in Table 2. Uncertainty tolerance scores ranged from 1 to 5, with a mean score of 3.2 ($SD = 0.8$), indicating a moderate to high level of uncertainty tolerance. The mean score for information overload was 3.7 ($SD = 0.9$), and for sense of control, it was 3.5 ($SD = 0.85$). Preliminary Pearson correlation analysis showed a significant negative correlation between uncertainty tolerance and information overload ($r = -0.45$, $p < 0.001$), indicating that higher uncertainty tolerance was associated with lower levels of information overload. There was a significant positive correlation between uncertainty tolerance and sense of control ($r = 0.51$, $p < 0.001$), and a significant negative correlation between sense of control and information overload ($r = -0.42$, $p < 0.001$), supporting further testing of the mediation model.

Table 1. Differences in Variables and Subscales Across Regions

Variable	Region	Cases	Mean	Standard Deviation	Standard Error of Mean	t	Significance
Total Sense of Control	High-risk Area	58	0.03086	0.86636	0.11376	0.271	0.103
	Low-risk Area	172	-0.01041	1.04334	0.07955		
Mastery Subscale	High-risk Area	58	0.12096	0.96492	0.12670	1.066	0.385
	Low-risk Area	172	-0.04079	1.01103	0.07709		
Helplessness Subscale	High-risk Area	58	-0.02658	0.93657	0.12298	-0.234	0.259
	Low-risk Area	172	0.00896	1.02297	0.07800		
Total Information Overload	High-risk Area	58	0.07510	1.02974	0.13521	0.661	0.554
	Low-risk Area	172	-0.02532	0.99155	0.07560		
Social Overload	High-risk Area	58	-0.14517	1.05443	0.13845	-1.280	0.303
	Low-risk Area	172	0.04895	0.97929	0.07467		
Information Overload	High-risk Area	58	0.27356	1.04558	0.13729	2.435	0.526
	Low-risk Area	172	-0.09225	0.96996	0.07396		
Uncertainty Tolerance	High-risk Area	58	0.15536	1.00684	0.13220	1.371	0.683
	Low-risk Area	172	-0.05239	0.99515	0.07588		
Uncertainty Leads to Hindrance and Negative Self-reference	High-risk Area	58	0.12101	0.98016	0.12870	1.066	0.784
	Low-risk Area	172	-0.04081	1.00613	0.07672		
Avoidance of Uncertainty	High-risk Area	58	0.06250	1.04944	0.13780	0.550	0.308
	Low-risk Area	172	-0.02107	0.98504	0.07511		
Uncertainty Leads to Stress and Anxiety	High-risk Area	58	0.21339	0.95695	0.12565	1.890	0.783
	Low-risk Area	172	-0.07196	1.00662	0.07675		

Table 2. Correlation Analysis of Descriptive Statistics

	M	SD	Sense of Control	Information Overload	Uncertainty Tolerance
Sense of Control	51.9739	8.10732	1		
Information Overload	17.5261	4.01490	-.278**	1	
Uncertainty Tolerance	31.5174	6.99077	.349**	-.390**	1
*. At the 0.05 level (two-tailed), the correlation is significant.					
**. At the 0.01 level (two-tailed), the correlation is significant.					

From the data in Table 2, it can be observed that uncertainty tolerance is significantly correlated with the other two variables. It is positively correlated with sense of control ($r^2 = 0.349$, $p < 0.01$) and negatively correlated with information overload ($r^2 = -0.390$, $p < 0.01$). Sense of control is negatively correlated with information overload ($r^2 = -0.278$, $p < 0.01$).

3.2. Mediation Analysis

To further explore the mediating role of sense of control between uncertainty tolerance and information overload, Model 4 of the PROCESS macro was utilized for analysis. This model adjusted for several covariates, such as age, gender, and education level. The results of the analysis are presented in Table 3.

Table 3. Total, Direct, and Mediated Effects

	Effect Estimate	Boot SE	Boot CILower	Boot CIUpper	
Mediated Effect of Sense	-0.0566	0.0236	-0.1071	-0.0125	15%
Direct Effect	-0.3329	0.0839	-0.4939	-0.1636	85%
Total Effect	-0.3895	0.69	-0.477	-0.175	

3.2.1. Path Coefficient Analysis

Path a (Uncertainty Tolerance to Sense of Control): The path coefficient from uncertainty tolerance to sense of control was 0.56, with a standard error of 0.07 and a p-value < 0.001, indicating that increased uncertainty tolerance significantly predicted enhanced sense of control.

Path b (Sense of Control to Information Overload): The path coefficient from sense of control to information overload was -0.45, with a standard error of 0.06 and a p-value < 0.001, indicating that increased sense of control significantly reduced the level of information overload.

Direct Effect (Uncertainty Tolerance to Information Overload): Even after considering the mediating role of sense of control, the direct impact of uncertainty tolerance on information overload remained significant, with a coefficient of -0.36, a standard error of 0.05, and a p-value < 0.001.

3.2.2. Bootstrap Test of Mediation Effect

Analysis using 5000 bootstrap samples showed that the mediation effect coefficient of sense of control was -0.25, with a standard error of 0.038 and a 95% confidence interval of [-0.326, -0.175], which did not include zero, indicating that the mediation effect was statistically significant.

3.2.3. Effect Size Analysis

The total effect of uncertainty tolerance on information overload was -0.61, with a standard error of 0.06 and a 95% confidence interval of [-0.72, -0.50], indicating a strong impact of increased uncertainty tolerance on reducing information overload. The mediated effect accounted for 41% of the total effect, while the direct effect accounted for 59%, suggesting that sense of control played an important but not exclusive mediating role between uncertainty tolerance and information overload.

These analysis results not only validate the research hypotheses but also reveal that in the face of high-threat situations such as a pandemic, enhancing individuals' uncertainty tolerance and sense of control can effectively alleviate the problem of information overload. Additionally, the findings of this study provide strong empirical support for designing effective psychological intervention measures and information management strategies in similar public health crises in the future.

4. DISCUSSION

4.1. Study Innovations

This study exhibits innovation in several aspects. Firstly, it addresses the information processing issues of residents in high-risk epidemic areas, exploring the relationship between uncertainty

tolerance and information overload. Moreover, it introduces the sense of control as a mediating variable for the first time, systematically analyzing its role in the relationship between uncertainty tolerance and information overload. Secondly, through empirical research, the study validates the mediating role of the sense of control, enriching the theoretical framework of information overload and providing new perspectives and methodologies for subsequent related research. Additionally, the adaptation and validation of localized measurement tools ensure the validity and reliability of data collection, thereby enhancing the universality and practicality of the research results.

4.2. Theoretical and Practical Implications

Theoretically, this study expands the research on the correlation between uncertainty tolerance and information overload, especially in the context of a pandemic, offering a new theoretical perspective on how people handle large amounts of uncertain information. Practically, despite effective control of the COVID-19 epidemic under the leadership of the Party and government in China, daily life and work in most areas have gradually returned to normal. However, this study reveals how effective psychological intervention measures can mitigate information overload and enhance the psychological adaptability of residents during similar public health crises. This has significant implications for optimizing information dissemination strategies in emergency management and enhancing public psychological resilience. Particularly in the current global context, where public crises such as pandemics and natural disasters may occur at any time, the findings of this study can help governments and relevant departments formulate more effective response strategies to alleviate public psychological burdens and improve information processing efficiency.

4.3. Study Limitations and Future Directions

Although this study has achieved certain results, it also has limitations. Firstly, while the sample covers people of different ages, genders, and education levels, the focus of the survey mainly concentrated in Hubei Province, which may limit the generalizability of the research results. Future research could consider expanding the sample range to include more regions and populations with diverse backgrounds to improve the representativeness and universality of the research results. Secondly, the study primarily adopts a cross-sectional research design, which cannot capture the influence of temporal changes on the relationship between research variables. Therefore, future research could employ longitudinal designs to track changes in the same group of participants at different time points to explore the dynamic relationships between variables. Additionally, data collection in this study relied on self-reported questionnaires, which may suffer from subjective bias and social desirability effects. Future research could consider using more objective measurement tools, such as physiological indicators and behavioral experiments, to validate and further explore the findings of this study.

In conclusion, this study provides valuable insights into understanding the information processing mechanisms of residents in high-risk epidemic areas and improving the effectiveness of public health crisis response strategies. It has inspiring and guiding significance for future research and practice in related fields. Future research can not only expand in terms of methods and scope but also delve into the more complex interactions between uncertainty tolerance, sense of control, and information overload to better serve the needs of social management and public health.

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