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How catastrophic misinterpretation triggers health anxiety: health information seeking as a mediator in rural China's information-poor populations

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Abstract

Introduction. Amid the post-pandemic surge in health anxiety, this study investigates how catastrophic misinterpretation exacerbates health anxiety in Chinese rural populations through maladaptive health information seeking, under the boundary conditions of metacognitive beliefs and health risk perception.

Method. Employing a cross-sectional survey design, it collected data from 150 rural residents in Northern China. All were from townships characterized by significant information poverty.

Analysis. Structural equation modeling assessed the direct effect, the mediating role, and the moderated mediation within the proposed model.

Results. First, catastrophic misinterpretation exhibited a strong direct effect on health anxiety. Second, health information seeking behaviour mediated this relationship. Third, metacognitive factors demonstrated complex moderating influences: positive beliefs about worry weakened the association between catastrophic misinterpretation and information seeking, whereas perceived uncontrollability of worry intensified the impact of information seeking on anxiety. Contrary to expectations, heightened health risk perception reduced the anxiety-provoking effects of information seeking, suggesting a protective regulatory function in information-poor environments.

Conclusion. This study proposes the information poverty-amplified anxiety view, bridging health anxiety and information behaviour theory by positioning structural information deficits as catalytic contextual factors. It uniquely establishes maladaptive health information seeking behaviour as a critical mediator that transforms catastrophic misinterpretations into sustained health anxiety within information-poor contexts. It also identifies the paradoxical protective function of health risk perception in populations with low information literacy.

Introduction

Against the backdrop of China's vigorous implementation of the 'Healthy China 2030' national strategy, which emphasizes the dual improvement of physical and mental health across all population groups (State Council, 2016), public health awareness and healthcare demands have surged significantly. This top-down health promotion initiative has paradoxically coincided with rising health anxiety among citizens, a phenomenon markedly exacerbated by the COVID-19 pandemic and its protracted aftermath, as evidenced by longitudinal studies on population mental health. Longitudinal data from the National Health Insight Reports (National Health Commission, 2024) demonstrate pervasive health anxiety among the public, with the Dr. Clove's Data Research Institute (2023) survey indicating that 98% of respondents experienced health complaints within the past year.

Health anxiety manifests through heightened sensitivity to minor somatic sensations. This amplified bodily awareness frequently precipitates catastrophic misinterpretation of normal physiological changes and subsequently triggers compulsive health information-seeking behaviour. Compulsive health information seeking behaviour drives query escalation that precipitates information overload and confirmation bias, forming self-perpetuating cycles that exacerbate health anxiety through negative reinforcement (Powell et al., 2011). The health anxiety amplification mechanism exhibits pronounced socioeconomic disparities in China, with rural information-poor populations disproportionately affected due to intersecting structural and cognitive vulnerabilities. As a multidimensional deprivation phenomenon, information poverty in these rural communities manifests through structurally deficient health information literacy and impaired health knowledge assimilation, constrained access to credible health platforms, creating systematic disadvantages in navigating health information ecosystems (Luo and Cui, 2013). As reflected in national statistics, rural China's information poverty manifests through three measurable gaps: a 34.2-percentage-point disparity in digital health information access (CNNIC, 2024), nearly 10-point lower health literacy rates (Chinese Center for Health Education, 2023). Compromised information evaluation capacity, with rural residents disproportionately vulnerable to online misinformation (Yan & Schroeder, 2025) and low health information literacy concentrated among less educated, older rural populations (Li & Chen, 2023). Their compromised capacity to filter, evaluate, and contextualize health information establishes a pathological cascade: catastrophic misinterpretation of normal or ambiguous somatic sensations triggers a self-reinforcing cycle of compulsive reassurance-seeking that deepens anxiety, particularly in rural, information-poor communities requiring targeted interventions.

While existing psychological research has established health anxiety within cognitive-behavioural frameworks, critical gaps persist at the intersection of information behaviour and socio-cognitive mechanisms, particularly for marginalized populations. First, prior studies (Agarwal et al. 2023; Deng et al., 2023; Tang et al., 2009) predominantly focus on clinical or urban samples, neglecting the unique vulnerabilities of rural information-poor groups, whose health anxiety may be compounded by structural information poverty. Second, although health information seeking behaviour is recognized as a mediator, its role in sustaining (rather than alleviating) anxiety cycles remains underexplored in contexts of information poverty. Third, the interaction between metacognitive beliefs (e.g., positive worry beliefs) and maladaptive information behaviour lacks empirical validation in Indigenous settings. This study addresses these gaps by examining the following:

RQ1: The information-behavioural pathway: How does catastrophic misinterpretation trigger maladaptive health information seeking behaviour, and how do these behaviours mediate its impact on health anxiety in Chinese rural information-poor populations?

RQ2: The metacognitive-informational boundary conditions: Under what cognitive conditions—specifically, when individuals hold strong positive beliefs about worry, perceive worries as

uncontrollable, or have elevated health risk perceptions—does this mediation pathway become particularly pronounced?

By integrating cognitive psychology with information behaviour theories, this study extends the health anxiety models by incorporating information poverty as a contextual amplifier of catastrophic cognition and theorizing maladaptive information seeking behaviour as a critical mediator. It advances information behaviour theory by delineating how metacognitive beliefs interact with information processing in anxiety formation. It also informs global interventions for developing regions by highlighting how structural information disparities perpetuate health anxiety cycles—a framework applicable to other information-poor populations worldwide.

Literature review and research hypotheses

Catastrophic misinterpretation is a psychological mechanism wherein individuals misinterpret bodily sensations and emotional responses triggered by internal or external stimuli as indicative of health danger (Austin & Richards, 2001; Clark, 1986). Affected individuals tend to exaggerate and misattribute ordinary bodily sensations as signs of serious illness, thereby exacerbating health-related anxiety.

The centrality of threat interpretation in anxiety experiences is well-documented. Salkovskis and Warwick's (1986) well-known cognitive-behavioural model of health anxiety posits that catastrophic misinterpretation plays a pivotal role in both the development and perpetuation of health anxiety. Supporting this, Hadjistavropoulos et al. (2012) identified core maladaptive cognitions—such as the perceived likelihood of illness, the perceived awfulness of illness, the perceived inability to cope, and the perceived inadequacy of medical services—as uniquely associated with health anxiety. Notably, most of these cognitions are intrinsically linked to catastrophic misinterpretation. Further empirical evidence by Weck et al. (2012) found that individuals with heightened health anxiety exhibit a stronger tendency to misinterpret bodily symptoms as indicators of catastrophic illness. Meta-analytic research by Ohst and Tuschen-Caffier (2018) corroborates these findings, demonstrating medium to large effect sizes in catastrophic misinterpretation between patients with panic disorder and both healthy controls and individuals with other anxiety disorders.

In the information society, developmental imbalances and inadequacies manifest as information poverty. Childer (1975) defined this concept as a state of impoverishment stemming from inadequate or inappropriate information practices. The formation of information poverty is not attributable to a single cause; rather, information-poor populations typically emerge from groups disadvantaged in terms of geographic distribution, economic standing, and socio-cultural resources (Chatman, 1996). Information poverty in rural China is operationally defined in this study using the information economy index. Following Zheng and Song (2019), areas with an index below 0.3—such as parts of Hengshui, Hebei—are classified as Level IV information-poor regions.

Crucially, Chinese rural information-poor populations may be particularly susceptible to catastrophic misinterpretation due to low critical information literacy and limited access to accurate health information (Zhang & Yang, 2023). Health information literacy evolved from the concept of 'health literacy' in US Healthy People 2030 (U.S. Department of Health and Human Services, 2025). It is defined as 'the ability and skills needed for identifying health information needs, accessing health relevant information from reliable health resources, and using health information for making sound health decisions for living healthier lives' (Kaur & Kaur, 2021). The physical, personal, and social barriers to health information access exacerbate both the prevalence and persistence of catastrophic misinterpretations. Such sense-unmaking, in turn, directly contributes to heightened health anxiety by preventing individuals from correcting maladaptive health beliefs.

Based on the above theoretical and empirical foundations, we propose:

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H1: Catastrophic misinterpretation positively predicts health anxiety in Chinese rural information-poor populations.

H1a: The severity of catastrophic misinterpretation positively predicts health anxiety in this population.

H1b: The duration of catastrophic misinterpretation positively predicts health anxiety in this population.

Catastrophic misinterpretation serves as a maintenance mechanism for health-related anxiety over time (Gautreau et al., 2015). This sustained anxiety state establishes a vicious cycle by reinforcing distorted interpretations of bodily signals. Within this maladaptive cognitive loop, health-anxious individuals frequently engage in health information seeking behaviour, which Johnson (1997) defined as 'purposive acquisition of information from selected information carriers'. However, empirical evidence suggests that this coping strategy often proves counterproductive. Existing research consistently demonstrates the counterproductive effects of health information seeking behaviour. Multiple studies (Baumgartner & Hartmann, 2011; White & Horvitz, 2009) confirm that health information seeking behaviour elevates health anxiety levels, with online health seeking proving particularly ineffective at anxiety relief and often exacerbating distress. Muse et al. (2012) established a dose-response relationship showing that more frequent online health information seeking correlated with both prolonged duration and increased severity of health anxiety symptoms.

For Chinese rural information-poor populations, this mediation mechanism may be particularly pronounced due to several contextual factors (Mou & Xu, 2020; Zhang & Yang, 2023): limited access to authoritative health information sources increases reliance on unverified online content; low health literacy reduces the ability to evaluate obtained information critically; and geographic isolation prolongs the anxiety- health information seeking behaviour feedback loop by delaying professional consultation opportunities. Building on this evidence, we propose:

H2: Health information seeking behaviour mediates the positive relationship between catastrophic misinterpretation and health anxiety in Chinese rural information-poor populations.

Metacognition refers to higher-order cognitive activity that involves monitoring and regulating cognitive processes (Jausovec, 2018). Two specific metacognitions that may interact with health anxiety are positive beliefs about worry and perceived uncontrollability of worry (Wells & King, 2006; Wells & Matthews, 1994). Positive beliefs about worry refer to the conviction that worry and anxiety can serve as an effective strategy for dealing with perceived problems. For example, 'worrying helps me find solutions to problems' or 'worrying prevents bad things'. On the contrary, perceived uncontrollability of worry means negative metacognitive beliefs concerning the uncontrollable and dangerous worry, like 'worrying makes me mad'. When it comes to health anxiety, it is thought to develop from maladaptive metacognitive regulatory mechanisms. Ongoing negative thoughts about health-related dangers and dysfunctional coping patterns mark such regulation. These, in turn, strengthen such negative thoughts through what is known as the cognitive-attentional syndrome. Empirical evidence (Solem, 2010) robustly supports this framework. Metacognitive beliefs directly influence health anxiety severity. Catastrophic misinterpretation—a core feature of health anxiety—is exacerbated by negative metacognitive beliefs and paradoxically maintained by positive beliefs (Bailey & Wells, 2015). Luo et al. (2018) demonstrated that positive metacognitive beliefs buffer the impact of catastrophic interpretations on health anxiety. These metacognitive processes bias health information seeking behaviour. For example, Meppelink et al. (2019)'s study on confirmation bias in health information-seeking found that individuals prioritize information confirming their existing

perceptions, leading to misinterpretation. Results showed a tendency to select belief-consistent over belief-inconsistent information, with the former perceived as more credible, helpful, and convincing—exhibiting both biased information selection and biased perceptions of message convincingness. The above evidence logically predicts that:

H3: For Chinese rural information-poor populations, positive beliefs about worry moderate the mediating effect of information-seeking behaviour in the relationship between catastrophic misinterpretation and health anxiety.

H4: For Chinese rural information-poor populations, perceived uncontrollability of worry weakens this mediation.

Health risk perception is rooted in Slovic et al.'s (1982) risk concept, which is 'a multiplicative combination of the probability of a hazardous event occurring and the severity of the resulting negative consequences'. Therefore, health risk perception refers to an individual's subjective appraisal of both (a) perceived susceptibility to health threats and (b) perceived severity of potential consequences. This subjective appraisal process renders the perception distinct from objective risk assessment. Heightened risk perception is typically understood to amplify threat-related cognitions and maladaptive behavioural responses.

Contrary to the traditional "amplifier" perspective, we propose a protective role of health risk perception among Chinese rural information-poor populations. Rather than strengthening the mediation pathway, heightened health risk perception appears to attenuate the problematic relationship between catastrophic misinterpretation and maladaptive information behaviour. Specifically, in the first-stage attenuation, elevated health risk perception weakens the link between catastrophic misinterpretation and compulsive information seeking, while catastrophic thinkers typically engage in excessive health information seeking, this effect may become non-significant at high health risk perception levels. In the second-stage buffering, high health risk perception reduces the anxiety-provoking impact of information seeking behaviour.

This protective effect may stem from the dual nature of health risk perception. The cognitive component helps individuals recognize the futility of excessive information seeking in resource-limited environments. The affective component motivates more adaptive coping strategies beyond information seeking. In information-poor contexts, heightened health risk perception appears to trigger a protective 'behavioural avoidance' rather than the predicted amplification effect. It promotes more selective information engagement. This manifests in three ways: reduced emotional dependence on unverified information sources, increased scepticism toward anecdotal health information, and heightened awareness of information access limitations. Thus, we put forward H5:

H5: For Chinese rural information-poor populations, health risk perception positively moderates the mediating effect of information-seeking behaviour in the relationship between catastrophic misinterpretation and health anxiety.

Our research model is illustrated in Figure 1.

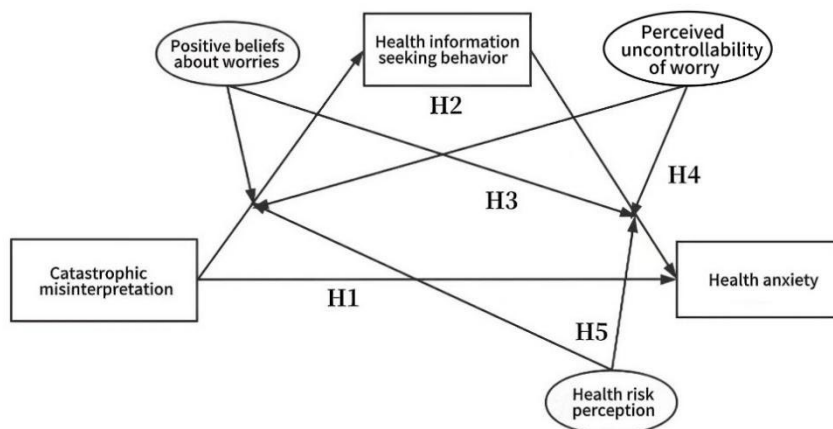


Figure 1. Association model of catastrophic misinterpretation and health anxiety

Questionnaire survey and data collection

Questionnaire design

This study utilized a structured questionnaire design. The questionnaire (see Table 1) utilized scales adapted from established Chinese and international instruments, including the Chinese Short Version Health Anxiety Scale and the Cognitions About Body and Health Questionnaire. The questionnaire comprises five parts: demographic characteristics, catastrophic misinterpretation, health information seeking behaviour, metacognitive beliefs, and health risk perception. All psychological constructs were measured using validated 5-point Likert scales, except for the demographic section, which employed categorical response formats.

The study employed rigorously validated measurement instruments through careful cross-cultural adaptation. All scales underwent standardized forward-backward translation and pilot testing, confirming adequate reliability (all α s > .75), ensuring cultural and psychometric appropriateness for the target population.

Research variables	Sources
Health anxiety	Chinese Short Version Health Anxiety Scale (Yuan & Zhang, 2013)
Catastrophic misinterpretation	The Cognitions About Body and Health Questionnaire (CABAH) (Rief et al., 1998)
Health Information Seeking Behaviour	Search frequency index (Baumgartner & Hartmann, 2011)
Metacognitive beliefs	The Chinese version of the Metacognitive Questionnaire (MCQ-30) (Fan et al., 2017)
Health risk perception	The four-dimensional framework of likelihood, severity, controllability, and familiarity proposed (Lan, 2019)

Table 1. Scale Development and Questionnaire Design Reference

Ethical considerations

All procedures performed in this study involving human participants were in accordance with the ethical standards of the Ethics Committee of the university where the first author worked, and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual adult participants included in the study. Each participant received a compensation of CNY 50 (approximately 7 USD).

Data collection

The data collection was conducted from February 25 to March 2, 2023 across four representative townships (Wugong, Liuchu, Guanting, and Yaozhuang) in Hengshui City, Hebei Province - a region characterized by significant information poverty (Information Economy Index = 0.29, classified as Tier-4 information poverty zone) (Zheng & Song, 2019). This site selection ensured the examination of populations with constrained health information access. Participants completed surveys through dual modalities: digital platform (QR code access) and traditional paper-based format. From the initial pool of 411 collected responses, rigorous quality control procedures were implemented. This yielded 150 valid questionnaires (36.5% validity rate) with a balanced gender distribution (1:1 ratio).

The study population comprised 77 males (51.3%) and 73 females (48.7%), demonstrating nearly equivalent gender representation. Age distribution followed a pyramidal pattern with a small youth cohort (12 participants, 8%), a moderate middle-aged group (31 participants, 20.7%), and a predominant elderly population (107 participants, 71.3%). This demographic composition reflects the aging population trends characteristic of rural Chinese communities while maintaining gender parity crucial for controlling sex-based confounding variables in health behaviour research. The substantial elderly representation (over two-thirds of respondents) is particularly noteworthy for health information behaviour research, given this group's documented challenges with health literacy and information poverty. The balanced gender ratio enhances the generalizability of findings across sexes, while the age distribution provides sufficient subsamples for potential stratified analyses.

Reliability and validity analysis

In order to assess the internal consistency of the scales of the questionnaire, we calculated Cronbach's alpha coefficients using SPSS. The entire scale demonstrated outstanding reliability, with a Cronbach's

alpha value of 0.972, which surpassed the commonly accepted threshold of 0.70. At the subscale level, all measures maintained robust internal consistency, with reliability coefficients consistently above 0.80, indicating highly stable measurement properties throughout the instrument.

Construct validity was examined using exploratory factor analysis with Kaiser-Meyer-Olkin and Bartlett's test of sphericity. The Kaiser-Meyer-Olkin value (0.827) indicated adequate sampling adequacy, while Bartlett's test confirmed the factorability of the correlation matrix. These results support the structural validity of the scales in measuring the intended constructs.

Common method deviation assessment

To avoid the problem of common method deviation caused by the self-report nature of data sources, we conducted Harman's single-factor test to evaluate potential common method variance. The unrotated factor analysis showed that the first factor accounted for only 37.871% of the variance, which is below the 40% threshold, suggesting that common method variance did not significantly distort the findings.

Correlation analysis

As presented in Table 2, the Pearson correlation analysis revealed statistically significant relationships among the key variables ($p < 0.01$), supporting the feasibility of further regression and mediation analyses.

	1	2	3	4	5	6
1.CM	1					
2.HISB	0.489**	1				
3.HA	0.727*	0.483**	1			
PBW	-0.413	-0.294**	-0.585**	1		
5.PUW	0.471	0.418**	0.697**	-0.708**	1	
6.HRP	-0.647**	-0.382**	-0.755**	0.733**	-0.798**	1

Note. CM = Catastrophic misinterpretation; HISB = Health information seeking behaviour; HA = Health Anxiety; PBW = Positive beliefs about worry; PUW = Perceived uncontrollability of worry; HRP = Health risk perception.

Table 2. Correlation analysis

Research results

The effect of catastrophic misinterpretation on health anxiety

To examine the predictive role of catastrophic misinterpretation on health anxiety, we conducted hierarchical regression analyses with two models (Aiken & West, 1991). The strength of this method lies in its ability to estimate the unique effects associated with each independent variable. This method enables unique partitioning of the total variance of the dependent variable accounted for by correlated independent variables (Wang & Guo, 2015). Model 1 (Control Model) included demographic covariates (gender, age, educational background). Model 2 (Predictive Model) added catastrophic misinterpretation as an independent variable. The results are shown in Table 3. As for Model 1 (Demographics Only), the control variables collectively explained 1.6% of the variance in health anxiety ($R^2 = 0.01$), but this model was not statistically significant ($F = 0.808$, $p > 0.05$). None of the demographic variables significantly predicted health anxiety. As for Model 2 (Adding Catastrophic Misinterpretation), the inclusion of catastrophic misinterpretation significantly improved model

fit ($\Delta R^2 = 0.525$, $F\text{-change} = 165.71$, $p < 0.001$), accounting for 54.1% of the variance in health anxiety ($R^2 = 0.541$, Adjusted $R^2 = 0.528$). catastrophic misinterpretation exhibited a strong positive effect on health anxiety ($B = 0.745$, $t = 12.873$, $p < 0.001$), indicating that higher levels of catastrophic misinterpretation predict greater health anxiety severity. These results support Hypothesis H1, confirming that is a robust predictor of health anxiety, with a substantial effect size.

Model 1		Model 2		
	Health anxiety			
	B	t	B	t
Constant	3.607	10.821***	0.988	3.229
Gender	-0.141	-1.067	-0.084	-0.922
Age	-0.135	-1.473	-0.083	-1.307
EB	0.045	0.435	0.130	1.818
CM			0.745	12.873***
R ²	0.016		0.541	
Adjusted R ²	0.000		0.528	
F	0.808		42.714***	

Note. CM = Catastrophic misinterpretation; EB = Educational background.

Table 3. Regression analysis results

To further investigate catastrophic misinterpretation's underlying mechanisms, we analysed its duration and severity as distinct predictors in a two-step hierarchical regression, as shown in Table 4. Model 1 examined the effect of catastrophic misinterpretation duration (controlling for demographics). Model 2 added catastrophic misinterpretation severity to assess incremental predictive power. In Model 1 (catastrophic misinterpretation duration only), catastrophic misinterpretation duration showed a significant but modest effect on health anxiety ($B = 0.202$, $t = 4.237$, $p < 0.001$), explaining 10.5% of the variance ($R^2 = 0.105$). This supports Hypothesis H1a, i.e., longer catastrophic misinterpretation duration is associated with elevated health anxiety. In Model 2 (adding catastrophic misinterpretation severity), catastrophic misinterpretation severity emerged as a stronger predictor ($B = 0.723$, $t = 11.427$, $p < 0.001$), increasing explained variance to 52.7% ($R^2 = 0.527$). catastrophic misinterpretation duration remained significant ($B = 0.202$, $p < 0.001$), but its effect was dwarfed by severity, supporting Hypothesis H1b. While both catastrophic misinterpretation duration and severity contribute to health anxiety, severity has a substantially larger impact, suggesting that interventions should prioritize mitigating exaggerated threat appraisals rather than merely addressing chronicity.

	Model 1		Model 2	
	Health anxiety			
	B	t	B	t
Constant	3.207	9.778	0.950	3.070**
Gender	-0.131	-1.049	-0.083	-0.915
Age	-0.140	-1.608	-0.080	-1.260
EB	0.041	0.417	0.134	1.868
DCM	0.202	4.327***	0.019	0.498
SCM			0.723	11.427***
R ²	0.129		0.543	
Adjusted R ²	0.105		0.527	
F	5.360***		34.236***	

Note. DCM = Duration of catastrophic misinterpretation; EB = Educational background; SCM = Severity of catastrophic misinterpretation.

Table 4. Regression analysis results

The mediation effect test

We conducted the mediation effect test in three sequential phases (Hayes, 2012). First, we examined the baseline relationship between catastrophic misinterpretation and health anxiety. This step establishes the existence of a significant effect to be mediated. Secondly, we tested (a) the association between catastrophic misinterpretation and the proposed mediator, and (b) the relationship between health information seeking behaviour and health anxiety while controlling for catastrophic misinterpretation. Thirdly, we employed a nonparametric bootstrapping approach with 5,000 resamples to generate bias-corrected confidence intervals for the indirect effect. It is a statistical method that randomly resamples the dataset with replacement to empirically approximate the sampling distribution, providing robust statistical evidence for mediation. The results are shown in Table 5.

The initial regression model (Model 1) demonstrated a highly significant total effect of catastrophic misinterpretation on health anxiety ($\beta = 0.745$, $t = 12.873$, $p < 0.001$), with catastrophic misinterpretation explaining a substantial 54.1% of the variance in health anxiety ($R^2 = 0.541$, $F(4,145) = 42.714$, $p < 0.001$). This large effect size (Cohen's $f^2=1.18$) suggests that individuals' tendencies toward catastrophic misinterpretation of bodily sensations strongly predict their levels of health anxiety. The demographic control variables collectively accounted for only 1.6% of the variance ($\Delta R^2 = 0.016$), with none reaching statistical significance (all $ps > 0.05$). Model 2 examined Path A (catastrophic misinterpretation $\rightarrow$ health information seeking behaviour) and revealed that catastrophic misinterpretation significantly predicted health information seeking behaviour ($\beta = 0.422$, $t = 6.474$, $p < 0.001$), accounting for 26.0% of the variance ($R^2 = 0.260$, $F(4,145) = 12.705$, $p < 0.001$). This medium-

to-large effect suggests that individuals with stronger tendencies towards catastrophic misinterpretation engage in more frequent health information seeking.

Model 3 examined Path B (health information seeking behaviour → health anxiety) and Path C (the direct effect of catastrophic misinterpretation). After controlling for catastrophic misinterpretation, health information seeking behaviour maintained a significant positive association with health anxiety ($\beta = 0.230$, $t = 2.809$, $p = 0.006$). The direct effect of catastrophic misinterpretation on health anxiety remained significant but was attenuated ($\beta = 0.660$ vs. original 0.745). The full model explained 56.5% of the variance in health anxiety ($R^2 = 0.565$, $F(5,144) = 37.373$, $p < 0.001$). The inclusion of health information seeking behaviour resulted in a statistically significant R^2 increase of 0.024 ($F(1,144) = 7.891$, $p = 0.006$).

To address limitations of traditional mediation tests (e.g., normality assumptions), we conducted a bias-corrected bootstrap analysis with 5,000 resamples. The results revealed a total effect of 0.745 (95% CI [0.631, 0.859]), a direct effect of 0.660 (95% CI [0.533, 0.787]), and an indirect effect of 0.085 (95% CI [0.011, 0.220]). It is shown in Table 6. The proportion of the total effect mediated by health information seeking behaviour was 11.41%, indicating partial mediation. This finding supports Hypothesis H2. It also suggests that while health information seeking behaviour explains a significant portion of the catastrophic misinterpretation-health anxiety relationship, catastrophic misinterpretation also influences health anxiety through other mechanisms not captured in this model.

	Model 1		Model 2		Model 3	
	Health anxiety		Health information seeking behaviour		Health anxiety	
	β	t	β	t	β	t
Constant	0.988	3.229**	2.489	7.231	0.484	1.387
Genders	-0.084	-0.922	-0.068	-0.664	-0.070	-0.788
Age	-0.083	-1.307	-0.054	-0.766	-0.072	-1.156
EB	0.130	0.071	-0.107	-1.336	0.152	2.159
CM	0.745	12.873***	0.422	6.474***	0.660	10.274***
HISB					0.230	2.809**
R	0.735		0.509		0.752	
R ²	0.541		0.260		0.565	
F	42.714***		12.705***		37.373***	

Note. CM = Catastrophic misinterpretation; EB = Educational background; HISB = Health information seeking behaviour.

Table 5. Multiple sequential regressions of the mediation effect

Effect relationship	Effect value	LLCI	ULCI	Effect proportion
Total effect	0.745	0.631	0.859	
Direct effect	0.660	0.533	0.787	88.59%
Indirect effect	0.085	0.011	0.220	11.41%

Table 6. Bootstrap mediation effect test results

Moderated mediation effects tests

The moderated mediation effect tests were conducted using Hayes' SPSS macro program. Controlling for gender and age, we used positive beliefs about worry, perceived uncontrollability of worry, and health risk perception as moderators. Model 58 (which assumes that both the first-stage and second-stage paths of the mediation model are moderated) was adopted for sequential testing, and the specific results are as follows.

The moderating role of positive beliefs about worry in mediation model

As shown in Table 7, Model 1 indicates that catastrophic misinterpretation can positively predict health information-seeking behaviour. The interaction term of catastrophic misinterpretation and positive beliefs about worry can negatively predict health information-seeking behaviour. Model 2 shows that health information seeking behaviour can positively predict health anxiety; both positive beliefs about worry and the interaction term of health information seeking behaviour and positive beliefs about worry can negatively predict health anxiety.

	Model 1		Model 2	
	Health information seeking behaviour		Health anxiety	
	β	t	β	t
Constant	0.206	0.769	2.974	15.001***
Genders	-0.034	-0.330	-0.026	-0.338
Age	-0.012	-0.164	-0.030	-0.554
EB	-0.097	-1.215	0.163	2.695*
CM	0.398	5.664***	0.524	8.973***
PBW	-0.022	-0.371	-0.193	-3.885***
CM $\times$ PBW	-0.111	-2.086*		
HISB			0.182	2.907**
HISB $\times$ PBW			-0.166	-3.345**
R	0.537		0.826	
R ²	0.289		0.683	
F	9.664***		43.671***	

Note. CM = Catastrophic misinterpretation; EB = Educational background; HISB = Health information seeking behaviour; PBW = Positive beliefs about worry.

Table 7. Bootstrap mediated effects test results with moderation

Further simple slope analysis is presented in Figures 2 and 3. Figure 2 shows that for participants with low levels of positive beliefs about worry (M-1SD), catastrophic misinterpretation significantly and positively predicts health information seeking behaviour (effect = 0.496, 95%CI = (0.324, 0.669), $p < 0.001$); for participants with high levels of positive beliefs about worry, catastrophic misinterpretation also significantly and positively predicts health information seeking behaviour (effect = 0.300, 95%CI = (0.138, 0.461), $p < 0.001$), but the predictive effect is weaker. This indicates that as the level of positive beliefs about worry among information-poor individuals increases, the predictive effect of catastrophic misinterpretation on health information-seeking behaviour gradually decreases.

As shown in Figure 3, for participants with low levels of positive beliefs about worry, health information-seeking behaviour significantly predicts health anxiety (effect = 0.329, 95%CI = (0.172, 0.487), $p < 0.001$). In contrast, for participants with high levels of positive beliefs about worry, health information-seeking behaviour does not significantly predict health anxiety (effect = 0.034, 95%CI = (-0.110, 0.179), $p = 0.638$). It can be seen that health information seeking behaviour plays a stronger role in exacerbating health anxiety when the level of positive beliefs about worry is low.

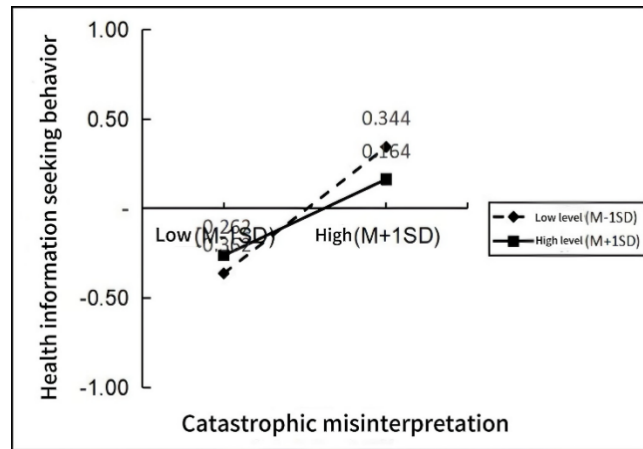


Figure 2. Moderating effect of positive beliefs about worry on the first stage of mediation

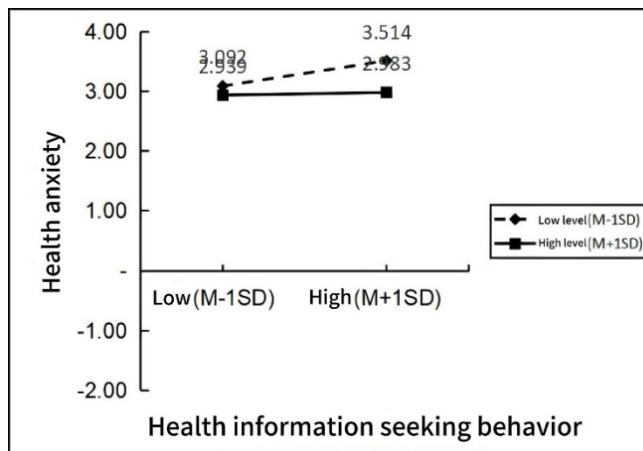


Figure 3. Moderating effect of positive beliefs about worry on the second stage of mediation

Table 8 presents the mediation effect sizes and their 95% bootstrap confidence intervals for health information seeking behaviour in the relationship between catastrophic misinterpretation and health anxiety. These effects are reported at three levels of positive beliefs about worry: mean minus one standard deviation (M-1SD), mean (M), and mean plus one standard deviation (M+1SD) (Edwards & Lambert, 2007). Therefore, the moderating effect of positive beliefs about worry varies across different levels. Hypothesis H3 is supported.

	Positive beliefs about worry	Effect value	Boot Standard error	LLCI	ULCI
The mediating role of positive beliefs about worry	M-1SD	0.163	0.051	0.078	0.274
	M	0.072	0.036	0.016	0.155
	M+1SD	0.010	0.029	-0.026	0.089

Table 8. Mediating effects of positive beliefs about worry at three levels

Moderating role of perceived uncontrollability of worry in the mediation model

As shown in Table 9, Model 1 indicates that catastrophic misinterpretation can significantly predict health information-seeking behaviour, whereas the perceived uncontrollability of worry and the interaction term of catastrophic misinterpretation and perceived uncontrollability of worry do not predict health information seeking behaviour. Model 2 shows that health information seeking behaviour, perceived uncontrollability of worry, and the interaction term of health information seeking behaviour and perceived uncontrollability of worry can positively predict health anxiety.

	Model 1		Model 2	
	Health information seeking behaviour		Health anxiety	
	β	t	β	t
Constant	0.156	0.587	2.893	15.358***
Genders	-0.014	-0.141	0.011	0.148
Age	-0.011	-0.158	-0.029	-0.578
EB	-0.083	-1.603	0.179	3.159
CM	0.336	4.724***	0.485	8.756***
PUW	0.125	1.938	0.311	5.724***
CM× PUW	0.091	1.768		
HISB			0.124	1.998*
HISB×PUW			0.110	2.252*
R	0.559		0.849	
R ²	0.313		0.721	
F	10.844***		52.493***	

Note. CM = Catastrophic misinterpretation; EB = Educational background; HISB = Health information seeking behaviour; PUW = Perceived uncontrollability of worry.

Table 9. Bootstrap mediated effects test results with moderation

Further simple slope analysis is presented in Figures 4 and 5. Figure 4 shows that for participants with high levels of perceived uncontrollability of worry, catastrophic misinterpretation significantly and positively predicts health information-seeking behaviour (effect = 0.413, 95%CI = (0.245, 0.582), $p < 0.001$). For participants with low levels of perceived uncontrollability of worry, catastrophic misinterpretation also significantly predicts health information-seeking behaviour (effect = 0.258, 95%CI = (0.096, 0.420), $p < 0.001$), but the predictive effect is weaker. This suggests that as the level of perceived uncontrollability of worry among information-poor individuals increases, the predictive effect of catastrophic misinterpretation on health information-seeking behaviour becomes increasingly stronger.

As shown in Figure 5, for participants with low levels of perceived uncontrollability of worry, health information seeking behaviour does not have a significant positive predictive effect on health anxiety (effect = 0.030, 95%CI = (-0.098, 0.158), $p = 0.642$); for participants with high levels of perceived uncontrollability of worry, health information seeking behaviour significantly predicts health anxiety (effect = 0.218, 95%CI = (0.052, 0.384), $p < 0.05$). It can be seen that health information seeking behaviour plays a stronger role in exacerbating health anxiety when the level of perceived uncontrollability of worry is high.

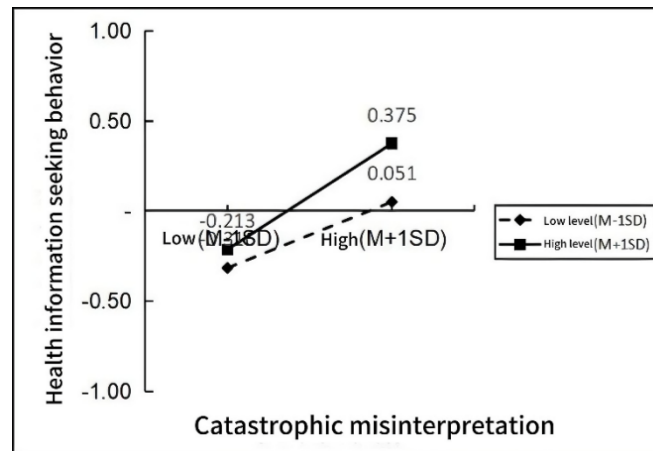


Figure 4. Moderating effect of perceived uncontrollability of worry on the first stage of mediation

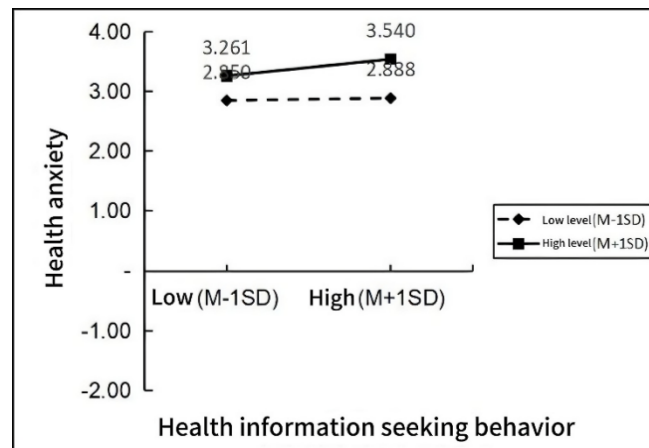


Figure 5. Moderating effect of perceived uncontrollability of worry on the second stage of mediation

Table 10 presents the mediation effect sizes and their 95% bootstrap confidence intervals for health information seeking behaviour in the relationship between catastrophic misinterpretation and health anxiety at three levels of perceived uncontrollability of worry: M-1SD, M, and M+1SD (Edwards & Lambert, 2007). In summary, the moderating effect of perceived uncontrollability of worry varies across different levels, and Hypothesis H4 is supported.

	Perceived uncontrollability of worry	Effect value	Boot Standard error	LLCI	ULCI
The mediating role of perceived uncontrollability of worry	M-1SD	0.008	0.023	-0.017	0.074
	M	0.042	0.029	0.003	0.111
	M+1SD	0.090	0.039	0.025	0.177

Table 10. Mediating effect of perceived uncontrollability of worry at three levels

Moderated mediation test: The role of health risk perception

We conducted a comprehensive moderated mediation analysis (Hayes, 2013) to examine whether health risk perception conditions the indirect relationship between catastrophic misinterpretation and health anxiety through health information seeking, while controlling for gender and age.

As presented in Table 11, Model 1 revealed three important findings regarding health information seeking behaviour: (1) catastrophic misinterpretation showed a strong positive predictive effect ($\beta = 0.388$, $t = 5.031$, $p < 0.001$), (2) health risk perception by itself did not significantly predict health information seeking behaviour ($\beta = 0.006$, $t = 0.087$, $p > 0.05$), while (3) the interaction between catastrophic misinterpretation and health risk perception negatively predicted health information seeking behaviour ($\beta = -0.300$, $t = -5.583$, $p < 0.001$). This pattern suggests that the relationship between catastrophic misinterpretation and health information seeking behaviour depends on individuals' levels of health risk perception.

Model 2 demonstrated that in predicting health anxiety: (1) both catastrophic misinterpretation ($\beta = 0.351$, $t = 5.321$, $p < 0.001$) and health information seeking behaviour ($\beta = 0.168$, $t = 2.762$, $p < 0.01$) were significant positive predictors, while (2) health risk perception showed a direct negative effect ($\beta = -0.394$, $t = -5.933$, $p < 0.001$). Importantly, (3) the interaction between health information seeking behaviour and health risk perception was marginally significant in the negative direction ($\beta = -0.104$, $t = -1.659$, $p < 0.10$), indicating that health risk perception may buffer the impact of information seeking on anxiety.

	Model 1		Model 2	
	Health information seeking behaviour		Health anxiety	
	β	t	β	t
Constant	-0.255	-0.972	3.002	15.094***
Genders	0.055	0.581	-0.018	-0.242
Age	0.064	0.942	-0.042	-0.794
EB	-0.049	-0.660	0.161	2.737**
CM	0.388	5.031***	0.351	5.321***
HRP	0.006	0.087	-0.394	-5.933***
CM× HRP	-0.300	-5.583***		
HISB			0.168	2.762**
HISB×HRP			-0.104	1.659*
R	0.630		0.837	
R ²	0.397		0.701	
F	15.694***		47.528***	

Note. CM = Catastrophic misinterpretation; EB = Educational background; HISB = Health information seeking behaviour; HRP = Health risk perception.

Table 11. Bootstrap mediated effects test results with moderation

Figure 6 illustrates the nature of the first-stage moderation. For individuals with low health risk perception (M-1SD), catastrophic misinterpretation strongly predicted health information seeking behaviour (effect = 0.619, 95% CI [0.411, 0.796], $p < 0.001$). In contrast, for those with high health risk perception (M+1SD), this relationship became non-significant (effect = 0.158, 95% CI [-0.010, 0.327], $p = 0.065$), indicating that elevated health risk perception attenuates the link between catastrophic thinking and information seeking.

Figure 7 reveals the second-stage moderation pattern. Among participants with low health risk perception, health information seeking behaviour significantly predicted health anxiety (effect = 0.247, 95% CI [0.089, 0.406], $p < 0.01$). However, for individuals with high health risk perception, this relationship was non-significant (effect = 0.088, 95% CI [-0.060, 0.235], $p = 0.176$), suggesting that heightened risk perception weakens the association between information seeking and subsequent anxiety.

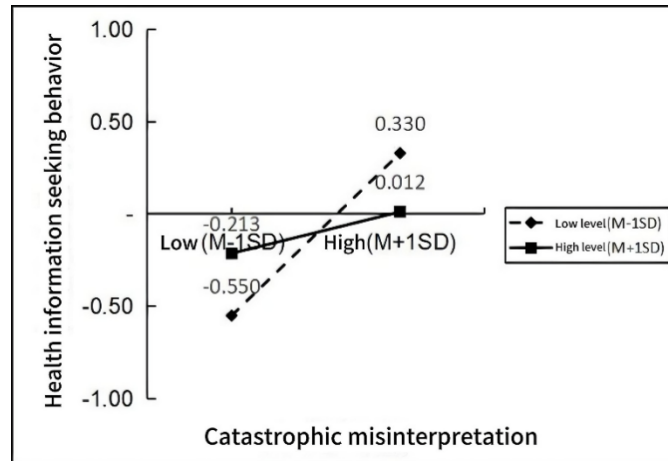


Figure 6. Moderating effect of health risk perception on the first stage of mediation

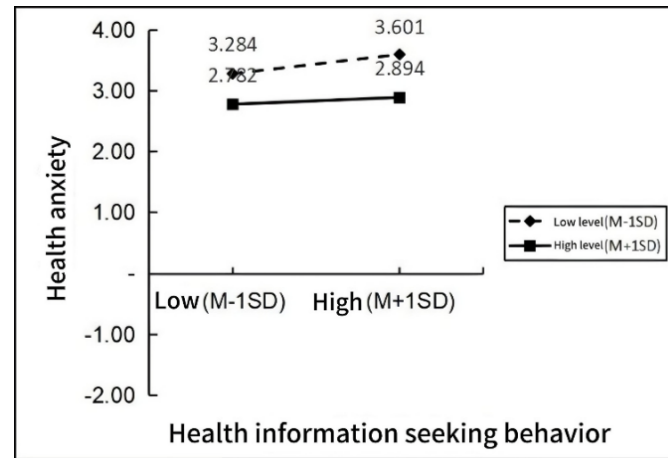


Figure 7. Moderating effect of health risk perception on the second stage of mediation

Table 12 presents the mediation effects at different levels of health risk perception (Edwards & Lambert, 2007): Low health risk perception (M-1SD): Effect = 0.153, 95% CI [0.073, 0.252] ; Mean health risk perception: Effect = 0.065, 95% CI [0.021, 0.131]; High health risk perception (M+1SD): Effect = 0.014, 95% CI [-0.016, 0.070]. The mediation effect systematically decreased from 0.153 (low health risk perception) to 0.014 (high health risk perception), with the effect becoming non-significant at high health risk perception levels.

These results clearly demonstrate that the indirect effect of catastrophic misinterpretation on health anxiety through health information seeking behaviour diminishes as health risk perception increases. Health risk perception acts as a negative moderator (buffering factor) in the mediation pathway, reducing the strength of the indirect relationship between catastrophic misinterpretation and health anxiety through health information-seeking behaviour. Therefore, Hypothesis H5 is not supported.

	Health risk perception	Effect value	Boot Standard error	LLCI	ULCI
The mediating role of health risk perception	M-1SD	0.046	0.023	0.073	0.525
	M	0.028	0.029	0.021	0.131
	M+1SD	0.021	0.039	-0.016	0.070

Table 12. Bootstrap mediated effects test results with moderation

Discussion

Support for Hypothesis H1 substantiates core tenets of contemporary health anxiety models (Weck et al., 2012), clearly demonstrating that catastrophic misinterpretation of benign bodily sensations significantly exacerbates health anxiety. This finding aligns well with the fear-avoidance model (Gautreau et al., 2014), which posits that catastrophic appraisals trigger a maladaptive cycle of hypervigilance and anxiety amplification. In our rural sample, this process appears particularly pronounced due to low health information literacy, which closely correlates with the area's poor standing on the aforementioned information economy index. It potentially creates an ecological niche where ambiguous somatic signals are more likely to be misinterpreted as threatening (Berrocal et al., 2007). The persistent attentional bias toward threat-relevant information among these individuals may represent an adaptive response that has gone awry in an environment where genuine health threats exist but are difficult to discern accurately.

The mediation effect supporting Hypothesis H2 offers essential insights into the behavioural mechanisms through which catastrophic misinterpretation translates into heightened health anxiety. Our results suggest that Chinese rural information-poor individuals engage in what might be termed 'compensatory information seeking' – a persistent search for health information driven by the inability to reconcile ambiguous somatic experiences with limited health knowledge. This finding extends previous work on health anxiety by demonstrating how structural information poverty interacts with cognitive factors to maintain health anxiety. The physiological nature of these misinterpreted sensations (Marcus et al., 2007) creates a self-perpetuating cycle where normal bodily fluctuations sustain information-seeking behaviour like query escalation that paradoxically increase anxiety rather than alleviate it.

Hypothesis H3 findings regarding positive beliefs about worry reveal an important protective mechanism in this population. The observed buffering effects at both stages of the mediation pathway (catastrophic misinterpretation → health information seeking behaviour and health information seeking behaviour → health anxiety) suggest that positive metacognitive beliefs may facilitate more adaptive information processing in several ways: (1) by promoting cognitive flexibility that allows reappraisal of threatening information (White & Horvitz, 2019), (2) by reducing the affective charge of ambiguous health information, and (3) by enabling individuals to disengage from unproductive information seeking loops. This aligns with recent work (Wells et al., 2021; Callesen et al., 2020) on metacognitive therapy and suggests potential intervention targets for this population.

The support for Hypothesis H4 highlights the detrimental role of perceived uncontrollability of worry in exacerbating health anxiety. Our results provide empirical support for the self-regulatory executive function model (Reinholdt-Dunne et al., 2019) in rural contexts, demonstrating how negative metacognitive beliefs exacerbate emotional responses to misinterpreted sensations and how these beliefs perpetuate health anxiety through increased information monitoring and impaired

disengagement from threat-related information. The finding that uncontrollability beliefs strengthen both stages of the mediation pathway suggests that these beliefs may create a ‘double vulnerability’. This vulnerability, simultaneously driving compulsive information seeking while undermining critical evaluation of obtained information (Singh & Brown, 2016), represents a particularly pernicious maintenance factor for health anxiety.

Hypothesis H5 results present a more complex picture of the role of health risk perception. Contrary to some previous findings (Renner et al., 2015; Zhang et al., 2022), our study suggests that in information-poor contexts, heightened health risk perception may serve an adaptive function by (1) promoting more selective information engagement, (2) reducing emotional dependence on unverified sources, and (3) increasing recognition of information limitations. This finding highlights the context-dependent nature of risk perception's effects. It suggests that in information-poor context, some degree of health risk perception may paradoxically protect against anxiety by preventing counterproductive information-seeking behaviour.

The revised model is shown in Figure 8.

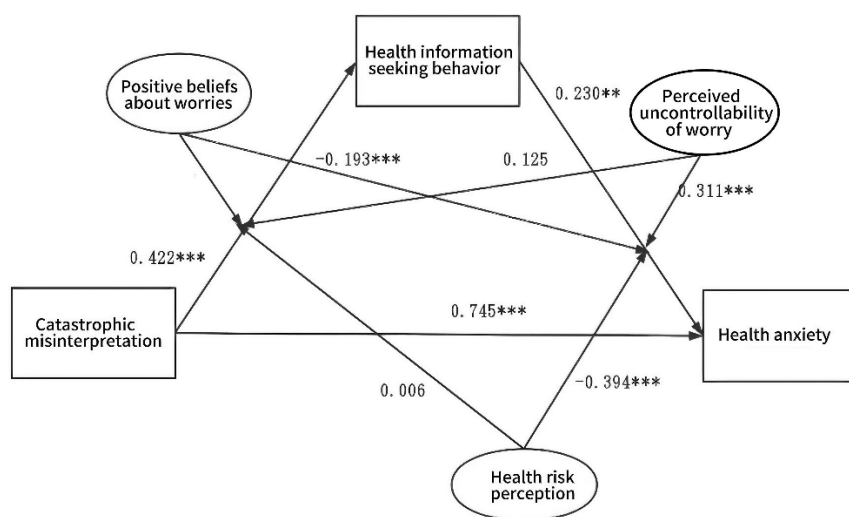


Figure. 8. The revised catastrophic misinterpretation-anxiety pathway model

Implications and recommendations

Targeted cognitive-behavioural interventions addressing core mechanisms

The correction of catastrophic misinterpretations should be prioritized through evidence-based interventions. In order to counteract the health anxiety amplification caused by misinterpretation, we recommend implementing tiered cognitive restructuring programs. These interventions should employ scenario-based cognitive reframing exercises that systematically challenge catastrophic appraisals of bodily sensations (Olatunji et al., 2014). The regulation of maladaptive information seeking requires comprehensive behavioural interventions. The compensatory information-seeking cycle can be disrupted through structured information validation training. Such training could be delivered by health information professionals, such as health librarians or information specialists, to equip users with systematic source evaluation skills, which would replace anxiety-driven search and query escalation patterns. Behavioural activation protocols should incorporate deliberate practice of information disengagement strategies to mitigate compulsive information seeking behaviour.

The strengthening of adaptive metacognition represents a crucial intervention target. The protective effects of positive beliefs about worry can be enhanced through dedicated metacognitive training modules. These interventions, ideally facilitated by professionals skilled in cognitive-behavioural approaches (e.g., psychologists or counsellors), should cultivate cognitive flexibility through guided reappraisal exercises that broaden symptom interpretation frameworks. Narrative-based techniques should reinforce existing success stories of adaptive coping within the community.

The reduction of uncontrollability beliefs necessitates targeted therapeutic components (Tillfors et al., 2015). The dual vulnerability created by negative metacognitive beliefs requires targeted intervention components. Problem-solving training should build concrete self-efficacy in health threat management. Psychoeducational modules should reframe maladaptive beliefs about worry's uncontrollability. This training and the accompanying psychoeducational modules to reframe maladaptive beliefs could be implemented by mental health practitioners. Mindfulness-based practices should be integrated to decrease emotional reactivity to ambiguous somatic signals.

Structural support systems for digital inclusion

The enhancement of health literacy should be achieved through community-embedded programs. Community-based health education initiatives should be developed with embedded literacy supports (Batterham et al., 2016). They should translate complex medical concepts into culturally relevant frameworks that align with local explanatory models of health. Information dissemination hubs should utilize multimodal formats to accommodate varying information literacy levels.

Reliable information access points should be established. Integrated mental health service points should establish clear pathways to authoritative health information. Frontline staff require training in guiding symptom conceptualization to reduce vague health concerns.

The development of protective social networks should leverage existing community structures. Community platforms should facilitate peer modelling of adaptive health information management (Obaremi & Olatokun, 2022). Structured group discussions should normalize healthy uncertainty tolerance and cognitive flexibility. Metacognitive principles should be subtly reinforced through existing community communication channels.

Systemic health information governance

A health misinformation governance system should be established. Combining local knowledge with medical expertise, the system should rapidly identify and correct prevalent catastrophic misinterpretations circulating in the community. Contextualized clarification campaigns should preemptively address common somatic misinterpretation triggers by employing the system (Southwell et al., 2019).

The optimization of information ecosystems should incorporate anxiety-reduction principles. Specially designed health information platforms should incorporate content filtering algorithms that prioritize solution-focused information architecture. Structured navigation tools should guide users toward actionable health management steps rather than diagnostic speculation. Platform design elements should consistently reinforce messages of controllability and adaptive coping.

Conclusion and limitations

This study theorizes a novel cognitive-informational behavioural pathway to explain health anxiety formation among information-poor populations in rural China. It illuminates the vicious cycle wherein catastrophic misinterpretation, amplified by maladaptive information behaviour and metacognitive

beliefs, fuels health anxiety among rural China's information-poor populations. Our findings confirm that catastrophic misinterpretation directly exacerbates health anxiety. More critically, we identify maladaptive health information-seeking behaviour as a partial mediator, revealing how structural information poverty transforms compensatory information seeking into an anxiety-amplifying loop. This extends the health anxiety model by incorporating information behaviour as a maintenance mechanism in low information literacy contexts.

The moderating effects of metacognitive beliefs further refine the theoretical framework. Positive beliefs about worry attenuated the mediation pathway. However, perceived uncontrollability of worry intensified the link between catastrophic misinterpretation and health information seeking behaviour. Surprisingly, health risk perception exhibited a protective role, suggesting contextual adaptation where heightened risk awareness may curb compulsive information seeking in resource-scarce environments—an innovative contribution to risk perception literature. It underscores the need for multilevel interventions.

While this study provides robust evidence, three limitations warrant attention. First, the cross-sectional design is lacking in the current study. The moderated mediation analyses, though theoretically grounded, cannot establish causality. Longitudinal or experimental designs (e.g., diary studies that track real-time information seeking and anxiety fluctuations) are necessary to validate temporal relationships. The second is related to sample representativeness. Participants were recruited from selected rural regions in Northern China. Therefore, the findings may not be generalized to other populations or other cultural contexts. Future work should extend this model to other marginalized populations globally, where similar intersections of low literacy and digital inequality may perpetuate health anxiety.

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