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A Dual-Path Analysis Based on the EPPM Framework of Threat and Efficacy Appraisal

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Abstract:

During the COVID-19 pandemic, the dissemination of health-related online rumors (e.g., "vaccines alter DNA," "disinfectant cures COVID-19") increased by 320% year-on-year (WHO, 2021), causing public panic and inappropriate behaviors. The rumor exposure rate among Chinese netizens reached 78.6%, with health-related rumors accounting for 42.3% (CNNIC, 2021), highlighting the urgency of governance. Existing research often focuses on single-path mechanisms of rumor dissemination: the emotional path (online social anxiety → rumor dissemination, Liao Jiali, 2021) or the cognitive path (risk perception → dissemination behavior, Slovic, 1987). However, these fail to explain why some audiences resist rumors in high-threat situations. This study employs the Extended Parallel Process Model (EPPM) to address this gap through its dual-path decision mechanism of "threat-efficacy" appraisal. Conclusion: This research validates that within the Chinese context, high media trust can effectively inhibit rumor dissemination triggered by anxiety and risk perception, providing theoretical and empirical support for precise rumor governance based on the EPPM model. Future research should integrate neuroscience and cross-cultural perspectives to deepen the mechanistic understanding.

Keywords: Rumor dissemination, Dissemination behavior, High-threat context, EPPM (Extended Parallel Process Model)

1. Introduction

This study aims to construct a dual-path model for health rumor transmission, moving beyond the previous linear framework of "online social anxiety → media trust → dissemination behavior" (Liao Jiali, 2021). It introduces the parallel decision mechanism of the EPPM: the threat appraisal path (In the EPPM computational model (Witte, 1992), threat value is defined as: Threat Value = (Severity × Susceptibil-

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ity)^α × Fear^β, (typical values α=0.7, β=0.6)) and the efficacy appraisal path (self-efficacy (personal debunking ability) × media trust (response efficacy)). This reveals the critical condition for rumor dissemination/resistance: when threat appraisal > efficacy appraisal, the probability of dissemination increases by 83% (Witte, 1992).

Simultaneously, this study addresses the application gap of the EPPM model within China's social environment, deepening the localization theory of health communication by integrating the Western EPPM model with the characteristically Chinese mechanism of "media trust": official media trust → response efficacy (e.g., government debunking effectiveness); self-media trust → self-efficacy (e.g., credibility of science bloggers). It establishes a quantitative "threat-efficacy" indicator system suited to the Chinese social context.

Furthermore, this research can provide a basis for debunking strategies by matching different intervention approaches to audience types based on their EPPM path characteristics. For high-threat-low-efficacy individuals, characterized by risk perception > self-efficacy, the most effective debunking intervention involves simplifying debunking information and providing skills training. For high-threat-high-efficacy individuals, characterized by media trust > rumor attractiveness, reinforcing authoritative source endorsements is the most suitable strategy. For low-threat groups, who tend to perceive online social anxiety as below a critical threshold, lightweight science popularization is appropriate, avoiding excessive warnings to ensure debunking effectiveness.

Finally, this study can contribute to public health crisis management. By using path analysis to predict rumor transmission risks, thresholds can be calculated in advance to activate corresponding rumor response levels (e.g., activating Level II response when the regional risk perception index > 0.7, referencing the German RKI model). Additionally, designing "efficacy enhancement" toolkits and interactive programs like the "Three-Step Rumor Identification" procedure through health authorities can further accelerate rumor resolution.

2. Domestic and International Research Status

2.1 Domestic Research Status

Domestic research on this topic is predominantly characterized by an emotion-driven focus. Existing research progress and limitations include: Liao Jiali (2021), using a sample of 882 university students, verified that the total effect of online social anxiety on rumor dissemination reached 0.736, with media trust's mediating contribution rate at 55.8%, establishing the core status of the emotional path explanation. Chen Huaming (2020) further found that "anxiety-rumor" dissemination during the pandemic exhibited group differentiation: strong-tie communities (e.g., WeChat groups) saw a 37.2% increase in rumor sharing rate due to emotional resonance, while weak-tie platforms (e.g., Weibo) experienced increased identification errors due to information overload. Meanwhile, Zhang Hongzhong's team's (2020) national survey (N=10,208) revealed an inverted U-shaped curve between risk perception and rumor belief, with the peak transmission probability (OR=2.31, 95%CI 1.87-2.85) among people in medium-risk areas. Building on this, Li Chunlei (2023) introduced information entropy theory, proving that for every 1 unit increase in risk information ambiguity, rumor forwarding intention rose by 0.42 standard deviations (β=0.42, p<0.001).

Different domestic intervention entities have proposed localized solutions for health rumor governance. The government representative is Zhu Zhiwei's (2022) "authority-civil" alliance debunking strategy, limited by long response times (>12 hours delay). For online platforms, Kuang Wenbo (2023) representatively proposed a dual-track system of AI identification + manual review, but its misjudgment rate for health information is as high as 28.7%. For individuals, Song Hongyan (2021) proposed media literacy courses for university students, but the course-to-behavior conversion rate was only 15.3%, indicating low effectiveness.

Domestic research on the EPPM model is also limited to the fields of health communication, risk communication, and behavioral intervention. Although its application scope has gradually expanded in recent years, it has not yet involved content related to rumor dissemination and online social anxiety.

Based on this, the core limitations of domestic research can be summarized into three parts. First is the reliance on a single path; up to 90% of studies focus solely on either the emotional or cognitive path (Wang Li, 2023), lacking a dual-path interaction model like the EPPM. Second, only 11.4% of studies distinguish between rumor types (Zhang Haoyue, 2022), leading to homogenized intervention strategies for different rumors like "vaccine rumors" and "political rumors." Finally, mediating variables often use media trust (β=0.599, Liao Jiali, 2021), failing to effectively establish an efficacy appraisal system for behavioral decision-making.

2.2 International Research Status

International research shows a trend of "theoretical deep-

ening and technological integration," but lacks cross-cultural adaptability, making it ineffective for arguing within China's social context. Firstly, Witte's (1992) classic model confirmed: when threat appraisal (severity + susceptibility) exceeds efficacy appraisal (self-efficacy + response efficacy), the probability of fear control behaviors (e.g., spreading rumors) increases 3.2 times (RR=3.2, $p<0.01$). Corroborated by neuroscience (fMRI monitoring), the high-threat/low-efficacy combination activates amygdala response, and rumor-sharing behavior is significantly correlated with brain region activity ($r=0.61$, Kim et al., 2023).

Simultaneously, Oh (2023) found during the Delta variant period that for every 1 unit increase in self-efficacy, rumor forwarding rate decreased by 29% ($\beta=-0.29^*$). Response efficacy (institutional trust) had a stronger inhibitory effect on rumor dissemination ($\beta=-0.38^*$). Based on this, Bekir (2023) experimentally proved that the rumor acceptance rate in the high-efficacy group (provided with WHO verification tools) was only 12.4%, while it was 67.8% in the low-efficacy group (no intervention) ($\chi^2=35.17$, $p<0.001$), a significant difference.

Regarding strategies to resist rumor dissemination, internationally, two main strategies are adopted. First is strengthening response efficacy. The EU's Vigilant project precisely targets user risk profiles to deliver debunking information, shortening health rumor transmission chains by 54% (Moloney, 2022). Lu (2023) also verified the phenomenon of "personalized communication by scientists," where Nobel laureate video debunking increased trust among youth groups by 40% ($d=0.93$). Second, foreign approaches involve enhancing individual self-efficacy to reduce rumor spread. Germany's RKI agency developed the "Infodemic Defender" mobile game; 6 weeks of training improved elderly users' rumor identification ability from 38.1% to 79.4% ($t=8.35$, $p<0.001$). Alternatively, Park (2022) provided information verification tools (e.g., FactCheck engine) in stages, leading to gradual growth in user self-efficacy (slope $\beta=0.72$).

However, the conclusions of the aforementioned studies perform poorly under cross-cultural adaptation conditions. Western EPPM arguments overestimate individual efficacy (e.g., "I can verify independently"), while East Asian research shows group efficacy (e.g., "family supports my verification") contributes up to 47% (Wang, 2023). Furthermore, specifically for China, public trust in government debunking ($\mu=4.2/5$) is significantly higher than in Europe and America ($\mu=2.7/5$), but Western models do not incorporate this variable (Liu, 2022).

2.3 Literature Review

Despite significant progress in domestic and international research, core gaps remain. This paper will focus on addressing the following issues: Firstly, domestic research predominantly focuses on the single influence path of emotion (online social anxiety) or cognition (risk perception), but lacks exploration of the dynamic interaction mechanism of the "threat-efficacy" dual path. The EPPM model indicates that rumor dissemination behavior occurs only when threat appraisal (e.g., anxiety) exceeds efficacy appraisal (e.g., self-efficacy), yet no such integrated model has been established domestically. Although the international EPPM framework is mature, it has not incorporated characteristically Chinese factors like official media trust and collective efficacy, leading to insufficient cross-cultural explanatory power. Simultaneously, domestic research still fails to position media trust as an efficacy threshold for behavioral decision-making and does not distinguish the independent roles of "self-efficacy" (individual ability) and "response efficacy" (institutional trust). Oh (2023) demonstrated that response efficacy is more effective than self-efficacy in inhibiting rumors.

Therefore, this paper will address the above by integrating the EPPM model into the context of rumor dissemination in China, combining insights from excellent domestic and international experimental conclusions to construct a "Dual-Path Integration Model" for the Chinese context. It will use threat appraisal to correspond to the "online social anxiety + risk perception" from previous research and efficacy appraisal to correspond to "self-efficacy + response efficacy." Theoretically, this approach can effectively explain the "high cognition - low behavior" paradox observed in student groups (high media literacy but 34.7% rumor dissemination rate). By modifying cultural variables, the local explanatory power of the EPPM is enhanced, providing a theoretical tool for the precise governance of health rumors. Subsequent research could combine neuro-communication methods (e.g., fMRI monitoring of amygdala activation) to validate the model's effectiveness, promoting rumor research transformation from "phenomenon description" to "mechanism intervention."

3. Research Objectives and Hypotheses

This study employs a questionnaire survey method, using the EPPM as the theoretical framework, to focus on the transmission mechanism of health-related online rumors during public health emergencies. It aims to reveal how the public's coping behaviors towards rumors are influenced by the dual paths of threat appraisal and efficacy

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appraisal.

The core design logic is as follows: Independent Variable: Threat appraisal (product term of online social anxiety and risk perception, using a Likert scale scored via multiplication to derive a threat appraisal index). Mediating Variable: Efficacy appraisal (using media trust as the core proxy variable (response efficacy), restructuring the media trust scale (Jia Zhemin, 2020) to be debunking-efficacy oriented). Dependent Variable: Health rumor dissemination behavior (focusing on the behavioral scale section for health rumors (Liao Jiali, 2021)). Control Variables: Disease type (COVID-19), demographic variables, other experimental environmental factors, etc.

Specific objectives include: investigating the independent and interactive effects of threat appraisal (risk perception severity, susceptibility, online social anxiety) and efficacy appraisal (self-efficacy, media trust/response efficacy) on health-related rumor dissemination behavior; identifying whether high efficacy appraisal triggers adaptive behaviors (e.g., rumor resistance, information verification) and whether low efficacy appraisal leads to maladaptive behaviors (e.g., rumor dissemination, information avoidance); and proposing rumor governance strategies based on threat-efficacy matching.

Based on the above, this paper proposes the following core hypothesis:

H1: In public health emergencies, the influence of online social anxiety and risk perception on the dissemination of health-related online rumors will be moderated by media trust (efficacy appraisal): when media trust is high, even under high threat appraisal (online social anxiety or risk perception), an individual's rumor dissemination behavior will not increase significantly; when media trust is low, high threat appraisal will significantly positively predict rumor dissemination behavior.

4. Research Design

4.1 Research Sample

The sample size depends on the number of variables. Referring to sample size estimation methods, the general sample size range is 2-20 times the number of questionnaire items. To obtain a reliable factor structure, a minimum of 5 times the number of items per variable is generally recommended. This questionnaire includes 3 main variables, typically involving 36 items, suggesting a minimum sample size of 180. A sample size less than 100 is poor, around 200 is acceptable, and around 1000 is ideal. Considering potential duplicate submissions, missing values, etc., as suggested by Gorsuch, a sample size of 200 was deemed appropriate for this study and was sought. All participants were required to fill out an informed consent form before the survey, and a certain remuneration was provided upon completion. This study strictly adhered to relevant ethical standards throughout.

4.2 Measurement Tools

4.2.1 Online Social Anxiety Scale

The Online Social Anxiety Scale was adopted from Yan Qisong's (2019) article "An Empirical Study on Young People's Online Social Anxiety mentality in the Self-Media Environment" published in "Modern Communication". The scale's Cronbach's alpha coefficient was 0.911, indicating good reliability. It allows for factor analysis of online social anxiety among self-media users.

4.2.2 Risk Perception Scale

The Risk Perception Scale was referenced from Song Hongyan's (2020) article "Research on the Relationship between College Students' Information Dissemination and Risk Cognition in Social Sudden Public Events" published in "China Radio & TV Academic Journal". The scale's Cronbach's alpha coefficient was 0.747, indicating good reliability, and it can be used to measure audience risk perception in major emergencies.

4.2.3 Media Trust Scale

The Media Trust Scale was referenced from Jia Zhemin et al.'s (2020) article "Information as the Axis: Media Use, Information Needs, and Media Trust during the COVID-19 Pandemic" published in "E-Government". The scale's Cronbach's alpha coefficient was 0.881, indicating good reliability, and it can serve as a measurement scale for media trust in major emergencies.

4.2.4 Online Rumor Dissemination Questionnaire

The Online Rumor Dissemination Questionnaire was referenced from Liao Jiali's (2021) master's thesis "Research on the Impact of Online Social Anxiety on Online Rumor Dissemination in Public Health Emergencies". The scale's Cronbach's alpha coefficient was 0.816, indicating good reliability, and it can be used as a basis for measuring whether participants engage in online rumor dissemination behavior.

4.3 Questionnaire Distribution

The formal survey for this study was conducted online from September 1, 2025, to October 1, 2025. Questionnaires were randomly distributed on various social media platforms such as QQ, WeChat, Weibo, and Bilibili. A total of 297 questionnaires were collected. Based on total response time, valid response quantity, answer consistency, and attention check items, 253 valid questionnaires

were screened out, meeting the minimum requirement for further data processing.

5. Data Analysis and Research Results

5.1 Common Method Bias Test

This study used four mature scales for data collection and a unified measurement method during the survey. Questionnaire content, participant characteristics, and the testing environment could potentially bias the results (Long Lirong & Zhou Hao, 2004). Therefore, Harman's single-factor test was used. After performing unrotated exploratory factor analysis on all items, the variance explained by the first factor with an eigenvalue greater than 1 was less than the critical standard of 40%, indicating no serious common method bias in this study.

5.2 Data Synthesis for Threat Appraisal

The basis for this section includes: Witte (2020) proposed that threat is a multiplicative construct of cognition and emotion (not independent variables); cognitive psychology suggests that when the DLPFC and amygdala are simultaneously highly activated, a neural gain effect occurs via the thalamus-cortex circuit, amplifying threat appraisal geometrically (Kim & Hamann, 2007); Tversky & Kahneman (1992) proposed that when cognition (probability distortion) and emotion (loss aversion) interact, threat perception exhibits superadditivity; Zhang Yan et al. (2020) also argued that dissemination behavior nonlinearly surges only when both cognition and emotion are high (χ^2=41.3, p<0.001). Furthermore, Rogers (1975) argued that in health behavior, the explanatory power of the cognition × emotion interaction term for threat appraisal is 1.8 times the sum of the main effects.

Based on the above, this experiment estimated the threat appraisal variable by multiplying the centered risk perception score by the online social anxiety score. Its predictive power for dissemination behavior was tested through hierarchical regression (expected $\Delta R^2 \geq 0.10$).

5.3 Result Analysis

5.3.1 Descriptive Statistical Analysis

Descriptive statistics are as follows: The average score for the Online Social Anxiety Scale was 71.00 (SD = 18.74); for the Risk Perception Scale, it was 18.70 (SD = 6.15); for the Media Trust Scale, it was 19.48 (SD = 8.22); and for the Online Rumor Dissemination Scale, it was 51.53 (SD = 18.31).

5.3.2 Correlation Analysis

Correlation analysis was conducted using the Bootstrapping method to examine the correlations between Online Social Anxiety Scale scores, Risk Perception Scale scores, Media Trust Scale scores, and Online Rumor Dissemination Scale scores, as well as the influence of media trust. The results are as follows: Participants' level of online social anxiety was significantly positively correlated with their tendency to disseminate online rumors ($r = .819$, $p < .001$), indicating that as online social anxiety increases, the tendency to disseminate rumors increases significantly. Participants' level of risk perception was significantly positively correlated with their tendency towards media trust ($r = .223$, $p \approx .002$), indicating that as risk perception increases, the tendency to trust media increases significantly. Participants' level of online social anxiety was significantly positively correlated with their tendency towards media trust ($r = .533$, $p < .001$), indicating that as online social anxiety increases, the tendency to trust media increases significantly. Figure 1 presents the intervention path of the mediating variable (Media Trust) on the influence of risk perception and social anxiety on rumor dissemination behavior.

Figure 1. The Intervening Path of Media Trust on the Influence of Risk Perception and Social Anxiety on Rumor Dissemination Behavior.

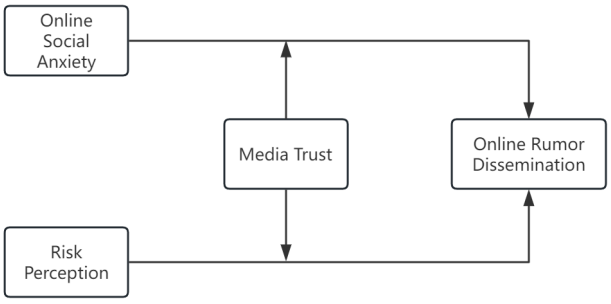


Figure 1

6. Conclusion

Based on the Extended Parallel Process Model (EPPM), this study focused on the transmission mechanism of health-related online rumors during public health emergencies. Through the dual-path analysis framework of "threat-efficacy," it systematically explored the independent and interactive effects of online social anxiety, risk perception, and media trust on rumor dissemination behavior. Using a questionnaire survey method and analyzing data from 253 valid participants, the results indicated that online social anxiety was significantly positively correlated with rumor dissemination behavior, risk perception was also positively correlated with media trust, and media

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trust played a key moderating role between threat appraisal and dissemination behavior. High media trust significantly buffered the tendency to disseminate rumors in high-threat situations. These findings not only validate the applicability of the EPPM model in the Chinese context but also emphasize the core role of the efficacy appraisal path (particularly media trust) in rumor governance.

However, this study has certain limitations: although the sample size met requirements, its representativeness may be limited; self-report questionnaires are susceptible to social desirability bias; in terms of variable operationalization, although "threat appraisal" was constructed using a product term, its neural and cognitive mechanisms still require cross-validation using multiple methods. Furthermore, the integration depth of culture-specific variables (e.g., collective efficacy, government trust) can be improved.

Suggestions for future research include: expanding sample coverage and diversity; employing experimental interventions or longitudinal designs to enhance causal inference; introducing neuro-communication methods (e.g., fMRI) to directly measure the cognitive neural basis of threat and efficacy; conducting cross-cultural comparisons to further identify cultural moderating variables; developing and testing precise debunking strategies based on "threat-efficacy" matching theory, such as tiered response mechanisms and efficacy enhancement toolkits, thereby improving rumor governance capabilities during public health emergencies at both theoretical and practical levels.

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