Exploring the Cognitive Factors of Corrective Health Information Adoption Intention in Infodemic Using SEM and fsQCA

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Adoption Intention in Infodemic Using SEM and fsQCA

Abstract: This paper applied the Protective Behavior Decision Model (PADM) and the Heuristic System Model (HSM) to explore the cognitive factors of the web users’ corrective health information adoption intention. The path analyses showed that both systematic processing and heuristic processing can positively affect perceived information overload and false information perception, and these two risk variables played intermediaries role between heuristic processing and corrective health information adoption intention; Systematic processing, protection action perception, stakeholder perception and e-health literacy positively affected the corrective health information adoption intention. The fsQCA found that there were two types of configurations leading to corrective health information adoption intention.Systematic processing, stakeholder perception, perceived information overload and hazard-related attributes were important antecedents. The results of this study can be helpful to take up measures to enhance the corrective health information adoption and reduce the risks brought by infodemic.

1 INTRODUCTION

“We’re not just fighting an epidemic, we’re fighting an infodemic”[1]. Infodemics are an excessive amount of information about a problem, which makes it difficult to identify a solution. They can spread misinformation, disinformation and rumors during a health emergency. Infodemics can also hamper an effective public health response and create confusion and distrust among people[2]. The production and disinformation of corrective health information can be helpful to eliminate the negative influences of infodemic. The corrective health information is to correct the public’s wrong beliefs, which are supported by clear evidence and expert opinion[3].Its key lies in changing the original beliefs of information receivers, telling people to ignore or not believe previous information, so as to reduce the harm caused by false health information or massive information. Some scholars have shown how experts can correct misinformation without compromising its credibility, proposing an intervention to reduce the spread of misinformation[4]. Others found that algorithmic corrections (performed by platforms) and social corrections (performed by peers) were equally effective in correcting false information and called for campaigns to encourage users to reject false or misleading information[5].

Information adoption is the process in which the subject consciously analyzes, evaluates, selects, accepts and uses information, and this process will affect the subject's subsequent behavior [5]. Zhang et al. [6] discussed the influencing factors of the adoption willingness of medical wearable technology from the aspects of technical attributes, health attributes and consumer attributes; Based on the theory of protection motivation, Guo explored users' intention to adopt health information from threat assessment and response assessment [7]; Liu used a protective decision-making model to explore the influence of citizens' willingness to use electric vehicles, and found that in addition to risk perception and protection action perception, trust and the environmental protection responsibility of authorities such as the government also played an important role [8].

In short, the current research mainly focuses on the dissemination process and correction effect of corrective health information, and pays less attention to users’ cognitive factors of corrective health information adoption intention. In addition, most of current researches conducted regression analysis to explore the casual relationship of variables and the limitations of symmetric statistical tests exit. Therefore, this paper integrates the PADM model and the HSM model to explore the cognitive and psychological factors of corrective health information adoption. The data were analyzed by structural equation model (SEM) and fuzzy-set qualitative comparative analysis (fsQCA) to understand the statistical associations and the set relations of the conjunctions and conditions.
2 THEORETICAL BACKGROUND AND HYPOTHESE

2.1 Theoretical model

The Protective Action Decision Model (PADM) is a comprehensive framework that explains how people's information processing behaviors and self-perceptions affect their responses to external risk events and hazards. Three dimensions of perceptions—protective action perception, stakeholder perception and risk perception—should be accounted for in the decisions whether to perform hazard adjustment actions. This model is widely used to study the decision-making process of the public’s protective behavior under the scenarios of disasters and environmental hazards, including anti-nuclear behavior intention assessment, city smog protection behavior and other studies have gradually begun to be introduced into specific research on decision-making of protective actions in the sudden public health situations.

However, PADM does not take into account how information is processed that may influence public risk responses, HSM provides a strategic framework helping the public understand individual risk communication processes and protective behaviors. This model defines two types of information processing: systematic processing and heuristic processing. Systematic processing is individuals making judgments by carefully examining information and correlating it with existing information. In heuristic processing, individuals often use simple peripheral cues without extra effort to help them make judgments about specific information. Both models emphasize the importance of information and communication, and explain the cognitive processes of how people make decisions in the face of uncertainty. Based on PADM and HSM, this study developed the theoretical model depicted in Figure 1.

2.2 Hypotheses

2.2.1 Risk perception

Risk perception is an individual's perception of environmental cue information that produces specific physical and social effects that influence their protective behavioral intentions and responses. According to PADM, risk perception is a key variable influencing an individual's response to extreme environmental events. In this paper, the risk perception concerning infodemic to the perception of information overload and false information perception.

J. Mou et al. have proved that consumers who accept online health information services will perceive risks from performance risks, psychology and time. Based on grounded theory, Zhao Ruihan found that risk perception can affect users' health information adoption behavior. Wu found that urban risk perception has a significant positive impact on individuals' self-protection behaviors. Based on the studies mentioned above, it should be assumed that users may take actions more urgently to adjust the harm in order to protect themselves after perceiving the risks brought by the infodemic.

H1: Risk perception (RP) positively affects corrective health information adoption intention (CHIAI).

H1a: Perceived information overload (PIO) positively affects corrective health information adoption
intention (CHIAI).

H1b: False information perception (FIP) positively affects corrective health information adoption intention (CHIAI).

2.2.2 Systematic processing

According to HSM theory, heuristic and systematic processing are two parallel types of cognitive information processing \(^{17}\), which are affected by the external environment \(^{18}\), and are the premise of people's attitude formation and reaction behavior. Wu pointed out that systematic processing can effectively improve the risk perception of city smog \(^{16}\); Zhu et al. found that systematic processing had a positive impact on individual risk perception \(^{10}\); Ryu et al. studied information in the context of the Fukushima nuclear accident and found that both types of information cognitive processing can have a positive impact on risk perception, and systematic processing can perceive higher risks \(^{18}\). Therefore, the relationships between systematic processing and risk perception could be assumed.

H2: Systematic processing (SP) positively affects risk perception (RP).

H2a: Systematic processing positively affects perceived information overload (PIO).

H2b: Systematic processing positively affects false information perception (FIP).

Chris found that heuristic processing had a positive effect on risk perception when subjects had a high level of motivation \(^{19}\). Wu found that heuristic processing can effectively improve the risk perception of city smog \(^{16}\). Other scholars have proved that high-level heuristic processing has a positive effect on risk perception in the study of anti-nuclear behavioral intentions \(^{8}\). As such, the relationship between heuristic processing and risk perception could be inferred.

H3: Heuristic processing (HP) positively affects risk perception (RP).

H3a: Heuristic processing (HP) positively affects perceived information overload (PIO).

H3b: Heuristic processing (HP) positively affects false information perception (FIP).

Griffin et al. argue that the way individuals process information affects behavioral stability over time \(^{20}\), and systematic processing has been proved a positive effect on an individual's behavioral responses \(^{21}\). Tao Xiaobo found that the main factors of heuristic cues and systematic cues for classification and identification have a positive effect on the intention to adopt information \(^{22}\). Therefore, it is assumed that.

H4a: Systematic processing (SP) positively affects corrective health information adoption intention (CHIAI).

H4b: Heuristic processing (HP) positively affects corrective health information adoption intention (CHIAI).

Tang proved that there is a mediating effect between social capital and informal preventive behaviors between serious disease risk perception \(^{23}\); Zhou Chunxiao found that disaster-affected experience affects disaster prevention behavior through risk perception, and risk perception plays an intermediary role \(^{24}\). Risk perception mediates the association between COVID-19 knowledge and preventive behavior during the COVID-19 outbreak \(^{25}\). As such, the mediating effects could be inferred.

H5a: Perceived information overload (PIO) mediates the relationship between systematic processing (SP) and corrective health information adoption intention (CHIAI).

H5b: False information perception (FIP) mediates between systematic processing (SP) and corrective health information adoption intention (CHIAI).

H6a: Perceived information overload (PIO) mediates between heuristic processing (HP) and corrective health information adoption intention (CHIAI).

H6b: False information perception (FIP) mediates between heuristic processing (HP) and corrective health information adoption intention (CHIAI).
2.2.3 Protection Action Perception

PADM believes that protection action perception includes two basic attributes, hazard-related attributes and resource-related attributes [9]. Hazard-related attributes refer to the belief that implementing protective actions will reduce risks and that individuals can perform these actions, it emphasizes the relationship between the disaster itself and hazard adjustment [8], reflecting the individual's perceived ability to protect people and property and hazard adjustment utility [9]. PADM shows that when people perceive higher levels of hazard-related attributes, they may be more confident in taking protective actions, thereby promoting intentional and actual behaviors [8]; Liu also found that hazard-related attributes were important in predicting individuals’ perceptions of urban haze crisis [8].

Resource-related attributes reflect the cost of conservation actions, such as time, money, cooperation, etc., and it emphasizes on the relationship between required resources and disaster adjustment [9]. PADM states that high levels of resource demand tend to correlate with low levels of adoption and actual behavioral risk adjustment [20]. When people perceive higher levels of resource demand, they may overestimate the cost of implementing conservation actions, thereby reducing their confidence in making risk adjustments [8]. Based on these findings, the relationships between protection action perception and health information adoption intention could be assumed.

H7: Hazard-related attributes (HA) positively affect corrective health information adoption intention (CHIAI).
H8: Resource-related attributes (RA) negatively affect corrective health information adoption intention (CHIAI).

2.2.4 Stakeholder perception

Stakeholder perceptions reflect the degree of cognitive evaluation by authorities and professionals [7]. Stakeholder perception is related to expertise, trustworthiness, and responsibility to protect [8][27], and the perceived trustworthiness of information obtained from authorities and experts can effectively improve the accuracy of risk communication [8]; different information sources Stakeholder perceptions of stimuli will accordingly motivate the public’s intention to take conservation action [27]. As a result, the influence of stakeholder perception could be assumed.

H9: Stakeholder perception (SP1) positively affects corrective health information adoption intention (CHIAI).

5. e-Health Literacy

Electronic health literacy refers to the ability of individuals to obtain, understand and evaluate health information or services through network electronic media, and use these health information or services to make health decisions in order to maintain and promote their own health [28]. Hsu indicated that users with higher e-health literacy were more willing to adopt the diet, exercise, and work-rest suggestions provided by mobile health [29]; Users’ e-health literacy can also directly affect the adoption behavior of online health information [30]. Based on these assumptions, the hypothesis considered that.

H10: E-health literacy (EHL) positively affects corrective health information adoption intention (CHIAI).

3 RESEARCH DESIGN

This study adopted the survey methodology to collect empirical data and a quantitative questionnaire concerning ten variables was developed. To be specific, SP was measured using five items [13][16]; HP was measured by four items [13][16]; FIP and PIO were measures based on Liu and Song’s findings [8][9]; HA, RA and SP1 were measured according to Liu and Lindell [8][9]; EHL was measured by five items [28]. CHIAI measurements were also developed using 4 items [31]. All variables were measured by a seven-point Likert scale anchored by 1 (totally disagree) and 7 (totally agree).
The participants of this study were randomly sampled from the web users in China. A total of 125 samples were collected for pre-testing. One item of HP and one of RA were deleted after exploratory factor analysis. Then a total of 402 questionnaires were collected, among which 365 questionnaires proved to be valid. 50.1% of the participants were male and 53% of the participants were under the age of 35. About 16% were senior citizens. CHIAI that users pay attention to mainly fall into two categories namely disease control&prevention and public health events. The common channel of obtaining such information was via social media and government official web portal.

Structural equation modeling (SEM) was employed to test the theoretical model and hypotheses to understand the statistical associations among the variables. Considering the limitations of symmetric statistical tests[32] and the occurrence of multiple realities, the same data set was also analyzed by fsQCA to explore the set relations of the condition.

4 DATA ANALYSIS AND RESULTS
4.1 Structural equation model analysis

Measurement Model Analysis. This paper applied SPSS24.0 and AMOS26.0 to analyze the reliability and validity of the scale. The Cronbach's alpha coefficient of each observation variable was greater than 0.7, and the CR value of each variable was also above 0.7; the KMO value was 0.899, and theAVE of each variable was greater than 0.5, indicating that the scale had good discriminant validity.

Structural Model Analysis. The results of the proposed research model showed a good fit: CMIN/df =2.213 ,GFI = 0.844, CFI = 0.916, NFI=0.858 and RMSEA = 0.058. The factors loading of all items measuring all the constructs in the model were high (≧ 0.62 ) and significant (p<0.001).

Mediating effect. This paper used Bootstrapping and the updated mediating effect test methodology[33]. In the SPtoPIOtoCHIAI pathway, the lower limit of the Bias-corrected confidence interval for indirect effects was -0.003 and the upper limit was 0.107; the lower limit of the Percentile confidence interval was -0.059 and the upper limit was 0.203. As a result, the indirect effect of SptoPIOtoCHIAI does not exist; similarly, the indirect effect of SptoFIPtoCHIAI does not exist. The indirect effects of HPtoPIOtoCHIAI and HPtoFIPtoCHIAI existed, indicating PIO and FIP had no mediating effect between SP and CHIAI, while HP had a significant mediating effect.

Figure 2. presented the path coefficients and their significance for each hypothesis and Table 1 listed the results of hypotheses tests.

![Path analysis results](image)

Notes: *** represents a very high level of significance (P<0.001); ** represents a high level of significance (P<0.01); * represents a significant level (P<0.05); ns represents no Significant (P>0.05).
Table 1. Hypotheses analysis results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>H1a</th>
<th>H1b</th>
<th>H2a</th>
<th>H2b</th>
<th>H3a</th>
<th>H3b</th>
<th>H4a</th>
<th>H4b</th>
<th>H5a</th>
<th>H5b</th>
<th>H6a</th>
<th>H6b</th>
<th>H7</th>
<th>H8</th>
<th>H9</th>
<th>H10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes: “Y” means that the hypothesis was supported, “N” means that the hypothesis was not supported.

4.2 fsQCA analysis

This paper used fsQCA 3.0 for the following analysis.

Calibration. The calibration steps included calculating the mean score of each construct, identifying three fuzzy conversion metrics as full membership, cross-over point and full non-membership, and finally transferring the original data to continuous data from 0 to 1 through calculating scalars and log adds[34].

Configuration. This paper set the consistency threshold to 0.8[35], the PRI (Proportional Reduction in Inconsistency) consistency threshold to 0.75, and the case frequency threshold to 2[36]. The results of each configuration obtained after the path normalization analysis were shown in Table 2.

Table 2. Configuration analysis results

<table>
<thead>
<tr>
<th>Variable</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S2a</td>
</tr>
<tr>
<td>SP</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>HP</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>FIP</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PFO</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>HA</td>
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<td>●</td>
</tr>
<tr>
<td>RA</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>SP1</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>EHL</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Consistency</td>
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<td>0.978</td>
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<tr>
<td>Raw Coverage</td>
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</tr>
<tr>
<td>Unique Coverage</td>
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<td>0.018</td>
</tr>
<tr>
<td>Overall Solution Consistency</td>
<td>0.961</td>
<td></td>
</tr>
<tr>
<td>Overall Solution Coverage</td>
<td>0.780</td>
<td></td>
</tr>
</tbody>
</table>

Notes: ● means the core condition exists; ● means the edge condition exists; ◁ means the core condition is missing; ◁ means the edge condition is missing; space means optional.

According to the above table, the overall consistency level of corrective health information adoption intention was 0.961, and the consistency of each antecedent condition configuration was higher than 0.9, the overall coverage rate was 0.780, and the model interpretation effect was shown to be good. The three types of antecedent configurational patterns that corrective health information adoption intention were as follows.

S1 indicated that the core conditions leading to corrective health information adoption intention were high-level systematic processing, high-level perception information overload, high-level hazard-related attributes, and high-level stakeholder perception. The auxiliary conditions were high-level heuristics processing and high-level resource-related attributes.

S2 included four sub-modes (S2a, S2b, S2c, S2d). The core conditions that led to the public's corrective health information adoption intention were high-level systematic processing and high-level stakeholder perception. The common auxiliary condition of the four sub-models was high-level electronic health literacy. Among the four sub-modes, the auxiliary conditions of S2a and S2b had high false information perception and
high level of disaster-related attributes. The auxiliary conditions of S2c included low-level heuristic processing and high-level hazard-related attributes; the auxiliary conditions of S2d were mainly low-level false information perception, low-level perception information overload, and low-level resource-related attributes.

4.3 Discussion

Structural equation model analysis results showed that both systematic processing and heuristic processing positively affected risk perception, which were consistent with previous studies\textsuperscript{11}\textsuperscript{16}; hazard-related attributes had a positive impact on corrective health information adoption intention. It indicated that when facing the infodemic, the public believed that adopting corrective health information needs to help themselves and their families resist risks\textsuperscript{8}\textsuperscript{9}; stakeholders perception positively affected corrective health information adoption intention verified that the responsible, professional and knowledgeable government, media and other authoritative institutions are more likely to gain the public's trust\textsuperscript{8}; e-health literacy also had a positive impact which coined that findings that the higher the electronic literacy level of the public, the more likely they are to adopt professional corrective health information\textsuperscript{20}. In this study, resource-related attributes positively influenced protection action decisions, which was on the contrary to the original hypothesis. We assumed that under the circumstance of anti-covid-19 and infodemic, people showed great concern of health information\textsuperscript{37} and were willing to allocate more resources to obtain and utilize professional health information to protect family and themselves\textsuperscript{38}.

The mediating effect showed that perceived information overload and false information perception had mediating effects in the relationship between heuristic processing and corrective health information adoption intention. The reason may be that the public is more vulnerable to uncertain health information in infodemic and the perception of false information and information overload increased accordingly\textsuperscript{38}, while the mediating effect of systematic processing was not significant. Path analysis also found that heuristic processing, perceived information overload, and false information perception had insignificant effects on protection action decision-making, reflecting the dominant role and direct influence of the systematic processing model\textsuperscript{38}, and after receiving more risk information, users may be more willing to adopt corrective health information for protection\textsuperscript{38}.

fsQCA found that there were three patterns of triggering corrective healthy adoption intentions. Comparing the coverage ratios of the three trigger modes, it can be seen that S1 had greater explanatory power. (1) According S1, a high level of systematic processing and heuristic processing can positively affect behavioral intentions, and heuristic processing is more susceptible to environmental influences\textsuperscript{18}. When facing infodemic, the public will make risk judgments through careful consideration, and adjust hazards with higher disaster-related attributes and stakeholder perceptions. (2) S2 proved that public in favor of high e-health literacy chose to carefully check the corrected health information to make judgments, coupled with their high stakeholder perception. The finding were in consistent with the ‘Attribution Theory’, which pointed out that professional and responsible government and other authoritative institutions played an important role in protecting the public, it is also reconciled by previous studies suggested that users with high e-health literacy were more willing to adopt the suggestions provided by mobile health\textsuperscript{29}.

5 CONCLUSIONS

From the perspective of risk information communication, this paper integrated the PADM and HSM models to address the problems of corrective health information adoption by examining the relationship among risk perception, protective action perception, stakeholder perception and corrective health information adoption intention using SEM. Using the sample of 365 web users, the SEM results show that hazard-related attributes, resource-related attributes, stakeholder perceptions are cognitive antecedents of protective behavior intention. The results highlights the influence of personal cognitive style represented by information cognitive processing
on risk perception and protective behavior intention. In addition, e-health literacy is also an important factor of users’ corrective health information adoption intention.

A fuzzy-set qualitative comparative analysis (fsQCA) was also conducted to understand the statistical associations and the set relations of the conjunctions and conditions. fsQCA found two configurations. The first one is “systematic processing • heuristic processing • perception information overload • hazard-related attributes • resource-related attributes • stakeholder perception”. The second includes four sub-modes, which are “systematic processing • false information perception • perception information overload • hazard-related attributes • resource-related attributes • stakeholder perception • e-health literacy”, “systematic processing • false information perception • perception information overload • hazard-related attributes • e-health literacy”, “systematic processing • ~heuristic processing • hazard-related attributes • e-health literacy” and “systematic processing • ~false information perception • ~perception information overload • ~resource-related attributes” • e-health literacy”.

The managerial implications are of two aspects. Firstly, the research result suggests that the society should expand the distribution channels for corrective health information in the infodemic. The government, media and other authoritative organizations should provide scientific and professional corrective health information in a timely manner. Secondly, web users should also apply the systematic way of cognitive information processing, enhancing the e-health literacy to better identify distorted health information when decision-making.

This paper also has some limitations. First of all, it focuses on the antecedents of cognitive level, variables of emotion level were excluded in the theoretical model; Secondly, a self-reported survey was carried out to collect data, the sample may have homology bias. Qualitative data of in-depth interviews and behavior observations are also valued theoretically and methodologically, and would be worthy of further exploration in the future studies.

REFERENCES


[30] Zhao Ruihan, Chen Yi (2020). Theoretical Model of the Multi-Dimensional Risk Perception of Online Health Information


