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A Study on the Impact of Information Framework on Residents' Willingness to Cooperate in the Context of Public Health Emergencies: The Mediating Effect of Perceived Effectiveness and the Moderating Effect of Self-Construal

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Abstract

This study explores the mechanism of the impact of information framework on residents' willingness to cooperate in the context of public health emergencies, and introduces perceived effectiveness as a mediator variable and self-construal as a moderator variable, to enrich the research perspective. The data were collected by questionnaire method. 96 effective questionnaires were collected in the first experiment, and 144 effective questionnaires were collected in the second experiment. SPSS was used to test independent samples, one-way ANOVA, Bootstrap mediation test, two-way ANOVA, and so on, to verify the mediating role of perceived effectiveness and the moderating role of self-construal. The purpose is to provide a new perspective of intervention for the improvement of residents' willingness to cooperate in the context of public health emergencies, and to provide theoretical basis and reference for improving the efficiency of public health emergency management and control, to promote social cooperation to cope with public health emergencies.

Keywords: information framework, perceived effectiveness, self-construal, public health emergency

1. Introduction

In recent years, there have been frequent public health emergencies around the world, such as the outbreak of infectious diseases such as swine flu and dengue fever and the spread of COVID-19 pneumonia, it has brought impacts on the life and social and economic development of people all over the world. The extent of damage caused by a public health emergency depends not only on the direct harm it causes, but also on how the public perceives and interprets the risk information obtained and what risk behaviors are generated (Huang S, Zhou C, Yuan Q, et al., 2023). In this context, information framework, as a tool of information transmission, plays a crucial role in guiding public awareness and behavior to cooperate in response to public health emergencies.

Therefore, this study takes the information framework as the independent variable, and introduces the perceived effectiveness as the intermediary variable, and the self-construal as the moderator variable, to further explore the mechanism of the influence of information framework on residents' willingness to cooperate. The purpose of this study is to provide a new intervention perspective for the improvement of residents' willingness to cooperate in the context of public health emergencies, and to provide theoretical basis and reference suggestions for the improvement of the control and prevention efficiency of public health emergencies, to promote social cooperation to cope with public health emergencies.

2. Theoretical Basis and Hypothesis Derivation

In the past research, information framework is often used in the research fields of consumer behavior, health behavior and so on, which is defined as the information is expressed by different measures, so that the information receivers have different judgments (Yang Qiang, Wu Junbao & Meng Lu, 2019), in the research of Kim et al, the information framework is divided into the promotion framework focusing on "Profit seeking" and the prevention framework focusing on "Harm avoiding". Some studies point out that loss aversion is prevalent in human beings, and that the prevention framework is more effective than the promotion framework in guiding consumers to avoid potential "Loss" and has more advantages in stimulating consumer response (Maheswaran D & Meyers-Levy J, 1990).

Self-construal can be divided into two types: independent self-construal and interdependent self-construal (Markus, H. R. & Kitayama, S, 1991), which refers to an individual's perception of the relationship between himself and others, that is, how much he thinks he is related or not related to others (Yang Qiang, Wu Junbao & Meng Lu, 2019). Based on the theory of moderating orientation and the relationship between self-construal and moderating orientation, Yang Qiang et al. (2019) pointed out that independent individuals tend to promote orientation, while interdependent individuals tend to prevent orientation, promoting frame advertisement for independent individuals and defending frame advertisement for dependent individuals will make individuals more willing to donate.

In addition, Sun Jin et al. (2023) pointed out that in the existing research, product perceived effectiveness, as an important variable, affects consumers' purchasing decisions. Lin et al. (2012) defined green product perceived effectiveness as consumers' subjective evaluation of whether green products achieve the expected results, the mediating role of the model in the interaction effects of self-construal, resource perception and green advertising appeal is also verified. Applying it to the current research situation, perceived effectiveness can be defined as an individual's subjective judgment of whether the information expressed in the information framework can achieve the desired effect.

To sum up, the research hypothesis and framework of this paper are as follows.

Table 1. Study hypotheses

Number	Hypothetical content
H1	Information Framework has a significant impact on residents' willingness to cooperate. Compared with the promotion framework, the residents' willingness to cooperate are stronger under the prevention Framework.
H2	Perceived effectiveness mediates the effect of information framework on residents' willingness to cooperate.
H3	Self-construal plays a moderating role in the influence of information framework on residents' willingness to cooperate.
H3a	In the promotion framework, the independent self-construal is more willing to cooperate than the interdependent self-construal.
H3b	In the prevention framework, the interdependent self-construal is more willing to cooperate than the independent self-construal.
H4	Self-construal plays a moderating role in the influence of information frame on perceived effectiveness.

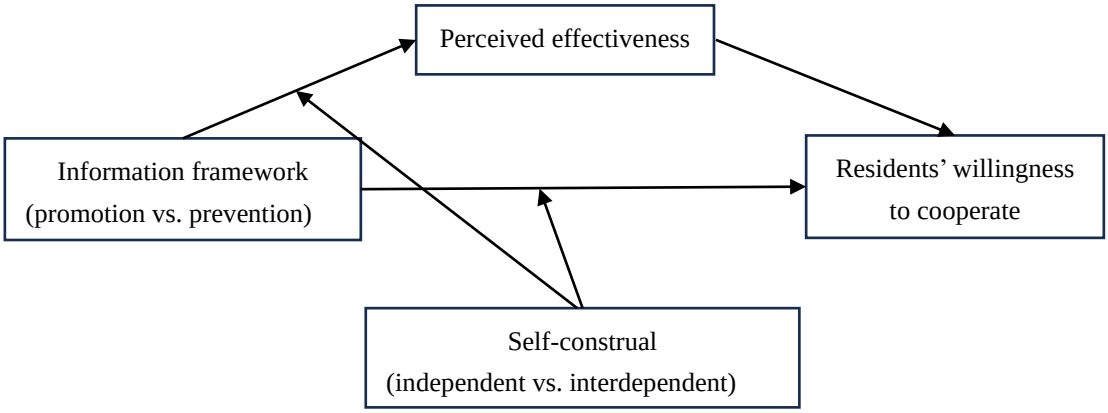

Figure 1. Research framework

3. Research Design

3.1 Methodology and Sample Collection

This study used online and offline questionnaires to conduct paid research. For the online questionnaire, participants entered the online questionnaire website and completed the questionnaire. After the questionnaire is completed and approved, the participants who fill in the questionnaire carefully will receive a certain amount of cash reward. For the offline survey, participants were given a random gift after the questionnaire was completed.

Two experiments were designed in this study. In experiment 1, Norovirus infection was selected as the scene introduction material to verify the main effect and mediating effect, and in experiment 2, Mycoplasma pneumoniae infection was selected as the scene introduction material to verify the moderating effect. Finally, a total of 106 questionnaires were collected and 96 of them were valid, with a recovery rate of 90.6%. Of these, 45 were in the promotion information framework group and 51 in the prevention information framework group. A total of 158 questionnaires were collected in experiment 2, and 144 questionnaires were finally valid, with a recovery rate of 91.1%. Of these, 71 were in the promotion framework and 73 were in the prevention framework.

3.2 Questionnaire Design

3.2.1 Questionnaire 1

The first part is scene introduction. First of all, the subjects were informed about the characteristics of public health emergencies, and then about the hazards of norovirus. The key points were highlighted in bold.

The second part is the situation classification and slogan display. In order to avoid the interference of other elements in the information material, the two groups of slogans were manipulated from different narrative angles. The display form and content structure of the two groups of slogans were consistent. For example, the slogan of the promotion framework group reads: “Don’t be greedy when eating raw food or cooked food, harvest good health and good health!” “Seek medical treatment in time, report truthfully, and protect yourself, others, and everyone!” “Assist the community, obey management, and build a healthy and harmonious home together!” The slogan of the prevention framework group reads, “Don’t be greedy when eating raw or cooked food. Don’t let the virus take advantage of the situation!” “Seek medical treatment in a timely manner. Report truthfully. Don’t Harm Yourself or others!” “Help the community. Obey the management. Don’t let the virus wreak havoc on your home!”. The important information in the slogan was written in red to attract the attention of the participants.

The third part is the manipulation test. The participants were asked to answer the question “Which mode of expression do you think this slogan prefers?” On the basis of reading the slogan information carefully. This question uses a 7-level Likert scale, with 1 representing “promoting positive effects” and 7 representing “avoiding harm.”

The fourth part is the measurement of perceived effectiveness. According to the scale of Kim et al (2005), the experiment was adapted from four aspects: pre-prevention, post-treatment, assistance to the community, and the effectiveness of banner information posting. The results of the experiment used the mean of four items to measure the level of perceived effectiveness.

The fifth part is the measurement of residents’ willingness to cooperate. According to Robert Heath 4R theory of crisis management process in the reduction, preparation, response, recovery of the four stages, and combined with the study of Miao aohan (2022). This study conducted scale design from three perspectives: pre-infection prevention, post-infection care, and cooperation with the community. The mean values of the three items were taken as the participants’ willingness to cooperate.

The sixth part is personal information collection.

3.2.2 Questionnaire II

The content of Questionnaire 2 is similar to questionnaire 1 in general, but the difference is that the experiment 2 is based on the scene of Mycoplasma pneumoniae infection, and the introduction of the scene and the display of the slogan are different. In addition, self-construal measurements were introduced to validate their moderating effect. Among them, the self-construct scale was adapted according to the experimental scenario with reference to the scales of Singelis et al. (1994), the scale included six self-independent items such as “I dare to express my opinions in public” and six self-interdependent items such as “I often feel that my relationships with others are more important than my own achievements”. The mean of 12 items was used to measure the independent self-construal/interdependent self-construal tendency.

4. Empirical Results

4.1 Experiment 1: The Effect of Information Framework on Residents’ Willingness to Cooperate and the Mediating Effect of Perceived Effectiveness

4.1.1 Manipulation Test

To test whether the signs were successfully manipulated, the researchers rated the content of the signs they saw (between 1 and 7, 1 for promoting a positive outcome and 7 for avoiding harm). Analyses were performed using an independent sample t-test. The results showed that there was a significant difference in the scores of the promotion framework and the prevention framework, and the scores in the prevention framework were significantly higher than those in the promotion framework ($M_{prevention} = 6.22$, SD = 0.642; $M_{promotion} = 1.67$, SD = 0.739; P = 0.00, t = -32.280, d = -6.156), the data were consistent with expectations, indicating that the manipulation of the banner information framework was successful.

4.1.2 The Effect of Information Framework on Residents' Willingness to Cooperate

In order to test the influence of information framework on residents' willingness to cooperate, the mean of the items of the behavior intention of the investigators was calculated as dependent variable, and the type of information framework was used as independent variable, descriptive statistics and one-way ANOVA are shown in Table 2 and Table 3, respectively.

Table 2. Descriptive statistics

Framework types	Promotion framework	prevention frameworks
Average	5.5926	6.3856
Standard deviation	1.82836	0.57105
Variance	3.343	0.326
Minimum	1.33	5.00
Maximum	7.00	7.00

Table 3. One-way ANOVA

	Sum of squares	Degrees of freedom	Mean Square	F	Significance
Between groups	15.034	1	15.034	8.649	0.004
Within groups	163.392	94	1.738		
Total	178.426	95			

The results showed that compared with the promotion framework, the persuasion effect of the prevention framework was better, that is, the participants' willingness to cooperate was stronger ($M_{prevention} = 6.39$, SD = 0.571; $M_{promotion} = 5.59$, SD = 1.828; F (1,94) = 8.649, p = 0.004), hypothesis 1 was validated.

4.1.3 Mediation of Perceived Effectiveness in the Main Effect

To test the mediating effect of perceived effectiveness in the main effect, SPSS PROCESS Model 4 and bootstrap were used for mediating test (sample size 5000, confidence interval = 95%).

The results showed that information framework affected individual's perceived effectiveness (LLCI = 0.1377, ULCI = 0.9113), perceived effectiveness also affected residents' willingness to cooperate (LLCI = 1.0498, ulci = 1.3383), and perceived effectiveness had significant mediating effect (LLCI = 0.1538, ulci = 1.1743), the effect coefficient was 0.6263, and the direct effect interval contained 0 (LLCI = -0.1162, ULCI = 0.4493), indicating that perceived effectiveness completely mediates between information framework and residents' willingness to cooperate. Therefore, hypothesis 2 is proven, the mediating effect results are shown in Table 4.

Table 4. Mediating role test of main effect perceived effectiveness

	Effect value	Boot CI Lower limit	Boot CI upper limit	Results
Indirect effects	0.6263	0.1538	1.1743	ab significant
Direct effect	0.1666	-0.1162	0.4493	C' not significant

4.1.4 Summary of Experiment 1

In experiment 1, questionnaire survey method was adopted, and group experiment was used to manipulate the types of information frameworks, and the level of perceived effectiveness and willingness to cooperate was measured, which verified the hypothesis 1 that "Information framework type has a significant effect on the

residents' willingness to cooperate. Compared with the promotion framework, individuals in the prevention framework are more willing to cooperate." and hypothesis 2 "Perceived effectiveness mediates the effect of information framework on residents' willingness to cooperate."

The first experiment did not introduce self-construal, and did not examine the moderating effect of independent/interdependent self-construal on the influence of information framework on residents' willingness to cooperate. Therefore, experiment 2 will continue to test hypothesis1 and 2 on the basis of further completion of the test of hypothesis 3.

4.2 Experiment 2: The Moderating Effect of Self-Construal (Independent Self-Construal/Interdependent Self-Construal) on the Information Framework Affecting Residents' Willingness to Cooperate and the Mediating Effect of Perceived Effectiveness

4.2.1 Information Frame Manipulation Experiment

Consistent with experiment 1, we continued to use independent-sample t-tests for statistical analysis of investigator ratings. The data showed that there was a significant difference in the scores of the promotion framework and the prevention framework, and the scores in the prevention framework were significantly higher than those in the promotion framework ($M_{prevention} = 6.24$, SD = 0.726; $M_{promotion} = 1.82$, SD = 0.674; P = 0.00, t = -37.851, d = -6.085), the data were consistent with expectations, indicating that the manipulation of the banner information framework was successful.

4.2.2 The Influence of Information Framework on Residents' Willingness to Cooperate

In order to test the influence of information framework on residents' willingness to cooperate, we continue to use the mean of each subject as the dependent variable and the type of information framework as the independent variable to carry out one-way analysis of variance, results of descriptive statistics and one-way Anova are shown in Table 5 and 6.

Table 5. Descriptive statistics

Framework types	Promotion framework	prevention frameworks
Average	5.7032	6.1972
Standard deviation	1.49336	0.74232
Variance	2.230	0.551
Minimum	1.67	3.33
Maximum	7.00	7.00

Table 6. One-way Anova

	Sum of squares	Degrees of freedom	Mean Square	F	Significance
Between groups	8.783	1	8.783	6.263	0.013
Within groups	199.142	142	1.402		
Total	207.925	143			

Compared with the slogan under the promotion framework, the persuasion effect of the prevention framework was better, that is, the participants' behavioral intention was stronger ($M_{prevention} = 5.70$, SD = 1.493; $M_{promotion} = 6.20$, SD = 0.742; F (1,142) = 6.263, P = 0.013), hypothesis 1 was confirmed again.

4.2.3 The Mediating Role of Perceived Effectiveness in the Main Effect

To test the mediating role of perceived effectiveness in the main effect, the mediation analysis Model SPSS Process Model 4 was continued, and mediation tests were performed using bootstrap (sample size = 5000, confidence interval = 90%).

The results showed that information framework affected individual's perceived effectiveness (LLCI = 0.0562, ULCI = 0.7816), perceived effectiveness could affect residents' willingness to cooperate (LLCI = 0.8301, ULCI = 1.0145), and perceived effectiveness had significant mediating effect (LLCI = 0.0540, ULCI = 0.7989), the effect coefficient was 0.3864, and the direct effect interval contained 0 (LLCI = -0.0977, ULCI = 0.3129), indicating that perceived effectiveness completely mediates between information framework and residents' willingness to cooperate. Thus, hypothesis 2 is again validated, the mediating effect-specific results are shown in

Table 7.

Table 7. Mediating Effect Tests of Perceived Effectiveness in the Main Effect

	Effect value	Boot CI lower limit	Boot CI upper limit	Results
Indirect effects	0.3864	0.0540	0.7989	ab significant
Direct effect	0.1076	-0.0977	0.3129	c' not significant

4.2.4. Moderating Effect of Self-Construal

In order to test the moderating effect of self-construal (independent self-construal/interdependent self-construal) on the influence of information framework on residents' willingness to cooperate, we took residents' willingness to cooperate as a dependent variable, information framework types and independent self-construal/interdependent self-construal were used as independent variables, and two-way ANOVA was used. Results are shown in Table 8.

Table 8. Test of Intersubjective Effects

Dependent variable: willingness of residents to cooperate

The source	Class III sum of squares	Degrees of freedom	Mean Square	F	Significance
Modify the model	36.068[a]	3	12.023	9.794	0.000
Intercept	5036.635	1	5036.635	4103.000	0.000
Information Framework	6.687	1	6.687	5.448	0.021
self-construal	1.781	1	1.781	1.451	0.230
Information Framework * self-construal	25.208	1	25.208	20.535	0.000
Error	171.857	140	1.228		
Total	5300.333	144			
Corrected total	207.925	143			

A. R-squared = 0. 173(adjusted r-squared = 0. 156)

The results showed that the main effect of information frame was significant (f (1,140) = 5.448, $p < 0.05$), there was no main effect of self-construal ($p > 0.1$), and there was significant interaction between information framework and self-construal (f (1,140) = 20.535, $p < 0.05$).

In the promotion framework, as shown in Figure 2, the participants with independent self-construal had stronger willingness to cooperate ($M_{independent}$= 6.257, $SD_{independent}$ = 0.627; $M_{dependent}$= 5.193, $SD_{dependent}$= 1.850, f (1,71) = 10.468, p = 0.002); In the prevention framework, interdependent self-construal subjects were more willing to cooperate ($M_{independent}$= 5.850, $SD_{independent}$= 0.894; $M_{dependent}$= 6.467, $SD_{dependent}$ = 0.452, F(1,69) = 14.382, p = 0.000). Thus, hypothesis 3 was verified.

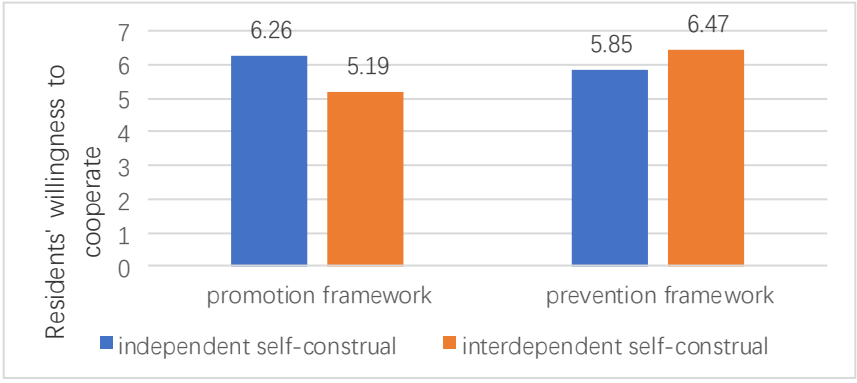

Figure 2. Moderating Effect of the Independent Self-Construal/Interdependent Self-Construal

4.2.5 The Mediating Role of Moderating Effect Perceived Effectiveness

In order to test the mediating role of perceived effectiveness in moderating effect, SPSS PROCESS Model 8 and bootstrap method were used for mediating test (sample size =5000, confidence interval =90%).

The results showed that in the mediation model, self-construal played a moderating role in the effect of information framework on perceived effectiveness (B = -1.37, t = -3.89, p = 0.0002, confidence interval [-2.07, -0.68]); Perceived effectiveness was a positive predictor of residents' willingness to cooperate (B= 0.89, t = 18.59, p = 0.000, confidence interval [0.79,0.98]), self-construal moderated the effect of information framework on residents' willingness to cooperate (B = -0.46, t = -2.20, p = 0.03, confidence interval [-0.89, -0.05]). Hypothesis 4 was verified.

4.2.6 Summary of Experiment 2

In experiment 2, questionnaire survey method was also adopted, and new materials were used on the basis of experiment 1 to verify the main effect of information framework and the mediating effect of perceived effectiveness, and self-construal variables were introduced to verify hypothesis 3 and hypothesis 4.

5. Conclusion

In response to Public Health Emergencies, information framework is a key factor, it can affect the residents' cooperative behavior and coping strategies. Through the research of this paper, we find that residents' willingness to cooperate is stronger under the prevention framework than under the promotion framework, moreover, different types of information framework affect residents' willingness to cooperate through different levels of perceived effectiveness, and residents' willingness to cooperate is higher in the prevention framework than in the promotion one. In addition, we also found that self-construal moderated the effects of information framework on perceived effectiveness and residents' willingness to cooperate, in the framework of promotion information, the independent self-construal has stronger perceived effectiveness and cooperative behavior intention than the interdependent self-construal; on the contrary, in the framework of prevention information, the interdependent self-construal has stronger perceived effectiveness and cooperative behavior intention than the independent self-construal.

Based on the findings of the text, here are some of our research recommendations:

1) Strengthen the guidance and cultivation of self-construal: self-construal is very important to the acceptance and influence of information framework. Training and educational activities can be carried out to enhance the self-construal awareness and capacity of residents, and enhance their understanding of the information framework and response capacity.
2) Focusing on perceived effectiveness: in disseminating information and providing guidance, emphasis is placed on the benefits and positive impacts of the participation of the population in response measures, such as protecting their own and others' health and reducing the spread of epidemics, emphasize the importance of individual actions, and connect with the core values of the residents, improve the sense of perceived effectiveness, thus improve the residents' cooperation.
3) Providing emotional and mental health support: adding mental health support to the information framework, paying attention to the psychological stress and anxiety residents may face in coping with public health events, and providing corresponding support and resources. Through the provision of mental health guidance, psychological counseling, support hotlines and other services to help residents maintain emotional stability, better participation in cooperative action.
4) Ensuring the authority and credibility of information: reducing the spread of rumors and false information by ensuring that information is transparent, accurate and authentic in its sources and that information is made public in a timely manner, responding to questions and concerns, in order to improve residents' trust in information, enhance residents' compliance, participation, acceptance and willingness to cooperate with information framework.
5) Multi-channel dissemination of information: use of multiple channels of communication such as television, radio and social media to reach a wider audience, ensuring that information reaches every resident in a timely manner and encouraging their participation in cooperation.
6) Build trust: Build trust between residents, the government and professional institutions, so that residents are willing to accept and follow the official information and recommendations, and enhance awareness of cooperation and action among residents.
7) Follow-up and evaluation: follow-up and evaluation of the impact of the information framework on residents' cooperation in response to public health emergencies. Through regular feedback surveys and data analysis, pay attention to the feedback and adjustment of perceived effectiveness, understand the actual

impact of different information frameworks, and adjust and optimize information dissemination strategies in a timely manner, to continuously improve the impact of information framework on residents' cooperative coping ability.

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