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Official and Unofficial Media Information and the Public Panic during the COVID-19 Pandemic in China: An Empirical Analysis

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Abstract

The rapid spread of COVID-19 worldwide, similar to the SARS pandemic in 2013, which suddenly appeared in China, has caused panic among the people. Consequently, there is a need for a prompt and empirical investigation into the key factors promoting public panic during the outbreak in a bid to complement the global fight against the consequences of COVID-19. In this paper, a binary regression logit model was utilized to measure panic level among the Chinese residents. Subsequently, the main factors behind the panic were verified. The results show that psychological panic among the public is driven mainly by the influx of Wuhan residents, dissemination of official COVID-19 related information, living conditions and discussions of the surrounding people, and concerns about the possibility of transmission. In this connection, respective government committee are advised to declare a moderate lockdown of the province of Hubei (or Wuhan City), promote the circulation of positive news about key pandemic results, intensify drug research and development, and provide psychological intervention as countermeasures against the public panic. This study also provides some useful recommendations for the public authority to combat the novel coronavirus and manage emergencies.

Keywords: COVID-19, Public Panic, Logit Regression Model, Emergency Management

1. Introduction

At the end of 2019, an unknown respiratory disease was discovered in Hubei province of China and soon became a global pandemic, overcoming regional borders (Shereen et al., 2020) . The infectious disease was caused by a severe acute respiratory viral syndrome coronavirus 2 (SARS-CoV-2), which is closely related to the SARS virus of 2003 (Drosten et al., 2003; Lai et al., 2020). This strain of coronavirus is presently referred to as COVID-19, formerly called "2019 novel coronavirus" or "2019-nCoV.". The disease can be transmitted directly via respiratory droplets of infected people during coughing or sneezing. The onset of symptoms takes approximately 2 to 14 days from the time of infection (Lai et al., 2020). As per the study of Lu et al. (Lu et al., 2020), two major factors are responsible for the COVID-19 pandemic, namely the high infectivity of the virus and its long incubation time.

The first case of severe pneumonia with an unknown cause was reported in early December 2019 in Wuhan, the capital of Hubei Province, China. Later, on 9 January 2020, the unknown causative agent was identified as a novel virus in the coronavirus family (ECDC 2020) by the Chinese Center for Disease Control and Prevention (CCDC) (ECDC, 2020; Shereen et al., 2020). Subsequently, it was listed as an international public health emergency on 30 January 2020 and finally declared a pandemic on 11 March 2020 (Ghebreyesus, 2020). To date, over 13 million cases and 570,000 deaths have been reported worldwide since 15 July 2020 (WHO, 2020a). Prior to March 2020, Wuhan city of China (WHO, 2020b) had the largest number of cases. In response to the COVID-19 outbreak, the Chinese government in January 2020 enforced several precautionary measures, including

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lockdown of major cities, stringent health screening, travel restrictions and home quarantine (Zhang et al., 2020). In addition, several new medical centers were set up at the Wuhan epicenter to accommodate infected patients (Burki, 2020). In early February 2020, two emergency specialty hospitals (the Huoshenshan and Leishenshan hospital) with total bed space of 2500 were established for the treatment of patients with severe COVID-19 infection (Burki, 2020). Furthermore, sixteen fortune-building hospitals named "Fang Cang" were also created to accommodate patients with mild infective symptoms (Global Times, 2020). The Fangcang hospitals include local sports stadiums, exhibition centers and cultural centers which were transformed to field hospitals containing series of temporary “square cabin”. These square-cabin hospitals were made a temporary quarantine station, in which not only efficient medical treatment was given to patients, but also allows families and friends to be segregated. Consequently, more than 12,000 patients were treated successfully in these hospitals within a month, contributing majorly to the disease prevention in the country (Global Times, 2020). During the 2003 SARS epidemic in China, improvement of hospitals' trend was pioneered. Similarly, a 1,000-bed prefabricated hospital (Xiaotangshan hospital) was designed in a week, and caters for almost 700 SARS patients in less than two months (Wang & Ruan, 2004).

The COVID-19 outbreaks caused physical damage to many infected people and brought a certain amount of panic and anxiety to the community. Research evidence from different countries has shown that a global catastrophe does have psychological effects like anxiety (Chen et al., 2020; Xie et al., 2020), depression (Duan et al., 2020; Yeasmin et al., 2020), panic attacks (Saurabh & Ranjan, 2020), denunciation (Jiao et al., 2020; Spinelli et al., 2020; Zhang et al., 2020) and irritability (Jiao et al., 2020). Besides, social media is considered one of the significant means by which panic is spread among general people. For example, when the first case of COVID-19 was reported in Wuhan, China, several people in various cities of China were scared of shopping and performing their daily activities. As a result, they started to store various kinds of groceries and protective materials such as facemasks and disinfectants, despite the assurance of the Chinese government to ensure adequate supply of basic necessities and protective equipment as a countermeasure against the pandemic. The public panic has a negative influence on the current fight against the COVID-19 pandemic, and consequently impedes social harmony and solidity among the people. Therefore, timely and scientific identification of the key factors that caused panic during the outbreak is very essential for social and public management of the pandemic.

Moreover, various studies had been conducted to identify people's sensitivity and fear perception during the outbreak from different aspects worldwide. For instance, Slovic et al. (Slovic, 1987) proposed three basic dimensions of public perception of risk: risk of fear, risk of uncertainty, and the number of individuals facing a specific risk, all of which have become a model for subsequent related researches. Chinese scholars like Xie Xiaofei et al. (2002), Kan et al. (2004), and Duoyong (2006) have constructed corresponding public risk perception models from varying perspectives and investigated the key factors triggering public panic during the SARS outbreak in 2003. A small number of studies focused on panic buying (Islam et al., 2020; Lins & Aquino, 2020; Naeem, 2020) and consumer panic (Keane & Neal, 2020) during major pandemics, while the majority ignore the factors affecting the panic among the public.

The present paper contributes in various ways. First, it offers a comprehensive model in combinations of cognitive factors, socio-demographic, and contextual factors other than individuals' physiological factors. Second, this study incorporates official and unofficial media information as separate factors to understand media influences' more specific reasons. Third, this study attempts to fill the literature gap by examining the sources of public panic during the prevailing COVID-19 outbreak and based on the country origin of the disease, China. These insights could help the public authority to handle emergencies and combat against the novel coronavirus. Fourth, in some research contexts where the dependent variable cannot be scaled into other than binary scale, logistic regression modeling becomes obvious. This study modeled public panic with such logistic regression, which can be primary research to replicate future research in many similar diseases.

The remainder of paper is structured accordingly. The next section provides a theoretical relevance of Panic and leading to the development of thireteen hypothesis. Section 3 explains methods selection, model construction, variable selection and scale design. The next section will be followed by the empirical investigation, result and discussion. The paper concludes by discussing its

implications, limitations, and future research directions.

2. Literature Review and Hypothesis Development

The theoretical relevance of panic can discuss from three perspectives, namely physiology, psychology and social psychology.

2.1 Panic in Physiological Context:

From the biological point of view, panic is closely associated with the structure of the brain. Complicated feelings of humans such as wrath, panic, sorrow, pleasure and disgust stimulate the brain's amygdala, upon which the reactive state of mind shifts is dependent. In the "thalamus and corresponding cortex," the stimulus information is transmitted through the sensory organs and into the lateral amygdala. After processing by the dynamic circuit of the internal amygdala, the corresponding "nerve nucleus in the hypothalamus" passes via the amygdala's central nucleus and controls physiological and regulatory reactions in response to fear stimuli. This is the reaction system of human brain region where anxiety happens (Xu & Sattar, 2020).

Some scientists think that the fear of predators is the cause of such inherent panic. In this respect, anxiety can be divided into two categories: inherent and learned. Fear of predators and hostile conspecifics are inherent fear, which are encrypted in the genes. Pavlov's experiment is a typical example of a learned fear, i.e., an awe-inspiring, emotional reaction of fear. Davis et al. proposed the description of various forms of fear based on a timeframe focused on panic and anxiety response of the "central nucleus of the amygdala (CeA)" and the "bed nucleus of the stria terminalis (BNST)." Mobbs et al. (Mobbs et al., 2010) have incorporated the concept of a continuum of predator-threatening ecology into human FMRI ("Functional Magnetic Resonance Imaging") experiments.

2.2 Panic in Psychological Context:

The previous discussions are necessary to understand the biological base of personal fear. Nevertheless, biological or neurological theories alone cannot interpret panic in its entirety. Fear of people should not remain unchanged, just as fear of animals. In contrast with animals, humans have more brain capacity, greater memory, strong communication skills and critical thinking ability. Thus, human anxiety is not only stimulated by genes and evolution but also social experiences, society and community. This foundation also encourages the study of panic from psychological perspective.

From psychology standpoint, panic is considered a collective emotion or attitude that is formed in response conceived threats. In the survival and development phase, it is an essential adaptive function (King et al., 1995; Lindsay, 1984). Many academics believe that threats are an essential source of fear. Basoglu et al., for instance, (Başoğlu et al., 2002) conclude that people would experience serious negative emotions towards natural catastrophes, such as confusion, worry, anxiety and fear. Armfield reports that the stronger the danger, the bigger the fear response (Armfield, 2006).

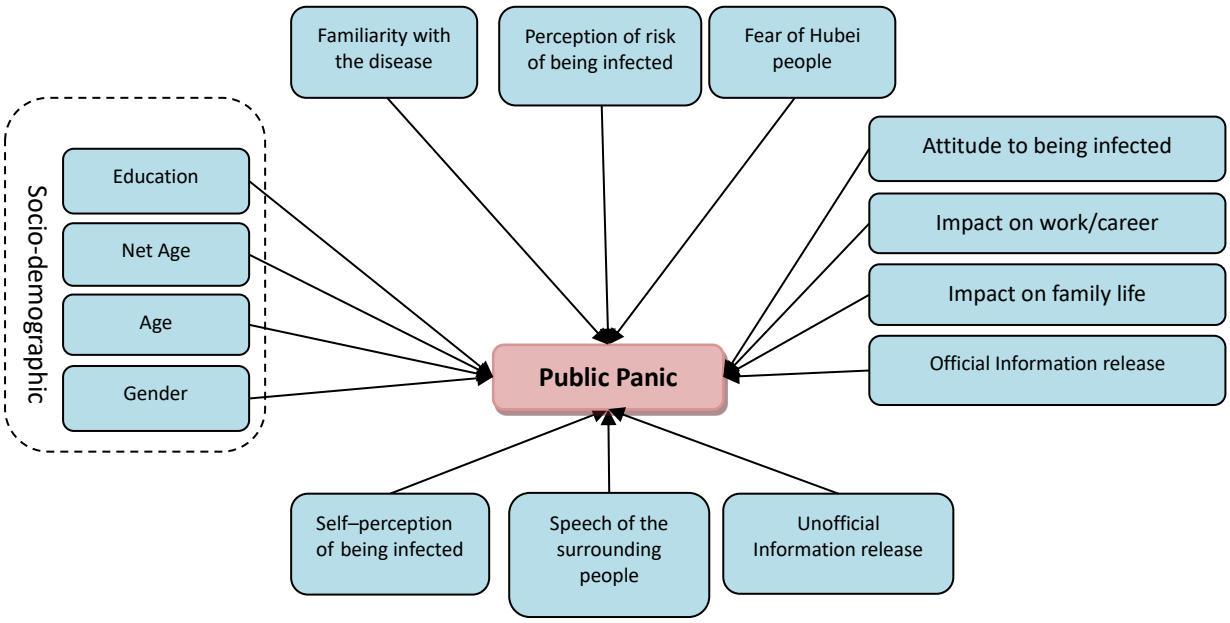

Figure 1. **Conceptual framework of public panic**

Moreover, the feeling of unpredictability and confusion about situations surrounding people is closely linked to fear (B. Zhang et al., 2020). The degree of fear depends not only on the subject's hazard but also on the interpretation and understanding of the danger by individuals. Since people vary in their experience and intelligence, many are unable to fully understand and interpret situations or facts. Thus, there is a degree of difference in the fear experienced by people. Researchers like Graziano et al. (Graziano et al., 1979) and King et al. (King et al., 1995) observed that socio-demographic factors such as age, gender, geographical location and economic situation have major effects on the variations of fear. Langford et al. articulated a psychological-cognitive theory model for predicting human risk perceptions and preferences concerning individual sensitivity factors (Langford et al., 2000). Slovic et al. have suggested three fundamental aspects of perception of danger among the public: 'unknown risk', 'fear risk' and 'the number of people at risk' (Fischhoff, 1995; Slovic, 1987). Some researchers have taken the SARS outbreak as an example to research the understanding of public risk, public fear, and strategic emergency response. Therefore, we propose the following hypothesis as shown (Figure 1):

H_1: Fear (fear of Hubei people) has a significant effect on the public panic during the covid-19 pandemic.

H_{3-6}: Socio-demographic factors (gender, age, net age and educational level) significantly influence the panic among the public during the covid-19 pandemic.

H_{7-8}: Perception (perception of surrounding people, self-perception and attitude) has a significant effect on the public panic during the pandemic.

H_9: Familiarity with the pandemic has a significant impact on the panic among the public during the covid-19 outbreak.

2.3 Panic in Socio-Psychological Context:

Analysis of panic as a cognitive response to external stimuli represents a new area that provides new insights and establishes the neccessity of the panic theory. From the socio-psychological context, panic is a reflexive reaction to outside stimuli. Wei et al. (Wei & Tang, 1998) summarized the stress theory into various models in their works. The stimulation theory for stress examines all stimuli that trigger stress in entities and the influences of different external stimuli as responses. The focus is to identify causal and quantitative relationships between stimuli and stress responses.

The stress theory model of "cognition-phenomenology-transaction (CPT)" is more relevant to this study, as more stress psychology and therapeutic procedures are involved in the theoretical model. This model includes stimulation, primary assessment, secondary assessment, and interaction between environmental effects. Stress is induced by unique relationships between people and the world. If people believe they cannot meet environmental requirements, they will encounter a difficult situation. This theory underlines individual-environmental interaction, listens to the individual's subjective action in a challenging situation and reviews the value of data input and behavioral change. Similar to Li & Wang (Li & Wang, 2011), some took the volcanic eruption in Wenchuan, a small county in Sichuan province of China as an instance to explore public panic and the response to the sudden catastrophes. Some of the reports from different areas and at varying catastrophe levels contrasted public psychological conditions and characteristics (Shao, 2007; Shi-Kan et al., 2003). However, others have also focused on the correlation between a press release and panic during major epidemics (Shao, 2007; H. Wang, 2003; Zhou, 2003). Therefore, we propose the following hypotheses:

H_{10-11}: Press (official or unofficial) release has a significant effect on the public panic during the covid-19 pandemic.

H_{12-14}: Impact of the pandemic on behavioral adjustment (work/career, family life and living conditions) significantly affects the public panic during the covid-19 outbreak.

3. Methods Selection and Model Construction

3.1 Methods Selection

The public showed some level of panic in the face of the 2019 novel coronavirus. The survey results indicate that 56.28 percent of people manifested obvious fears towards the pandemic and its consequences, as the outbreak progresses. Although 43.72 percent of people experienced panic, their feelings subsided as the pandemic advances. In this paper, public panic (Y) over the 2019 coronavirus is defined by a two-value variable (1 and 0), where 1 denotes an increase of panic and 0 signifies an unchanged or reduced panic. The investigation also revealed that huge factors such as the virus's pathogenicity and the fear of natives of Hubei province, which is represented by X1, X2 ... XN, contributed to panic experienced by people living in the pandemic.

Since the dependent variable Y is set as a

binary random variable in this article, neither generalized multiple linear regression nor the least square method can directly estimate the model. The logistic regression model is mainly employed in studying the occurrence probability (p) of certain phenomena, such as the rise or fall of stock and the success or failure of company. Besides, the method is also used to investigate the factors that relate to the occurrence probability (p). The binary logistic model was used to identify the influential factors that raise public panic over the COVID-19 pandemic and its effects on government emergency management and control of the novel coronavirus.

3.2 Model Construction

The probability of the dependent variable $Y=1$ is set as P the probability of $Y=0$ is $1-P(0\le P\le 1)$. To further explore the relationship between the probability P and the independent variable, the natural logarithm of $\frac{P}{1-P}$ is captured and $Ln\frac{P}{1-P}$ is obtained, named as $\mathrm{Logit}P$, and the value range of this logarithm is $(-\infty,+\infty)$, with $\mathrm{Logit}P$ as the dependent variable; $x=(x_1,x_2,\Lambda\ ,x_k)^T$ is set as an independent variable, and the observed values of the group n are marked as $(x_{i1},x_{i2},\Lambda\ ,x_{ik},y_i)\ i=1,2,\Lambda\ ,n$ $X_i=(1,x_{i1},x_{i2},\Lambda\ ,x_{ik})^T$ and $x_{i0}=1$ are marked, the logistic regression model of y_i and $x_{i1},x_{i2},\Lambda\ ,x_{ik}$ is as follows:

$$\mathrm{Logit}P=\beta_0+\beta_1\chi_1+\beta_2\chi_2+.....+\beta_N\chi_N \quad (1)$$

After capturing the logarithm of both sides of the model, the following model (2) was obtained:

$$P=\frac{EXP(\beta_0+\beta_1\chi_1+\beta_2\chi_2+.....\beta_N\chi_N)}{1+EXP(\beta_0+\beta_1\chi_1+\beta_2\chi_2+.....\beta_N\chi_N)} \quad (2)$$

In model (2), the dependent variable Y is a binary variable with only two values (0 and 1). The study object of the model is the probability $P(y=1\mid X)$ when the dependent variable is 1. $X=(1,x_1,x_2,\Lambda\ ,x_k)^T\ x_i$ In comparison, it represents the i factor of the effects Y.

In the logistical linear regression model, the error form of discrete variables follows the Bernoulli distribution rather than the normal division, indicating that normality is not assumed; simultaneously, the variance of binary variables is unstable and has heteroscedasticity. In contrast to the lowest square estimate rule, the non-linear characteristics of a logistic transformation use the maximum probability estimation method to seek the best regression coefficients (the minimum residual square sum). Therefore, the criterion for assessing the model's suitability becomes the probability value instead of the sum of squares of deviations. This study used SPSS 23.0 for modeling and performs the empirical analysis based on the relevant survey data.

3.3. Variable Selection and Scale Design

This article draws on the relevant questionnaire design rules, such as Churchill et al. (Churchill & Iacobucci, 2006). We designed and created the questionnaire based on the relevant literature and pandemic characteristics. The project was continuously assessed to ensure the understandability and typicality of the questionnaire. This assessment was facilitated by nine invited experts and researchers (including three scholars in this field, three heads of Psychological Counseling Agencies, and three government officials). Subsequently, the suggested modifications were effected.There are two parts to this questionnaire: the first part relates to the respondents' core characteristics and the second part subjectively evaluates the respondents' relevant panic-related factors. The 0-1 binary classification method was used to characterize all items.

To make filling out the questionnaire more convenient, the questionnaire was uploaded to the Wenjuan Xing platform (an online survey platform whose services include questionnaire establishment, distribution, management, analysis and more). Moreover, by adding criteria such as single response from "same device" and "same IP address" cum other settings, repeated answers from the same respondent were eliminated. Consequently, a useful link was created (https://www.wjx.cn/m/55471936.aspx). The combination of directional and non-directional methods was used to promote the questionnaire link. After a week of sharing the survey link, a total of 462 questionnaires were collected. An overall of 462 questionnaires were delivered, while 416 was utilized for the analysis, demonstrating a response rate of 90.04%. Table A1 shows the corresponding assessment index system.

4. Empirical Analysis

The empirical analysis includes examination of the descriptive statistical analysis and analysis of the empirical result, along with the necessary discussions as follows:

4.1 Descriptive Statistical Analysis:

The author initially conducted descriptive statistics of the samples before the empirical analysis. The response of gathered respondents showed no obvious systematic deviation throughout the analysis, indicating the reliability of the accumulated data. The relevant statistical results of the descriptive analysis are shown in Table A2. The women constitute 62.77% of the respondents, indicating that women are more sensitive to the pandemic. The education level of interviewees' is high, with 92.21% or more graduating from college. It can be said that high school graduates understand the purpose and importance of the survey items better compared to less educated population. On related items specifically affecting citizens' panic, the results indicate that 91.13% of respondents are familiar with the pandemic situation. Nearly 95.02% believed that the pandemic is highly sensitive, i.e., most respondents understood the sensitivity of the pandemic. It was also observed that about 84,63% participants were scared of the Hubei people's influx, which is mainly due to either Hubei (Wuhan) being a large portion of the first and second group or their recent contact with Hubei (Wuhan). Also, approximately 81.82% of the participants feared being infected with the virus. After further study, it was discovered that the leading cause of their concern is the unavailability of the specific pandemic-related treatment plan.

The pandemic affects almost two-thirds (67.75% and 69.26%) of the participants' work and family life respectively. Also, about 82.68% of respondents considered the impact of the formal pandemic information to be enormous, whereas 60.61% believed that informal pandemic information has little influence on them. In addition, almost half of respondents (46.1%) posited that their living conditions were significantly affected by the COVID-19 pandemic. However, 56.28% of the participants believed that the pandemic would trigger a more obvious fear on their livelihood may be due to the enhanced public governance, proper emergency handling and consistent pandemic management capacity.

4.2 Empirical Result and Discussion:

The corresponding empirical test was carried out with the aid of SPSS 23.0. First, the overall condition of dependent variables was analyzed through frequency statistical analysis. Second, the meaning and effect of independent variable X on dependent variable Y was examined successively through the p-value of each variable's standardization coefficient, which is obtained in the results of logit regression analysis; the corresponding influence range was further analyzed in combination with OR value. Similarly, the backward logistics regression (LR) method was used to further optimize the model. Third, using the Nagelkerke (R) and Hosmer-Lemeshow (HL) test values, fitness and efficacy of each optimization model were compared and verified. Last, the quality of each optimization model was compared with the accuracy of regression prediction. Tables A3 – A5, and Table 1 show the corresponding empirical analysis results. As presented in table A3, "fear of the outbreak" was used as a dependent variable for logit binary regression analysis and defined with “the presence or absence of an obvious fear. While, table A4 and A5 show that if the model does not contain any independent variables but only terms, the model's overall prediction accuracy is 63.46%. The model consistency is increased to 82.45% after seven rounds of optimization, which shows that the introduction of respective independent variables significantly improved the model's predictability effect.

For the Model overall quality analysis, Table 1 shows that after seven rounds of optimization, Model 7's Cox & SnellR2 and Nagelkerke R2 are 0.515 and 0.528 respectively, which are significantly better than Model 1's 0.320 and 0.395, indicating that after multiple rounds of optimization, the overall fitness of the model was further improved. The p-value in model 1 is 0.002, which is lower than 0.05; according to the Hosmer-Lemeshow test value, model 1 fails the HL test and is fitted poorly to the model. Besides, the p-value in Model 7 is 0.801 and above 0.05, indicating that Model 7 passes the HL test and has a good fit. According to the probability ratio test, it can be noted that, although the p-values of the probability ratios of Model 1 and Model 7 are both below 0.05, the AIC and BIC values in Model 7 are significantly lower than the corresponding values in Model 1 after several optimization rounds, which further shows that the overall efficacy of Model 7 is better than that of Model 1.

Table 1 shows that six independent variables [X1-X6] were eliminated after seven rounds of optimization, implying that these six independent variables had no significant effect on public panic. The deleted independent variables including

gender, age, net age, educational level, familiarity with the pandemic, and perception of the possibility of being infected with the virus. According to the findings of Islam et al. (Islam et al., 2020), gender (male/female) has no connection with public panic; however, in contrast to the predicted relations of higher education (bachelor), the age (above 30 years) exhibits a worsening effect on the public panic during the outbreak. Moreover, the career impact regression coefficient (X9) is 0.067, but statistically insignificant (z=0.265, p=0.791>0.05). From the descriptive statistical analysis, it can be observed that despite the negative impact of pandemic on work or career reported by about two-thirds (67.75%) of respondents, the Chinese government had issued several policies in time to sustain the economy. In addition, the coefficient of regression of the epidemic's impact on family life (X10) is 0.160, which is not statistically significant (Z=0.635, p=0.525 > 0.05). According to the descriptive statistical analysis, about two-thirds (69.26%) of respondents believed that the pandemic had greatly affected their family life.

Table 1: **The Empirical Results**

Independent variable	Model 1					Model 7				
	B	S.E.	Z	P	OR	β	S.E.	Z	P	OR
X_1	-0.268	0.235	-1.137	0.255	0.765					
X_4	0.018	0.482	0.037	0.970	1.018					
X_5	-0.189	0.467	-0.405	0.685	0.827					
X_6	0.440	0.610	0.721	0.471	1.553					
X_7	0.792	0.343	2.310	0.021	2.208	0.830	0.338	2.547	0.014	2.294
X_8	1.460	0.338	4.318	0.000	4.306	1.513	0.334	4,524	0.000	4.539
X_9	0.067	0.253	0.265	0.791	1.069					
X_{10}	0.160	0.252	0.635	0.525	1.174					
X_{11}	0.681	0.317	2.146	0.032	1.976	0.709	0.308	2.302	0.021	2.031
X_{12}	0.632	0.255	2.482	0.013	1.882	0.665	0.250	2.664	0.008	1.945
X_{13}	0.744	0.243	3.812	0.001	2.169	0.772	0.239	3.231	0.001	2.165
X_{14}	1.680	0.495	3.396	0.001	5.366	1.757	0.489	3.589	0.000	5.794
Constant β_0	-3.246	0.835	-3.886	0.000	0.039	-3.068	0.468	-6.550	0.000	0.047
Cox&SnellR^2			0.320					0.515		
Nagelkerke R^2			0.395					0.528		
Hosmer-Lemeshow Test	χ^2=24.141(P=0.002； df=11)					χ^2=2.338(P=0.801； df=5)				
Likelihood Ratio Test	χ^2=103.542(P=0.000； df=12)					χ^2=100.745(P=0.000； df=6)				
AIC	499.304					466.102				
BIC	559.764					514.317				

Note: Cox & SnellR^2 and Nagelkerke R^2 test the goodness of fit of the whole model. The test value is expected to be in range of 0–1. The closer the value is to 1, the higher the regression model's goodness of fit, or vice versa. Similarly, the Hosmer-Lemeshow test verifies the goodness of fit of the model from another aspect. If the p-value is greater than 0.05, it means that the model fulfills the HL test criteria or vice versa. The likelihood ratio test was used to analyze the effectiveness of the overall model. If the p-value is below 0.05, then the model is effective, or vice versa. Akaike Information Criterion (AIC) and Bayesian information criterion (BIC) were used for corresponding comparative analysis when the model is optimized in multiple rounds. The lower these two values are, the better the model's fit.

Analysis of significant variable results in the model (Table 1) revealed that the regression coefficient of fear of influx of Hubei (Wuhan) residents (X7) is 0.830, which is statistically significant at the 5% level (z = 2.547, p = 0.014 < 0.05). This indicates that the severe viral affliction of Hubei (Wuhan) people and their influx brought obvious fear to people in other parts of the country. On the other hand, the regression coefficient of the fear of being infected (X8) is 1.513, which is statistically significant at the 1% level (z = 4.524, p = 0.000 < 0.05). This implies that the public is still afraid of being infected. Thus, the regression coefficient of the official release of COVID-19 related information (X11) is 0.709, which is significant at the 5% level (z = 2.302, p = 0.021 < 0.05), indicating that the official dissemination of relevant information by the government during the pandemic has a significant impact on the public

panic. This finding is in line with the other research outcomes (Finch et al., 2016; Xu & Sattar, 2020). Although government released timely and authentic information in the face of the sudden outbreak, the reality is often cruel. In the wake of the outbreak where it is difficult to see the inflection point, a certain amount of panic is unavoidable.

The impact of unofficial information on the population during the pandemic had a regression coefficient (X12) of 0.665, which is statistically significant at the 5% level ($z = 2.664$, $p = 0.008 < 0.05$), indicating that the circulation of relevant unofficial information during the pandemic caused significant panic among the people. This result aligns with the contemporary research findings (Han et al., 2020; Xu & Sattar, 2020). In addition, the regression coefficient of the living conditions and discourse of the surrounding people (X13) is 0.772, and it is statistically significant at 1% level ($z = 3.231$, $p = 0.001 < 0.05$). This shows that the living conditions and utterance of the nearby people have an obvious "contagion" effect on individual's emotion. Apparently, people's views are influenced by the views of others around to a certain extent and most people are easily affected by the emotions of those around them. Therefore, a statistically significant regression coefficient value of 1.757 was observed for the self-perceived likelihood of being infected (X14) at the 1% level ($z = 3.589$, $p = 0.000 < 0.05$), indicating that the variable has a significant impact on the panic among people. According to the descriptive statistical analysis, only 14.07% of the respondents think they are more likely to be infected. However, no corresponding therapeutic drugs have been approved so far. Therefore, relevant scientific research should be encouraged to repress the spread of the pandemic. Similarly, rapid medical intervention can effectively prevent the pandemic and significantly reduce the public panic.

5. Conclusions:

This study was undertaken in order to contribute to the ongoing combat against the COVID-19 pandemic. It aims to describe the main factors affecting the panic of the public. Subsequently, we constructed a mathematical/statistical model, consulted relevant literature and evaluate experts' proposals to describe how panic affects human beings. Besides, an appropriate questionnaire for data collection was carried out on this basis. The results of the analysis show that the model is fit and efficient. Also, the accuracy of the model prediction was increased from 63.46% to 82.45% following optimism, implying that this model is scientific in construction. The independent X_1, X_4, X_5, X_6, X_9 and X_{10} variables were finally removed after seven rounds of model optimization. However, individual panic level during the pandemic was affected by the independent variables X_7, X_8, X_{11}, X_{12}, X_{13} and X_{14}. In other words, fears of Hubei (Wuhan) residents, fear of being infected, official dissemination of information, informal publications, the living conditions and conversations of neighboring people, and the self-conceived chance of being infected with the virus were observed in this study as critical factors causing panic among the public.

6. Implication of the Study

The study proffers several implications for policymakers and academics fighting directly and indirectly against the pandemic's adversity. First, one of the significant factors eliciting the public fear during the pandemic is the fear of Hubei (Wuhan) people (X7). Moreover, the effect will continue even for a period after the end of the pandemic, a long-term fear will be lasting to the people outside Hubei (Wuhan). Therefore, intensifying the prevention and elimination of the Hubei pandemic is necessary for the entire country. In addition, the movement restriction placed on the Hubei (Wuhan) area should have been extended to provide a psychological buffer to non-Hubei (Wuhan) residents. Also, the epidemic prevention and control work in Hubei (Wuhan) must be strategically and positively displayed through the official mainstream media and other unofficial micro-media channels in a bid to properly manage the pandemic. In this way, people in the non-Hubei (Wuhan) area can get the true picture of the situation on time, thereby alleviating and eliminating their panic towards people from Hubei (Wuhan). Given the susceptibility nature of the virus, which can cause panic among people, prevention in various regions needs to be strengthened. Similarly, different countermeasures against the virus at the individual level must also be publicized through various channels. Simultaneously, adequate supply of different protective products such as facial masks, disinfectants, etc. should be provided to ensure a significant reduction in the rate of multi-channel and multi-method virus infections and further alleviate and eliminate panic in the public.

Second, during the ongoing pandemic, the Chinese government used emerging technologies such as big data to promptly, transparently, and objectively disclose the pandemic information. In particular, during the early and mid-stages of the

pandemic, the validity of information about the increasing number of infected cases or other real information was also discouraged. Therefore, the government should pay more attention to the publicity of essential successes or positive information such as the bravery events that occurred in tacking the pandemic to restore people's trust and hope, and also mitigate the panic caused by the truth.

Third, during the pandemic, people tend to spend more time sharing COVID-19 related information via the mainstream media channel and informal social media such as WeChat and QQ. The uncontrolled circulation of shallow and unofficial information makes it difficult for people to understand the truth of the situation, thereby exacerbating people's panic. Therefore, there is a need for the official mainstream media to utilize several unofficial social media to disclose real pandemic information in a timely and multi-channel fashion, while strengthening their supervision of the network to rid the cyberspace of inauthentic information. In the meantime, it is important to establish and improve a response mechanism that will identify and refute rumors. The public must also enhance their ability to discern the authenticity of unofficial information and refrain from disseminating fake news to ease or eliminate the panic arising from informal information channel.

Fourth, considering the contagious nature of emotions, individual panic can be further aggravated if a certain amount of panic is expressed by the neighbors during the pandemic. In this regard, the panic can easily be transformed into a mass panic via social sharing of emotions through the internet. Hence, relevant government departments should provide more positive information to strengthen the mental capacity of individuals. Similarly, government should improve transparency in their administration, strengthen digital management, and advice people on the right attitude in order to increase people's trust in their management of the pandemic via different means.

Fifth, people tend to feel insecure as drugs are still in the development phase and are yet to be approved for the treatment of COVID-19. Moreover, the social stigma endured by SARS patients in 2003 still lingers in the minds of many, which further provoke their fear of being infected by the current pandamic. Therefore, government should provide adequate financial support to hasten the research and development of therapeutic drugs and minimizes individuals' panic.

As a final point, similar to panic caused by other emergencies, panic arising due to the pandemic also result from several factors which co-exist and interact to further exacerbate the public panic. Therefore, the Government should not rely on a single measure to resolve and eliminate people's panic. They must also consider psychological intervention while strengthening guidance in media systems, mechanisms, and management.

7. Limitations and Suggestions for Future Study

There are some limitations to our study. First, self-reporting has drawbacks with numerous stereotypes compared to face-to-face interviews. Additional distortions include sample misrepresentations which can affect the panic estimates and general anxiety observed. Second, since it was an online survey, this analysis is not reflective of those who are out of the internet platforms. Third, this is a cross-sectional study, which only identifies panic and anxiety predictors, and not their impacts in different time. Longitudinal observation is significant, especially when a post-traumatic experience is potentially available. Fourth, the study utilized a logistic regression model using SPSS, which may be extended in the future studies by employing the Partial Least Square-Structural Equation Modeling or covariance-based Structural Equation Modeling approach to structural equation modeling.

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References

[1] Armfield, J. M. (2006). Cognitive vulnerability: A model of the etiology of fear. Clinical Psychology Review, 26(6), 746–768. https://doi.org/10.1016/j.cpr.2006.03.007

[2] Başoğlu, M., Şalcioğlu, E., & Livanou, M. (2002). Traumatic stress responses in earthquake survivors in Turkey. Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies, 15(4), 269–276.

[3] Burki, T. (2020). Outbreak of coronavirus disease 2019. The Lancet Infectious Diseases, 20(3), 292–293. https://doi.org/https://doi.org/10.1016/S1473-3099(20)30076-1.

[4] Chen, F., Zheng, D., Liu, J., Gong, Y., Guan, Z., & Lou, D. (2020). Depression and anxiety among adolescents during COVID-19: A cross-sectional study. Brain , Behavior , and Immunity, 88(January), 36–38.

[5] Churchill, G. A., & Iacobucci, D. (2006). Marketing research: methodological

foundations. Dryden Press New York.

[6] Drosten, C., Günther, S., Preiser, W., Van Der Werf, S., Brodt, H.-R., Becker, S., Rabenau, H., Panning, M., Kolesnikova, L., & Fouchier, R. A. M. (2003). Identification of a novel coronavirus in patients with severe acute respiratory syndrome. New England Journal of Medicine, 348(20), 1967–1976.

[7] Duan, L., Shao, X., Wang, Y., Huang, Y., Miao, J., & Yang, X. (2020). An investigation of mental health status of children and adolescents in china during the outbreak of COVID-19. Journal of Affective Disorders, 275(January), 112–118.

[8] Duoyong, S. (2006). A Quantitative Model about Panic Perception of the Individual Based on Logit Modeling and Its Empirical Research [J]. Management Review, 10.

[9] ECDC. (2020). Event background COVID-19. Stockholm: European Center for Disease Control and Prevention; 2020. ECDC. www.ecdc.europa.eu/en/novelcoronavirus/ event-background-2019.

[10] Finch, K. C., Snook, K. R., Duke, C. H., Fu, K.-W., Tse, Z. T. H., Adhikari, A., & Fung, I. C.-H. (2016). Public health implications of social media use during natural disasters, environmental disasters, and other environmental concerns. Natural Hazards, 83(1), 729–760. https://doi.org/10.1007/s11069-016-2327-8

[11] Fischhoff, B. (1995). Risk Perception and Communication Unplugged: Twenty Years of Process1. Risk Analysis, 15(2), 137–145. https://doi.org/10.1111/j.1539-6924.1995.tb00308.x

[12] Ghebreyesus, T. A. (2020). WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020. World Health Organization, 11.

[13] Global Times. (2020). Closure of all Wuhan's makeshift hospitals indicates another stage in victory against COVID-19. Global Times. https://www.globaltimes.cn/ content/1179616.shtml

[14] Graziano, A. M., DeGiovanni, I. S., & Garcia, K. A. (1979). Behavioral treatment of children's fears: A review. Psychological Bulletin, 86(4), 804.

[15] Han, X., Wang, J., Zhang, M., & Wang, X. (2020). Using social media to mine and analyze public opinion related to COVID-19 in China. International Journal of Environmental Research and Public Health, 17(8). https://doi.org/10.3390/ijerph17082788

[16] Islam, S., Zannatul, M., & Potenza, M. N. (2020). Panic and generalized anxiety during the COVID-19 pandemic among Bangladeshi people: An online pilot survey early in the outbreak. Journal of Affective Disorders, 276(January), 30–37. https://doi.org/doi:10.1016/j.jad.2020.06.049.

[17] Jiao, W. Y., Wang, L. N., Liu, J., Fang, S. F., Jiao, F. Y., Pettoello-Mantovani, M., & Somekh, E. (2020). Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic. Journal of Pediatric, 221, 264–266. http://journals.sagepub.com/doi/10.1177/1120700020921110%0Ahttps://doi.org/10.1016/j.reuma.2018.06.001%0Ahttps://doi.org/10.1016/j.arth.2018.03.044%0Ahttps://reader.elsevier.com/reader/sd/pii/S1063458420300078?token=C039B8B13922A2079230DC9AF11A333E295FCD8

[18] Kan, S., & Weipeng, H. (2004). A Comparative Study of Risk Cognition and Psychological Behavior of Beijing People in the SARS Epidemic. Chinese Journal of Clinical Psychology, 12(3), 293–298.

[19] Keane, M. P., & Neal, T. (2020). Consumer Panic in the COVID-19 Pandemic.

[20] King, N., Hamilton, D., & Ollendick, T. (1995). Children's Phobias – a Behavioural Perspective. British Journal of Psychiatry, 167(3), 417. https://doi.org/DOI: 10.1192/S0007125000065259

[21] Lai, C., Shih, T., Ko, W., Tang, H., & Hsueh, P. (2020). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. International Journal of Antimicrobial Agents, 55(January).

[22] Langford, I. H., Day, R. J., Georgiou, S., & Bateman, I. J. (2000). A cognitive social psychological model for predicting individual risk perceptions and preferences. http://hdl.handle.net/10068/569648

[23] Li, H. Q., & Wang, S. H. (2011). Research on the relationship between public demand, risk perception and psychological behavior in sudden disasters. Dajia, 18, 107–108.

[24] Lindsay, S. J. E. (1984). Treating children's fears and phobias—A behavioural approach: RJ Morris and TR Kratochwill Pergamon Press, New York (1983). Pergamon.

[25] Lins, S., & Aquino, S. (2020). Development and initial psychometric properties of a panic buying scale during COVID-19 pandemic. Heliyon, 6(9), e04746. https://doi.org/10.1016/j.heliyon.2020.e04746

[26] Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., Wang, W., Song, H., Huang, B., Zhu, N., Bi, Y., Ma, X., Zhan, F., Wang, L., Hu, T., Zhou, H., Hu, Z., Zhou, W., Zhao, L., … Tan, W. (2020). Genomic

characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. The Lancet, 395(10224), 565–574. https://doi.org/https://doi.org/10.1016/S0140-6736(20)30251-8

[27] Mobbs, D., Yu, R., Rowe, J. B., Eich, H., FeldmanHall, O., & Dalgleish, T. (2010). Neural activity associated with monitoring the oscillating threat value of a tarantula. Proceedings of the National Academy of Sciences of the United States of America, 107(47), 20582–20586. https://doi.org/10.1073/pnas.1009076107

[28] Naeem, M. (2020). Do social media platforms develop consumer panic buying during the fear of Covid-19 pandemic. Journal of Retailing and Consumer Services, 58(January). https://doi.org/https://doi.org/10.1016/j.jretconser.2020.102226.

References

[29] Saurabh, K., & Ranjan, S. (2020). Compliance and Psychological Impact of Quarantine in Children and Adolescents due to Covid-19 Pandemic. Indian Journal of Pediatrics, 87(7), 532–536. https://doi.org/10.1007/s12098-020-03347-3

[30] Shao, P. R. (2007). Terror from the media? An Introduction and enlightenment of media panic. Shanghai J. Rev., 24, 23–25.

[31] Shereen, M. A., Khan, S., Kazmi, A., Bashir, N., & Siddique, R. (2020). COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. Journal of Advanced Research.

[32] Shi-Kan, F.-H., Jia-Jianming, L.-W., Song-Zhaoli, G.-J., & Chen-Xuefeng, -Lu-Jiafang. (2003). The risk perceptions of SARS and socio-psychological behaviors of urban people in China. Acta Psychologica Sinica, 35(04), 546–554.

[33] Slovic, P. (1987). Risk Perception. Science, 236(4799), 280–285.

[34] Spinelli, M., Lionetti, F., Pastore, M., & Fasolo, M. (2020). Parents' Stress and Children's Psychological Problems in Families Facing the COVID-19 Outbreak in Italy. Front Psychol, 11. https://doi.org/https://doi.org/10.3389/fpsyg.2020.01713.

[35] Wang, H. (2003). The causes and elimination of group panic psychology: An interpretation of group psychology from the SARS epidemic. Journal of Beijing University Posts Telecommunication, 5, 1–4.

[36] Wang, W., & Ruan, S. (2004). Simulating the SARS outbreak in Beijing with limited data. Journal of Theoretical Biology, 227(3), 369–379. https://doi.org/10.1016/j.jtbi.2003.11.014

[37] Wei, Y. H., & Tang, S. Q. (1998). Several main stress theory models and their evaluation. Journal of Psychological Sc, 5, 441–444.

[38] World Health Organization (WHO). (2005). Statement on the Second Meeting of the International Health Regulations. Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV); 2005. URL: Https://Www. Who. Int/News-Room/Detail/30-01-2020-Statement-Onthe-Second-Meeting-of-the-International-Health-Regulations.

[39] World Health Organization (WHO). (2020a). Coronavirus Disease 2019. In Coronavirus disease (COVID-19) Situation Report – 177 (Vol. 177). https://doi.org/10.1213/xaa.0000000000001218

[40] World Health Organization (WHO). (2020b). Coronavirus disease 2019 (COVID-19). In Situation report - 45 (Vol. 45). https://doi.org/10.1213/XAA.0000000000001218

[41] Xiaofei, X., & Yuhui, L. (2002). OPPORTUNITY-THREAT PERCEPTION IN RISK SITUATION [J]. Journal of Chinese Psychology Acta Psychologica Sinica, 3.

[42] Xie, X., Xue, Q., Zhou, Y., Zhu, K., Liu, Q., Zhang, J., & Song, R. (2020). A practical approach to using multiple-race response data: A bridging method for public-use microdata. JAMA Pediatrics, 174(9), 898–900. https://doi.org/10.1353/dem.2008.0004

[43] Xu, T., & Sattar, U. (2020). Conceptualizing COVID-19 and Public Panic with the Moderating Role of Media Use and Uncertainty in China: An Empirical Framework. Healthcare, 8, 249. https://doi.org/10.3390/healthcare8030249

[44] Yeasmin, S., Banik, R., Hossain, S., Hossain, N., & Mahumud, R. (2020). Impact of COVID-19 pandemic on the mental health of children in Bangladesh: A cross-sectional study. Children and Youth Services Review, 117(January). https://doi.org/https://doi.org/10.1016/j.childyouth.2020.105277.

[45] Zhang, B., Zhou, H., & Zhou, F. (2020). Study on SARS-COV-2 transmission and the effects of control measures in China 3. MedRxiv. https://doi.org/doi:10.1101/2020.02.16.20023770

[46] Zhang, L., Li, H., & Chen, K. (2020). Effective Risk Communication for Public Health Emergency : Reflection on the COVID-19 (2019-nCoV) Outbreak in Wuhan, China. Healthcare, 8(64), 1–13.

[47] Zhou, X. H. (2003). Propagation distortion: A

social psychological analysis of “SARS” rumors.
Sociological Study, 17, 45–56.

Appendices

Table A1: **Determinants of Panic among Chinese People During the 2019-nCoV Pandemic**

Variables	Variable meaning	Value range
Y	Panic over the pandemic	1 - have obvious fear, 0 - basically have no obvious fear
X_1	Gender	1 - male, 0 - female
X_2	Age	1 - under 18 years, 0 - over 18 years
X_3	Net age	1 - less than one year, 0 - more than one year
x_4	Education level	1 - below college, 0 - above college
X_5	Familiarity with the pandemic	1 - more familiar, 0 – unfamiliar
X_6	Perception of the possibility of being infected with the virus	1 - susceptible to infection, 0 - less susceptible to infection
X_7	The fear of the Hubei people	1 - feel dreadful, 0 - do not feel dreadful
X_8	Attitude towards the virus once infected	1 - feel scared, 0 - do not feel scared
X_9	Impact of the pandemic on work/career	1- the impact is great, 0 - the impact is not great.
X_{10}	Impact of the pandemic on family life	1 - the impact is great, 0 - the impact is not great.
X_{11}	Impact of official information release	1 - the impact is great, 0 - the impact is not great.
X_{12}	Impact of unofficial information release	1 - the impact is great, 0 - the impact is not great.
X_{13}	Impact of the living conditions and speech of the surrounding people	1 - the impact is great, 0 - the impact is not great.
X_{14}	Self-perception of the possibility of being infected	1 - the possibility of infection is great, 0 - the possibility of infection is less.

Table A2: **Descriptive Statistical Analysis Table**

Variable name	Categorical variable	Proportion（%）
Y=Panic of the pandemic	1 - have obvious fear	56.28
	0 - have no obvious fear	43.72
X_1=Gender	1 - man	37.23
	0 - woman	62.77
X_2=Age	1 - under 18 years of age	1.52
	0 - above 18 years of age	98.48
X_3=Net age	1 - less than one year	1.73
	0 - more than one year	98.27
X_4=Education level	1 - below college	7.79
	0 - above college	92.21
X_5=Familiarity with the pandemic	1 - more familiar	91.13
	0 – unfamiliar	8.87
X_6=Perception of the possibility of being infected with the virus	1 - susceptible to infection	95.02
	0 - less susceptible to infection	4.98
X_7=The fear of Hubei people	1 - feel dreadful	84.63
	0 - don't feel dreadful	15.37
X_8=Attitude towards the virus once infected	1 - feel scared	81.82
	0 - don't feel scared	18.18
X_9=Impact of the pandemic on work / career	1 - the impact is great	67.75
	0 - the impact is great	32.25
X_{10}=Impact of the pandemic on family life	1 - the impact is great	69.26
	0 - the impact is great	30.74
X_{11}=Impact of official information release	1 - the impact is great	82.68
	0 - the impact is great	17.32
X_{12}=Impact of unofficial information release	1 - the impact is great	39.39
	0 - the impact is great	60.61
X_{13}=Impact of the living conditions and speech of the surrounding people	1 - the impact is great	46.1
	0- the impact is great	53.9
X_{14}=Self-perception on the possibility of being infected	1 - the possibility of infection is high	14.07
	0 - the possibility of infection is low	85.93

Table A3: **Basic Summary of the Logit Binary Regression Analysis**

Dependent variable name	Option	Frequency	Percentage（%）
Fear of the outbreak	0 - have no obvious fear	188	45.19
	1 - have obvious fear,	228	54.81
	Total	416	100
Summary	Efficiency	416	100
	Missing	0	0
	Total	416	100

Table A4: **Prediction Accuracy of Model Without Independent Variables**

Actual observation			Prediction		
			Fear of the outbreak		Accuracy
			0	1	
Initial model	Fear of the outbreak	0	0	152	0%
		1	0	264	100%
	Summary				63.46%

Table A5: **The Prediction Accuracy of the Model**

			Predictive value		Prediction accuracy	Prediction error rate
			0	1		
Model 1	**Actual value**	0	118	70	62.77%	37.23%
		1	47	181	79.39%	20.61%
	Summary				71.88%	28.12%
			Predictive value		**Prediction accuracy**	**Prediction error rate**
			0	1		
Model 7[1]	**Actual value**	0	145	33	81.46%	18.54%
		1	40	198	83.19%	16.81%
	Summary				82.45%	17.55%

[1] In model 1, all the independent variables were introduced into the Logit binary regression model. According to the significance (p-value) of the independent variable coefficients in the model, the least significant independent variables were removed gradually. After seven rounds of optimization, the remaining six independent variable coefficients (p-value) were statistically significant at the level of 5%. Due to the article's limited space, the empirical section only enlists model 1 and 7 for comparative analysis.