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Households' Earthquake Disaster Preparedness Behavior: The Role of Trust in and Help From Stakeholders

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Earthquake is one of the most serious natural disasters. Taking scientific and reasonable earthquake preparedness measures can effectively reduce casualties and economic losses caused by earthquakes. It is important to understand how residents choose such earthquake preparedness measures to guide them accordingly. However, the current research has failed to address rural areas in developing countries and has inconsistency conclusions for two aspects related to stakeholders involved: the assistance the victims can get from stakeholders for applying earthquake preparedness measures and the trust in stakeholders' disaster relief abilities. In this study, the rural residents affected by Wenchuan earthquake, Ya'an earthquake and Yibin earthquake were taken as the research objects, and 674 valid questionnaires were obtained through field household surveys. A Multinominal Logit Model (MNL) was constructed to explore the influence of villagers' trust in the disaster relief ability of stakeholders and the help they can get from stakeholders on their preparedness behavior. The results show that the less trust the villagers have on the government and the community, and the more help they can get from the outside while preparing measures, the more inclined they are to take the disaster preparedness measures. Furthermore, the education level of villagers in earthquake-stricken areas has significant positive impacts on people's earthquake preparedness behavior. People who are not born in rural areas are more likely to take earthquake preparedness measures. In addition, male, young and married villagers are more likely to take earthquake preparedness measures in their daily lives. This study enriches the theory of rural disaster prevention and mitigation, and provides reference for the practice of disaster prevention and mitigation in earthquake-stricken rural areas.

Keywords: multi-stakeholders, MNL model, trust, help, villagers earthquake preparedness behavior

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INTRODUCTION

China is one of the countries with the most serious earthquake disasters in the world, with many wide distributed, highly intense earthquakes, which causes serious disaster consequences (Imirbaki, 2018). Three recent earthquakes in Sichuan Province in China have caused huge damage. Wenchuan M8.0 earthquake in 2008, Lushan M7.0 earthquake in Ya'an in 2013 and Changning M6.0 earthquake in Yibin in 2019 have caused more than 70,000 deaths, with losses exceeding one trillion yuan,

especially in rural areas. It is clear to see that in Sichuan region, earthquakes happen frequently and it is important to be prepared for residents for the next coming earthquake.

Existing research shows that scientific and reasonable disaster preparedness behavior can reduce the negative impact of earthquake disasters (Li et al., 2017). Xu et al. systematically analyzed the influence relationship between risk perception and residents' disaster preparedness behavior (Xu et al., 2019). Zhou believed that improving residents' livelihood resilience and adjusting residents' livelihood strategies were effective means to deal with disaster risks (Zhou et al., 2021). Ma explored the correlation between community resilience and residents' disaster preparedness by establishing a Tobit regression model (Ma et al., 2021). However, existing studies mostly focus on the driving factors of disaster-preparedness behaviors among urban residents, while few studies consider such factors among rural residents (Lian et al., 2021).

Furthermore, effective disaster preparedness behavior also needs the participation of other stakeholders, including the government, communities, families and individuals (Han et al., 2020). Existing research shows that perceived stakeholder characteristics, such as trust, responsibility and help affect people's judgment of disasters, could affect people's disaster preparedness behavior (Wei et al., 2016a; Han et al., 2021). Among the perceived characteristics of stakeholders, the public's trust in the ability of relevant government departments and social organizations to cope with disasters has received great attention in recent years (Deyoung and Peters, 2016; Wei et al., 2019). The help from different stakeholders that local residents can get when preparing for earthquake disaster is another emerging factor that affects their disaster preparedness behavior (Wei et al., 2019). However, the current research results are not always consistent on these two factors. Therefore, it is necessary to explore the impact of stakeholders on residents' disaster preparedness behavior in rural China.

Therefore, this study takes the three rural earthquake-stricken areas in Sichuan Province as the case areas, and controls the socio-demographic variables of the villagers in the disaster areas to explore whether the villagers' trust in stakeholders' disaster relief ability and the assistance they can get from stakeholders affect their earthquake preparedness behavior. In such way, this work contributes to systematically investigate the disaster situation and influence factors of rural residents and reveal the differences between them. The significance of this study is to supplement and improve the understanding of influencing factors of rural farmers' earthquake preparedness behavior, further enrich the theoretical framework of disaster prevention and mitigation, provide theoretical support for the formulation of disaster prevention and mitigation guidelines, and promote the development of disaster prevention and mitigation in China. At the same time, the awareness of disaster preparedness has been effectively spread to residents and farmers to advocate them to take effective disaster preparedness behavior.

LITERATURE REVIEW

There is a growing body of empirical research that explores the relationship between preparedness behavior and demographic factors. And such factors include residents' age, gender, education level, earthquake experience and so on. With the increase of age, the probability of residents taking disaster preparedness measures will decrease (Tang and Feng, 2018; Wu et al., 2018). Some studies find that men had higher levels of preparedness than women (Chen et al., 2021; Wang et al., 2021). Some studies believe that education level has a positive impact on disaster preparedness (Mabuku et al., 2018; Zheng and Wu, 2020). For example, Hoffmann et al. (Hoffmann and Muttarak, 2017) find that education can increase disaster preparedness actions. Atreya et al. (Atreya et al., 2017)also confirm that people with higher education levels were more active in disaster preparedness. In addition, there is a significant correlation between residents' disaster preparedness behavior and their disaster experience (Bronfman et al., 2016). People who have experienced an earthquake are more likely to take disaster preparedness measures than people who have not. Another study finds out that migrants are more prepared than locals (Green et al., 2021).

Stakeholders involved in disaster control and prevention have significant influence on residents' disaster preparedness behavior (Kim and Jae, 2020). Stakeholders refer to the individuals and groups that have important interests in an organization's decisions or activities, or all the individuals and groups that are influenced by an organization in realizing its goals. Stakeholder theory is one of the dominant approaches for analyzing the normative obligations of those engaged in business (Hasnas, 2013), and is widely applied in the study of earthquake preparedness behavior (Wei et al., 2016). Stakeholders in earthquake preparedness are individuals or groups that have an important influence on residents' disaster preparedness behaviors (Deng et al., 2015; Wu et al., 2020). In most cases, the government and its relevant parts act as stakeholders, and the stakeholder characteristics include the trust in varied stakeholders, feeling of responsibility, etc., (Wu et al., 2018). In the event of an earthquake, the participation of stakeholders is very important in disaster response decision-making (Coppola, 2018), and stakeholders can support the resilience of buildings and infrastructure, the delivery of health and human services, and the restoration of transport and transportation systems (Taeby and Zhang, 2019). Existing research shows that people's trust in stakeholders' disaster relief ability (Deyoung and Peters, 2016; Cheng and Tsou, 2018) and the help they can get from stakeholders (Wei et al., 2019) for preparing are two factors that significantly affect their earthquake preparedness behaviors.

Even though stakeholders have an important influence on residents' disaster preparedness behavior, there are different results about this aspect of the research. One study has found that the public confidence in local governments' ability to respond to disasters enhances their willingness to prepare for disasters, but has no significant impact on their actual preparedness behavior (Basolo et al., 2009). Another evidence shows that residents' confidence in government disaster relief cannot predict the degree of disaster preparedness measures they take (Deyoung and Peters, 2016). In Chile, researchers find that trust in authorities is a strong predictor of environmental hazards risk perception (Bronfman et al., 2016). However, lessons from

TABLE 1 | Selection and explanation of social demographic variables.

	Variable	Variable declaration
Demographic characteristic	City and county	1 = Wenchuan County; 2 = Lushan County; 3 = Changning County
	Gender	1 = Man; 2 = Woman
	Age	The corresponding numerical value is the corresponding age. For example: 25 = 25 years old
	Is the current place of residence the birthplace?	1 = No; 2 = Yes
	Education Level	1 = Uneducated; 2 = Primary School; 3 = Junior High School; 4 = Senior High School; 5 = University and above
Architectural features	Year of residence	The corresponding value is the corresponding year. For example, 2008 = 2008
	Residential structure type	1 = Bamboo-grass structure, 2 = Stone-wood structure; 3 = Masonry structure; 4 = Brick-concrete structure; 5 = Steel-concrete structure
	Type of house	1 = Own house; 2 = Rent house; 3 = Other

the Netherlands show that the trust in government reduces the public's risk perception of flooding, and in turn, discourages individual's preparedness intention (Terpstra, 2011). Similarly, scholars also find out that the Chinese residents' trust in the government's ability of disaster prevention and mitigation can reduce their judgment on the degree of disaster impacts, thus reducing the disaster preparedness behavior (Han et al., 2017a; Han et al., 2017b); while American residents' confidence in Federal Emergency Management Agency (FEMA) is positively correlated with their probability of taking disaster preparedness measures (Kim and Oh, 2015).

Similarly, facing different natural disasters, the research conclusions on the influence of the help and support that residents can get from stakeholders on their disaster preparedness behavior are not completely consistent. For example, the emergency information that individuals can get through social networks such as family, friends and neighbors (Rooney and White, 2017) as well as learning about other people's disaster experiences can help individuals understand the consequences of disasters and thus facilitate their disaster preparedness behaviour (Becker et al., 2017). However, some studies have found that if a person thinks that the help they can get is enough to resist threats, the probability that they take the initiative to prepare for disasters will be reduced (Mulilis et al., 2010). Therefore, more related empirical research is very necessary to provide context-specific recommendations, especially for areas like rural China that have not received much attention until recently.

METHODS

Based on the literature review, the questionnaire designed in this study consists of three parts, namely, social and demographic variables (control variables), villagers' trust in disaster relief ability of stakeholders and help from stakeholders variables (explanatory variables) and disaster preparedness behavior variables (dependent variables).

Control variables: Demographic variables studied by Wei et al. (2019), Goltz and Bourque (Goltz and Bourque, 2017) include gender, age, education, birthplace and other factors. In addition, the type of housing structure (Liu et al., 2007), geographical location (Sim et al., 2021) and residence year (Zhou et al., 2009) also have an impact on disaster preparedness behavior. Combined with the pre-investigation, this study adds the housing type index, and finally designed eight sociodemographic variables (shown in **Table 1**):

Explanatory variables: In previous studies, different stakeholders are considered as residents, peers, government officials, media and other forms (Apatu et al., 2015). Bo et al. (Fan and Zhan, 2013) conduct a systematic stakeholder analysis on the government, military, non-governmental organizations, enterprises, victims and media. And Basolo's (Basolo et al., 2009) study finds that the ability of local government to deal with disasters is positively correlated with the willingness of residents to prepare for disasters. Therefore, this study takes the government as a typical stakeholder. Babcicky and Seebauer (Babcicky and Seebauer, 2017) believe that more forms of social capital or social network should be added, such as kinship and connection with external resources. In general, individuals can access all kinds of urgent information through social networks such as family, friends and neighbors (Rooney and White, 2017), therefore, this study also considers the role of family members, relatives, friends and neighbors as stakeholders in residents' disaster preparedness behavior. To sum up, this study mainly considers the following six kinds of social stakeholders: 1) Government; 2) Family members; 3) Relatives; 4) Friends; 5) Neighbors; 6) Other social relations.

Trust in disaster relief ability and available help in disaster preparedness measures are considered as two independent variables. The question is set to: How much do you trust the ability of six different groups of stakeholders to respond to disasters. For each kind of stakeholders and the responses are measured by Likert 5 sub-scale, ranging from 1 to 5, representing no confidence at all to very confident. As such, the range of measurement value is 6–30. Another question is: the degree of help that can be obtained from six different stakeholders in earthquake preparedness. Similarly, for each kind of stakeholders, Likert 5 sub-scale is used, with 1 representing no help and 5 representing all-round help, so the range of measurement value is 6–30.

In addition, risk perception has a certain relationship with residents' disaster preparedness behavior (Xu et al., 2018a; Qing

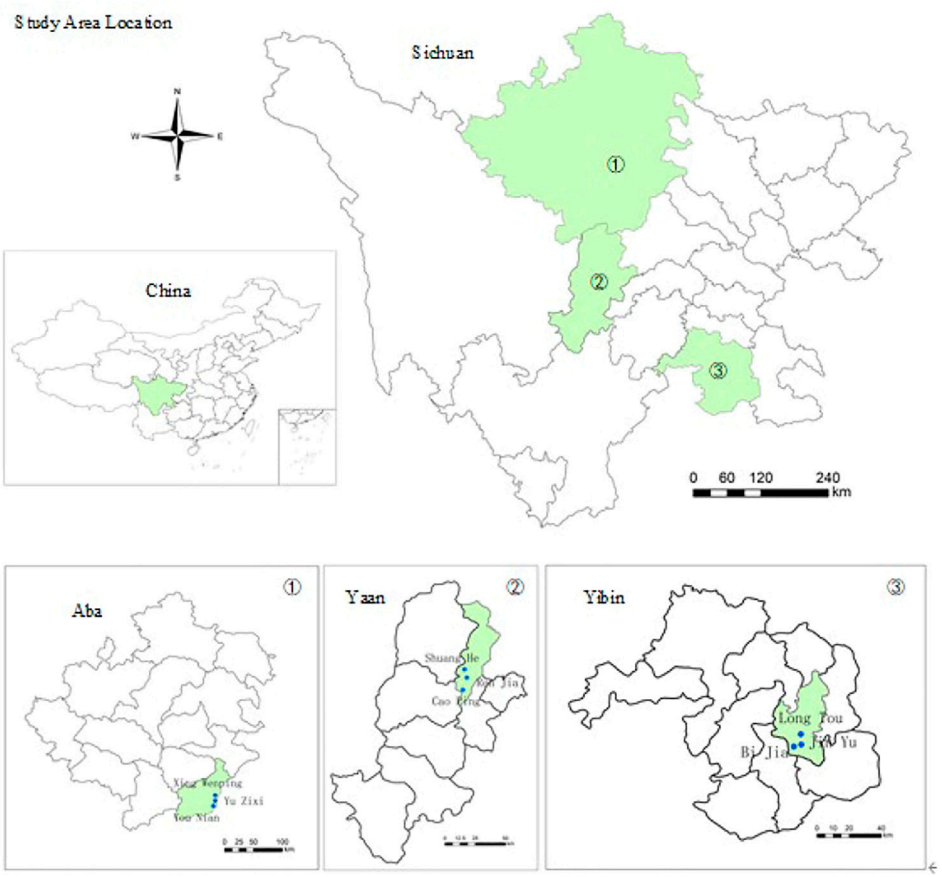

FIGURE 1 | Location of sample villages.

et al., 2021), this study sets a question of perceived disaster preparedness degree: How do you think you are prepared for the earthquake with the help of Likert 5 sub-scale. 1 means completely unprepared, and 5 means completely ready.

Dependent variables: According to the existing research, the most common disaster preparedness behaviors are preparing emergency disaster kits (Lindell and Perry, 2000; Doyle et al., 2018), buying insurance (Xu et al., 2018a; Xu et al., 2018b), making escape plans (Sudo et al., 2019) and learning knowledge (Yong et al., 2020) etc. Based on the characteristics of villagers in Sichuan earthquake-stricken areas, this study considers six specific earthquake preparedness measures: 1) purchasing disaster insurance; 2) preparing valuables for carrying; 3) preparing sufficient food, medicine and other storage materials; 4) participating in evacuation drills; 5) making an escape plan; 6) learning disaster prevention knowledge. Respondents have selected the above six disaster preparedness activities according to the actual disaster preparedness measures. The research design questionnaire is included in the **Supplementary Appendix**.

Sample Selection and Data Collection

Sichuan Province is located in the hinterland of southwest China, with an area of 486,000 square kilometers. In Southwest of China, especially in Sichuan Province, There are high frequency and magnitude of earthquakes, causing great damages. At 14: 28 on 12 May 2008, an earthquake measured 8.0 on the Richter scale occurred in Wenchuan County, Sichuan Province and it left 89,000 people dead and missing (Guo, 2009); At 21: 19 on 8 August 2017, an earthquake measured 7.0 on the Richter scale occurred in Jiuzhaigou County, Aba Prefecture, Sichuan Province, caused 20 people's lives and injured about 500 others (Liang, 2019); At 22: 55 on 17 June 2019, an earthquake measured 6.0 on the Richter scale occurred in Changning County, Yibin City, Sichuan Province, killed 13 compatriots (Jia, 2019). Therefore, this study takes the villagers in rural areas seriously affected by these three earthquakes as the research objects, and randomly selects three sample villages in each earthquake-stricken area, counting totally nine sample villages, namely: Younian Village, Yuzixi Village and Xingwenping Village in Wenchuan County, Aba Autonomous Prefecture; Renjia Village, Shuanghe Village and Caoping Village in Lushan County, Ya 'an City; Bijia Village, Jinyu Village and Longtou Village in Changning County, Yibin City. The geographical locations of the villages is shown in **Figure 1** and the spatial distribution of respondents is shown in **Figure 2**.

The questionnaire survey was carried out by three groups, each with six people, during January 5th and 10 January 2020.

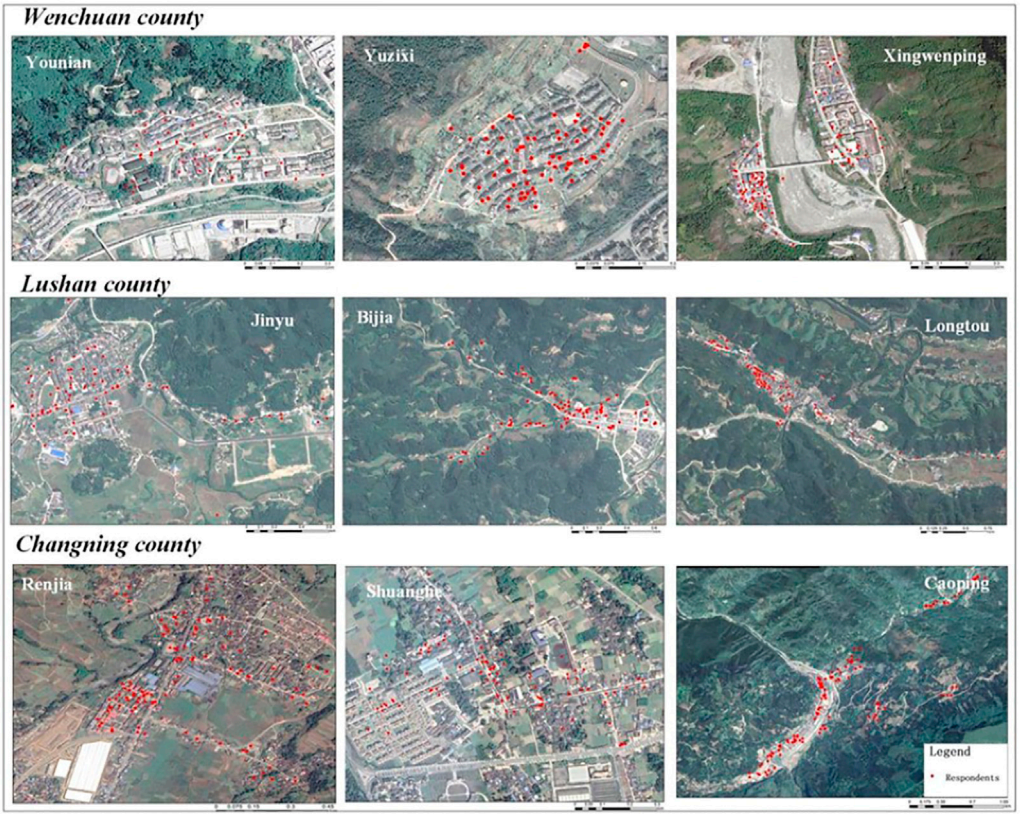

FIGURE 2 | Spatial distribution of respondents.

TABLE 2 | Number and proportion of questionnaires collected by villages.

City and county where the sample village is located	Sample village	Number of valid returned questionnaires	Percentage%
Wenchuan County, Aba Autonomous Prefecture	Younian village	78	11.57
	Yuzixi village	71	10.53
	Xingwenping village	65	9.64
Lushan County, Ya 'an City	Renjia village	76	11.28
	Shuanghe village	83	12.31
	Caoping village	68	10.09
Changning County, Yibin City	Bijia village	78	11.57
	Jinyu village	71	10.53
	Longtou village	84	12.46
Total		674	100.00

The researchers randomly selected households to carry out the questionnaire survey. In order to obtain the accurate geographical location of the respondents' households, the researchers used Ovi map software to locate the geographical location with the consent of the respondents. A total of 714 questionnaires were collected during this survey period, of which 674 were valid, with an effective rate of 94.40%. The number of valid returned questionnaires are shown in **Table 2**. The socio-demographic information of interviewees is shown in **Table 3**.

Model Specification

Multinominal Logit Model (MNL) is widely used in the research of multiple choices, mainly through the calculation of utility functions to determine the item to obtain the probability of individual different choices. Different disaster preparedness behaviors as discrete variables with general models will cause deviation. Therefore, this study chooses MNL to establish the model, and explores the relationship between villagers' trust in the disaster relief ability of stakeholder, the disaster preparedness help available from stakeholder and the daily

TABLE 3 | Socio-demographic information of respondents.

Variable	Variable definition	Frequency	Percentage%
City and county	Yibin	210	31.2
	Ya'an	254	37.7
	Wenchuan	210	31.2
Gender	Man	311	46.1
	Woman	363	53.9
Age	35 below	152	22.6
	36–60	380	56.4
	61 above	142	21.1
Birthplace	Not local	441	65.4
	Local	233	34.6
Academic degree	Primary school and below	340	50.4
	Junior school	223	33.1
	Senior high school	72	10.7
	University and above	39	5.8

disaster preparedness behaviors of the topic, by controlling the demographic variables of respondents.

Suppose that the nth respondent chooses the effect of the ith disaster preparedness behavior as U_{ni}, J_n is the scheme set, then i $\in J_n$, $U_{ni} = V_{ni}+\varepsilon_{ni}$, and $V_{ni} = \beta' X_{nk}$. Among them, ε_{ni} is the random error term; X_{nk} is the kth factor which affects the nth disaster preparedness behavior; β' is the parameter to be estimated. Then the probability that the nth respondent chooses the ith disaster preparedness behavior is:

$$P_n(i) = \mathrm{Prob}\left(U_{ni} \geq U_{nj}, j \in J_n, i \neq j\right) = \mathrm{Prob}\left(V_{ni} + \varepsilon_{ni}, j \in J_n, i \neq j\right) = \mathrm{Prob}\left[V_{ni} + \varepsilon_{ni} \geq \max_{j \in J_n}\left(V_{nj} + \varepsilon_{nj}\right)\right] \quad (1)$$

If each random term ε_{ni} obeys independent identical distribution, then:

$$f(\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_n) = \prod_n g(\varepsilon_n) \quad (2)$$

Where $g(\varepsilon_n)$ is the distribution function corresponding to the nth respondent. Assuming that $g(\varepsilon_n)$ obeys the double exponential distribution, the probability of choosing the ith disaster preparedness behavior in J_n is:

$$p_{in} = \frac{\exp(V_{in})}{\sum_{j \in J_n} \exp\left(V_{jn}\right)} = \frac{1}{\sum_{j \in J_n} \exp\left(V_{jn}\right) - \sum_{j \in J_n} \exp(V_{in})} = \frac{\exp\left(\beta' X_{nk}\right)}{\sum_{j \in J_n} \exp\left(\beta' X_{nk}\right)} \quad (3)$$

RESULTS AND DISCUSSION

Reliability and Validity Test

SPSS software was used to test the reliability and validity of the questionnaire. As shown in the **Table 4**, Cronbach's Alpha of all scales was greater than 0.7, indicating that the scales had good reliability.

TABLE 4 | Scale reliability test.

Variables	Items	Cronbach's alpha
Trust in stakeholders	6	0.904
Help available for disaster preparedness	6	0.865
Disaster preparedness behaviour	6	0.732

TABLE 5 | Scale validity test.

KMO	Bartlett's test of sphericity		
	Approx.Chi-square	df	Sig.
0.886	7038.737	171	0.00

As shown in **Table 5**, the KMO value of the scale was greater than 0.7, and the *p* value of Bartlett's Test of Sphericity was lower than 0.05, indicating that the scale had good validity.

Collinearity Analysis

In this study, Variance Inflation Factor (VIF) is used to test multicollinearity. When VIF value is greater than 10, it is considered that there is strong multicollinearity among variables, which will seriously affect the model fitting (Wu and Pan, 2014). After inspection, the VIF values of the variables in this study are all less than 2, which indicates that there is no multicollinearity among the variables, and model analysis can be carried out. The results of multicollinearity detection are shown in **Table 6**.

Model Result Fitting

MNL model was established by SPSS to fit the above data. Options for disaster preparedness are defined as: purchasing disaster insurance, preparing valuables, preparing sufficient materials, participating in disaster drills, making an escape plan, learning disaster prevention knowledge, and nothing as the reference group. The model fitting significance *P is* 0.008 (<0.05) and *Nagellkerke* R^2 is 0.235, which indicates that the model fitting effect is good. It can be seen from **Table 6** that the likelihood ratio test *p* values of all variables are less than 0.05, which indicates that these variables have a significant impact on the choice of disaster preparedness behavior of villagers in earthquake-stricken areas in the selected sample villages. The fitting results of MNL model are shown in **Table 7**.

Socio-Demographic Variables

As shown in **Table 7**, compared with the villagers living in Yibin, the villagers in Ya'an (−1.040) and Wenchuan (−0.507) are less likely to take part in disaster preparedness drills, and there is no significant difference in other measures ($p > 0.05$). In addition, other variables have significant influence on disaster preparedness behavior. Gender has significant difference in disaster preparedness behavior. Compared with women, men

TABLE 6 | Multiple collinearity and independent variable likelihood ratio test.

Variable	Model fitting condition	Likelihood ratio test			Collinearity test	
	The-2 log-likelihood of the reduced model	Chi square	Degree of freedom	*p*-value	Tolerance	VIF
Intercept distance	3300.279	0	0			
City and county	3328.695	28.417	12	0.005	0.858	1.166
Gender	3321.374	21.096	6	0.002	0.901	1.11
Age	3312.988	12.709	6	0.048	0.627	1.595
Birthplace	3319.238	18.96	6	0.004	0.93	1.075
Level of education	3318.778	17.499	6	0.013	0.63	1.586
Years of residence	3320.605	20.327	6	0.002	0.986	1.014
Structure type	3339.503	39.224	24	0.026	0.93	1.075
Type of house	3314.546	12.981	6	0.043	0.972	1.028
Perceptual preparation	3348.043	99.226	6	0.000	0.846	1.181
Trust in disaster relief ability	3317.278	16.999	6	0.009	0.674	1.483
Help available for disaster preparedness	3316.801	16.522	6	0.011	0.663	1.507

TABLE 7 | MNL model parameter estimation (ref = reference group; β= intercept).

	Purchasing disaster insurance		Preparing valuables		Preparing sufficient materials		Participate in evacuation drills		Making an escape plan		Learning disaster prevention knowledge	
	β	*p*-value	β	*p*-value	β	*p*-value	β	*p*-value	β	*p*-value	β	*p*-value
Intercept distance	−43.616	0.125	−7.786	0.685	−5.492	0.576	−62.402	0.020	−75.370	0.002	−58.826	0.007
City and county (Yibin = ref)												
Wenchuan	−0.041	0.908	0.500	0.141	−0.032	0.921	−0.507	0.041	0.108	0.689	−0.046	0.861
Ya ' an	−0.572	0.107	−0.326	0.374	−0.55	0.105	−1.04	0.000	−0.302	0.263	−0.176	0.489
Male (Female = ref)	0.786	0.004	0.827	0.002	0.695	0.007	0.775	0.000	0.812	0.000	0.686	0.001
Age	−0.592	0.017	−0.517	0.036	−0.646	0.008	−0.545	0.005	−0.316	0.097	−0.464	0.011
Not born locally (Local birth = ref)	0.450	0.109	0.822	0.002	0.771	0.003	0.808	0.000	0.701	0.001	0.657	0.002
Level of education	0.324	0.040	0.322	0.034	0.298	0.049	0.223	0.075	0.207	0.092	0.292	0.013
Years of residence	0.021	0.133	0.003	0.734	0.002	0.664	0.031	0.020	0.037	0.002	0.029	0.007
Type of house (other = ref)												
Own house	0.056	0.941	−0.311	0.638	0.522	0.543	0.692	0.296	0.74	0.272	0.643	0.298
Rent a house	−2.167	0.093	−0.317	0.688	−0.032	0.974	−0.24	0.763	0.349	0.654	0.032	0.965
Type of structure (steel concrete structure = ref)												
Bamboo and grass structure	0.693	0.592	1.37	0.207	0.674	0.603	0.788	0.423	−0.202	0.873	0.770	0.406
Stone and wood structure	0.089	0.939	−0.744	0.542	0.169	0.857	−19.672		−1.539	0.173	−0.974	0.265
Masonry structure	2.039	0.000	1.672	0.001	1.022	0.052	1.290	0.004	1.364	0.001	1.182	0.004
Brick-concrete structure	0.315	0.301	0.395	0.178	0.284	0.318	−0.151	0.516	0.110	0.628	0.061	0.782
Perceptual preparation	1.039	0.000	0.979	0.000	1.260	0.000	0.716	0.000	0.810	0.000	0.764	0.000
Trust in disaster relief ability	0.230	0.728	0.335	0.208	1.040	0.117	−0.882	0.048	−0.784	0.009	−0.855	0.068
Help available for disaster preparedness	0.088	0.894	0.036	0.956	−0.508	0.441	1.200	0.017	1.085	0.027	1.112	0.018

are more likely to purchase disaster insurance (0.786), prepare valuables (0.827), prepare sufficient materials (0.695), participate in evacuation drills (0.775), make an escape plan (0.812) and learn disaster prevention knowledge (0.686). All the six measures: purchasing disaster insurance (−0.592), preparing valuables (−0.517), preparing sufficient materials (−0.646), participating in evacuation drills (−0.545), making an escape plan (−0.316), and learning disaster prevention knowledge (−0.464) are negatively correlated with age. Non-native-born residents are more inclined to prepare valuables (0.822), prepare sufficient materials (0.771), participate in evacuation drills (0.808), make an escape plan (0.701), and learn disaster prevention knowledge (0.657). Among them, the probability of preparing valuables is the highest, and the probability of learning disaster prevention knowledge is the lowest. The education level of villagers in earthquake-stricken areas is significantly positively correlated with purchasing of disaster insurance (0.324), preparing valuables (0.322), preparing sufficient materials (0.298), participating in evacuation drills (0.223), making an escape plan (0.207), and learning disaster prevention knowledge

(0.292). The length of residence has a positive impact on participation in disaster drills (0.031), development of escape plans (0.037) and learning disaster prevention knowledge (0.029). The seismic capability of rural buildings is negatively correlated with residents' disaster preparedness behavior. Compared with steel-concrete structure, villagers living in masonry structures are more likely to purchase disaster insurance (2.039), prepare valuables (1.672), prepare sufficient materials (1.022), participate in evacuation drills (1.290), make an escape plan (1.364), and learn disaster prevention knowledge (1.182).

Explanatory Variables

As shown in **Table 7**, there is a significant positive correlation between the perceived level of earthquake preparedness and the actual probability of taking measures such as purchasing disaster insurance (1.039), preparing valuables (0.979), preparing sufficient materials (1.260), participating in evacuation drills (0.716), making an escape plan (0.810), and learning disaster prevention and reduction knowledge (0.764). That is, the self-perception of earthquake preparedness level of rural residents is consistent with the actual disaster preparedness behavior, and there is no obvious deviation in perception. There is a significant negative correlation between the degree of trust of villagers regarding stakeholders' disaster relief ability and the probability of participating in evacuation drills (−0.822), making an escape plan (−0.784), and it has no significant effect on other disaster preparedness behaviors ($p > 0.05$). The degree of help that villagers in earthquake-stricken areas can get from different stakeholders in disaster preparedness is significantly positively correlated with the probability of participating in evacuation drills (1.200), making an escape plan (1.085), and learning disaster prevention knowledge (1.112). The more help rural residents can get from stakeholders in earthquake preparedness, the higher the degree of disaster preparedness actions they take.

In addition, the degree of help that villagers in earthquake-stricken areas can get from different stakeholders in earthquake preparedness measures has significant positive impacts on their preparedness measures. The more help rural residents can get from six different stakeholder groups in earthquake preparedness measures, the higher the degree of disaster preparedness actions they would take. This is consistent with the previous conclusion that when faced with disasters, the degree of social support has a positive impact on the perception of residents in disaster areas, thus promoting them to take disaster preparedness actions (Han et al., 2017a). In an emergency, people depend on each other to get help and information (Perry and Lindell, 2003), which will promote the transformation of preventive measures into concrete actions (Kim and Kang, 2010).

DISCUSSION

In this research, we analyze the disaster preparedness behavior of rural residents from typical disaster areas in Sichuan Province. We classify six specific disaster preparedness behaviors and explore their influencing factors.

There is no significant difference in the residents' disaster preparedness behavior in the three regions except in the participating in evacuation drills. This is because these three areas have experienced many earthquakes, and the residents have similar earthquake experiences. Disaster experience is regarded as an important driving factor of disaster preparedness behavior (Atreya et al., 2017) and one of the key predictors of disaster preparedness behavior (Hoffmann and Muttarak, 2017). Therefore, we believe that similar disaster experiences can motivate residents to take similar disaster preparedness behaviors. Becker et al. (Becker et al., 2017)find that disaster experiences, life accidents, and other people's disaster descriptions can help individuals understand the consequences of disasters and facilitate disaster-preparedness interactions in communities as well.

There are though significant differences between individuals with different demographic characteristics. Men are more active in disaster preparedness than women. This could be cause by that women have more family activities and they are less aware of crisis, so their cognition of earthquake disaster ability is lower than that of men, and the corresponding possibility of disaster preparedness is also lower (Yue and Ou, 2005; Su et al., 2007). Older people are less likely to take disaster preparedness measures, and people with higher levels of education are more likely to take disaster preparedness measures, which is consistent with the conclusion of Wu et al. (Wu et al., 2018). While it is not possible to improve disaster preparedness by changing the nature of the public, disaster preparedness education can be more targeted to women, the elderly, the less educated population and other groups. Non-native residents are more likely to take a range of preparedness measures. This is consistent with the conclusion of Paul et al. (Paul and Bhuiyan, 2010). Compared with native people, non-native people have a weaker sense of belonging. Yang et al. point out the connection between belonging and sense of security. Non-natives have a sense of crisis due to their weak sense of belonging, so they are more likely to take disaster prevention measures.

The characteristics of houses can also affect residents' disaster preparedness behavior, the younger the age of the house, the more likely the villagers of the house to prepare for disaster. Zhou et al. (Zhou et al., 2009)also find that residential year significantly affected residents' disaster preparedness level. Villagers living in masonry structures were more likely to adopt a range of disaster preparedness measures than those living in steel-concrete structures. According to the statistics of Ming et al. (Ming et al., 2017), in the earthquake, masonry structure and civil structure of the damage rate of the damage rate is relatively high. The seismic performance of buildings is negatively correlated with villagers' disaster preparedness measures.

This study finds that trust in government is negatively correlated with individual disaster preparedness behavior. By surveying survivors of the Yushu earthquake, Han et al. find that trust in government tends to decrease the respondents' perceived consequences of and reported preparedness for future potential earthquakes (Han et al., 2020). However, there are many conflicting results on the relationship between government trust and disaster preparedness. Through a survey of residents in North Carolina, Deyoung et al. (Deyoung and Peters, 2016) find that there is no significant relationship between trust in the government and

individual disaster preparedness behavior. Wang (Wang and Han, 2018) also finds that in the United States, where individualism prevails, the more the general public trusts the government, the higher the disaster preparedness level is. Although it is positively correlated with the actual emergency preparedness level, it is not significant. He believes that this is a result of cultural differences. The general public in China have a much higher degree of trust in government than the citizens in western countries (Li, 2016). For disasters and emergency management, China has no policy made clear that the public should take their own responsibility facing emergencies. On the contrary, the government often gives a person a kind of impression that the government can save you in disaster (Han et al., 2020). as a result, Chinese residents are highly dependent on the government, which makes them less prepared for disasters. Therefore, we need to recognize that disaster reduction is not entirely a matter of the government, nor can the government cover all aspects of disaster reduction (Wang and Han, 2018). While emphasizing the leading role of the government, we must also advocate the participation of social forces.

CONCLUSION

To understand how residents in rural areas of China choose various earthquake preparedness behavior to reduce damages, it is desired to understand how these behaviors are related to their perception of the help they can get in preparation and their trust in the different stakeholders in reducing and preventing earthquake damages. Since there is no consistent conclusion regarding these two explanatory variables, it is necessary to carry out related research in rural earthquake-stricken areas with control variables like socio-demographic variables. Through theoretical and empirical research, this paper investigates several villages in Sichuan province that have experienced major earthquakes. A Multinominal Logit (MNL) model is used to explore and analyze the influencing factors of rural residents' disaster preparedness behavior, especially the influence of stakeholders on residents' disaster preparedness behavior. The results of this study show that stakeholders play a very important role in residents' disaster preparedness behavior, which is manifested in that trust and available help to stakeholders will reduce residents' willingness to take disaster preparedness behavior. In addition, the willingness of residents to take disaster preparedness behavior is affected by age, gender, educational background, housing type and years of residence. The main findings of the study areas are as follows:

(1) Among the sociodemographic variables, males and young villagers are more inclined to actively take disaster preparedness measures. The villagers' education level and residence years significantly affect their disaster preparedness activities.
(2) The villagers' trust in disaster relief ability of different stakeholders has significant negative impacts on their disaster preparedness behavior. In addition, the relationship between trust and disaster preparedness may be different in different regions and cultures. On the contrary, the degree of disaster preparedness assistance that villagers can get from stakeholders significantly affects their daily disaster preparedness behavior positively.

This study further confirms the importance of earthquake education and disaster preparedness assistance. Due to the differences in residence, age, education level and social experience, different groups of people face different risks during the earthquake. Therefore, it is necessary to formulate targeted publicity and education measures according to the different characteristics of the publicity objects (Peng and Huang, 2020). Some recommendations are given in this context: Organizing regular earthquake education and disaster preparedness measure publicity through village speakers; Setting up early warning devices and equipment in places with large crowds such as squares or commissary; Posting comprehensive earthquake preparedness behaviors and implementation methods on community bulletin boards; and establishing community disaster preparedness work boxes to obtain specific disaster preparedness assistance that residents want, etc. In addition, because the villagers' high trust in the disaster relief ability of stakeholders will reduce the villagers' daily vigilance in disaster prevention, it is necessary to further objectively emphasize the uncertainty of earthquake disasters and the importance of self-prevention in daily publicity and education, so as to promote disaster prevention and mitigation for all people. While relying on the government, we must also advocate the participation of social forces, not only social organizations, but also enterprises and the public.

To summarize, this research sheds lights on the rural residents earthquake preparedness behavior, and provide practical guidance for rural disaster prevention planning and construction, especially from the stakeholder perspective in Rural China.

While empirical results for rural areas in Sichuan have been found in this research, there are limitations. These may be taken up in subsequent research work:

(1) The scope of the study is limited. The selected villages are all from Sichuan province, and most of them are near the epicenter. Although these locations are representative to some extent, they cannot represent other earthquake-affected areas in China, and the general applicability of the conclusions needs further study. This paper has some limitations in regional distribution.
(2) This study does not deeply explore the specific impact path and intermediary effect between each influencing factor and residents' disaster preparedness behavior. This will be further studied in the future research.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and

institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

Manuscript draft: HZ, LiyT, LT, YA, and TW; Research design and methods: HZ, YA, and TW; Data collection and analysis: YW and JZ; Revision: All authors.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2022.926432/full#supplementary-material

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