Confidence in authorities, neighborhood cohesion and natural hazards preparedness in Taiwan

Abstract: Household preparedness is important for resilience building and disaster risk reduction. Limited studies have explored the correlations between confidence in authorities, neighborhood cohesion, and natural disaster preparedness, especially in the eastern cultural context. This study investigates the associations between confidence in authorities, neighborhood cohesion, and household disaster preparedness actions in Taiwan - a natural-hazards-prone region. Poisson and logit regression models are constructed to estimate the correlations by analyzing an updated and representative 2013 Taiwan Social Change Survey open data with the control of necessary confounding variables (e.g., disaster experience, risk perception, and demographic characteristics). The results show that, when controlling confounding variables, households with a higher degree of confidence in authorities and neighborhood cohesion degree are still more likely to adopt more preparedness activities, but not necessarily more likely to conduct each specific preparedness activity (e.g., purchase disaster insurance). These findings bridge the gap of current knowledge about the role of perceptions of stakeholders' characteristics in motivating the public's preparedness for disasters and emergencies.

Keywords: Taiwan, confidence, neighborhood, preparedness, trust

1. Introduction

Disaster preparedness is vital to increasing the resilience of a family, a community, a city, and even a society [1–4]. Natural hazards are unavoidable, but mitigation and preparation can save lives and economic losses [5]. Many national governments and international institutions (e.g., the United Nations) have advocated "disaster preparedness" as one of the priorities of disaster management and an essential way of achieving resilience [6–8]. Effective disaster preparedness requires the involvement of all stakeholders, not only the governments and communities but also households and individuals [9,10].

Given the significant role of the individual and household disaster preparedness in mitigating the impacts of natural disasters, theoretical models have been developed to understand the factors affecting individual and household preparedness behaviors [11-13]. The Health Belief Model, Extended Parallel Process Model, Theory of Planned Behavior and Social Cognitive Theory [11], the Protective Motivation Model [12], and the Protective Action Decision Model [13] are the most commonly applied analysis frameworks pertaining to individual and household preparedness behaviors for disasters, and the Protective Action Decision Model developed by Lindell is one of the most widely adopted [13], which we will adopt for this study.

This model has three primary clusters of influencing factors for disaster preparedness at household level: (1) socioeconomic, demographic and contextual factors, (2) hazards attributes related variables and (3) preparedness behaviors related contributors [14–17]. Specifically, gender, age, education, income, ethnicity, marital status, children in a home, home property ownership, community tenure are commonly included socioeconomic and demographic variables. The hazards attribute related variables include disaster experience, the proximity to environmental hazards, the perceived magnitude, probability, and intrusiveness of specific hazard, and so on. Preparedness behaviors related contributors include variables like perceived efficacy of specific preparedness actions, the trust and perceived responsibility among different

stakeholders such as government agencies and individuals. Among the three clusters of influencing factors, the roles of preparedness behaviors related contributors are the least investigated [16]. Therefore, we focus on the associations between the trusts in stakeholders, the neighborhood cohesion, and disaster preparedness in this paper.

Prior studies indicated that perceived stakeholder characteristics, such as trust, confidence, and feeling of responsibility would influence people's hazard adjustment to hazards [18–20]. Among perceived stakeholder characteristics, the role of trust in authorities, especially the public's confidence in authorities' capacity in hazard response, has been given much prominence in recent years [21–25]. However, findings from the limited studies are inconsistent and ambiguous. Investigations from California and New Orleans demonstrated that confidence in local government's capacity in disaster response encouraged the public's intention to prepare for disasters, but such positive effect on the actual preparedness actions was not significant [21]. Another survey from North Carolina also demonstrated that the confidence in government was not a predictor of disaster preparedness [22]. However, confidence in the Federal Emergency Management Agency was found to be positively associated with compliance with evacuation orders [23].

In China, only one such study was found, demonstrating that the trust in government could reduce people's self-evaluated preparedness degree [24], while another paper indicated that the trust in government and experts were positive predictors of people's mitigation intentions [25]. The role of trust in risk perception could vary in different countries [26], and these psychological factors could have both universal, cross-cultural equivalence, and cultural variations [27]. Therefore, the role of perceived characteristics of stakeholders, especially the trust and confidence in authorities, in promoting the public's disaster preparedness needs to be further investigated.

The neighborhood cohesion also referred to as the sense of community [27,28], is another emerging factor that would influence people's preparedness for disasters in recent literature. Both positive and negative correlations between the sense of community and risk coping are found in previous studies [29]. For example, the sense

of community was found to be a positive predictor of wildfire mitigation and preparedness in rural communities in Australia, but the correlation became insignificant in the wildland-urban interface areas [30]. While the sense of community could enhance community cohesion and then support the collective decision and community preparedness [31], whether this will encourage peoples' preparedness is uncertain. Some have found that neighborhood cohesion could diminish both environmental risk coping intentions and actions [32], others have found that neighborhood cohesion is a positive predictor of preparedness [22,33–35], due to the varied social contexts and cultures. Since the correlation between neighborhood cohesion and disaster preparedness has rarely been examined in the East, this analysis aims to plug this knowledge gap, and the neighborhood cohesion is mainly used as the terminology in the discourse to keep the consistency.

In short, following the current literature examining household's adoption of disaster preparedness activities from the socio-psychological theories, we find that the role of confidence in authorities concluded from previous studies is inconsistent and ambiguous, and the influence of neighborhood cohesion has been rarely investigated in the Eastern context. In response to these two research gaps, the present study aims to examine the correlations between confidences in authorities, neighborhood cohesion and the adoptions of preparedness actions using an updated and representative data collected in Taiwan in 2013. Specifically, we hypothesize that:

H1: With a higher degree of confidence in authorities, the household would have a higher preparedness degree;

H2: With a higher degree of neighborhood cohesion, the household would have a higher preparedness degree.

2. Methods

2.1 Data and Sampling

The 2013 Taiwan Social Change Survey (TSCS) (round 6, year 4) - Risk Society Survey (RSS) data were analyzed in this paper [36]. Questionnaire survey is the most common research method regarding risk perception and behavior response to natural hazards [37]. Taiwan Social Change Survey is a series of representative surveys conducted by the Institute of Sociology at the Academia Sinica, which is one of the most reputable research institutes in Taiwan. The data are publicly accessible for researchers in the Survey Research Data Archive after registration.

The 2013 RSS adopted a 3-stage probability proportional to size sampling (PPS) method. Township, village, and individual are the three sampling units. The systematic sampling method was used in each of the sampling stages. The survey was implemented by trained interviewers with the assistance of the Computer-Assisted Personal Interviewing (CAPI) system. The targeted population was adults 18 years old and above in Taiwan. The RSS group successfully collected 2005 individual questionnaires, and all of them were included in the analysis.

2.2 Measures and Descriptive Analysis

Dependent Variables: According to prior academic reviews and suggestions from practical intuitions like FEMA, household preparedness refers to the self-protective activities households taken for disaster response and recovery, and these actions can be

121 long-term solutions (e.g., purchase insurance), emergency protective actions (e.g.,
122 move cars and secure appliances), preparing materials (e.g., emergency kits) or capacity
123 building activities (e.g., learn knowledge or participate in exercises) [7,13,38,39].
124 Therefore, all the six disaster preparedness activities used in the 2013 TSGS survey
125 were included in analysis. The original question was, "have you done any of the
126 following disaster preparedness activities?" (with multiple choices). The activities were
127 (1) “move cars or valuable furniture to a safer place"; (2) “purchase disaster insurance”;
128 (3) “secure heavy furniture or electronic equipment to the wall or floor at home”; (4)
129 “prepare an emergency kit”; (5) “learn and plan an evacuation routine nearby”; and (6)
130 “participate in disaster response exercise or drills”. If a respondent had adopted one
131 activity, one score would be given to that activity; otherwise, the score would be given
132 a zero. The aggregation score of the adoption to the six preparedness activities would,
133 therefore, range from zero to six for the preparedness measure. Each preparedness
134 activity was further used as a separate variable in the analysis to explore the differences
135 in adaptations between varied preparedness activities.

136 Overall, the general public in Taiwan adopted less than two disaster preparedness
137 activities, with an average value of 1.61 within the proposed six. The public adopted
138 different preparedness activities differently. Move cars or other valuable equipment to
139 a safer place was the most widely adopted action, and 57% of the respondents adopted
140 it. 31% of the respondents secured their heavy furniture or electronic equipment before
141 emergencies, 30% of them learned and planned evacuation routine nearby, 18% of them

had emergency kit in home, 14% of them had participated in emergency exercises and drills, and only 12% of them had purchased disaster insurance (Table 1).

Table 1 Descriptive analysis

Variable	N	Mean	SD	Min	Max
Preparedness	2005	1.61	1.43	0	6
Move valuable things	2005	0.57	0.49	0	1
Purchase insurance	2005	0.12	0.32	0	1
Secure furniture	2005	0.31	0.46	0	1
Prepare emergency kit	2005	0.18	0.38	0	1
Be aware of evacuation plan	2005	0.30	0.46	0	1
Participate in drill	2005	0.14	0.34	0	1
Confidence	2005	15.90	4.49	5	25
Organizational membership	2005	0.92	1.56	0	12
N of daily contact	1996	3.42	1.29	1	6
Neighbor cohesion	2005	6.02	2.20	0	10
Typhoon probability	1969	2.13	1.10	1	5
Typhoon consequence	1966	3.12	1.47	1	5
Typhoon anxiety	1992	3.09	1.35	1	5
Earthquake probability	1911	2.74	1.17	1	5
Earthquake consequence	1971	4.20	1.16	1	5
Earthquake anxiety	1989	3.71	1.28	1	5
Year of residence	2005	5.48	1.56	1	7
Perceived status	1945	4.63	1.75	1	10
Family income	1514	9.13	5.04	1	26
Demographics					
Age	2005	47.25	17.19	20	100
		Freq.		Percent	
Gender	Female	985		49.13	
	Male	1,020		50.87	
Children	No	1,189		59.30	
	Yes	816		40.70	
Religion	No	391		19.50	
	Yes	1,614		80.50	
Homeownership	Renter	348		17.36	
	Owner	1,625		81.05	
	Missing	32		1.60	
Marriage	Single	566		28.23	
	Married	1,219		60.80	
	Divorced	93		4.64	
	Widowed	127		6.33	
Education	Primary	363		18.10	
	Middle	203		10.12	

	High	158	7.88
	College+	1,281	63.89
Job status	Fulltime	1,048	52.27
	Part-time	260	12.97
	Jobless	62	3.09
	Students	140	6.98
	Housework	495	24.69
Area	Megacity	426	21.25
	Small city	529	26.38
	New town	564	28.13
	Traditional town	194	9.68
	General town	201	10.02
	Remote town	91	4.54
Disaster experience	No	951	47.43
	Typhoon	618	30.82
	Earthquake	210	10.47
	Both	226	11.27
Total		2005	100

Independent Variables： Confidence in authorities and neighborhood cohesion are considered as the two independent variables. In the present study, confidence in authorities refer to the households' confidence in the capability of authorities in managing a disaster when it occurs (e.g., disaster response), and the authorities cover the governments, nonprofit organizations, and experts, which are the primary stakeholders regarding disaster and emergency management [40]. The following question was chosen from the questionnaire to measure the confidence in authorities: "do you have confidence in the following institutions or authorities' capacity for disaster response?" Five kinds of authorities were proposed: (1) the "central" government, (2) the county government, (3) the township government, (4) nonprofit organizations, and (5) experts. The confidence in each of the authority was measured by a five-degree Likert scale, ranging from one to five, representing the meaning of "no confidence at

all" to "Lots of confidence." The aggregation of the degree of confidence to all the five authorities was used as the measure of confidence in authorities, ranging from five to twenty-five, with a mean value of 15.90 and a standard deviation of 4.49. The Cronbach's alpha test of the five variables was 0.7684, indicating good internal consistency.

The neighborhood cohesion included three variables, the daily contact network, the neighborhood contact, and neighbor mutual help. The daily contact degree was obtained by asking the question "how many persons would you contact on average during a normal day, including all the people you talked to, said hi, called, wrote a letter, or communicated through the internet?" The answer was an option ranged from one to six, indicating the range of persons contacted from"0-4", "5-9", "10-19", "20-49", "50-99", to "more than 100". The average value was 3.42, indicating a number between 10 and 49 (persons?). The neighborhood cohesion was calculated by two questions in the original survey. The first one was "how many of your current neighbors you have contacted?" and the answers ranged from one to five with the meaning of "0", "1-4", "5-9", "10-29" and "more than 30" (persons). The second one was "how many of your neighbors you can ask for help if needed, such as picking mails, taking care of kids?", and the answers were "0" (1), "1-2" (2), "3-4" (3), "5-9" (4), and "above 10" (5) persons. The sum of the two variables was used as a neighborhood cohesion score, ranged from zero to ten, with a mean value of 6.02, and a standard deviation of 2.20. The Cronbach alpha's test of the two variables was 0.7519, indicating that the two variables can be treated as one. Therefore, two variables, one as daily contact and the other as the

neighbor (aggregated variable) were used as neighborhood cohesion indicators in this analysis.

Besides, the organizational affiliation was included since it is an indicator of the respondent's personal network. The respondents were asked about their membership to seven kinds of organizations, including (1) political associations, (2) community management committee, (3) social service organizations, (4) religious organizations, (5) recreation organizations, (6) worker union, and (7) others. If a respondent was a member of one kind of the organizations, and he/she has participated actively, he or she was given two scores. If a respondent was a member but had not actively participated, he or she was given one score. If a respondent was not a member of the organizations, he or she was given a zero score. The sum of the organization affiliation scores of the seven proposed organizations was used as the organizational affiliation score. A minimum value of zero and a maximum value of 14 was possible. In our analysis, it ranged from zero to twelve, with a mean value of 0.92, and a standard deviation of 1.56.

Risk perception of typhoon and earthquake were included in this analysis as well because they are the two most common natural hazards in Taiwan [41]. The risk perception of each kind of hazards (typhoon and earthquake) had three dimensions, the perceived probability, perceived consequence (controllability), and anxiety. Take the typhoon as an example; the perceived probability was obtained by the question "how do you feel the likelihood of a typhoon would hit your area?"; the perceived consequence was asked by the question "how do you think you are able to control the typhoon impact on your family if it occurred?", with a higher degree of control means

a lower potential consequence; and the anxiety was inquired by the question "how worried are you about the typhoon?" The answers to all the above questions were measured by Likert scales, ranging from one to five, indicating the increasing degree of perceived probability, consequence, and anxiety. On average, the perceived probability of earthquake was 2.74, while the perceived probability of typhoon was 2.13; the perceived consequence of earthquake was 4.20, while the perceived consequence of typhoon was 3.12; the anxiety level for earthquakes was 3.71, and the anxiety level for typhoon was 2.13. Overall, the respondents had higher degrees of risk perception of an earthquake than a typhoon.

Control Variables： The disaster experience, geographical variations, necessary socioeconomic, and demographic variables were included as control variables in the analysis (Table 1). As shown in table 1, 47.43% of the respondents had no disaster experience, 30.82% of them had experienced typhoon only and typhoon-induced flood, 10.47% of them had experienced earthquake only, while the last 11.27% had experienced both typhoon and earthquake.

Regarding the geographical variations, 21.25% of the respondents were from megacities, 26.38% were from small-medium cities, 28.13% were from newly developed towns, 9.68% were from traditional industrialized towns, 10.02% were from general small towns, and the last 4.54% were from remote areas.

Regarding demographic variables, 50.87% of the respondents were male, 40.70% of them had at least one child in a home, 80.50% of them had religious beliefs, and 81.05% owned the apartment or space they were occupying. For education degree,

18.10% of the respondents only attended primary school, 10.12% attended middle school or equivalent, 7.88% attended high school or equivalent, and 63.89% had college or above education experience. In terms of marital status, 28.23% of the respondents were single, 60.80% were married, 4.64% were divorced, and 6.33% were widowed. For current job status, 52.27% of the respondents had full-time jobs, 12.97% had part-time jobs, 3.09% had no jobs, 6.98% were students and not in the job market yet, and 24.69% were only involved in housework (Table 1).

On average, the respondents were 47.25 years old, with about 5.48 years living experience in their current community. Their average family monthly income between 70 to 80 thousand New Taiwan dollar (2,393~2,734 US dollar). Their average perceived social status in the social ladder (1-10) was 4.63, which is below the median (5), with a standard deviation of 1.75.

2.3 Data Analysis

The aggregation of the adaptation of the six preparedness activities was used as the measure of preparedness degree. Since it is a variable with count values, and similar mean and variance (mean=1.61, sd=1.43), Poisson regression models were employed for analysis [42]. We first explored the confidence in authorities, the neighborhood cohesion's effects on the degree of preparedness, and then added the control variables, such as disaster experience, socioeconomic and demographic variables, and lastly, the risk perceptions of typhoon and earthquake were included (Table 2). In order to explore the influence on each specific preparedness activity, Logistic regression models were

used to estimate the correlations, and the odds ratio were reported (Table 3). In all the models, if the included variables had missing values, the case was dropped automatically by the statistic software. If more than one variable were integrated as one indicator, Cronbach's alpha test was implemented to test the internal consistency. The data analysis was implemented by the statistic software Stata 13.1 MP version.

3. Results

Overall, the confidence in authorities and neighborhood cohesion are positively correlated with the degree of preparedness (Table 2). With a higher degree of confidence in authorities, a higher degree of organizational affiliation, more daily contacted persons, and a higher neighborhood cohesion, the respondents are more likely to have a higher degree of disaster preparedness. These positives effects are consistent, even when the disaster experience, the basic socioeconomic and demographic variables are controlled (prepare2 model), or the mediating effects of the risk perceptions are included (prepare3 model). Full results of the Poisson regression analysis with all confounding variables are shown in Table A.1 of Appendices.

Table 2 Poisson regression results (with significant predictors) on the degree of preparedness

	Prepare1	Prepare2	Prepare3
Confidence	1.03*** (0.00)	1.02*** (0.01)	1.02** (0.01)
Membership	1.04*** (0.01)	1.04** (0.01)	1.04** (0.01)
Daily contact	1.12*** (0.02)	1.08*** (0.02)	1.07*** (0.02)
Neighbor	1.05*** (0.01)	1.06*** (0.01)	1.06*** (0.01)
Disaster experience (no as reference)			
Typhoon		1.25*** (0.06)	1.19*** (0.06)
Earthquake		ns	ns
Both		1.22** (0.08)	ns
Residence		ns	0.96** (0.01)
Education		1.07** (0.03)	1.07* (0.03)

Area (megacity as reference)			
Small city		ns	ns
New town		0.84** (0.05)	0.86* (0.05)
Traditional town		ns	ns
General town		0.81* (0.07)	ns
Remote town		ns	ns
Typhoon-P			1.05* (0.02)
Typhoon-C			0.95** (0.02)
Typhoon-A			1.06** (0.02)
Earthquake-P			1.05* (0.02)
Earthquake-C			0.92*** (0.02)
Earthquake-A			1.06* (0.02)
N	1996	1478	1414
pseudo R^2	0.033	0.046	0.057

Incidence Rate Ratios reported; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ns represents "not significant".

The experience of different kinds of disasters would have different impacts on people's adoption of protective activities. The positive correlation between typhoon experience and the adoption of protective activities is significantly positive, but the earthquake experience's association with the degree of preparedness is not significant. Of socioeconomic and demographic variables used, the community residence time and the education degree are the only two significant ones. With longer time residing in the current community, people would have a lower degree of preparedness, while with a higher education degree, they would have higher preparedness degrees.

When the risk perceptions of typhoon and earthquake were included in the model (prepare3), the effects of confidence in authorities, organizational affiliation, and neighborhood cohesion remained the same in terms of directions and magnitude. The daily contact's impact became a little bit lower (1.09 vs. 1.08). Apparently, the risk perceptions did not affect the effects of the independent variables. The risk perception measures, especially the perceived probability and perceived consequence, have

277 different effects on the degree of preparedness. With a higher perceived probability of
278 typhoon, or earthquake, they would adopt more protective activities. However, the
279 perceived controllability of typhoon and earthquake were negatively advocated with the
280 adoption of protective activities. The anxiety of natural hazards (both typhoon and
281 earthquake) were also positively correlated with the degree of preparedness.

282 In the logistic regression models (Table 3), with the control of all confounding
283 variables, the confidence in authorities, number of daily contact persons, and
284 neighborhood cohesion were positive with all the proposed six preparedness activities,
285 though some of the correlations were not statistically significant. With a higher degree
286 of neighborhood cohesion, the respondent would have a significantly higher probability
287 of relocating valuable facilities, fixing unstable facilities, preparing an emergency kit,
288 having an evacuation plan, and participating emergency exercise and drills. Full results
289 of the logistic regression analysis with all confounding variables are shown in Table
290 A.2 of Appendices.

291 Table 3. Logistic regression results (with independent variables) on separate preparedness activities

	Move	Insurance	Fix	Kit	Evacuation	Drill
Confidence	1.03*	1.02	1.03	1.03	1.02	1.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Membership	1.03	1.09	1.05	1.01	1.14***	1.12*
	(0.04)	(0.06)	(0.04)	(0.05)	(0.04)	(0.05)
Daily contact	1.08	1.15	1.06	1.18*	1.17**	1.20**
	(0.06)	(0.09)	(0.06)	(0.08)	(0.06)	(0.08)
Neighbor	1.10**	1.09	1.16***	1.10*	1.10**	1.06
	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)

Confounding variables were controlled but not shown in this table; Odds ratios reported; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

292

4. Discussion

In this paper, the associations between confidence in authorities, neighborhood cohesion, and household disaster preparedness are examined using an updated and representative survey data in Taiwan (2013 Taiwan Social Change Survey). Six kinds of disaster preparedness activities are included: relocating valuable facilities, purchasing insurance, fixing unstable facilities within the home, preparing an emergency kit, having an evacuation plan, and participating in emergency exercises and drills. Disaster experience, risk perception of the major natural hazards (earthquake and typhoon), organizational affiliation, geographic variations, and necessary socioeconomic, and demographic variables are controlled.

The results indicate that no matter whether the controlled variables are included or not, a higher degree of confidence in authorities' capacity in disaster response is positively correlated with a higher degree of household preparedness actions, which supports Hypothesis 1. Though all the correlations between the confidence in authorities and individual preparedness actions are positive, only the confidence in authorities and the relocating valuable facilities is significant. This result is consistent with a prior study in Taiwan in that the public with higher degrees of trust in government and experts had a higher degree of mitigation intention [25], and our study extends this to the household's actual preparedness behaviors. Similar observations were also found for studies in the United States [21–23], though the observations in the United States were not consistent. It seems that the role of confidence or trust in authorities in encouraging the general public's adoption of preparedness for natural hazards in Taiwan is different from the situation in

315 Mainland China, where the trust in government was found to be negatively associated with
316 people's self-reported preparedness degrees [24]. However, another national study in
317 Mainland China demonstrated that community vote participation was strongly correlated
318 with the individual's awareness preparedness and material preparedness for earthquake [43].
319 These inconsistent results indicate that more investigations are needed to differentiate the
320 two dimensions of trust [44]---intention trust and capacity trust (confidence) and the
321 perceived preparedness and actual preparedness behaviors.

322 For disaster risk reduction policy, the trust in government or authorities may encourage
323 their compliance with government avocations. Meanwhile, the overconfidence of the
324 government's capacity in disaster management could also discourage the public's own
325 preparation for disasters. Therefore, the framing of public policy of disaster governance
326 needs to consider the converse impact of the confidence of people to the respective
327 government. The individual's responsibility and role in disaster risk reduction are rarely
328 mentioned in the disaster and emergency management policy discourses in Mainland China
329 [45,46]. It is essential to use the "whole community" [9] concept to increase the public's
330 understanding that disaster risk reduction is the responsibility of both individuals and the
331 government.

332 The results also suggest that a higher degree of neighborhood cohesion, including the
333 neighborhood contact and daily contact indicators, are positively associated with a higher
334 degree adoption of preparedness activities, which supports Hypothesis 2. Besides, the other
335 social capital indicator related to organizational affiliation is also positively associated with
336 the overall degree of preparedness. This finding resonates most prior studies, indicating
337 that neighborhood cohesion is positive predictors of disaster preparedness [22,33–35],

unlike the Italy study which demonstrated that place attachment could diminish risk coping intentions [32]. Social capital could play a "double-edged sword" effect on disaster and emergency management [47]. It could support people's response and recovery from disasters, it may also encourage collective actions within communities, but it may also lead to people downplaying risks and discourage their preparation for disasters and uncertainties [48].

The disaster characteristics are also significant predictors of preparedness. Since both typhoon and earthquake, the two most common natural hazards in Taiwan are included, we also found the two hazards had slightly varied effects. People with typhoon experience alone had a significantly higher degree of preparedness, while the earthquake experience's effect was not significant. Both the perceived probability and anxiety of typhoon and earthquake are positively correlated with the overall preparedness, while people would have a lower degree of preparedness when they feel lower control of hazards. This result proved that the characteristics of the hazard matter when considering the effects of disaster experience and risk perception on people's preparedness behaviors. The risk perception could encourage people's preparedness actions for more controllable or predictable natural hazards, such as hurricane [49] but not for hazards that are relatively difficult to control and predict, such as terrorist attack [50].

In sum, we investigated the correlations between confidence in authorities, neighborhood cohesion, and disaster preparedness by controlling disaster experience, risk perception, socioeconomic and demographic variables using an updated and representative survey data from Taiwan. The results provided insights about the influencing factors of people's disaster preparedness from the perceived stakeholders perspective, which

significantly contributed observations to current knowledge of disaster mitigation and preparedness behavior studies.

However, restricted by the pre-designed questionnaire of the 2013 Taiwan Social Change Survey, the present study is unavoidable to have some limitations on measurement design. More forms of social capital or social network, such as kinship connection, linkage to external resources should be included to explore how various forms of social capital can affect individual and household's preparedness behaviors. Second, the survey did not include the adjustment behaviors perceptions, such as the efficacy and usefulness of the preparedness actions. Future research, including both the characteristics of the hazards, the perceived attributes of key stakeholders, and the perception of adjustment behaviors are needed.

5. Conclusion

The correlations between confidence in authorities, the neighborhood cohesion, and disaster preparedness are analyzed using an updated and representative survey data from Taiwan. The disaster experience, risk perception, geographic variations, socioeconomic, and demographic variables were controlled in the regression models. The results demonstrate that both trusts in authorities and neighborhood cohesion are positive predictors of the overall degree of preparedness, but not all such effects on separate preparedness actions are significant. Experience of typhoons could encourage people's adoption of preparedness actions, but the earthquake experience's effect was not significant. The perceived probability, the feeling of anxiety, and the feeling of controllability of both typhoon and earthquake are positively associated with the overall adoption of preparedness actions. People in the newly developed towns have a lower degree of preparedness than

people in megacities, which education is the only consistent and significant positive predictor of preparedness within the socioeconomic and demographic variables. This paper contributes to current knowledge about people's adoption of preparedness activities to natural hazards.

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Appendices

Table A.1. Full results of Poisson regression on the degree of preparedness

	Prepare1	Prepare2	Prepare3
Confidence	1.03*** (0.00)	1.02*** (0.01)	1.02** (0.01)
Membership	1.04*** (0.01)	1.04** (0.01)	1.04** (0.01)
Daily contact	1.12*** (0.02)	1.08*** (0.02)	1.07*** (0.02)
Neighbor	1.05*** (0.01)	1.06*** (0.01)	1.06*** (0.01)
Disaster experience (no as reference)			
Typhoon		1.25*** (0.06)	1.19*** (0.06)
Earthquake		1.05 (0.08)	1.00 (0.08)
Both		1.22** (0.08)	1.10 (0.07)
Residence		0.97 (0.01)	0.96** (0.01)
Owner		0.97 (0.05)	0.98 (0.06)
Having children		1.01 (0.05)	1.02 (0.05)
status		1.02 (0.01)	1.01 (0.01)
Job (fulltime as reference)			
Part-time		1.00 (0.07)	0.98 (0.07)
Jobless		0.83 (0.12)	0.82 (0.12)
Students		0.96 (0.09)	0.94 (0.09)
Housework		1.00 (0.07)	1.02 (0.07)
Income		1.00 (0.00)	1.00 (0.00)
Male		0.98 (0.04)	0.99 (0.04)
Age		1.00 (0.00)	1.00 (0.00)
Education		1.07** (0.03)	1.07* (0.03)
Religion		0.98 (0.05)	0.96 (0.05)
Marriage (single as reference)			
Married		1.04 (0.07)	1.02 (0.07)
Divorced		0.81 (0.10)	0.81 (0.10)
Widowed		0.88 (0.14)	0.93 (0.15)
Area (megacity as reference)			
Small city		1.07 (0.06)	1.11 (0.06)
New town		0.84** (0.05)	0.86* (0.05)
Traditional town		0.85 (0.07)	0.90 (0.08)
General town		0.81* (0.07)	0.84 (0.08)
Remote town		0.86 (0.10)	0.84 (0.10)
Typhoon-P			1.05* (0.02)
Typhoon-C			0.95** (0.02)
Typhoon-A			1.06** (0.02)
Earthquake-P			1.05* (0.02)
Earthquake-C			0.92*** (0.02)
Earthquake-A			1.06* (0.02)
N	1996	1478	1414
pseudo R^2	0.033	0.046	0.057

Incidence Rate Ratios reported; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

404 Table A.2. Full results of Logit regression on separate preparedness activities

	Move	Insurance	Fix	Kit	Evacuation	Drill
Confidence	1.03* (0.02)	1.02 (0.02)	1.03 (0.02)	1.03 (0.02)	1.02 (0.02)	1.03 (0.02)
Membership	1.03 (0.04)	1.09 (0.06)	1.05 (0.04)	1.01 (0.05)	1.14*** (0.04)	1.12* (0.05)
Daily contact	1.08 (0.06)	1.15 (0.09)	1.06 (0.06)	1.18* (0.08)	1.17** (0.06)	1.20** (0.08)
Neighbor	1.10** (0.03)	1.09 (0.05)	1.16*** (0.04)	1.10* (0.04)	1.10** (0.04)	1.06 (0.04)
Disaster experience (no as reference)						
Typhoon	1.66*** (0.23)	1.14 (0.22)	1.52** (0.21)	1.17 (0.19)	0.98 (0.14)	1.65** (0.30)
Earthquake	0.81 (0.16)	0.48* (0.17)	1.70* (0.35)	0.92 (0.24)	0.92 (0.20)	1.21 (0.34)
Both	1.14 (0.22)	1.05 (0.28)	1.23 (0.24)	1.01 (0.23)	1.11 (0.21)	1.55 (0.37)
Residence	0.95 (0.04)	0.82*** (0.05)	0.93 (0.04)	0.95 (0.05)	0.97 (0.04)	0.96 (0.05)
Owner	0.76 (0.12)	2.23** (0.62)	0.95 (0.16)	0.91 (0.18)	1.07 (0.18)	0.72 (0.15)
Children	1.15 (0.15)	1.15 (0.22)	0.99 (0.14)	0.90 (0.15)	1.01 (0.14)	1.00 (0.18)
Status	1.00 (0.04)	1.04 (0.06)	1.05 (0.04)	0.99 (0.05)	1.03 (0.04)	1.04 (0.05)
Income	1.01 (0.01)	1.03 (0.02)	0.98 (0.01)	1.00 (0.02)	1.00 (0.01)	1.00 (0.02)
Gender	1.08 (0.13)	0.90 (0.16)	1.07 (0.14)	0.82 (0.12)	1.05 (0.13)	0.84 (0.13)
Age	1.00 (0.01)	1.02* (0.01)	1.00 (0.01)	0.98 (0.01)	1.00 (0.01)	1.00 (0.01)
Education	1.02 (0.07)	1.20 (0.14)	1.00 (0.07)	1.16 (0.11)	1.29** (0.10)	1.18 (0.13)
Religion	1.09 (0.16)	0.90 (0.19)	0.83 (0.13)	0.94 (0.17)	0.97 (0.15)	0.80 (0.15)
Job (fulltime as reference)						
Part-time	1.14 (0.22)	0.87 (0.25)	0.86 (0.17)	0.99 (0.23)	1.44 (0.28)	0.46** (0.14)
Jobless	0.79 (0.27)	1.16 (0.61)	0.70 (0.28)	0.74 (0.36)	0.72 (0.29)	0.53 (0.30)
Students	0.66 (0.18)	0.77 (0.33)	0.82 (0.24)	0.69 (0.24)	1.20 (0.33)	1.48 (0.46)
Housework	1.05 (0.20)	0.50* (0.16)	1.47 (0.29)	1.33 (0.32)	1.22 (0.25)	0.59 (0.17)
Marriage (single as reference)						
Married	0.98 (0.19)	0.99 (0.28)	0.89 (0.18)	1.74* (0.42)	0.92 (0.19)	1.03 (0.26)
Divorced	0.54* (0.17)	0.89 (0.45)	0.71 (0.24)	0.57 (0.28)	0.92 (0.31)	0.91 (0.39)
Widowed	1.15 (0.46)	1.35 (0.86)	0.75 (0.32)	1.31 (0.77)	0.59 (0.30)	1.00 (.)
Area (megacity as reference)						
Small city	0.91 (0.16)	1.23 (0.27)	1.20 (0.21)	1.37 (0.27)	1.17 (0.20)	1.41 (0.31)
New town	0.56*** (0.09)	0.58* (0.15)	0.80 (0.14)	0.89 (0.18)	0.85 (0.15)	1.15 (0.26)
Traditional town	0.64 (0.16)	0.65 (0.25)	0.95 (0.24)	0.58 (0.19)	1.18 (0.30)	0.90 (0.32)
General town	0.51** (0.13)	0.96 (0.36)	0.79 (0.21)	0.56 (0.20)	0.86 (0.23)	1.22 (0.42)
Remote town	0.68 (0.21)	0.57 (0.31)	0.62 (0.20)	0.62 (0.26)	1.08 (0.35)	0.94 (0.43)
Typhoon-P	1.12 (0.07)	1.07 (0.10)	1.08 (0.07)	1.16 (0.09)	1.03 (0.07)	1.19* (0.10)

Typhoon-C	0.95 (0.05)	0.92 (0.07)	0.94 (0.05)	0.84** (0.05)	0.94 (0.05)	0.90 (0.06)
Typhoon-W	1.12* (0.07)	0.95 (0.08)	1.23*** (0.08)	1.11 (0.08)	1.12 (0.07)	0.97 (0.08)
Earthquake-P	1.18** (0.07)	1.07 (0.10)	1.05 (0.07)	0.98 (0.07)	1.13 (0.07)	1.08 (0.09)
Earthquake-C	0.85** (0.05)	0.88 (0.08)	0.89 (0.06)	0.93 (0.07)	0.86* (0.05)	0.88 (0.07)
Earthquake-W	1.16* (0.07)	1.07 (0.10)	1.12 (0.07)	1.11 (0.09)	1.06 (0.07)	0.95 (0.08)
N	1414	1414	1414	1414	1414	1365
pseudo R^2	0.070	0.115	0.063	0.070	0.080	0.108

405 Odds ratios reported; Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
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References

[1] K. Cui, Z. Han, D. Wang, Resilience of an Earthquake-Stricken Rural Community in Southwest China: Correlation with Disaster Risk Reduction Efforts, International Journal of Environmental Research and Public Health. 15 (2018) 407. doi:10.3390/ijerph15030407.

[2] D. Paton, D. Johnston, Disasters and communities: vulnerability, resilience and preparedness, Disaster Prevention and Management: An International Journal. 10 (2001) 270–277. doi:10.1108/EUM0000000005930.

[3] T. Sim, D. Wang, Z. Han, Assessing the Disaster Resilience of Megacities: The Case of Hong Kong, Sustainability. 10 (2018) 1137. doi:10.3390/su10041137.

[4] UNISDR, Disaster Statistics, (2018). https://www.unisdr.org/we/inform/disaster-statistics (accessed June 1, 2018).

[5] NIBS, Natural Hazard Mitigation Saves: 2017 Interim Report, National Institute of BUILDING SCIENCES, 2017.

[6] UNISDR, Sendai Framework for Disaster Risk Reduction 2015-2030, Nuited Nations, Geneva, 2015.

[7] FEMA, 2016 National Preparedness Report, FEMA, 2016. https://www.fema.gov/media-library/assets/documents/116951 (accessed July 3, 2017).

[8] Xinhua, China to form ministry of emergency management, (2018). http://www.xinhuanet.com/english/2018-03/13/c_137035514.htm (accessed June 1, 2018).

[9] FEMA, A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action | FEMA.gov, 2011. https://www.fema.gov/media-library/assets/documents/23781 (accessed March 28, 2017).

[10] D. Paton, J. McClure, P.T. Bürgelt, Natural hazard resilience: The role of individual and household preparedness, in: Disaster Resilience: An Integrated Approach, 2006: p. 27.

[11] L.T. Ejeta, A. Ardalan, D. Paton, Application of Behavioral Theories to Disaster and Emergency Health Preparedness: A Systematic Review, PLoS Curr. (2015). doi:10.1371/currents.dis.31a8995ced321301466db400f1357829.

[12] D.L. Floyd, S. Prentice-Dunn, R.W. Rogers, A Meta-Analysis of Research on Protection Motivation Theory, Journal of Applied Social Psychology. 30 (2000) 407–429. doi:10.1111/j.1559-1816.2000.tb02323.x.

[13] M.K. Lindell, R.W. Perry, The Protective Action Decision Model: Theoretical Modifications and Additional Evidence, Risk Analysis. 32 (2012) 616–632. doi:10.1111/j.1539-6924.2011.01647.x.

[14] S. Kohn, J.L. Eaton, S. Feroz, A.A. Bainbridge, J. Hoolachan, D.J. Barnett, Personal Disaster Preparedness: An Integrative Review of the Literature, Disaster Medicine and Public Health Preparedness. 6 (2012) 217–231. doi:10.1001/dmp.2012.47.

[15] G. Wachinger, O. Renn, C. Begg, C. Kuhlicke, The Risk Perception Paradox—Implications for Governance and Communication of Natural Hazards, Risk Analysis. 33 (2013) 1049–1065. doi:10.1111/j.1539-6924.2012.01942.x.

[16] M. Lindell, North American Cities at Risk: Household Responses to Environmental Hazards, in: H. Joffe, T. Rossetto, J. Adams (Eds.), Cities at Risk, Springer Netherlands, 2013: pp. 109–130. doi:10.1007/978-94-007-6184-1_7.
[17] J. Levac, D. Toal-Sullivan, T.L. O`Sullivan, Household Emergency Preparedness: A Literature Review, J Community Health. 37 (2012) 725–733. doi:10.1007/s10900-011-9488-x.
[18] S. Arlikatti, M.K. Lindell, C.S. Prater, others, Perceived stakeholder role relationships and adoption of seismic hazard adjustments, International Journal of Mass Emergencies and Disasters. 25 (2007) 218.
[19] D. Paton, Risk communication and natural hazard mitigation: how trust influences its effectiveness, International Journal of Global Environmental Issues. 8 (2008) 2–16. doi:10.1504/IJGENVI.2008.017256.
[20] J. Wei, F. Wang, M.K. Lindell, The evolution of stakeholders' perceptions of disaster: A model of information flow, J Assn Inf Sci Tec. 67 (2016) 441–453. doi:10.1002/asi.23386.
[21] V. Basolo, L.J. Steinberg, R.J. Burby, J. Levine, A.M. Cruz, C. Huang, The Effects of Confidence in Government and Information on Perceived and Actual Preparedness for Disasters, Environment and Behavior. 41 (2009) 338–364. doi:10.1177/0013916508317222.
[22] S.E. DeYoung, M. Peters, My Community, My Preparedness: The Role of Sense of Place, Community, and Confidence in Government in Disaster Readiness, International Journal of Mass Emergencies and Disasters. 34 (2016) 250–282.
[23] J. Kim, S.S. Oh, Confidence, knowledge, and compliance with emergency evacuation, Journal of Risk Research. 18 (2015) 111–126. doi:10.1080/13669877.2014.880728.
[24] Z. Han, X. Lu, E.I. Hörhager, J. Yan, The effects of trust in government on earthquake survivors' risk perception and preparedness in China, Nat Hazards. 86 (2017) 437–452. doi:10.1007/s11069-016-2699-9.
[25] S. Lin, D. Shaw, M.-C. Ho, Why are flood and landslide victims less willing to take mitigation measures than the public?, Nat Hazards. 44 (2007) 305–314. doi:10.1007/s11069-007-9136-z.
[26] M.J. Viklund, Trust and Risk Perception in Western Europe: A Cross-National Study, Risk Analysis. 23 (2003) 727–738. doi:10.1111/1539-6924.00351.
[27] D. Paton, R. Bajek, N. Okada, D. McIvor, Predicting community earthquake preparedness: a cross-cultural comparison of Japan and New Zealand, Nat Hazards. 54 (2010) 765–781. doi:10.1007/s11069-010-9500-2.
[28] D. Paton, L. Smith, D. Johnston, others, When good intentions turn bad: promoting natural hazard preparedness, The Australian Journal of Emergency Management. 20 (2005) 25.
[29] M. Bonaiuto, S. Alves, S. De Dominicis, I. Petruccelli, Place attachment and natural hazard risk: Research review and agenda, Journal of Environmental Psychology. 48 (2016) 33–53. doi:10.1016/j.jenvp.2016.07.007.
[30] C.E. Anton, C. Lawrence, Does Place Attachment Predict Wildfire Mitigation and Preparedness? A Comparison of Wildland–Urban Interface and Rural Communities, Environmental Management. 57 (2016) 148–162. doi:10.1007/s00267-015-0597-7.

[31] M. Bihari, R. Ryan, Influence of social capital on community preparedness for wildfires, LANDSCAPE AND URBAN PLANNING. 106 (2012) 253–261. doi:10.1016/j.landurbplan.2012.03.011.
[32] S. De Dominicis, F. Fornara, U. Ganucci Cancellieri, C. Twigger-Ross, M. Bonaiuto, We are at risk, and so what? Place attachment, environmental risk perceptions and preventive coping behaviours, Journal of Environmental Psychology. 43 (2015) 66–78. doi:10.1016/j.jenvp.2015.05.010.
[33] Y.-C. Kim, J. Kang, Communication, neighbourhood belonging and household hurricane preparedness, Disasters. 34 (2010) 470–488. doi:10.1111/j.1467-7717.2009.01138.x.
[34] S. Mishra, S. Mazumdar, D. Suar, Place attachment and flood preparedness, Journal of Environmental Psychology. 30 (2010) 187–197. doi:10.1016/j.jenvp.2009.11.005.
[35] D. Xu, L. Peng, S. Liu, X. Wang, Influences of Risk Perception and Sense of Place on Landslide Disaster Preparedness in Southwestern China, Int J Disaster Risk Sci. (2018) 1–14. doi:10.1007/s13753-018-0170-0.
[36] Yang-chih Fu (2015). 2013 Taiwan Social Change Survey (Round 6, Year 4): Risk Social(Restricted Access Data) (R090050) [data file]. Available from Survey Research Data Archive, Academia Sinica. doi:10.6141/TW-SRDA-R090050-1.
[37] D.K. Bird, The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation - a review of current knowledge and practice, Natural Hazards and Earth System Sciences. 9 (2009) 1307–1325.
[38] K.J. Tierney, M.K. Lindell, R.W. Perry, eds., Facing the Unexpected: Disaster Preparedness and Response in the United States, Joseph Henry Press, Washington, D.C., 2001.
[39] J. Sutton, K. Tierney, Disaster Preparedness: Concepts, Guidance, and Research, Natural Hazards Center, Boulder, CO, 2006.
[40] T.E. Drabek, The Human Side of Disaster, Second Edition, 2 edition, CRC Press, Boca Raton, FL, 2013.
[41] J.-C. Chang, Natural hazards in Taiwan, GeoJournal. 38 (1996) 251–257. doi:10.1007/BF00204716.
[42] IDRE-UCLA, Poisson Regression | Stata Data Analysis Examples, IDRE Stats. (2018). https://stats.idre.ucla.edu/stata/dae/poisson-regression/ (accessed March 9, 2018).
[43] G. Wu, Z. Han, W. Xu, Y. Gong, Mapping individuals' earthquake preparedness in China, Nat. Hazards Earth Syst. Sci. 18 (2018) 1315–1325. doi:10.5194/nhess-18-1315-2018.
[44] R. Hardin, Trust and trustworthiness, Russell Sage Foundation, 2002.
[45] T. Sim, L. Dominelli, J. Lau, A Pathway To Initiate Bottom-up Community-based Disaster Risk Reduction Within A Top-down System: The Case Of China, International Journal of Safety and Security Engineering. 7 (2017) 283–293.
[46] M. Zou, Y. Yuan, China's comprehensive disaster reduction, Int. J. Disaster Risk Sci. 1 (2010) 24–32. doi:10.3974/j.issn.2095-0055.2010.01.005.
[47] D. Aldrich, Building Resilience: Social Capital in Post-Disaster Recovery, University of Chicago Press, 2012.

[48] P. Babcicky, S. Seebauer, The two faces of social capital in private flood mitigation: opposing effects on risk perception, self-efficacy and coping capacity, Journal of Risk Research. 20 (2017) 1017–1037. doi:10.1080/13669877.2016.1147489.
[49] D.N. Sattler, C.F. Kaiser, J.B. Hittner, Disaster Preparedness: Relationships Among Prior Experience, Personal Characteristics, and Distress, Journal of Applied Social Psychology. 30 (2000) 1396–1420. doi:10.1111/j.1559-1816.2000.tb02527.x.
[50] L.B. Bourque, R. Regan, M.M. Kelley, M.M. Wood, M. Kano, D.S. Mileti, An Examination of the Effect of Perceived Risk on Preparedness Behavior, Environment and Behavior. 45 (2013) 615--649.