

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Household Emergency Preparedness In China: a cross-sectional survey

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-032462
Article Type:	Research
Date Submitted by the Author:	24-Jun-2019
Complete List of Authors:	Dai, Yajun Xu, Wei Xu, Weilan Ning, Ning; Harbin Medical University, Social Medicine Liu, Chaojie; La Trobe University, Public Health Chen, Yi; Harbin Medical University, Social Medicine; Liang, Libo; School of Health Management, Harbin Medical University, ; Gao, Lijun; Harbin Medical University, Social Medicine Kang, Zheng; Harbin Medical University, Health policy; Jiao, Mingli; Harbin Medical University, Health policy Sun, Hong Song, Tie Sun, Wei Cao, Ruoxiang Hao, Yanhua; Harbin Medical University, Social Medicine Wu, Qunhong; Harbin Medical University, Social Medicine
Keywords:	ACCIDENT & EMERGENCY MEDICINE, PUBLIC HEALTH, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

SCHOLARONE™  
Manuscripts

# Household Emergency Preparedness In China: a cross-sectional survey

## Title Page

**Title:** Household Emergency Preparedness in China: a Cross-sectional Survey

**Author names and affiliations:**

1. Yajun Dai, graduate students in Master degree ,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [daiyajun0408@163.com](mailto:daiyajun0408@163.com)
2. Wei Xu, PhD student,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [13836138161@163.com](mailto:13836138161@163.com)
3. Weilan Xu, Doctor degree,Qiqihar Medical College of Nursing, Qiqihar, Heilongjiang, China Email: [lxdoctor@163.com](mailto:lxdoctor@163.com)
4. Ning Ning, Doctor degree,associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [ningninghyd@163.com](mailto:ningninghyd@163.com)
5. Chaojie Liu, Postdoctoral degree, professor, School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia Email: [c.liu@latrobe.edu.au](mailto:c.liu@latrobe.edu.au)
6. Chaoyi Chen, graduate students in Master degree,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [749134597@qq.com](mailto:749134597@qq.com)
7. Libo Liang, Doctor degree,associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [llbhit@163.com](mailto:llbhit@163.com)
8. Lijun Gao, Master degree,associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email:[gg73@163.com](mailto:gg73@163.com)
9. Zheng Kang, Doctor degree,associate professor,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email:[kangzheng0086@126.com](mailto:kangzheng0086@126.com)
10. Mingli Jiao, Doctor degree, professor,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [minglijiao@126.com](mailto:minglijiao@126.com)
11. Hong Sun, Doctor degree, professor,School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [840616724@qq.com](mailto:840616724@qq.com)
12. Tie Song, Master degree, Center for Disease Control and Prevention of Guangdong Province, Guangzhou, Guangdong, China Email:[tsong@cdcp.org.cn](mailto:tsong@cdcp.org.cn)
13. Wei Sun, Master degree , Center for Disease Control and Prevention of Sichuan Province , Chengdu, Sichuan, China Email: [sunwei80@yahoo.com](mailto:sunwei80@yahoo.com)
14. Ruoxiang Cao, Master degree, Beijing Municipal Center for Disease Control and Prevention, Beijing, China Email:[bjcaoruoxiang@163.com](mailto:bjcaoruoxiang@163.com)

**Corresponding authors' information:**

1. Yanhua Hao,Doctor degree, professor,School of Health Management, Harbin Medical University, Harbin,

1  
2  
3 Heilongjiang, China Email: [hyhyjw@126.com](mailto:hyhyjw@126.com)  
4

5  
6 2. Qunhong Wu,,Doctor degree, professor,School of Health Management, Harbin Medical University, Harbin,  
7 Heilongjiang, China Email: [wuqunhong@163.com](mailto:wuqunhong@163.com)  
8  
9

10  
11 **Word count:** Main Text word count: 3393;  
12

13 **Conflict of interest statement:**  
14

15  
16 We declare that we have no financial and personal relationships with other people or organizations that can  
17 inappropriately influence our work, there is no professional or other personal interest of any nature or kind in  
18 any product, service or company that could be construed as influencing the position presented in our study. Our  
19 study sponsor: Professor Yanhua Hao(corresponding) Organized surveyors to conduct field research for getting  
20 the first-hand survey data nonprofitable, then her graduate students to input these data into computer software  
21 Epidata, analyzing the results of this research only for academic research, finally, we decide to submit the  
22 report for publication.  
23  
24  
25  
26  
27  
28  
29

30 **Abstract**  
31

32 **Objective** This study aimed to assess household preparedness for emergency events and its determinants in  
33 China. **Design:** A cross-sectional questionnaire survey was conducted on 3,541 households in China in  
34 2015. **Participants:** Households were selected using a stratified cluster sampling strategy, representing  
35 central, eastern, western and southern regions of China. The designed questionnaires were administered  
36 through face-to-face interviews. **Outcome Measures:** Household emergency preparedness was measured  
37 with 14 indicators, tapping into the supply of nine emergency necessities (food and water, extra batteries,  
38 battery-powered radio, battery-operated flashlight, first aid kit, gas mask, fire extinguisher, escape ropes,  
39 whistle), coverage of accident insurance, knowledge of local emergency response systems (emergency  
40 numbers, exit routes and shelters), and availability of a household evacuation plan. If an individual acted on  
41 nine of the 14 indicators, they were deemed well-prepared. Logistic regression models were established to  
42 identify predictors of well-preparedness based on 3,541 returned questionnaires containing no missing  
43 values. **Results:** Only 9.9% of households were well-prepared for emergencies: 53.6% did not know what  
44 to do and 31.6% did not want to think about it. A higher level of preparedness was found in the respondents  
45 who participated in emergency training activities (AOR=2.458), had better emergency knowledge  
46 (AOR=2.278), reported less fate-submissiveness (AOR=1.622) and more self-reliance (AOR=1.376), had a  
47 higher income (AOR=1.400), and held more positive attitudes toward preparedness (AOR=1.295).  
48 **Conclusion:** Household preparedness for emergency events is poor in China. lack of motivation, negative  
49 attitude to preparedness and knowledge shortfall are major but remediable barriers for household  
50 preparedness.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **Key word: household preparedness, emergency preparedness, disaster preparedness**  
4

5 **Strengths and limitations**  
6

- 7
- 8 ● Firstly investigated the situation with international commonly used indicators, to identify the factors &  
9 barriers preventing residents from preparing for emergency events.
  - 10
  - 11 ● Except for some predictors consistent with previous researches, some interesting findings closely  
12 related with Chinese Auspicious culture contributed to the poor household preparedness.
  - 13
  - 14 ● But one adult respondent was invited to represent each household in this study, and opinions from  
15 family members are not always consistent.
  - 16
  - 17 ● The 14 emergency items included in this study are not exhaustive. An emphasis on other aspects may  
18 lead to different results.
  - 19
  - 20
  - 21
  - 22

23 **Introduction**  
24

25 No community is immune from the risk of emergencies and disasters in today's increasingly interconnected  
26 world. Many emergency events may be difficult to prevent. Inadequate preparation in response to these  
27 events can cause a tremendous loss in terms of human lives and health, property and infrastructure. It was  
28 estimated that natural disasters alone cost over US\$ 100 billion annually worldwide.<sup>1</sup> According to the *2016*  
29 *Humanitarian Response Plan* launched by the World Health Organization (WHO), US\$ 2.2 billion was  
30 needed to provide lifesaving health services to more than 79 million people in more than 30 countries due  
31 to protracted emergencies that year.<sup>2</sup> In the first half year of 2016, 68.77 million people in China were  
32 affected by floods, hail and geological disasters, resulting in 505 deaths and a direct economic loss of 89.04  
33 billion Chinese Yuan (US\$12.9645 billion).<sup>3</sup>  
34  
35  
36  
37  
38

39 Strengthening emergency responses can effectively reduce human casualties and contribute to sustainable  
40 post-event development. It is deemed a cost-effective investment in preventing losses and is considered one  
41 of the four priority areas in the Sendai Framework for Disaster Risk Reduction 2015-2030, which was  
42 endorsed by the third United Nations World Conference in Japan.<sup>4</sup> Over the past few decades, emergency  
43 response efforts have evolved from a focus on top-down relief assistance to a more comprehensive strategy  
44 with a greater emphasis on community participation and pre-event preparedness for better risk  
45 management. This is because emergency victims often face geographical isolation as a result of damage to  
46 local infrastructure such as energy, road and communication facilities.<sup>5</sup> Consequently, the arrival of  
47 external rescue support may experience two or more days of delay.<sup>6</sup> But rescue efforts in the first couple of  
48 days in disastrous events are critical.<sup>7</sup> Community and household preparedness in self-rescue efforts prior  
49 to the arrival of external assistance may result in the difference between the chance of survival and death.<sup>8</sup>  
50 Empirical evidence shows that sufficient household preparedness can significantly mitigate the negative  
51 consequences of emergency events.<sup>9</sup>  
52  
53  
54  
55  
56  
57  
58  
59

60 The United Nations International Strategy for Disaster Reduction (UNISDR) defined preparedness as the

1  
2  
3 “knowledge, capacities and actions to effectively respond to the effects of hazard events, whether or not  
4 they have occurred”.<sup>10</sup> Preparedness activities can be developed at the individual, household, community  
5 and governmental levels. Household preparedness plays a critical role because it is an integral part of any  
6 individual and community effort. Household emergency preparedness requires stockpiling emergency  
7 supplies, planning for emergency events and other actions like buying accident insurance.<sup>11-12</sup>  
8  
9

10  
11 Previous studies revealed poor household preparedness for disastrous events across a range of different  
12 settings.<sup>13-14</sup> Despite a rise in the number of publications on household preparedness in developed  
13 countries, there is a serious shortage of literature documenting the situation in developing countries.  
14 Empirical evidence shows that household preparedness is associated with many factors, including  
15 knowledge, risk awareness, prior exposure to disasters, attitudes toward emergency preparedness,<sup>15</sup> and  
16 trust in the government.<sup>16</sup> Socioeconomic status may also play an important role.<sup>17-18</sup> Developing countries  
17 are facing ever-increasing challenges and costs associated with disastrous events.<sup>19</sup> But experiences from  
18 developed countries cannot be extrapolated to developing countries without consideration of the local  
19 contexts.  
20  
21

22  
23 China is a disaster-prone country with the largest population and high population density. But little is  
24 known about the household preparedness of China in response to emergencies.<sup>12</sup> This study aimed to assess  
25 the level of household emergency preparedness in China and identify the factors associated with household  
26 preparedness. The findings of the study can provide evidence for better planning for the emergency  
27 response system.  
28  
29  
30  
31  
32  
33

## 34 35 36 37 **METHODS**

38  
39 A cross-sectional questionnaire survey was conducted on 3,541 households in four regions of China.  
40  
41

### 42 **Study population**

43  
44 A multistage stratified sampling strategy was adopted to select participating households. In the first stage,  
45 we identified four regions purposively considering diversities in geographic location and socioeconomic  
46 development: Beijing is the capital of China; Guangdong represents the most developed region in eastern  
47 China; Heilongjiang and Sichuan represent the less developed regions in central and western China,  
48 respectively. These four regions have a total population of more than 25 million, accounting for over 18%  
49 of the entire population in China. Of the four regions, Sichuan is an earthquake-prone area and recently  
50 experienced the Jiuzhaigou earthquake in 2017 and the Wenchuan earthquake in 2008. Guangdong is most  
51 frequently affected by typhoons. Meanwhile, many infectious diseases erupted in Guangdong, such as  
52 SARS in 2003 and dengue fever in 2014.  
53  
54  
55  
56  
57

58  
59 The second stage involved a selection of two municipalities in each province (two districts in Beijing) with  
60

1  
2  
3 varied social and economic conditions. We then randomly selected one urban and one rural residential  
4 community from each participating municipality/district. A total of 3,650 households in these communities  
5 were approached and invited to participate in this study: 1000 in Beijing, 850 in Guangdong, 900 in  
6 Heilongjiang and 900 in Sichuan.  
7  
8

### 9 10 **Data collection**

11  
12 Data were collected from April to September 2015. A research team comprising ten trained researchers and  
13 postgraduate students from Harbin Medical University visited the selected households. Verbal informed  
14 consent was obtained prior to the survey. One adult member from each household was interviewed. The  
15 questionnaire was administered anonymously, which took about 20 minutes to complete. Of the 3,650  
16 invited households, 3,580 (98.1%) completed the questionnaire survey. The final data analyses included  
17 3,541 (98.9%) questionnaires that contained no missing values.  
18  
19  
20  
21

### 22 23 **Dependent variable**

24  
25 Household preparedness was measured by 14 items that were commonly used in previous studies. These  
26 included the supply of nine emergency necessities (three-day-supply of non-perishable food and water,  
27 battery-powered radio, extra batteries, battery-operated flashlight, first aid kit, gas mask, fire extinguisher,  
28 escape ropes, whistle) as recommended by the national public education “ready” program in the US,<sup>20</sup>  
29 coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit  
30 routes and shelters), and availability of an evacuation plan.<sup>21-22</sup>  
31  
32  
33  
34

### 35 36 **Independent variables**

37  
38 The selection of independent variables was guided by two behavioral theories: the KAP (Knowledge,  
39 Attitudes and Practice) theory and the Theory of Reasoned Action (TRA). The KAP theory addresses the  
40 intertwined effects between knowledge, attitudes and behaviors, whereas, the TRA emphasizes the  
41 importance of human reasoning as many contextual factors can weigh into human decision on actions.<sup>23-24</sup>  
42  
43  
44

45 The independent variables tested in this study included:

46  
47 *Demographic and socioeconomic characteristics:* age, region and residency (urban vs rural), educational  
48 attainments, and monthly household income (estimated in Chinese Yuan). Previous studies showed that  
49 socioeconomic factors not only determine the available resources, but also predict the knowledge and  
50 attitudes of an individual toward human actions, in particular those for preventive purposes. People with  
51 low socioeconomic status are less likely to invest and act on risk prevention and risk management  
52 activities.<sup>25-26</sup>  
53  
54  
55

56  
57 *Knowledge:* 16 statements were designed based on the national guidelines for emergency responses in  
58 China to test the relevant knowledge of respondents. They were asked to judge whether these statements  
59  
60

1  
2  
3 were correct, incorrect, or if they were unsure. A correct answer was given a score of one point. This  
4 generated an overall knowledge score for each respondent ranging from 0 to 16.  
5  
6

7 *Risk awareness:* respondents were asked to rate their concerns about natural and man-made disasters, social  
8 safety events, and public health emergencies on a five-point Likert scale (1-5). A summed score was  
9 calculated for each respondent (ranging from 4 to 20), with a higher score indicating a higher level of  
10 concern.  
11  
12

13  
14 *Attitudes:* respondents were asked to rate on a five-point Likert scale (1-5) their interests in gathering  
15 information regarding emergency responses, perceived importance of such information, and willingness to  
16 discuss this topic with others. A summed score was calculated (ranging from 3 to 15), with a higher score  
17 indicating a higher level of endorsement with emergency preparedness.  
18  
19

20  
21 *Fate-submissiveness and self-reliance:* respondents were asked to rate on a five-point Likert scale (1-5)  
22 their inclination of submissiveness to fate or luck, in comparison with the determination of self-rescue in  
23 emergency events.  
24  
25

26  
27 *Past experience:* prior exposure to emergency events and participation in emergency training activities over  
28 the past year were measured in this study. Experiences play a pivotal role in the development of human  
29 behaviors.<sup>27</sup>  
30  
31

32 Respondents were also asked to choose all the reasons that prevented “people from preparing for  
33 emergencies” from the following list: (1) “do not know what to do”; (2) “do not want to think about it”; (3)  
34 “nothing can be done”; (4) “it takes too much time”; (5) “it takes too much money”; (6) “do not have the  
35 ability to prepare”; (7) “professionals will do the rescue job”; (8) “do not believe emergency will happen to  
36 the family”; (9) “do not have enough information from the government and the public media”. The list was  
37 developed based on findings of previous studies.<sup>28-29</sup>  
38  
39  
40  
41

## 42 **Statistical analysis**

43  
44  
45 We estimated the number and percentage of households acting on each of the 14 indicators for emergency  
46 preparedness. Differences in actions across households were tested using chi-square tests.  
47  
48

49 If an individual acted on 14 indicators, they were considered to be well-prepared.<sup>21</sup> A multivariate logistic  
50 regression model was established to identify independent variables associated with well-preparedness. In  
51 the regression model, independent variables measuring knowledge, risk awareness, attitudes,  
52 fate-submissiveness and self-reliance were transformed into a nominal measure: ‘above average score’  
53 versus ‘on/below average score’. The model employed an enter approach based on the maximum likelihood  
54 estimation method, with an enter/exit criterion ( $\alpha$ ) of 0.05/0.01. All statistical analyses were performed  
55 using SPSS V.22.0.  
56  
57  
58  
59  
60



## Ethics approval

The research Ethical Committee of Harbin Medical University approved the study protocol.

## RESULTS

### Characteristics of respondents

Nearly half (47.9%) of the respondents were aged between 31 to 50 years; 54.4% were women; 41.7% held a college degree; 53.1% had a monthly household income of above ¥3500. Most (64.3%) respondents lived in urban areas. The majority (79.2%) were married at the time of the survey (Table 1).

**Table 1. Socio-demographic characteristics of respondents**

Characteristics	N	%
<b>Gender</b>		
Male	1614	45.6
Female	1927	54.4
<b>Age (Years)</b>		
18-30	1010	28.5
31-50	1687	47.6
51+	844	23.9
<b>Education</b>		
College degree or above	1476	41.7
No college degree	2065	58.3
<b>Residency</b>		
Urban	2277	64.3
Rural	1264	35.7
<b>Region</b>		
Beijing	988	27.9
Heilongjiang	862	24.3
Guangdong	811	22.9
Sichuan	880	24.9
<b>Monthly household income (Yuan)</b>		

0-3499	1659	46.9
3500+	1882	53.1
<b>Marital status</b>		
Married	2803	79.2
Not married	738	20.8

### Household emergency preparedness

The respondents had relatively good knowledge of their local emergency response systems, with 93.9% knowing the emergency numbers, 74.9% being aware of the evacuation exit routes, and 62.4% being able to locate the emergency shelters. But less than half of the households were well-prepared in terms of necessities (apart from 80% having a battery-operated flashlight), having accident insurance coverage, and having developed an evacuation plan. Overall, households in Beijing performed worse than those in the other regions. Urban households outperformed their rural counterparts in insurance coverage and knowledge of local emergency response systems. But rural households were more likely to have an evacuation plan and stockpile food/water, radio, flashlight and escape ropes. Only a small number of households (9.9%) were deemed well-prepared, acting on nine or more of the emergency indicators (Table 2).

**Table 2. Number and percentage (%) of households acting on emergency items**

Action	Total N=3541	Regions				P	Residency	
		Beijing N=988	Heilongjiang N=862	Guangdong N=811	Sichuan N=880		Urban N=2266	Rural N=1275
<b>Possession of emergency necessities</b>								
three-day supply of food and	1101 (31.1)	230 (23.3)	350 (40.6)	264 (32.6)	257 (29.2)	0.000	684 (30.2)	417 (32.7)*

water								
extra batteries	1151 (32.5)	261 (26.4)	313 (36.3)	268 (33.0)	309 (35.1)	0.000	728 (32.1)	423 (33.2)
battery-powered radio	990 (28.0)	187 (18.9)	338 (39.2)	239 (29.5)	226 (25.7)	0.000	600 (26.5)	390 (30.6)*
battery-operated flashlight	2843 (80.3)	718 (72.7)	704 (81.7)	651 (80.3)	770 (87.5)	0.000	1760 (77.7)	1083 (84.9)*
first aid kit	1215 (34.3)	307 (31.1)	237 (27.5)	382 (47.1)	289 (32.8)	0.000	881 (38.9)*	334 (26.2)
gas mask	164 (4.6)	36 (3.6)	39 (4.5)	58 (7.2)	31 (3.5)	0.001	113 (5.0)	51 (4.0)
fire extinguisher	931 (26.3)	174 (17.6)	148 (17.2)	315 (38.8)	294 (33.4)	0.000	625 (27.6)*	306 (24.0)
escape rope	403 (11.4)	69 (7.0)	141 (16.4)	94 (11.6)	99 (11.3)	0.000	233 (10.3)	170 (13.3)*
whistle	387 (10.9)	95 (9.6)	117 (13.6)	73 (9.0)	102 (11.6)	0.010	264 (11.7)*	123 (9.6)
Coverage of accident insurance	819 (23.1)	291 (29.5)	147 (17.1)	132 (16.3)	249 (28.3)	0.000	582 (25.7)*	237 (18.6)
Household evacuation plan	1083 (30.6)	151(15.3)	255 (29.6)	292 (36.0)	385 (43.8)	0.000	673 (29.7)	446 (35.0)*
<b>Knowledge of local emergency response systems</b>								
Evacuation route	2652 (74.9)	742 (75.1)	599 (69.5)	626 (77.2)	685 (77.8)	0.003	1767 (78.0)*	885 (69.4)
Emergency shelter	2210 (62.4)	584 (59.1)	523 (60.7)	500 (61.7)	603 (68.5)	0.001	1447 (63.9)	763 (59.8)
Emergency phone numbers	3325 (93.9)	915 (92.6)	788 (91.4)	781 (96.3)	841 (95.6)	0.000	2170 (95.8)*	1155 (90.6)
Actions on nine or more indicators	352 (9.9)	48 (4.9)	91 (10.6)	92 (11.3)	121 (13.8)	0.001	236 (10.4)	116 (9.1)

\* $p < 0.05$  in urban-rural comparisons.

### Factors associated with emergency preparedness

The level of well-preparedness varied by region, household income, emergency training, knowledge and

1  
2  
3 attitudes toward emergency preparedness, self-reliance, and fate submissiveness ( $p < 0.05$  in chi-square tests,  
4 Table 3). However, no significant differences in the level of well-preparedness were found in respondents  
5 of a different gender, age, education, residency, prior exposure to emergency events, and risk awareness  
6 ( $p > 0.05$  in chi-square tests, Table 3).  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

**Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)**

Independent variable	N	N (%) of well-prepared	AOR	(95% Confidence Interval)	P
<b>Gender</b>					
Male (reference)	1614	169 (10.5)			
Female	1927	183 (9.5)	0.871	(0.692, 1.096)	0.238
<b>Age (Years)</b>					
18-30 (reference)	1010	98 (9.7)			
31-50	1687	166 (9.8)	1.003	(0.760, 1.324)	0.981
51+	844	88 (10.4)	1.329	(0.959, 1.840)	0.087
<b>Education</b>					
College degree or above	1476	152 (10.3)	0.979	(0.777, 1.234)	0.858
No college degree (reference)	2065	200 (9.7)			
<b>Residency</b>					
Urban	2277	236 (10.4)	1.079	(0.816, 1.426)	0.595
Rural (reference)	1264	116 (9.2)			
<b>Region*</b>					
Beijing (reference)	988	48 (4.9)			
Heilongjiang	862	91 (10.6)	3.473	(2.359, 5.115)	0.000
Guangdong	811	92 (11.3)	3.590	(2.413, 5.342)	0.000
Sichuan	880	121 (13.8)	3.692	(2.547, 5.354)	0.000
<b>Monthly household income (Yuan)*</b>					
0-3499 (reference)	1659	147 (8.9)			
3500+	1882	205 (10.9)	1.400	(1.067, 1.838)	0.015
<b>Prior exposure to emergency events</b>					
Yes	1332	155 (11.6)	1.254	(0.965, 1.629)	0.091
No (reference)	2209	197 (8.9)			
<b>Participation in emergency training*</b>					
Yes	957	158 (16.5)	2.458	(1.937, 3.119)	0.000
No (reference)	2584	194 (7.5)			
<b>Emergency knowledge score*</b>					
> average	3127	333 (10.6)	2.278	(1.403, 3.699)	0.001
≤ average (reference)	414	19 (4.6)			
<b>Risk awareness score</b>					
> average	1302	145 (11.1)	1.173	(0.922, 1.493)	0.195
≤ average (reference)	2239	207 (9.2)			
<b>Attitudes toward emergency*</b>					
> average	1947	216 (11.1)	1.295	(1.012, 1.657)	0.040
≤ average (reference)	1594	136 (8.5)			
<b>Self-reliance*</b>					
> average	2378	263 (11.1)	1.376	(1.059, 1.787)	0.017
≤ average (reference)	1163	86 (7.4)			
<b>Fate submissiveness*</b>					
> average (reference)	431	31 (7.2)			
≤ average	3110	321 (10.3)	1.622	(1.080, 2.437)	0.020
<b>Constants</b>			0.000		0.000

\*  $p < 0.05$  in univariate chi-square tests

1  
2  
3  
4  
5  
6 The logistic regression model confirmed that socio-economic status, knowledge and attitudes toward  
7 emergency preparedness were significant predictors of the level of well-preparedness after adjustments for  
8 variations in other variables. A higher level of preparedness was found in respondents who participated in  
9 emergency training activities (AOR=2.458), had better emergency knowledge (AOR=2.278), reported less  
10 fate-submissiveness (AOR=1.622) and more self-reliance (AOR=1.376), had a higher income  
11 (AOR=1.400), and held more positive attitudes toward preparedness (AOR=1.295) (Table 3).  
12  
13  
14  
15  
16

17  
18 The perceived barriers reported by the respondents for hindering household preparedness echoed well with  
19 the findings of the logistic model. More than half (53.6%) of the respondents cited knowledge shortage as a  
20 major barrier. This was followed by inertia: 31.6% did not want to think about it; 28.1% believed that  
21 emergency professionals would do the rescue job for them; 21.5% did not believe an emergency would  
22 happen to the family. In addition, 24.4% of respondents blamed the government and the public media for  
23 the limited availability of information. Resource restrictions were not perceived as a major barrier for  
24 household emergency preparedness: less than 20% respondents cited the lack of time, money and personal  
25 ability as a barrier (Figure 1).  
26  
27  
28  
29  
30  
31  
32

## 33 **DISCUSSION**

### 34 **Low level of household preparedness in China**

35  
36 Overall, the level of household emergency preparedness in China is low, with less than 10% of households  
37 acting on nine or more emergency indicators out of a possible 14. This result is consistent with the findings  
38 of studies conducted elsewhere in China.<sup>23</sup> Poor household preparedness for emergency events is common  
39 in many developing countries, such as Turkey and Iran.<sup>17,19</sup> The performance of developed countries,  
40 although better than in developing countries, is also far from satisfactory. In Australia, about one-fifth of  
41 households have sufficient supplies of items for emergency events such as a torch, radio, mobile phone,  
42 first aid kit, appropriate batteries and an emergency contact list.<sup>24</sup> A study in the US revealed that 12.3% of  
43 American households possessed a three-day supply of water and nonperishable food, an evacuation plan, a  
44 working flashlight and radio.<sup>25</sup> Similarly, 30% of households in Japan stockpiled food and drinking water  
45 for emergency events.<sup>17</sup>  
46  
47  
48  
49  
50  
51  
52  
53

### 54 **Factors contributing to the low level of household preparedness**

55  
56 Findings of the logistic regression model and ranking of perceived barriers reported by the respondents  
57 point to the same conclusion: knowledge is a major determinant of household emergency preparedness  
58 (Figure 2). The odds of well-preparedness doubles for respondents with a higher than average level of  
59  
60

1  
2  
3 knowledge. Training would also double the odds of well-preparedness, possibly through filling knowledge  
4 gaps. This is echoed by over half of the respondents who reported knowledge shortage as the major barrier  
5 to preparing for emergency events.  
6  
7

8  
9 However, it is important to note that great efforts need to be made in community mobilization.  
10 Fate-submissiveness and a lack of recognition of self-reliance were identified as a significant predictor of  
11 poor-preparedness in the logistic regression model. Similarly, a lack of motivation to act (“do not want to  
12 think about it” and “leave it to professionals”) was reported as the second most significant barrier in  
13 household emergency preparedness.  
14  
15

16  
17 Surprisingly, the most developed region, Beijing, was found to be the worst performer, despite the fact that  
18 higher household income is associated with well-preparedness. The underlying reasons are unknown. But  
19 clearly, it cannot be fully explained by individual factors. This study also failed to confirm the significant  
20 effects of age, gender, education, prior experience and risk awareness as revealed in previous studies.<sup>14, 26</sup>  
21  
22

### 23 24 **Policy implications**

25  
26 Large improvements can be made in relation to emergency preparedness in China. Public knowledge on  
27 emergency responses is universally poor in China.<sup>23</sup> Educational campaigns, if designed and implemented  
28 properly, can effectively improve public knowledge. However, this has to be done through multiple  
29 avenues. Governmental agencies can coordinate the timely provision of adequate information about  
30 emergency events. Emergency training can be offered through specifically designed drill exercise,<sup>30</sup> or as  
31 part of the national essential education system. In Japan, a disaster-prone country for example, disaster  
32 mitigation has been integrated into its national school curriculum.<sup>31</sup>  
33  
34

35  
36 However, knowledge improvement by itself is not enough. The mentality of inertia in the public needs to  
37 be addressed. A positive correlation between the recognition of self-reliance and better household  
38 preparedness is evident as confirmed in this study and others.<sup>32</sup> But unfortunately, many traditional cultures  
39 encourage fate submissiveness.<sup>18</sup> A study in Saudi Arabia found that most (93%) respondents believed that  
40 floods, earthquakes and other natural disasters are signs of God.<sup>33</sup> Fatalism is an attitude of self-defeatism  
41 which may lead individuals into helpless, undermining their efforts of individual preparedness.<sup>34-35</sup> Chinese  
42 society also embraces an auspicious culture, encouraging people to pursue luck and avoid ominous things.  
43 It is taboo to talk about bad things, such as disaster and death. People prefer to pin their hopes on illusory  
44 things, rather than be prepared for real threats.<sup>36-37</sup>  
45  
46  
47  
48  
49  
50  
51

52  
53 Lessons learnt from past experiences may help change the mentality of inertia. In Australia, for example,  
54 bush fires impose a regular risk for many households. The preparedness of individual households can make  
55 a difference between life and death. The National Partnership Agreement on Natural Disaster Resilience in  
56 Australia therefore emphasizes the significance of involving multiple parties including individuals.<sup>38</sup>  
57 Emergency response systems are often complex and adaptive. A highly participatory strategy would  
58  
59  
60

1  
2  
3 encourage individuals to take more responsibility, become less dependent on the government, and leave  
4 more resources for others.<sup>39</sup> Trust in the government is important given that it is most likely to play a  
5 coordinating role in emergency events.<sup>40</sup> However, over-reliance on the government and professional  
6 workers could dampen household efforts for future disasters.<sup>41</sup> A study of post-earthquake survivors in  
7 China showed that high expectations of the public on the government are associated with high trust in the  
8 government, leading to increased complacency in individual efforts in preparedness.<sup>16</sup> In China,  
9 governmental response to disasters from the military force has often been extraordinarily rapid and  
10 efficient. For example, an earthquake-relief headquarter was established by the army 18 minutes after the  
11 earthquake strike in Ya'an and 5000-6000 rescue workers were deployed on the same day. But people need  
12 to realize that there is always a gap before the full functioning of external rescue assistance, a gap which  
13 needs to be filled by the survivors of disasters.<sup>7</sup> Poor cooperation from those being rescued can also  
14 jeopardize professional efforts.

## 21 22 **Conclusion**

23  
24 The overall level of household emergency preparedness in China is extremely low. A lack of knowledge  
25 presents a great barrier to household preparedness. Although training can be an effective measure for  
26 improving knowledge, a more comprehensive strategy needs to be adopted to address issues associated  
27 with the lack of motivation,. Emergency response systems should emphasize individual responsibilities as  
28 well as those from the government and professional workers.

## 31 32 **Strengths and limitations**

33  
34 **Strengths:** As disaster-prone country, few studies on household preparedness were conducted in China.  
35 This study firstly investigated the situation with international commonly used indicators, to identify the  
36 factors & barriers preventing Chinese residents from preparing for emergency events. Except for some  
37 predictors consistent with previous researches, some interesting findings closely related with Chinese  
38 Auspicious culture contributed to the poor household preparedness. This paper could provide evidences for  
39 understanding and making targeted education programs for improving household disaster preparedness.

40  
41 **Limitations:** There are several limitations in this study. One adult respondent was invited to represent each  
42 household in this study. But opinions from family members are not always consistent.<sup>13</sup> Household  
43 preparedness can involve many aspects. The 14 emergency items included in this study are not exhaustive.  
44 An emphasis on other aspects may lead to different results.

45  
46 **Data sharing statement** No additional data are available.

## 47 48 **Open access**

49  
50 This is an Open Access article distributed in accordance with the Creative Commons Attribution Non  
51 Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this  
52 work non-commercially, and license their derivative works on different terms, provided the original work is  
53 properly cited and the use is non-commercial.

## 54 55 **Author contributions**

56  
57 YJ analyzed the data and drafted the manuscript. YH and QH took overall responsibility for the study  
58 design, coordinated and conducted the survey, and participated in writing this manuscript. WX, WLX, NN,  
59  
60



1  
2  
3 CY, LL, LG, ZK,TS, WS,RC participated in the design of the research and conducted the survey. CJ  
4 interpreted the results of statistical analyses, articulated the storyline, and wrote the manuscript. YJ, WX,  
5 WLX and NN contributed equally. Y H and QW as co-corresponding authors.  
6  
7

### 8 **Conflicts of interests statement**

9  
10  
11 We declare that we have no financial and personal relationships with other people or organizations that can  
12 inappropriately influence our work, there is no professional or other personal interest of any nature or kind  
13 in any product, service or company that could be construed as influencing the position presented in our  
14 study.  
15  
16

17  
18 **Patient and public involvement:** No patient involved  
19

### 20 **Funding**

21  
22  
23 This work was supported by the National Natural Scientific Fund of China grant number (71673072,  
24 71173064, 71473065), and the Ministry of Health Public Benefit Fund for Health Sector (201002028),  
25 Heilongjiang Province philosophy & Social Science Fund (18GLD302).  
26  
27

28 **Participant consent:** Obtained.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

1. World Bank. Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention; 2010
2. Health needs from humanitarian emergencies at an all-time high, WHO. [www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/](http://www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/). Accessed June 6, 2016.
3. China National Commission for Disaster Reduction. The Briefing of China's natural disasters in 2016. Bei Jing, China, Emergency Office. <http://www.mca.gov.cn/article/zrzh/201606/index.htm>. Accessed October 11, 2016.
4. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction (UNISDR). <https://www.unisdr.org/we/inform/publications/43291> Accessed March 18, 2015.
5. Serrao-Neumann, Silvia, F. Crick, and D. L. Choy. Post-disaster social recovery: disaster governance lessons learnt from Tropical Cyclone Yasi. *Natural Hazards*. 2018;1-18. <https://doi.org/10.1007/s11069-018-3345-5>
6. United Nations International Strategy for Disaster Reduction. Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. United Nations International Strategy for Disaster Reduction (2007).
7. Liu CJ, Robinson P. The role of volunteers in disaster settings: better organization is needed. *Australian and New Zealand Journal of Public Health* [https://doi.org/37.6\(2013\):595-59610.1111/1753-6405.12139](https://doi.org/37.6(2013):595-59610.1111/1753-6405.12139)
8. Kim, Y. C., and J. Kang. "Communication, neighborhood belonging and household hurricane preparedness." *Disasters*. 2010;34(2). <https://doi.org/470.10.1111/j.1467-7717.2009.01138.x>
9. Levac, J, D. Toal-Sullivan, and T. L. O'Sullivan. "Household Emergency Preparedness: A Literature Review." *Journal of Community Health*. 2012;37(3):725-733. <https://doi.org/10.1007/s10900-011-9488-x>
10. United Nations Office for Disaster Risk Reduction (UNISDR). 2009 UNISDR terminology on disaster risk reduction (2009). <https://www.unisdr.org/we/inform/publications/7817> Accessed 2009.
11. Greenberg MR, Dyen S, and Elliott S. "The public's preparedness: self-reliance, flashbulb memories, and conservative values." *American Journal of Public Health*. 2013;103(6):E85-E91. <https://doi.org/10.2105/AJPH.2012.301198>.
12. Xu, Dingde, et al. Influences of Risk Perception and Sense of Place on Landslide Disaster Preparedness in Southwestern China. *International Journal of Disaster Risk Science*. 2018;9(2):1-14. <https://doi.org/10.1007/s13753-018-0170-0>
13. Hung, Li San. "Gender, Intra-Household Dynamics, and Household Hurricane Preparedness: An Exploratory Study

- 1  
2  
3  
4 Employing a Dyadic Interview Approach." *International Journal of Disaster Risk Science*. 2018;(1):1-12.  
5 <https://doi.org/110.1007/s13753-018-0158-9>  
6  
7  
8 14. Onuma, Hiroki, J. S. Kong, and S. Managi. "Household preparedness for natural disasters: Impact of disaster experience  
9 and implications for future disaster risks in Japan." *Mpra Paper*. 2016;(21). <https://doi.org/10.1016/j.ijdr.2016.11.004>  
10  
11  
12 15. Han X, Ding YB, Zhang HW, et al. Prevention of sudden disaster risk and public participation in megacity. *Shanghai J*  
13 *Prev Med*. 2015;(5):248–255  
14  
15  
16 16. Han, Ziqiang, et al. "The effects of trust in government on earthquake survivors' risk perception and preparedness in  
17 China." *Natural Hazards*. 2017;1(86):437-452.  
18  
19 <https://doi.org/10.1007/s11069-016-2699-9>  
20  
21  
22  
23 17. Joffe, Helene. "Cultural Barriers to Earthquake Preparedness." *Risk Management* (2012).  
24  
25  
26 18. Debastiani, S. D., et al. "Preparedness Perceptions, Sociodemographic Characteristics, and Level of Household  
27 Preparedness for Public Health Emergencies: Behavioral Risk Factor Surveillance System, 2006-2010." *Health Secure*.  
28 2015;13(5):317-326. <https://doi.org/10.1089/hs.2014.0093>  
29  
30  
31 19. Mahdaviazad, H, and G. Abdolahifar. "Assessing Household Natural Disaster Preparedness in Shiraz, Iran, 2011:  
32 Results of a Knowledge, Attitude, and Practices Survey." *Disaster Medicine & Public Health*  
33 *Preparedness*.2014;8(4):349. <https://doi.org/10.1017/dmp.2014.61>  
34  
35  
36  
37 20. FEMA.Emergency Kit Checklist for Parents. Available at:  
38 [https://www.fema.gov/media-library-data/1e04d512b273e2133cb865833cc0e32d/FEMA\\_checklist\\_parent\\_508\\_071513](https://www.fema.gov/media-library-data/1e04d512b273e2133cb865833cc0e32d/FEMA_checklist_parent_508_071513)  
39 [https://www.fema.gov/media-library-data/1e04d512b273e2133cb865833cc0e32d/FEMA\\_checklist\\_parent\\_508\\_071513](https://www.fema.gov/media-library-data/1e04d512b273e2133cb865833cc0e32d/FEMA_checklist_parent_508_071513)  
40 [.pdf](https://www.fema.gov/media-library-data/1e04d512b273e2133cb865833cc0e32d/FEMA_checklist_parent_508_071513). Publication date: August 21, 2013  
41  
42  
43 21. Alrousan, T. M., L. M. Rubenstein, and R. B. Wallace. Preparedness for natural disasters among older US adults: a  
44 nationwide survey. *American Journal of Public Health*. 2014;104(3):506. <https://doi.org/10.2105/ajph.2013.301559>  
45  
46  
47 22. Corwin K A , Brand B D , Hubbard M L , et al. Household preparedness motivation in lahar hazard zones: assessing the  
48 adoption of preparedness behaviors among laypeople and response professionals in communities downstream from  
49 Mount Baker and Glacier Peak (USA) volcanoes. *Journal of Applied Volcanology*. 2017;6(1):3.  
50  
51 <https://doi.org/10.1186/s13617-017-0055-8>  
52  
53  
54 23. Li, L., et al. Intervention effects of knowledge and skills of the public to respond to public health emergencies in  
55 Sichuan province, China. *Eval Rev* 2013;37(2):140-57.  
56  
57  
58 <https://doi.org/10.1177/0193841x14523619>  
59  
60

- 1
- 2
- 3
- 4 24. Glanz K , Rimer B K , Viswanath K . Health Behavior: Theory, Research, and Practice;2015.
- 5
- 6 25. Tony, Merritt, et al. Household disaster preparedness and information sources: Rapid cluster survey after a storm in New
- 7 South Wales, Australia. *Bmc Public Health*. 2008;8(1):1-9. <https://doi.org/10.1186/1471-2458-8-195>
- 8
- 9
- 10 26. House J S , Herzog R C K R. Age, Socioeconomic Status, and Health. *The Milbank Quarterly*. 1990; 68(3):383-411.
- 11 <https://doi.org/10.2307/3350111>
- 12
- 13
- 14 27. Mincer J A . Schooling, Experience, and Earnings. *Industrial and Labor Relations Review*, 1976;29(3).
- 15 <https://doi.org/10.2307/2521600>
- 16
- 17
- 18 28. Anita C, Malcolm W, Alonzo P ,et al. Getting actionable about community resilience: the Los Angeles County
- 19 Community Disaster Resilience project. *American Journal of Public Health*, 2013;103(7):1181-1189.
- 20 <https://doi.org/10.2105/AJPH.2013.301270>
- 21
- 22
- 23 29. Blessman, J, Skupski, J, Jamil, M, et al. Barriers to at-home-preparedness in public health employees: Implications for
- 24 disaster preparedness training. *Journal of Occupational and Environmental Medicine*, 2009;(49)3:318–326.
- 25 <https://doi.org/10.1097/jom.0b013e31803225c7>
- 26
- 27
- 28 30. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis* 1998;(18)3:243–252.
- 29 <https://doi.org/110.1111/j.1539-6924.1998.tb01291.x>
- 30
- 31
- 32 31. Iemura, Hirokazu, et al. "Earthquake and tsunami questionnaires in Banda Aceh and surrounding areas." *Disaster*
- 33 *Prevention & Management* 2006;15(1):21-30. <https://doi.org/10.1108/09653560610654211>
- 34
- 35
- 36 32. Khunwishit S. Community resilience in Thailand: A case study of flood response in Nakhonsawan City Municipality.
- 37 University of North Texas, 2013.
- 38
- 39
- 40 33. Alshehri, Saud Ali, Y. Rezgui, and H. Li. "Public perception of the risk of disasters in a developing economy: the case
- 41 of Saudi Arabia." *Natural Hazards*. 2013;65(3):1813-1830.
- 42 <https://doi.org/10.1007/s11069-012-0445-5>
- 43
- 44
- 45 34. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis*.1998;18(3):243–252.
- 46 <https://doi.org/10.1111/j.1539-6924.1998.tb01291.x>
- 47
- 48
- 49 35. Baytiyeh, Hoda, and M. Naja. "The effects of fatalism and denial on earthquake preparedness levels." *Disaster*
- 50 *Prevention & Management*. 2016;25(2):154-167.
- 51 <https://doi.org/10.1108/DPM-07-2015-0168>
- 52
- 53
- 54 36. Nie Lin. A Summary of China's Emergency Preparedness Culture Theory. *Science and Technology Forum* (the second
- 55
- 56
- 57
- 58
- 59
- 60

half of the month), 2012(7): 189-190.

<https://doi.org/10.3969/j.issn.1007-3973.2012.07.111>

37. Peng Zongchao, Nie Lin. Analysis of the Status Quo and Development Path of Urban Emergency Preparedness Culture in China. *China Emergency Management*, 2012(5): 37-40.
38. Governments, Council Of Australian. "National Strategy for Disaster Resilience." *Australian Journal of Emergency Management*. 2011;27.  
<https://doi.org/10.1111/1467-8500.12299>
39. C C. Household preparedness for public health emergencies--14 states, 2006-2010.[J]. *Mmwr Morbidity & Mortality Weekly Report*.2012;61(36):713.  
<https://doi.org/10.1001/jama.2012.13026>
40. Basolo V, Steinberg LJ, Burby RJ, Levine J, Cruz AM, Huang C. The Effects of Confidence in Government and Information on Perceived and Actual Preparedness for Disasters. *Environment and Behavior*. 2009;41(3):338-364.  
<https://doi.org/10.1177/0013916508317222>
41. Terpstra T. Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior. *Risk Analysis*.2011;31(10):1658-1675. <https://doi.org/10.1111/j.1539-6924.2011.01616.x>

### Figure legend/caption

Table 1. Socio-demographic characteristics of respondents

Table 2. Number and percentage (%) of households acting on emergency items

\* $p < 0.05$  in urban-rural comparisons.

Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)

\*  $p < 0.05$  in univariate chi-square tests

Figure 1. Barriers reported by respondents (%) for not preparing for emergencies

*Figure 1 Note: Q1 "do not know what to do"; Q2 "do not want to think about it"; Q3 "nothing can be done"; Q4 "it takes too much time"; Q5 "it takes too much money"; Q6 "do not have the ability to prepare"; Q7 "professionals will do the rescue job"; Q8 "do not believe emergency will happen to the*

1  
2  
3 *family*”; Q9 “do not have enough information from the government and the public media”.

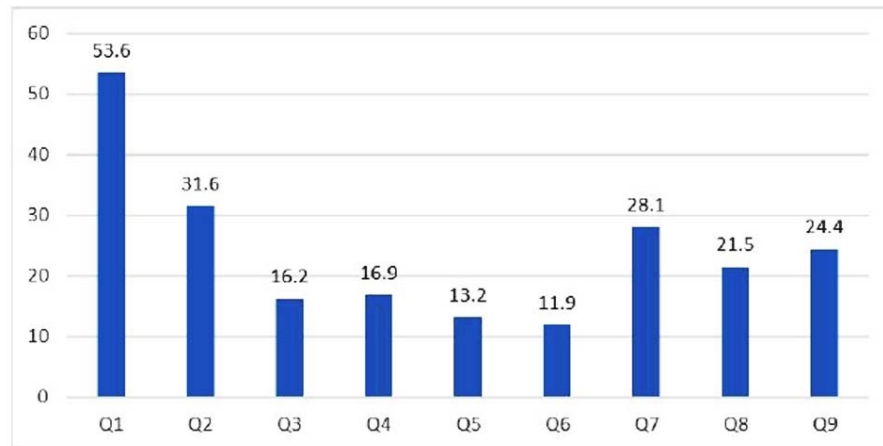
4  
5 Figure 2. Link between perceived barriers and factors predicting well-preparedness  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

**Figure 1. Barriers reported by respondents (%) for not preparing for emergencies**

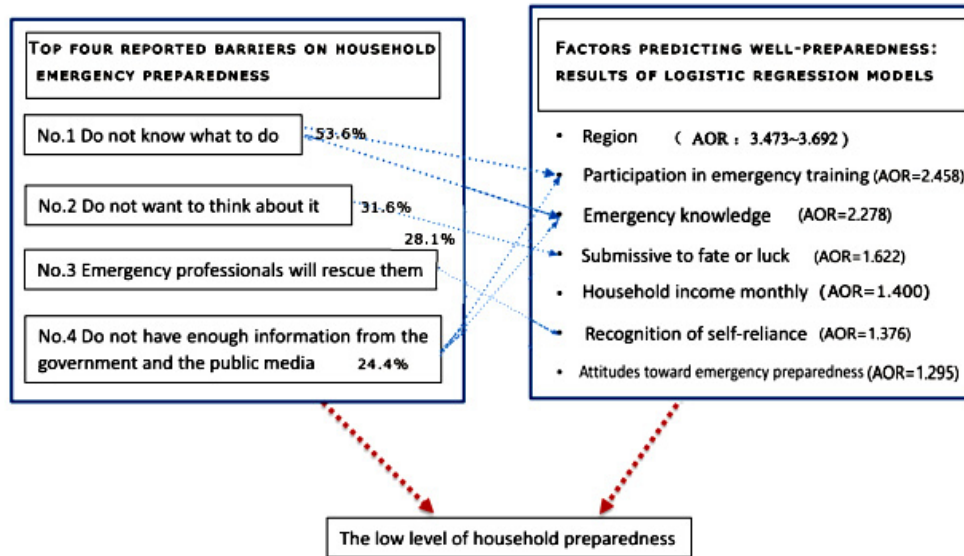


*Note: Q1 "do not know what to do"; Q2 "do not want to think about it"; Q3 "nothing can be done"; Q4 "it takes too much time"; Q5 "it takes too much money"; Q6 "do not have the ability to prepare"; Q7 "professionals will do the rescue job"; Q8 "do not believe emergency will happen to the family"; Q9 "do not have enough information from the government and the public media".*

Figure 1. Barriers reported by respondents (%) for not preparing for emergencies

90x90mm (300 x 300 DPI)





25 Figure 2. Link between perceived barriers and factors predicting well-preparedness

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Page No	Recommendation
<b>Title and abstract</b>	1 ✓	2	(a) Indicate the study's design with a commonly used term in the title or the abstract
		2	(b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>			
Background/rationale	2 ✓	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3 ✓	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>			
Study design	4 ✓	4	Present key elements of study design early in the paper
Setting	5 ✓	4	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 ✓	4	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7 ✓	5	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/measurement	8* ✓	6	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9		Describe any efforts to address potential sources of bias
Study size	10 ✓	6	Explain how the study size was arrived at
Quantitative variables	11 ✓	6	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 ✓	6	(a) Describe all statistical methods, including those used to control for confounding
		6	(b) Describe any methods used to examine subgroups and interactions
		6	(c) Explain how missing data were addressed
		6	(d) If applicable, describe analytical methods taking account of sampling strategy
			(e) Describe any sensitivity analyses
<b>Results</b>			
Participants	13* ✓	7	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			(b) Give reasons for non-participation at each stage
			(c) Consider use of a flow diagram
Descriptive data	14* ✓	7	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each

			variable of interest
Outcome data	15* ✓	8	Report numbers of outcome events or summary measures
Main results	16 ✓	8-9	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		9	(b) Report category boundaries when continuous variables were categorized
		9	(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>			
Key results	18 ✓	10-11	Summarise key results with reference to study objectives
Limitations	19 ✓	12	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20		Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21 ✓	12	Discuss the generalisability (external validity) of the study results
<b>Other information</b>			
Funding	22 ✓	13	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Household Emergency Preparedness In China: A Cross-Sectional Survey

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-032462.R1
Article Type:	Original research
Date Submitted by the Author:	10-Sep-2019
Complete List of Authors:	Chen, Chao yi; Harbin Medical University, Social Medicine; Xu, Wei Dai, Yajun Xu, Weilan Liu, Chaojie; La Trobe University, Public Health Wu, Qunhong; Harbin Medical University, Social Medicine Gao, Lijun; Harbin Medical University, Social Medicine Kang, Zheng; Harbin Medical University, Health policy; Hao, Yanhua; Harbin Medical University, Social Medicine Ning, Ning; Harbin Medical University, Social Medicine
<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	Emergency medicine, Public health
Keywords:	ACCIDENT & EMERGENCY MEDICINE, PUBLIC HEALTH, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

SCHOLARONE™  
Manuscripts

# Household Emergency Preparedness In China: A Cross-Sectional Survey

## Title Page

**Title:** Household Emergency Preparedness in China: A Cross-Sectional Survey

**Author names and affiliations:**

1. Chaoyi Chen\*, graduate student in Master degree, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [749134597@qq.com](mailto:749134597@qq.com)/[qq328867128@126.com](mailto:qq328867128@126.com)
2. Wei Xu\*, PhD student, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [13836138161@163.com](mailto:13836138161@163.com)
3. Yajun Dai, graduate student in Master degree, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [daiyajun0408@163.com](mailto:daiyajun0408@163.com)
4. Weilan Xu, PhD, Qiqihar Medical College of Nursing, Qiqihar, Heilongjiang, China Email: [lxdoctor@163.com](mailto:lxdoctor@163.com)
5. Chaojie Liu, PhD, professor, School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia Email: [c.liu@latrobe.edu.au](mailto:c.liu@latrobe.edu.au)
6. Qunhong Wu, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [wuqunhong@163.com](mailto:wuqunhong@163.com)
7. Lijun Gao, Master degree, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [gg73@163.com](mailto:gg73@163.com)
8. Zheng Kang, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [kangzheng0086@126.com](mailto:kangzheng0086@126.com)
9. Yanhua Hao, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [hyhyjw@126.com](mailto:hyhyjw@126.com)
10. Ning Ning, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [ningninghyd@163.com](mailto:ningninghyd@163.com)

**Corresponding authors' information:**

1. Yanhua Hao, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [hyhyjw@126.com](mailto:hyhyjw@126.com)
2. Ning Ning, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [ningninghyd@163.com](mailto:ningninghyd@163.com)

**Word count:** Main Text word count: 3180;

**Conflict of interest statement:**

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service or company that could be construed as influencing the position presented in our study. Our study sponsor: Professor Yanhua Hao (corresponding author) initiated and coordinated the study. All of the data were collected from field surveys. The funders play no role in the design, data collection, data analyses, and writing of the manuscript.

## Abstract

**Objective** This study aimed to assess household preparedness for emergency events and its determinants in China. **Design:** A cross-sectional questionnaire survey was conducted on 3,541 households in China in 2015. **Participants:** Households were selected using a stratified cluster sampling strategy, representing central, eastern, western and southern regions of China. The designed questionnaires were administered through face-to-face interviews. **Outcome Measures:** Household emergency preparedness was measured with 14 indicators, tapping into the supply of nine emergency necessities (food and water, extra batteries, battery-powered radio, battery-operated flashlight, first aid kit, gas mask, fire extinguisher, escape ropes, whistle), coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit routes and shelters), and availability of a household evacuation plan. If an individual acted on nine of the 14 indicators, they were deemed well-prepared. Logistic regression models were established to identify predictors of well-preparedness based on 3,541 returned questionnaires containing no missing values. **Results:** Only 9.9% of households were well-prepared for emergencies: 53.6% did not know what to do and 31.6% did not want to think about it. A higher level of preparedness was found in the respondents who have attained higher education (AOR=0.826 compared with the higher level), participated in emergency training activities (AOR=2.299), had better emergency knowledge (AOR=2.043), reported less fate-submissiveness (AOR=1.385) and more self-reliance (AOR=1.349), prior exposure to emergency events (AOR=1.280), and held more positive attitudes toward preparedness (AOR=1.286). **Conclusion:** Household preparedness for emergency events is poor in China. Lack of motivation, negative attitude to preparedness and knowledge shortfall are major but remediable barriers for household preparedness.

**Key word:** household preparedness, emergency preparedness, disaster preparedness

### Strengths and limitations

- This study quantified household preparedness for emergency events for the first time in China and identified factors associated with emergency preparedness
- The findings of the determinants of poor household preparedness are closely aligned with the Chinese Auspicious culture.
- One adult respondent from each household was invited to complete the survey. But opinions from the family members may not always been consistent.
- The 14 emergency items included in this study reflected priorities in emergency responses in China, which may not be exhaustive. The importance of the emergency items was not differentiated either.
- We presented the results of both logistic regression and linear regression analyses, which are largely consistent.

### Introduction

No community is immune from the risk of emergencies and disasters in today's increasingly interconnected world. Many emergency events may be difficult to prevent. Inadequate preparation in response to these events can cause a tremendous loss in terms of human lives and health, property and infrastructure. It was estimated that natural disasters alone cost over US\$ 100 billion annually worldwide.<sup>1</sup> According to the 2016

1  
2  
3 *Humanitarian Response Plan* launched by the World Health Organization (WHO), US\$ 2.2 billion was  
4 needed to provide lifesaving health services to more than 79 million people in more than 30 countries due  
5 to protracted emergencies that year.<sup>2</sup> In the first half year of 2016, 68.77 million people in China were  
6 affected by floods, hail and geological disasters, resulting in 505 deaths and a direct economic loss of 89.04  
7 billion Chinese Yuan (US\$12.9645 billion).<sup>3</sup>  
8  
9

10  
11 Strengthening emergency responses can effectively reduce human casualties and contribute to sustainable  
12 post-event development. It is deemed a cost-effective investment in preventing losses and is considered one  
13 of the four priority areas in the Sendai Framework for Disaster Risk Reduction 2015-2030, which was  
14 endorsed by the third United Nations World Conference in Japan.<sup>4</sup> Over the past few decades, emergency  
15 response efforts have evolved from a focus on top-down relief assistance to a more comprehensive strategy  
16 with a greater emphasis on community participation and pre-event preparedness for better risk management.  
17 This is because emergency victims often face geographical isolation as a result of damage to local  
18 infrastructure such as energy, road and communication facilities.<sup>5</sup> Consequently, the arrival of external  
19 rescue support may experience two or more days of delay.<sup>6</sup> But rescue efforts in the first couple of days in  
20 disastrous events are critical.<sup>7</sup> Community and household preparedness in self-rescue efforts prior to the  
21 arrival of external assistance may result in the difference between the chance of survival and death.<sup>8</sup>  
22 Empirical evidence shows that sufficient household preparedness can significantly mitigate the negative  
23 consequences of emergency events.<sup>9</sup>  
24  
25  
26  
27  
28  
29  
30  
31

32 The United Nations International Strategy for Disaster Reduction (UNISDR) defined preparedness as the  
33 “knowledge, capacities and actions to effectively respond to the effects of hazard events, whether or not  
34 they have occurred”.<sup>10</sup> Preparedness activities can be developed at the individual, household, community  
35 and governmental levels. Household preparedness plays a critical role because it is an integral part of any  
36 individual and community effort. The concept of household preparedness emphasizes household  
37 responsibilities and the capability to reduce risks and damage,<sup>11</sup> which requires stockpiling emergency  
38 supplies, planning for emergency events and other actions like buying accident insurance.<sup>12-13</sup>  
39  
40  
41  
42  
43

44 Previous studies revealed poor household preparedness for disastrous events across a range of different  
45 settings.<sup>14-15</sup> Despite a rise in the number of publications on household preparedness in developed countries,  
46 there is a serious shortage of literature documenting the situation in developing countries. Empirical  
47 evidence shows that household preparedness is associated with many factors, including knowledge, risk  
48 awareness, prior exposure to disasters, attitudes toward emergency preparedness,<sup>16</sup> and trust in the  
49 government. Socioeconomic status may also play an important role.<sup>17-18</sup> Developing countries are facing  
50 ever-increasing challenges and costs associated with disastrous events. But experiences from developed  
51 countries cannot be extrapolated to developing countries without consideration of the local contexts.  
52  
53  
54  
55  
56

57 China is a disaster-prone country with the largest population and high population density. But little is  
58 known about the household preparedness of China in response to emergencies. This study aimed to assess  
59 the level of household emergency preparedness in China and identify the factors associated with household  
60

1  
2  
3 preparedness. The findings of the study can provide evidence for better planning for the emergency  
4 response system.  
5

## 6 7 **METHODS**

8  
9 A cross-sectional questionnaire survey was conducted on 3,541 households in four regions of China.  
10

### 11 12 **Study population**

13  
14 A multistage stratified sampling strategy was adopted to select participating households. In the first stage,  
15 we identified four regions purposively considering diversities in geographic location and socioeconomic  
16 development: Beijing is the capital of China; Guangdong represents the most developed region in eastern  
17 China; Heilongjiang and Sichuan represent the less developed regions in central and western China,  
18 respectively. These four regions have a total population of more than 25 million, accounting for over 18%  
19 of the entire population in China. Of the four regions, Sichuan is an earthquake-prone area and recently  
20 experienced the Jiuzhaigou earthquake in 2017 and the Wenchuan earthquake in 2008. Guangdong is most  
21 frequently affected by typhoons. Meanwhile, many infectious diseases erupted in Guangdong, such as  
22 SARS in 2003 and dengue fever in 2014.  
23  
24

25  
26 The second stage involved a selection of two municipalities in each province (two districts in Beijing) with  
27 varied social and economic conditions. We then randomly selected one urban and one rural residential  
28 community from each participating municipality/district. A total of 3,650 households in these communities  
29 were approached and invited to participate in this study: 1000 in Beijing, 850 in Guangdong, 900 in  
30 Heilongjiang and 900 in Sichuan.  
31  
32

### 33 34 **Data collection**

35  
36 Data were collected from April to September 2015. A research team comprising ten trained researchers and  
37 postgraduate students from Harbin Medical University visited the selected households. One adult member  
38 from each household was interviewed. Verbal informed consent was obtained prior to the survey. The  
39 questionnaire was administered anonymously, which took about 20 minutes to complete. Of the 3,650  
40 invited households, 3,580 (98.1%) completed the questionnaire survey. The final data analyses included  
41 3,541 (98.9%) questionnaires that contained no missing values.  
42  
43  
44  
45  
46  
47  
48  
49

### 50 51 **Dependent variable**

52  
53 Household preparedness was measured by 14 items that were commonly used in previous studies. A list of  
54 emergency items was generated through literature review. The selection of the emergency items in this  
55 study considered the relevance of the emergency items to the common disastrous events in China. The  
56 relevant emergency items were prioritized in accordance with the National Disaster Prevention Manual  
57 published by the Ministry of Civil Affairs of China and the CDC Behavioral Risk Factor Surveillance  
58  
59  
60



1  
2  
3 System. These included nine general emergency necessities (three-day-supply of non-perishable food and  
4 water, battery-powered radio, extra batteries, battery-operated flashlight, first aid kit, gas mask, fire  
5 extinguisher, escape ropes, whistle) as recommended by the national public education “ready” program in  
6 the US and some preparedness items source from the General Preparedness Module,<sup>18,19</sup> as well as  
7 coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit  
8 routes and shelters), and availability of an evacuation plan.<sup>20-21</sup>  
9  
10  
11  
12

### 13 **Independent variables**

14  
15  
16 The selection of independent variables was guided by two behavioral theories: the KAP (Knowledge,  
17 Attitudes and Practice) theory and the Theory of Reasoned Action (TRA). The KAP theory addresses the  
18 intertwined effects between knowledge, attitudes and behaviors, whereas, the TRA emphasizes the  
19 importance of human reasoning as many contextual factors can weigh into human decision on actions.<sup>22-23</sup>  
20  
21  
22

23 The independent variables tested in this study included:

24  
25 *Demographic and socioeconomic characteristics:* age, region and residency (urban vs rural), educational  
26 attainments, and monthly household income (estimated in Chinese Yuan). Previous studies showed that  
27 socioeconomic factors not only determine the available resources, but also predict the knowledge and  
28 attitudes of an individual toward human actions, in particular those for preventive purposes. People with  
29 low socioeconomic status are less likely to invest and act on risk prevention and risk management  
30 activities.<sup>24-25</sup>  
31  
32  
33

34  
35 *Knowledge:* 16 statements were designed based on the national guidelines for emergency responses in  
36 China to test the relevant knowledge of respondents. They were asked to judge whether these statements  
37 were correct, incorrect, or if they were unsure. A correct answer was given a score of one point. This  
38 generated an overall knowledge score for each respondent ranging from 0 to 16.  
39  
40  
41

42 *Risk awareness:* respondents were asked to rate their concerns about natural and man-made disasters, social  
43 safety events, and public health emergencies on a five-point Likert scale (1-5). A summed score was  
44 calculated for each respondent (ranging from 4 to 20), with a higher score indicating a higher level of  
45 concern.  
46  
47  
48

49 *Attitudes:* respondents were asked to rate on a five-point Likert scale (1-5) their interests in gathering  
50 information regarding emergency responses, perceived importance of such information, and willingness to  
51 discuss this topic with others. A summed score was calculated (ranging from 3 to 15), with a higher score  
52 indicating a higher level of endorsement with emergency preparedness.  
53  
54  
55

56 *Fate-submissiveness and self-reliance:* respondents were asked to rate on a five-point Likert scale (1-5)  
57 their inclination of submissiveness to fate or luck, in comparison with the determination of self-rescue in  
58 emergency events.  
59  
60

1  
2  
3 *Past experience*: prior exposure to emergency events and participation in emergency training activities over  
4 the past year were measured in this study. Experiences play a pivotal role in the development of human  
5 behaviors.<sup>26</sup>  
6  
7

8 Respondents were also asked to choose all the reasons that prevented “people from preparing for  
9 emergencies” from the following list: (1) “do not know what to do”; (2) “do not want to think about it”; (3)  
10 “nothing can be done”; (4) “it takes too much time”; (5) “it takes too much money”; (6) “do not have the  
11 ability to prepare”; (7) “professionals will do the rescue job”; (8) “do not believe emergency will happen to  
12 the family”; (9) “do not have enough information from the government and the public media”. The list was  
13 developed based on findings of previous studies.<sup>27-28</sup>  
14  
15  
16  
17

### 18 **Statistical analysis**

19  
20  
21 We estimated the number and percentage of households acting on each of the 14 indicators for emergency  
22 preparedness. These indicators were commonly used for measuring the preparedness of the household. Each  
23 positive answer was given 1 point. A score of actions on over nine out of the 14 points was categorized as well  
24 prepared. Differences in actions across households were tested using chi-square tests.  
25  
26

27 A multivariate logistic regression model was established to identify independent variables associated with  
28 well-preparedness. We also performed a linear regression analysis using the “summed points” as a  
29 dependent variable.  
30  
31

32 In the regression models, independent variables measuring knowledge, risk awareness, attitudes,  
33 fate-submissiveness and self-reliance were transformed into a nominal measure: ‘above average score’  
34 versus ‘on/below average score’. The models employed an enter approach based on the maximum  
35 likelihood estimation method, with an enter/exit criterion ( $\alpha$ ) of 0.05/0.01. All statistical analyses were  
36 performed using SPSS V.22.0.  
37  
38  
39

### 40 **Ethics approval**

41  
42 This study was funded by the National Natural Science Foundation of China. Ethics approval for the study  
43 protocol was obtained from the Ethics Committee of Harbin Medical University.  
44  
45  
46

## 47 **RESULTS**

### 48 **Characteristics of respondents**

49  
50 Nearly half (47.9%) of the respondents were aged between 31 to 50 years; 54.4% were women; 41.7% held  
51 a college degree or above; 72.1% had a monthly household income of above ¥3500. Most (64.3%)  
52 respondents lived in urban areas. The majority (79.2%) were married at the time of the survey (Table 1).  
53  
54  
55  
56  
57  
58  
59  
60

**Table 1. Socio-demographic characteristics of respondents**

Characteristics	N	%
<b>Gender</b>		
Male	1614	45.6
Female	1927	54.4
<b>Age (Years)</b>		
18-24	359	10.1
25-44	1882	53.2
45-64	994	28.1
>64	282	8.6
<b>Education</b>		
Secondary education or below	1325	37.4
High school education	740	20.9
College or above	1476	41.7
<b>Residency</b>		
Urban	2277	64.3
Rural	1264	35.7
<b>Region</b>		
Beijing	988	27.9
Heilongjiang	862	24.3
Guangdong	811	22.9
Sichuan	880	24.9
<b>Monthly household income (Yuan)</b>		
0-3499	987	27.9
3500+	2554	72.1
<b>Marital status</b>		
Married	2803	79.2
Not married	738	20.8

### Household emergency preparedness

The respondents had relatively good knowledge of their local emergency response systems, with 93.9% knowing the emergency numbers, 74.9% being aware of the evacuation exit routes, and 62.4% being able to locate the emergency shelters. But less than half of the households were well-prepared in terms of necessities (apart from 80% having a battery-operated flashlight), having accident insurance coverage, and having developed an evacuation plan. Overall, households in Beijing performed worse than those in the other regions. Urban households outperformed their rural counterparts in insurance coverage and knowledge of local emergency response systems. But rural households were more likely to have an evacuation plan and stockpile food/water, radio, flashlight and escape ropes. Only a small number of households (9.9%) were deemed well-prepared, acting on nine or more of the emergency indicators s

(Table 2).

**Table 2. Number and percentage (%) of households acting on emergency items**

Action	Total N=3541	Regions				P	Residency	
		Beijing N=988	Heilongjiang N=862	Guangdong N=811	Sichuan N=880		Urban N=2266	Rural N=1275
<b>Possession of emergency necessities</b>								
three-day supply of food and water	1101 (31.1)	230 (23.3)	350 (40.6)	264 (32.6)	257 (29.2)	<0.001	684 (30.2)	417 (32.7)*
extra batteries	1151 (32.5)	261 (26.4)	313 (36.3)	268 (33.0)	309 (35.1)	<0.001	728 (32.1)	423 (33.2)
battery-powered radio	990 (28.0)	187 (18.9)	338 (39.2)	239 (29.5)	226 (25.7)	<0.001	600 (26.5)	390 (30.6)*
battery-operated flashlight	2843 (80.3)	718 (72.7)	704 (81.7)	651 (80.3)	770 (87.5)	<0.001	1760 (77.7)	1083 (84.9)*
first aid kit	1215 (34.3)	307 (31.1)	237 (27.5)	382 (47.1)	289 (32.8)	<0.001	881 (38.9)*	334 (26.2)
gas mask	164 (4.6)	36 (3.6)	39 (4.5)	58 (7.2)	31 (3.5)	0.001	113 (5.0)	51 (4.0)
fire extinguisher	931 (26.3)	174 (17.6)	148 (17.2)	315 (38.8)	294 (33.4)	<0.001	625 (27.6)*	306 (24.0)
escape rope	403 (11.4)	69 (7.0)	141 (16.4)	94 (11.6)	99 (11.3)	<0.001	233 (10.3)	170 (13.3)*
whistle	387 (10.9)	95 (9.6)	117 (13.6)	73 (9.0)	102 (11.6)	0.010	264 (11.7)*	123 (9.6)
Coverage of accident insurance	819 (23.1)	291 (29.5)	147 (17.1)	132 (16.3)	249 (28.3)	<0.001	582 (25.7)*	237 (18.6)
Household evacuation plan	1083 (30.6)	151 (15.3)	255 (29.6)	292 (36.0)	385 (43.8)	<0.001	673 (29.7)	446 (35.0)*
<b>Knowledge of local emergency response systems</b>								
Evacuation route	2652 (74.9)	742 (75.1)	599 (69.5)	626 (77.2)	685 (77.8)	0.003	1767 (78.0)*	885 (69.4)
Emergency shelter	2210 (62.4)	584 (59.1)	523 (60.7)	500 (61.7)	603 (68.5)	0.001	1447 (63.9)	763 (59.8)
Emergency phone numbers	3325 (93.9)	915 (92.6)	788 (91.4)	781 (96.3)	841 (95.6)	<0.001	2170 (95.8)*	1155 (90.6)
Actions on nine or more indicators	352 (9.9)	48 (4.9)	91 (10.6)	92 (11.3)	121 (13.8)	0.001	236 (10.4)	116 (9.1)

\* $p < 0.05$  in urban-rural comparisons.

About 0.4% of households did not prepare any emergency items at home, compared with 2.3% having one item and 10.9% having three items. The majority of households owned 5 emergency items. About 10% owned over 9 emergency items (Figure 1).

### Factors associated with emergency preparedness

The level of well-preparedness varied by region, prior exposure to emergency events, emergency training, knowledge and attitudes toward emergency preparedness, education, self-reliance, and fate submissiveness ( $p < 0.05$  in chi-square tests, Table 3). However, no significant differences in the level of well-preparedness were found in respondents of a different gender, age, residency, and risk awareness ( $p > 0.05$  in chi-square tests, Table 3).

The logistic regression model confirmed that socio-economic status, knowledge and attitudes toward emergency preparedness were significant predictors of the level of well-preparedness after adjustments for variations in other variables. Higher levels of preparedness were associated with higher educational attainments, participation in emergency training activities (AOR=2.299), better emergency knowledge (AOR=2.043), less fate-submissiveness (AOR=1.385) and more self-reliance (AOR=1.349), prior exposure to emergency events (AOR=1.280) and more positive attitudes toward preparedness (AOR=1.286) (Table 3). The linear regression analysis generated similar results (Supplementary file).

**Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)**

Independent variable	N	N (%) of well-prepared	AOR	(95% Confidence Interval)		P
<b>Gender</b>						
Male (reference)	1614	169 (10.5)	1.134	(0.949,	1.356)	0.167
Female	1927	183 (9.5)				
<b>Age (Years)</b>						
18-24 (reference)	359	67(1.9)				
25-44	1882	371(10.5)	0.773	(0.539,	1.110)	0.440
45-64	994	161(4.6)	0.939	(0.666,	1.322)	0.716
>64	282	51(1.5)	0.846	(0.553,	1.829)	0.440
<b>Education*</b>						
Secondary education or below	1325	257(7.3)	0.757	(0.591,	0.970)	0.028
High school education	740	123(3.5)	0.826	(0.677,	1.007)	0.059
College or above (reference)	1476	275(7.8)				
<b>Residency</b>						
Urban	2277	236 (10.4)	1.142	(0.940,	1.382)	0.181
Rural (reference)	1264	116 (9.2)				
<b>Region*</b>						
Beijing (reference)	988	48 (4.9)				
Heilongjiang	862	91 (10.6)	3.409	(2.531,	4.592)	0.000
Guangdong	811	92 (11.3)	3.890	(2.910,	5.199)	0.000
Sichuan	880	121 (13.8)	3.450	(2.574,	4.625)	0.000
<b>Monthly household income (Yuan)</b>						
0-3499 (reference)	987	191 (5.4)				
3500+	2554	464 (13.1)	1.202	(0.972,	1.486)	0.089
<b>Prior exposure to emergency events*</b>						
Yes	1332	155 (11.6)	1.280	(1.042,	1.571)	0.019
No (reference)	2209	197 (8.9)				
<b>Participation in emergency training* last year</b>						
Yes	957	158 (16.5)	2.299	(1.902,	2.779)	0.000
No (reference)	2584	194 (7.5)				
<b>Emergency knowledge score*</b>						
> average	3127	333 (10.6)	2.043	(1.460,	2.859)	0.000
≤ average (reference)	414	19 (4.6)				
<b>Risk awareness score</b>						
> average	1302	145 (11.1)	1.047	(0.866,	1.265)	0.638
≤ average (reference)	2239	207 (9.2)				
<b>Attitudes toward emergency preparedness*</b>						
> average	1947	216 (11.1)	1.286	(1.067,	1.575)	0.011
≤ average (reference)	1594	136 (8.5)				
<b>Self-reliance*</b>						
> average	2378	263 (11.1)	1.349	(1.059,	1.562)	0.018
≤ average (reference)	1163	86 (7.4)				
<b>Fate submissiveness*</b>						
> average (reference)	431	31 (7.2)				
≤ average	3110	321 (10.3)	1.385	(1.028,	1.868)	0.033
<b>Constants</b>						
			0.015			0.000

\*  $p < 0.05$  in univariate chi-square tests

1  
2  
3  
4 The perceived barriers reported by the respondents for hindering household preparedness echoed well with  
5 the findings of the regression models. More than half (53.6%) of the respondents cited knowledge shortage  
6 as a major barrier. This was followed by inertia: 31.6% did not want to think about it; 28.1% believed that  
7 emergency professionals would do the rescue job for them; 21.5% did not believe an emergency would  
8 happen to the family. In addition, 24.4% of respondents blamed the government and the public media for  
9 the limited availability of information. Resource restrictions were not perceived as a major barrier for  
10 household emergency preparedness: less than 20% respondents cited the lack of time, money and personal  
11 ability as a barrier (Figure 2).  
12  
13  
14  
15  
16

## 17 **DISCUSSION**

### 18 **Low level of household preparedness in China**

19  
20  
21  
22 Overall, the level of household emergency preparedness in China is low, with less than 10% of households  
23 acting on nine or more emergency indicators out of a possible 14. This result is consistent with the findings  
24 of studies conducted elsewhere in China. Poor household preparedness for emergency events is common in  
25 many developing countries, such as Turkey and Iran.<sup>29</sup> The performance of developed countries, although  
26 better than in developing countries, is also far from satisfactory. In Australia, about one-fifth of households  
27 have sufficient supplies of items for emergency events such as a torch, radio, mobile phone, first aid kit,  
28 appropriate batteries and an emergency contact list. A study in the US revealed that 12.3% of American  
29 households possessed a three-day supply of water and nonperishable food, an evacuation plan, a working  
30 flashlight and radio. Similarly, 30% of households in Japan stockpiled food and drinking water for  
31 emergency events.<sup>15</sup>  
32  
33  
34  
35  
36  
37  
38

### 39 **Factors contributing to the low level of household preparedness**

40  
41 Findings of the logistic regression model and ranking of perceived barriers reported by the respondents  
42 point to the same conclusion: knowledge is a major determinant of household emergency preparedness  
43 (Figure 3). The odds of well-preparedness doubled in the respondents with a higher than average level of  
44 knowledge. Training would also double the odds of well-preparedness, possibly through filling knowledge  
45 gaps. This is echoed by over half of the respondents who reported knowledge shortage as the major barrier  
46 to preparing for emergency events. The association between knowledge and preparedness for emergency  
47 events is further supported by the link between education in general and preparedness. Prior exposure to  
48 emergency events may also improve the knowledge and attitudes of people, resulting in better preparedness  
49 for emergency events. These findings are consistent with previous studies.<sup>30, 31</sup>  
50  
51  
52  
53  
54  
55

56 Fate-submissiveness and a lack of recognition of self-reliance were identified as a significant predictor of  
57 poor-preparedness in the logistic regression model. Similarly, a lack of motivation to act (“do not want to  
58 think about it” and “leave it to professionals”) was reported as the second most significant barrier in  
59  
60

1  
2  
3 household emergency preparedness.  
4

5 Surprisingly, the most developed region, Beijing, was found to be the worst performer. The underlying  
6 reasons warrant further studies. Clearly, the results cannot be fully explained by individual differences.  
7  
8

9 Similar to the results of this study, gender and age were not found to be associated with disaster  
10 preparedness in several previous studies.<sup>32,33</sup>  
11  
12

### 13 **Policy implications**

14  
15  
16 Large improvements can be made in relation to emergency preparedness in China. Public knowledge on  
17 emergency responses is universally poor in China. Educational campaigns, if designed and implemented  
18 properly, can effectively improve public knowledge. However, this has to be done through multiple  
19 avenues. Governmental agencies can coordinate the timely provision of adequate information about  
20 emergency events. Emergency training can be offered through specifically designed drill exercise,<sup>34</sup> or as  
21 part of the national essential education system. In Japan, a disaster-prone country for example, disaster  
22 mitigation has been integrated into its national school curriculum.<sup>35</sup>  
23  
24  
25  
26

27 However, knowledge improvement by itself is not enough. The mentality of inertia in the public needs to  
28 be addressed. A positive correlation between the recognition of self-reliance and better household  
29 preparedness is evident as confirmed in this study and others.<sup>36</sup> But unfortunately, many traditional cultures  
30 encourage fate submissiveness. A study in Saudi Arabia found that most (93%) respondents believed that  
31 floods, earthquakes and other natural disasters are signs of God.<sup>37</sup> Fatalism is an attitude of self-defeatism  
32 which may lead individuals into helpless, undermining their efforts of individual preparedness.<sup>38-39</sup> The  
33 Chinese society also embraces an auspicious culture, encouraging people to pursue luck and avoid ominous  
34 things. It is taboo to talk about bad things, such as disaster and death. People prefer to pin their hopes on  
35 illusory things, rather than be prepared for real threats.<sup>40-41</sup>  
36  
37  
38  
39  
40  
41

42 Lessons learned from past disaster experiences may help change the mentality of inertia and risk perception.  
43 In Australia, for example, bush fires impose a regular risk for many households. The preparedness of  
44 individual households can make a difference between life and death. The National Partnership Agreement  
45 on Natural Disaster Resilience in Australia therefore emphasizes the significance of involving multiple  
46 parties including individuals.<sup>42</sup> Emergency response systems are often complex and adaptive. A highly  
47 participatory strategy would encourage individuals to take more responsibility, become less dependent on  
48 the government, and leave more resources for others.<sup>43</sup> Trust in the government is important given that it is  
49 most likely to play a coordinating role in emergency events.<sup>44</sup> However, over-reliance on the government  
50 and professional workers could dampen household efforts for future disasters.<sup>45</sup> A study of post-earthquake  
51 survivors in China showed that high expectations of the public on the government are associated with high  
52 trust in the government, leading to increased complacency in individual efforts in preparedness.<sup>16</sup> In China,  
53 governmental response to disasters from the military force has often been extraordinarily rapid and efficient.  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 For example, an earthquake-relief headquarter was established by the army 18 minutes after the earthquake  
4 strike in Ya'an and 5000-6000 rescue workers were deployed on the same day. But people need to realize  
5 that there is always a gap before the full functioning of external rescue assistance, a gap which needs to be  
6 filled by the survivors of disasters.<sup>7</sup> Poor cooperation from those being rescued can also jeopardize  
7 professional efforts.  
8  
9

## 10 11 **Conclusion**

12  
13  
14 The overall level of household emergency preparedness in China is extremely low. A lack of knowledge  
15 presents a great barrier to household preparedness. Although training can be an effective measure for  
16 improving knowledge, a more comprehensive strategy needs to be adopted to address issues associated  
17 with the lack of motivation. Emergency response systems should emphasize individual responsibilities as  
18 well as those from the government and professional workers.  
19  
20  
21

22  
23 **Data sharing statement** All data relevant to the study are included in the article or uploaded as  
24 supplementary information.  
25

## 26 27 **Open access**

28  
29 This is an Open Access article distributed in accordance with the Creative Commons Attribution Non  
30 Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this  
31 work non-commercially, and license their derivative works on different terms, provided the original work is  
32 properly cited and the use is non-commercial.  
33  
34  
35

## 36 37 **Author contributions**

38  
39 CY, WX, YJ, and WLX analyzed the data and drafted the manuscript. YH and NN took overall responsibility  
40 for the study design, coordinated and conducted the survey, and participated in writing and modifying this  
41 manuscript. QW, LG, and ZK participated in the design of the study, data collection, and writing of the  
42 manuscript. Chaojie Liu interpreted the results of statistical analyses, articulated the storyline, and wrote the  
43 manuscript.\* CY, WX these two authors contributed equally.  
44  
45

## 46 47 **Acknowledgement**

48  
49 The authors are grateful to the support of local officials including three senior researchers (Tie Song, Wei  
50 Sun, Ruoxiang Cao in data collection in the sampled municipalities) lead the investigation in different parts  
51 of China. Additionally, we thank Mingli Jiao, Hong Sun and Libo Liang for their advice in this study. We  
52 are grateful to the participants of the study and the postgraduate students who helped collection and  
53 preparation of the data.  
54

## 55 56 **Conflicts of interests statement**

57  
58 We declare that we have no financial and personal relationships with other people or organizations that can  
59 inappropriately influence our work, there is no professional or other personal interest of any nature or kind  
60

1  
2  
3 in any product, service or company that could be construed as influencing the position presented in our  
4 study.  
5  
6

7 **Patient and public involvement:** Patients and the public were not involved in the design or planning of the  
8 study.  
9

#### 10 **Funding**

11 This work was supported by the National Natural Scientific Fund of China grant number (71673072,  
12 71173064, 71473065), and the Ministry of Health Public Benefit Fund for Health Sector (201002028),  
13 Heilongjiang Province philosophy & Social Science Fund (18GLD302).  
14

15 **Participant consent:** Obtained in this study.  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

1. World Bank. Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention;2010
2. World Health Organization. Health needs from humanitarian emergencies at an all-time high, [www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/](http://www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/). Accessed June 6, 2016.
3. China National Commission for Disaster Reduction. The Briefing of China's natural disasters in 2016. Bei Jing, China, Emergency Office. <http://www.mca.gov.cn/article/zrzh/201606/index.htm>. Accessed October 11, 2016.
4. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction (UNISDR). <https://www.unisdr.org/we/inform/publications/43291> Accessed March 18, 2015.
5. Serrao-Neumann, Silvia, F. Crick, and D. L. Choy. Post-disaster social recovery: disaster governance lessons learnt from Tropical Cyclone Yasi. *Natural Hazards*. 2018;1-18. <https://doi.org/10.1007/s11069-018-3345-5>
6. United Nations, Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, January 22, 2005, available at: <https://www.refworld.org/docid/42b98a704.html> [accessed 31 August 2019]
7. Liu CJ, Robinson P. The role of volunteers in disaster settings: better organization is needed. *Australian and New Zealand Journal of Public Health*. Dec, 2013;37(6):595-6. <https://doi.org/10.1111/1753-6405.12139>
8. Kim, Y. C., and J. Kang. "Communication, neighborhood belonging and household hurricane preparedness." *Disasters*. 2010;34(2). <https://doi.org/10.1111/j.1467-7717.2009.01138.x>
9. Levac, J, D. Toal-Sullivan, and T. L. O'Sullivan. "Household Emergency Preparedness: A Literature Review." *Journal of Community Health*. 2012;37(3):725-733. <https://doi.org/10.1007/s10900-011-9488-x>
10. United Nations Office for Disaster Risk Reduction (UNISDR). 2009 UNISDR terminology on disaster risk reduction (2009). <https://www.unisdr.org/we/inform/publications/7817> Accessed 2009.
11. Heidenström, Nina & Kvarnlöf, Linda. Coping with blackouts: A practice theory approach to household preparedness. *Journal of Contingencies and Crisis Management*. 2017;26(1). <https://doi.org/10.1111/1468-5973.12191>
12. Greenberg MR, Dyen S, and Elliott S. "The public's preparedness: self-reliance, flashbulb memories, and conservative values." *American Journal of Public Health*. 2013;103(6):E85-E91. <https://doi.org/10.2105/AJPH.2012.301198>.
13. Xu, Dingde, et al. Influences of Risk Perception and Sense of Place on Landslide Disaster Preparedness in Southwestern China. *International Journal of Disaster Risk Science*. 2018;9(2):1-14. <https://doi.org/10.1007/s13753-018-0170-0>
14. Hung, Li San. "Gender, Intra-Household Dynamics, and Household Hurricane Preparedness: An Exploratory Study Employing a Dyadic Interview Approach." *International Journal of Disaster Risk Science*. 2018;(1):1-12. <https://doi.org/10.1007/s13753-018-0158-9>
15. Onuma, Hiroki, J. S. Kong, and S. Managi. "Household preparedness for natural disasters: Impact of disaster experience and implications for future disaster risks in Japan." *Mpra Paper*. 2016;(21). <https://doi.org/10.1016/j.ijdr.2016.11.004>
16. Han X, Ding YB, Zhang HW, et al. Prevention of sudden disaster risk and public participation in megacity. *Shanghai J Prev Med*. 2015;(5):248-255
17. Han, Ziqiang, et al. "The effects of trust in government on earthquake survivors' risk perception and preparedness in

- China." *Natural Hazards*. 2017;1(86):437-452. <https://doi.org/10.1007/s11069-016-2699-9>
18. Debastiani, S. D., et al. "Preparedness Perceptions, Sociodemographic Characteristics, and Level of Household Preparedness for Public Health Emergencies: Behavioral Risk Factor Surveillance System, 2006-2010." *Health Secure*. 2015;13(5):317-326. <https://doi.org/10.1089/hs.2014.0093>
19. FEMA. Emergency Supply Kit Checklists for Parents and Kids-Ready Kids. Available at: <https://www.fema.gov/media-library/assets/documents/34326>. Publication date: August 21, 2013
20. Alrouسان, T. M., L. M. Rubenstein, and R. B. Wallace. Preparedness for natural disasters among older US adults: a nationwide survey. *American Journal of Public Health*. 2014;104(3):506. <https://doi.org/10.2105/ajph.2013.301559>
21. Corwin K A , Brand B D , Hubbard M L , et al. Household preparedness motivation in lahar hazard zones: assessing the adoption of preparedness behaviors among laypeople and response professionals in communities downstream from Mount Baker and Glacier Peak (USA) volcanoes. *Journal of Applied Volcanology*. 2017;6(1):3. <https://doi.org/10.1186/s13617-017-0055-8>
22. Li, L., et al. Intervention effects of knowledge and skills of the public to respond to public health emergencies in Sichuan province, China. *Eval Rev* 2013;37(2):140-57. <https://doi.org/10.1177/0193841x14523619>
23. Glanz K , Rimer B K , Viswanath K . *Health Behavior: Theory, Research, and Practice*;2015.
24. Debastiani S D, Strine T W, Vagi S J, et al. Preparedness Perceptions, Sociodemographic Characteristics, and Level of Household Preparedness for Public Health Emergencies: Behavioral Risk Factor Surveillance System, 2006-2010. *Health Security*, 2015, 13(5):317-326. <https://doi.org/10.1089/hs.2014.0093>
25. House J S , Herzog R C K R. Age, Socioeconomic Status, and Health. *The Milbank Quarterly*. 1990; 68(3):383-411. <https://doi.org/10.2307/3350111>
26. Mincer J A . Schooling, Experience, and Earnings. *Industrial and Labor Relations Review*, 1976;29(3). <https://doi.org/10.2307/2521600>
27. Anita C, Malcolm W, Alonzo P ,et al. Getting actionable about community resilience: the Los Angeles County Community Disaster Resilience project. *American Journal of Public Health*, 2013;103(7):1181-1189. <https://doi.org/10.2105/AJPH.2013.301270>
28. Blessman, J, Skupski, J, Jamil, M, et al. Barriers to at-home-preparedness in public health employees: Implications for disaster preparedness training. *Journal of Occupational and Environmental Medicine*, 2009;(49)3:318-326. <https://doi.org/10.1097/jom.0b013e31803225c7>
29. Mahdaviazad, H, and G. Abdolahifar. "Assessing Household Natural Disaster Preparedness in Shiraz, Iran, 2011: Results of a Knowledge, Attitude, and Practices Survey." *Disaster Medicine & Public Health Preparedness*.2014;8(4):349. <https://doi.org/10.1017/dmp.2014.61>
30. Siegrist M, Gutscher H. Natural Hazards and Motivation for Mitigation Behavior: People Cannot Predict the Affect Evoked by a Severe Flood. *Risk Anal*.2008;28(3):771-778. <https://doi.org/10.1111/j.1539-6924.2008.01049.x>
31. Chan, Emily & Yue, Janice & Lee, Poyi & Shuxin Wang, Susan. (2016). Socio-demographic Predictors for Urban

- Community Disaster Health Risk Perception and Household Based Preparedness in a Chinese Urban City. *PLoS Currents*. 8. <https://doi.org/10.1371/currents.dis.287fb7fee6f9f4521af441a236c2d519>
32. Chaney, Philip & S. Weaver, Greg & A. Youngblood, Susan & Pitts, Kristin. Household Preparedness for Tornado Hazards: The 2011 Disaster in DeKalb County, Alabama. *Weather, Climate, and Society*. 2013,5(4):345-358. <https://doi.org/0.1175/WCAS-D-12-00046.1>
33. Edwards, M.L. 1993. Social location and self-protective behavior: Implications for earthquake preparedness. *International Journal of Mass Emergencies and Disasters* 11(3): 293-303.
34. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis* 1998;(18)3:243–252. <https://doi.org/110.1111/j.1539-6924.1998.tb01291.x>
35. Iemura, Hirokazu, et al. "Earthquake and tsunami questionnaires in Banda Aceh and surrounding areas." *Disaster Prevention & Management* 2006;15(1):21-30. <https://doi.org/10.1108/09653560610654211>
36. Khunwishit S. Community resilience in Thailand: A case study of flood response in Nakhonsawan City Municipality. University of North Texas, 2013.
37. Alshehri, Saud Ali, Y. Rezgui, and H. Li. "Public perception of the risk of disasters in a developing economy: the case of Saudi Arabia." *Natural Hazards*. 2013;65(3):1813-1830. <https://doi.org/10.1007/s11069-012-0445-5>
38. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis*.1998;18(3):243–252. <https://doi.org/10.1111/j.1539-6924.1998.tb01291.x>
39. Baytiyeh, Hoda, and M. Naja. "The effects of fatalism and denial on earthquake preparedness levels." *Disaster Prevention & Management*. 2016;25(2):154-167. <https://doi.org/10.1108/DPM-07-2015-0168>
40. Nie Lin. A Summary of China's Emergency Preparedness Culture Theory. *Science and Technology Forum (the second half of the month)*, 2012(7): 189-190. <https://doi.org/10.3969/j.issn.1007-3973.2012.07.111>
41. Peng Zongchao, Nie Lin. Analysis of the Status Quo and Development Path of Urban Emergency Preparedness Culture in China. *China Emergency Management*, 2012(5): 37-40.
42. Governments, Council Of Australian. "National Strategy for Disaster Resilience." *Australian Journal of Emergency Management*. 2011;27. <https://doi.org/10.1111/1467-8500.12299>
43. C C. Household preparedness for public health emergencies--14 states, 2006-2010.[J]. *Mmwr Morbidity & Mortality Weekly Report*.2012;61(36):713. <https://doi.org/10.1001/jama.2012.13026>
44. Basolo V, Steinberg LJ, Burby RJ, Levine J, Cruz AM, Huang C. The Effects of Confidence in Government and Information on Perceived and Actual Preparedness for Disasters. *Environment and Behavior*. 2009;41(3):338-364. <https://doi.org/10.1177/0013916508317222>
45. Terpstra T. Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior. *Risk Analysis*.2011;31(10):1658-1675. <https://doi.org/10.1111/j.1539-6924.2011.01616.x>

### Figure legend/caption

Table 1. Socio-demographic characteristics of respondents

1  
2  
3 Table 2. Number and percentage (%) of households acting on emergency items

4 \* $p < 0.05$  in urban-rural comparisons.

5  
6 Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)

7 \*  $p < 0.05$  in univariate chi-square tests

8  
9  
10 Figure 1. Distribution (%) of households preparedness of 14 emergency items

11  
12  
13 Figure 2. Barriers reported by respondents (%) for not preparing for emergencies

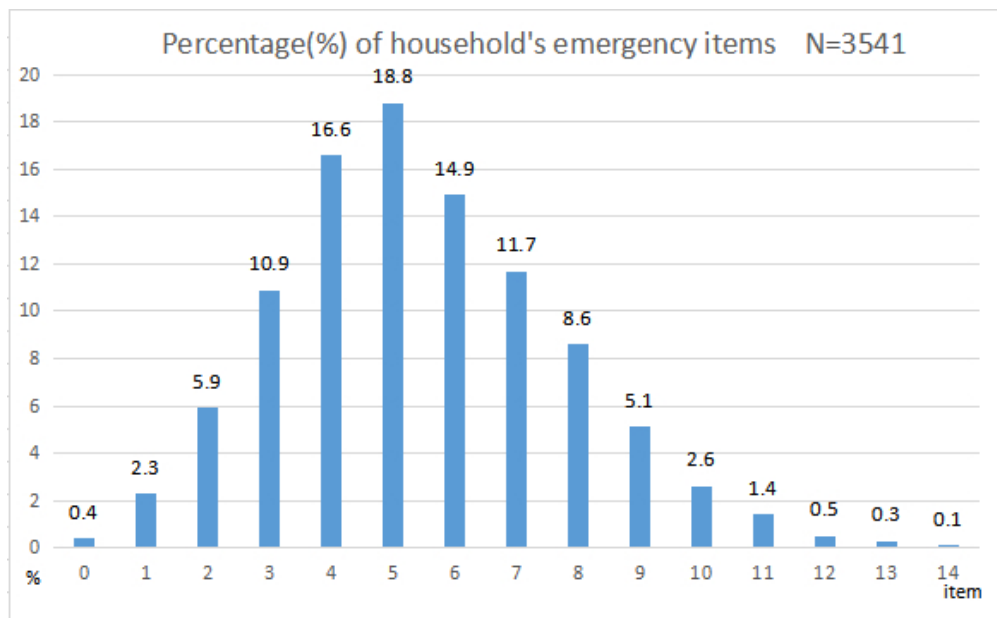
14  
15 *Figure 2 Note: Q1 “do not know what to do”; Q2 “do not want to think about it”; Q3 “nothing can be*  
16 *done”; Q4 “it takes too much time”; Q5 “it takes too much money”; Q6 “do not have the ability to*  
17 *prepare”; Q7 “professionals will do the rescue job”; Q8 “do not believe emergency will happen to the*  
18 *family”; Q9 “do not have enough information from the government and the public media”.*

19  
20 Figure 3. Link between perceived barriers and factors predicting well-preparedness

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

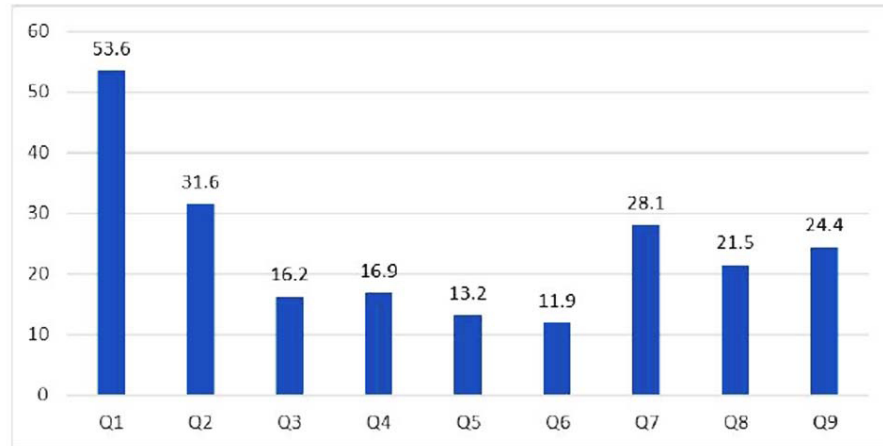
For peer review only

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60





**Figure 2. Barriers reported by respondents (%) for not preparing for emergencies**



*Note: Q1 "do not know what to do"; Q2 "do not want to think about it"; Q3 "nothing can be done"; Q4 "it takes too much time"; Q5 "it takes too much money"; Q6 "do not have the ability to prepare"; Q7 "professionals will do the rescue job"; Q8 "do not believe emergency will happen to the family"; Q9 "do not have enough information from the government and the public media".*

Figure 2

Figure 3. Link between perceived barriers and factors predicting well-preparedness

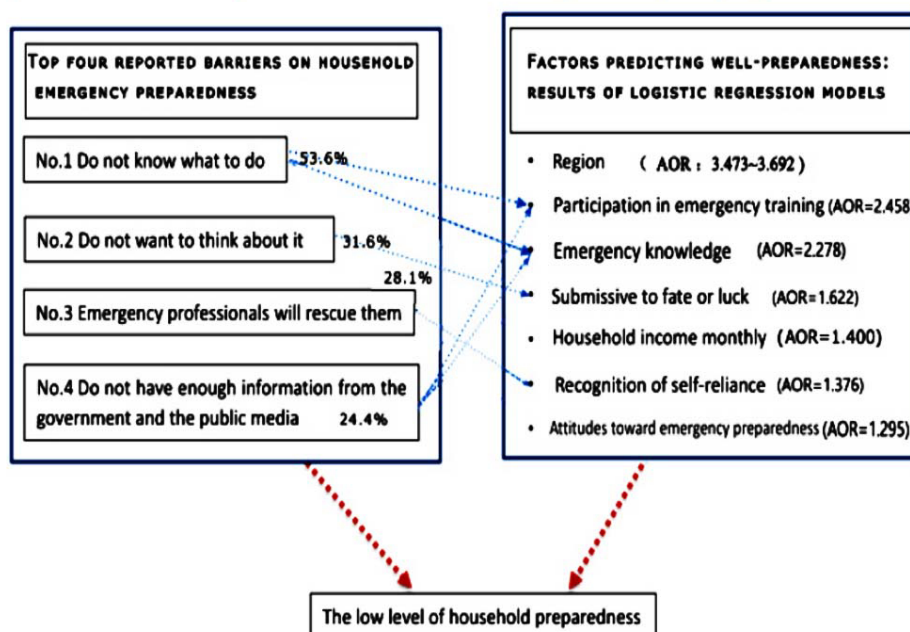


Figure 3

**Attachment 1. Re-analyze the data by multiple linear regression approach.**

	Non-standardization coefficient		Standardized beta	T	p
	$\beta$	Standard error			
Constants	4.936	.188		26.202	<.001
Participation in emergency training	.958	.084	.186	11.409	<.001
Region	-.304	.034	-.151	-8.838	<.001
Emergency knowledge	.815	.116	.115	7.027	<.001
Self-reliance	.460	.095	.080	4.840	<.001
Emergency experience	.316	.080	.067	3.959	<.001
Attitudes toward emergency preparedness	.345	.082	.075	4.228	<.001
Fate submissiveness	-.330	.097	-.059	-3.397	.001
Gender	-.190	.074	-.041	-2.551	.011

After multiple linear regression analysis, five factors were excluded, and total of eight factors were identified in the regression equation. The variables affecting the total emergency preparedness of household were gender, participation in emergency training, emergency experience, province, self-efficacy, etc. Compared with the results of logistic regression, it is only increase the gender variable as significant one. However, this survey is mainly conducted on the household preparedness level, thus, gender cannot be a key Influential variable. After analysis of variance,  $F=40.533$   $P<0.01$ , indicating that the model is statistically significant, with  $R^2=0.083$  after adjustment. The Durbin-Waston test is used to analyze whether the residuals are independent of each other. The DW value is 1.733, indicating that the residuals are independent of each other. At the same time, the variance expansion factor VIF is between 1.000-1.208, both  $<10$  (that is, the tolerance is  $>0.1$ ), indicating that there is no multicollinearity between the variables. (**Attachment 1**)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Page No	Recommendation
<b>Title and abstract</b>	1 ✓	2	(a) Indicate the study's design with a commonly used term in the title or the abstract
		2	(b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>			
Background/rationale	2 ✓	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3 ✓	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>			
Study design	4 ✓	4	Present key elements of study design early in the paper
Setting	5 ✓	4	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 ✓	4	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7 ✓	5	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/measurement	8* ✓	6	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9		Describe any efforts to address potential sources of bias
Study size	10 ✓	6	Explain how the study size was arrived at
Quantitative variables	11 ✓	6	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 ✓	6	(a) Describe all statistical methods, including those used to control for confounding
		6	(b) Describe any methods used to examine subgroups and interactions
		6	(c) Explain how missing data were addressed
		6	(d) If applicable, describe analytical methods taking account of sampling strategy
			(e) Describe any sensitivity analyses
<b>Results</b>			
Participants	13* ✓	7	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			(b) Give reasons for non-participation at each stage
			(c) Consider use of a flow diagram
Descriptive data	14* ✓	7	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each

			variable of interest
Outcome data	15* ✓	8	Report numbers of outcome events or summary measures
Main results	16 ✓	8-9	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		9	(b) Report category boundaries when continuous variables were categorized
		9	(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>			
Key results	18 ✓	10-11	Summarise key results with reference to study objectives
Limitations	19 ✓	12	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20		Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21 ✓	12	Discuss the generalisability (external validity) of the study results
<b>Other information</b>			
Funding	22 ✓	13	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Household Preparedness for Emergency Events: a cross-sectional survey on residents in four regions of China

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-032462.R2
Article Type:	Original research
Date Submitted by the Author:	10-Oct-2019
Complete List of Authors:	Chen, Chao yi; Harbin Medical University, Social Medicine; Xu, Wei; Harbin Medical University, School of Health Management Dai, Yajun; Harbin Medical University, the school of Public Health Xu, Weilan; Harbin Medical University, the school of Public Health Liu, Chaojie; La Trobe University, Public Health Wu, Qunhong; Harbin Medical University, the School of Health Management Gao, Lijun; Harbin Medical University, the School of Health Management Kang, Zheng; Harbin Medical University, The School of Health Management; Hao, Yanhua; Harbin Medical University, The school of Health Management Ning, Ning; Harbin Medical University, Social Medicine
<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	Emergency medicine, Public health
Keywords:	ACCIDENT & EMERGENCY MEDICINE, PUBLIC HEALTH, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

SCHOLARONE™  
Manuscripts

# Household Preparedness for Emergency Events: a cross-sectional survey on residents in four regions of China

## Title Page

**Title:** Household Preparedness for Emergency Events: a cross-sectional survey on residents in four regions of China

**Author names and affiliations:**

1. Chaoyi Chen\*, graduate student in Master degree, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [749134597@qq.com](mailto:749134597@qq.com)/[qq328867128@126.com](mailto:qq328867128@126.com)
2. Wei Xu\*, PhD student, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [13836138161@163.com](mailto:13836138161@163.com)
3. Yajun Dai, graduate student in Master degree, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [daiyajun0408@163.com](mailto:daiyajun0408@163.com)
4. Weilan Xu\*, PhD, Qiqihar Medical College of Nursing, Qiqihar, Heilongjiang, China Email: [lxdoctor@163.com](mailto:lxdoctor@163.com)
5. Chaojie Liu, PhD, professor, School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia Email: [c.liu@latrobe.edu.au](mailto:c.liu@latrobe.edu.au)
6. Qunhong Wu, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [wuqunhong@163.com](mailto:wuqunhong@163.com)
7. Lijun Gao, Master degree, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [gg73@163.com](mailto:gg73@163.com)
8. Zheng Kang, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [kangzheng0086@126.com](mailto:kangzheng0086@126.com)
9. Yanhua Hao, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [hyhyjw@126.com](mailto:hyhyjw@126.com)
10. Ning Ning, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [ningninghyd@163.com](mailto:ningninghyd@163.com)

**Corresponding authors' information:**

1. Yanhua Hao, PhD, professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [hyhyjw@126.com](mailto:hyhyjw@126.com)
2. Ning Ning, PhD, associate professor, School of Health Management, Harbin Medical University, Harbin, Heilongjiang, China Email: [ningninghyd@163.com](mailto:ningninghyd@163.com)

**Word count:** Main Text word count: 3750;

**Conflict of interest statement:**

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service or company that could be construed as influencing the position presented in our study. Our study sponsor: Professor Yanhua Hao (corresponding author) initiated and coordinated the study. All of the data were collected from field surveys. The funders play no role in the design, data collection, data analyses, and writing of the manuscript.

## Abstract

**Objective** This study aimed to assess household preparedness for emergency events and its determinants in China. **Design:** A cross-sectional questionnaire survey was conducted on 3,541 households in China in 2015. **Participants:** Households were selected using a stratified cluster sampling strategy, representing central, eastern, western and southern regions of China. The designed questionnaires were administered through face-to-face interviews. **Outcome Measures:** Household emergency preparedness was measured with 14 indicators, tapping into the supply of nine emergency necessities (food and water, extra batteries, battery-powered radio, battery-operated flashlight, first aid kit, gas mask, fire extinguisher, escape ropes, whistle), coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit routes and shelters), and availability of a household evacuation plan. If an individual acted on nine of the 14 indicators, they were deemed well-prepared. Logistic regression models were established to identify predictors of well-preparedness based on 3,541 returned questionnaires containing no missing values. **Results:** Only 9.9% of households were well-prepared for emergencies: 53.6% did not know what to do and 31.6% did not want to think about it. A higher level of preparedness was found in the respondents who have attained higher education (AOR=0.826 compared with the higher level), participated in emergency training activities (AOR=2.299), had better emergency knowledge (AOR=2.043), reported less fate-submissiveness (AOR=1.385) and more self-reliance (AOR=1.349), prior exposure to emergency events (AOR=1.280), and held more positive attitudes toward preparedness (AOR=1.286). **Conclusion:** Household preparedness for emergency events is poor in China. Lack of motivation, negative attitude to preparedness and knowledge shortfall are major but remediable barriers for household preparedness.

**Key word: household preparedness, emergency preparedness, disaster preparedness**

### Strengths and limitations

- This study quantified household preparedness for emergency events for the first time in China and identified factors associated with emergency preparedness
- The findings of the determinants of poor household preparedness are closely aligned with the Chinese Auspicious culture.
- One adult respondent from each household was invited to complete the survey. But opinions from the family members may not always been consistent.
- The 14 emergency items included in this study reflected priorities in emergency responses in China, which may not be exhaustive. The importance of the emergency items was not differentiated either.
- We presented the results of both logistic regression and linear regression analyses, which are largely consistent.

### Introduction

No community is immune from the risk of emergencies and disasters in today's increasingly interconnected world. Many emergency events may be difficult to prevent. Inadequate preparation in response to these events can cause a tremendous loss in terms of human lives and health, property and infrastructure. It was



1  
2  
3 estimated that natural disasters alone cost over US\$ 100 billion annually worldwide.<sup>1</sup> According to the *2016*  
4 *Humanitarian Response Plan* launched by the World Health Organization (WHO), US\$ 2.2 billion was  
5 needed to provide lifesaving health services to more than 79 million people in more than 30 countries due  
6 to protracted emergencies that year.<sup>2</sup> In the first half year of 2016, 68.77 million people in China were  
7 affected by floods, hail and geological disasters, resulting in 505 deaths and a direct economic loss of 89.04  
8 billion Chinese Yuan (US\$12.9645 billion).<sup>3</sup>  
9  
10  
11

12  
13 Strengthening emergency responses can effectively reduce human casualties and contribute to sustainable  
14 post-event development. It is deemed a cost-effective investment in preventing losses and is considered one  
15 of the four priority areas in the Sendai Framework for Disaster Risk Reduction 2015-2030, which was  
16 endorsed by the third United Nations World Conference in Japan.<sup>4</sup> Over the past few decades, emergency  
17 response efforts have evolved from a focus on top-down relief assistance to a more comprehensive strategy  
18 with a greater emphasis on community participation and pre-event preparedness for better risk management.  
19 This is because emergency victims often face geographical isolation as a result of damage to local  
20 infrastructure such as energy, road and communication facilities.<sup>5</sup> Consequently, the arrival of external  
21 rescue support may experience two or more days of delay.<sup>6</sup> But rescue efforts in the first couple of days in  
22 disastrous events are critical.<sup>7</sup> Community and household preparedness in self-rescue efforts prior to the  
23 arrival of external assistance may result in the difference between the chance of survival and death.<sup>8</sup>  
24 Empirical evidence shows that sufficient household preparedness can significantly mitigate the negative  
25 consequences of emergency events.<sup>9</sup>  
26  
27  
28  
29  
30  
31  
32  
33

34 The United Nations International Strategy for Disaster Reduction (UNISDR) defined preparedness as the  
35 “knowledge, capacities and actions to effectively respond to the effects of hazard events, whether or not  
36 they have occurred”.<sup>10</sup> Preparedness activities can be developed at the individual, household, community  
37 and governmental levels. Household preparedness plays a critical role because it is an integral part of any  
38 individual and community effort. The concept of household preparedness emphasizes household  
39 responsibilities and the capability to reduce risks and damage,<sup>11</sup> which requires stockpiling emergency  
40 supplies, planning for emergency events and other actions like buying accident insurance.<sup>12-13</sup>  
41  
42  
43  
44

45 Previous studies revealed poor household preparedness for disastrous events across a range of different  
46 settings.<sup>14-15</sup> Despite a rise in the number of publications on household preparedness in developed countries,  
47 there is a serious shortage of literature documenting the situation in developing countries. Empirical  
48 evidence shows that household preparedness is associated with many factors, including knowledge, risk  
49 awareness, prior exposure to disasters, attitudes toward emergency preparedness,<sup>16</sup> and trust in the  
50 government. Socioeconomic status may also play an important role.<sup>17-18</sup> Developing countries are facing  
51 ever-increasing challenges and costs associated with disastrous events. But experiences from developed  
52 countries cannot be extrapolated to developing countries without consideration of the local contexts.  
53  
54  
55  
56  
57

58 China is a disaster-prone country with the largest population and high population density. But little is  
59 known about the household preparedness of China in response to emergencies. This study aimed to assess  
60

1  
2  
3 the level of household emergency preparedness in China and identify the factors associated with household  
4 preparedness. The findings of the study can provide evidence for better planning for the emergency  
5 response system.  
6  
7

## 8 **METHODS**

9

10  
11 A cross-sectional questionnaire survey was conducted on 3,541 households in four regions of China.  
12  
13

### 14 **Study population**

15

16 A multistage stratified sampling strategy was adopted to select participating households. In the first stage,  
17 we identified four regions purposively considering diversities in geographic location and socioeconomic  
18 development: Beijing is the capital of China; Guangdong represents the most developed region in eastern  
19 China; Heilongjiang and Sichuan represent the less developed regions in central and western China,  
20 respectively. These four regions have a total population of more than 25 million, accounting for over 18%  
21 of the entire population in China. Of the four regions, Sichuan is an earthquake-prone area and recently  
22 experienced the Jiuzhaigou earthquake in 2017 and the Wenchuan earthquake in 2008. Guangdong is most  
23 frequently affected by typhoons. Meanwhile, many infectious diseases erupted in Guangdong, such as  
24 SARS in 2003 and dengue fever in 2014.  
25  
26  
27  
28  
29

30  
31 The second stage involved a selection of two municipalities in each province (two districts in Beijing) with  
32 varied social and economic conditions. We then randomly selected one urban and one rural residential  
33 community from each participating municipality/district. A total of 3,650 households in these communities  
34 were approached and invited to participate in this study: 1000 in Beijing, 850 in Guangdong, 900 in  
35 Heilongjiang and 900 in Sichuan.  
36  
37  
38

### 39 **Data collection**

40

41  
42 Data were collected from April to September 2015. A research team comprising ten trained researchers and  
43 postgraduate students from Harbin Medical University visited the selected households. One adult member  
44 from each household was interviewed. Verbal informed consent was obtained prior to the survey. The  
45 questionnaire was administered anonymously, which took about 20 minutes to complete. Of the 3,650  
46 invited households, 3,580 (98.1%) completed the questionnaire survey. The final data analyses included  
47 3,541 (98.9%) questionnaires that contained no missing values.  
48  
49  
50

### 51 **Dependent variable**

52

53  
54 Household preparedness was measured by 14 items that were commonly used in previous studies. A list of  
55 emergency items was generated through literature review. The selection of the emergency items in this  
56 study considered the relevance of the emergency items to the common disastrous events in China. The  
57 relevant emergency items were prioritized in accordance with the National Disaster Prevention Manual  
58  
59  
60

1  
2  
3 published by the Ministry of Civil Affairs of China and the CDC Behavioral Risk Factor Surveillance  
4 System. These included nine general emergency necessities (three-day-supply of non-perishable food and  
5 water, battery-powered radio, extra batteries, battery-operated flashlight, first aid kit, gas mask, fire  
6 extinguisher, escape ropes, whistle) as recommended by the national public education “ready” program in  
7 the US and some preparedness items source from the General Preparedness Module,<sup>18,19</sup> as well as  
8 coverage of accident insurance, knowledge of local emergency response systems (emergency numbers, exit  
9 routes and shelters), and availability of an evacuation plan.<sup>20-21</sup>

### 14 15 **Independent variables**

16  
17 The selection of independent variables was guided by two behavioral theories: the KAP (Knowledge,  
18 Attitudes and Practice) theory and the Theory of Reasoned Action (TRA). The KAP theory addresses the  
19 intertwined effects between knowledge, attitudes and behaviors, whereas, the TRA emphasizes the  
20 importance of human reasoning as many contextual factors can weigh into human decision on actions.<sup>22-23</sup>

21  
22 The independent variables tested in this study included:

23  
24  
25  
26  
27 *Demographic and socioeconomic characteristics:* age, region and residency (urban vs rural), educational  
28 attainments, and monthly household income (estimated in Chinese Yuan). Previous studies showed that  
29 socioeconomic factors not only determine the available resources, but also predict the knowledge and  
30 attitudes of an individual toward human actions, in particular those for preventive purposes. People with  
31 low socioeconomic status are less likely to invest and act on risk prevention and risk management  
32 activities.<sup>24-25</sup>

33  
34  
35  
36  
37 *Knowledge:* 16 statements were designed based on the national guidelines for emergency responses in  
38 China to test the relevant knowledge of respondents. They were asked to judge whether these statements  
39 were correct, incorrect, or if they were unsure. A correct answer was given a score of one point. This  
40 generated an overall knowledge score for each respondent ranging from 0 to 16.

41  
42  
43  
44  
45 *Risk awareness:* respondents were asked to rate their concerns about natural and man-made disasters, social  
46 safety events, and public health emergencies on a five-point Likert scale (1-5). A summed score was  
47 calculated for each respondent (ranging from 4 to 20), with a higher score indicating a higher level of  
48 concern.

49  
50  
51  
52  
53 *Attitudes:* respondents were asked to rate on a five-point Likert scale (1-5) their interests in gathering  
54 information regarding emergency responses, perceived importance of such information, and willingness to  
55 discuss this topic with others. A summed score was calculated (ranging from 3 to 15), with a higher score  
56 indicating a higher level of endorsement with emergency preparedness.

57  
58  
59  
60 *Fate-submissiveness and self-reliance:* respondents were asked to rate on a five-point Likert scale (1-5)  
their inclination of submissiveness to fate or luck, in comparison with the determination of self-rescue in

1  
2  
3 emergency events.  
4

5  
6 *Past experience*: prior exposure to emergency events and participation in emergency training activities over  
7 the past year were measured in this study. Experiences play a pivotal role in the development of human  
8 behaviors.<sup>26</sup>  
9

10  
11 Respondents were also asked to choose all the reasons that prevented “people from preparing for  
12 emergencies” from the following list: (1) “do not know what to do”; (2) “do not want to think about it”; (3)  
13 “nothing can be done”; (4) “it takes too much time”; (5) “it takes too much money”; (6) “do not have the  
14 ability to prepare”; (7) “professionals will do the rescue job”; (8) “do not believe emergency will happen to  
15 the family”; (9) “do not have enough information from the government and the public media”. The list was  
16 developed based on findings of previous studies.<sup>27-28</sup>  
17  
18  
19

## 20 21 **Statistical analysis**

22  
23 We estimated the number and percentage of households acting on each of the 14 indicators for emergency  
24 preparedness. These indicators were commonly used for measuring the preparedness of the household. Each  
25 positive answer was given 1 point. A score of actions on over nine out of the 14 points was categorized as well  
26 prepared. Differences in actions across households were tested using chi-square tests.  
27  
28

29  
30 A multivariate logistic regression model was established to identify independent variables associated with  
31 well-preparedness. We also performed a linear regression analysis using the “summed points” as a  
32 dependent variable.  
33  
34

35  
36 In the regression models, independent variables measuring knowledge, risk awareness, attitudes,  
37 fate-submissiveness and self-reliance were transformed into a nominal measure: ‘above average score’  
38 versus ‘on/below average score’. The models employed an enter approach based on the maximum  
39 likelihood estimation method, with an enter/exit criterion ( $\alpha$ ) of 0.05/0.01. All statistical analyses were  
40 performed using SPSS V.22.0.  
41  
42  
43

## 44 **Ethics approval**

45  
46 This study was funded by the National Natural Science Foundation of China. Ethics approval for the study  
47 protocol was obtained from the Ethics Committee of Harbin Medical University.  
48  
49

## 50 **RESULTS**

### 51 **Characteristics of respondents**

52  
53 Nearly half (47.9%) of the respondents were aged between 31 to 50 years; 54.4% were women; 41.7% held  
54 a college degree or above; 72.1% had a monthly household income of above ¥3500. Most (64.3%)  
55 respondents lived in urban areas. The majority (79.2%) were married at the time of the survey (Table 1).  
56  
57  
58  
59  
60

**Table 1. Socio-demographic characteristics of respondents**

Characteristics	N	%
<b>Gender</b>		
Male	1614	45.6
Female	1927	54.4
<b>Age (Years)</b>		
18-24	359	10.1
25-44	1882	53.2
45-64	994	28.1
>64	282	8.6
<b>Education</b>		
Secondary education or below	1325	37.4
High school education	740	20.9
College or above	1476	41.7
<b>Residency</b>		
Urban	2277	64.3
Rural	1264	35.7
<b>Region</b>		
Beijing	988	27.9
Heilongjiang	862	24.3
Guangdong	811	22.9
Sichuan	880	24.9
<b>Monthly household income (Yuan)</b>		
0-3499	987	27.9
3500+	2554	72.1
<b>Marital status</b>		
Married	2803	79.2
Not married	738	20.8

### Household emergency preparedness

The respondents had relatively good knowledge of their local emergency response systems, with 93.9% knowing the emergency numbers, 74.9% being aware of the evacuation exit routes, and 62.4% being able to locate the emergency shelters. But less than half of the households were well-prepared in terms of necessities (apart from 80% having a battery-operated flashlight), having accident insurance coverage, and having developed an evacuation plan. Overall, households in Beijing performed worse than those in the other regions. Urban households outperformed their rural counterparts in insurance coverage and knowledge of local emergency response systems. But rural households were more likely to have an

evacuation plan and stockpile food/water, radio, flashlight and escape ropes. Only a small number of households (9.9%) were deemed well-prepared, acting on nine or more of the emergency indicators (Table 2).

**Table 2. Number and percentage (%) of households acting on emergency items**

Action	Total N=3541	Regions				P	Residency	
		Beijing N=988	Heilongjiang N=862	Guangdong N=811	Sichuan N=880		Urban N=2266	Rural N=1275
<b>Possession of emergency necessities</b>								
three-day supply of food and water	1101 (31.1)	230 (23.3)	350 (40.6)	264 (32.6)	257 (29.2)	<0.001	684 (30.2)	417 (32.7)*
extra batteries	1151 (32.5)	261 (26.4)	313 (36.3)	268 (33.0)	309 (35.1)	<0.001	728 (32.1)	423 (33.2)
battery-powered radio	990 (28.0)	187 (18.9)	338 (39.2)	239 (29.5)	226 (25.7)	<0.001	600 (26.5)	390 (30.6)*
battery-operated flashlight	2843 (80.3)	718 (72.7)	704 (81.7)	651 (80.3)	770 (87.5)	<0.001	1760 (77.7)	1083 (84.9)*
first aid kit	1215 (34.3)	307 (31.1)	237 (27.5)	382 (47.1)	289 (32.8)	<0.001	881 (38.9)*	334 (26.2)
gas mask	164 (4.6)	36 (3.6)	39 (4.5)	58 (7.2)	31 (3.5)	0.001	113 (5.0)	51 (4.0)
fire extinguisher	931 (26.3)	174 (17.6)	148 (17.2)	315 (38.8)	294 (33.4)	<0.001	625 (27.6)*	306 (24.0)
escape rope	403 (11.4)	69 (7.0)	141 (16.4)	94 (11.6)	99 (11.3)	<0.001	233 (10.3)	170 (13.3)*
whistle	387 (10.9)	95 (9.6)	117 (13.6)	73 (9.0)	102 (11.6)	0.010	264 (11.7)*	123 (9.6)
Coverage of accident insurance	819 (23.1)	291 (29.5)	147 (17.1)	132 (16.3)	249 (28.3)	<0.001	582 (25.7)*	237 (18.6)
Household evacuation plan	1083 (30.6)	151 (15.3)	255 (29.6)	292 (36.0)	385 (43.8)	<0.001	673 (29.7)	446 (35.0)*
<b>Knowledge of local emergency response systems</b>								
Evacuation route	2652 (74.9)	742 (75.1)	599 (69.5)	626 (77.2)	685 (77.8)	0.003	1767 (78.0)*	885 (69.4)
Emergency shelter	2210 (62.4)	584 (59.1)	523 (60.7)	500 (61.7)	603 (68.5)	0.001	1447 (63.9)	763 (59.8)
Emergency phone numbers	3325 (93.9)	915 (92.6)	788 (91.4)	781 (96.3)	841 (95.6)	<0.001	2170 (95.8)*	1155 (90.6)
Actions on nine or more indicators	352 (9.9)	48 (4.9)	91 (10.6)	92 (11.3)	121 (13.8)	0.001	236 (10.4)	116 (9.1)

\* $p < 0.05$  in urban-rural comparisons.

About 0.4% of households did not prepare any emergency items at home, compared with 2.3% having one item and 10.9% having three items. The majority of households owned 5 emergency items. About 10% owned over 9 emergency items (Figure 1).

### Factors associated with emergency preparedness

The level of well-preparedness varied by region, prior exposure to emergency events, emergency training, knowledge and attitudes toward emergency preparedness, education, self-reliance, and fate submissiveness ( $p < 0.05$  in chi-square tests, Table 3). However, no significant differences in the level of well-preparedness were found in respondents of a different gender, age, residency, and risk awareness ( $p > 0.05$  in chi-square tests, Table 3).

The logistic regression model confirmed that socio-economic status, knowledge and attitudes toward emergency preparedness were significant predictors of the level of well-preparedness after adjustments for variations in other variables. Higher levels of preparedness were associated with higher educational attainments, participation in emergency training activities (AOR=2.299), better emergency knowledge (AOR=2.043), less fate-submissiveness (AOR=1.385) and more self-reliance (AOR=1.349), prior exposure to emergency events (AOR=1.280) and more positive attitudes toward preparedness (AOR=1.286) (Table 3).

**Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)**

Independent variable	N	N (%) of well-prepared	AOR	(95% Confidence Interval)		P
<b>Gender</b>						
Male (reference)	1614	169 (10.5)	1.134	(0.949,	1.356)	0.167
Female	1927	183 (9.5)				
<b>Age (Years)</b>						
18-24 (reference)	359	67(1.9)				
25-44	1882	371(10.5)	0.773	(0.539,	1.110)	0.440
45-64	994	161(4.6)	0.939	(0.666,	1.322)	0.716
>64	282	51(1.5)	0.846	(0.553,	1.829)	0.440
<b>Education*</b>						
Secondary education or below	1325	257(7.3)	0.757	(0.591,	0.970)	0.028
High school education	740	123(3.5)	0.826	(0.677,	1.007)	0.059
College or above (reference)	1476	275(7.8)				
<b>Residency</b>						
Urban	2277	236 (10.4)	1.142	(0.940,	1.382)	0.181
Rural (reference)	1264	116 (9.2)				
<b>Region*</b>						
Beijing (reference)	988	48 (4.9)				
Heilongjiang	862	91 (10.6)	3.409	(2.531,	4.592)	0.000
Guangdong	811	92 (11.3)	3.890	(2.910,	5.199)	0.000
Sichuan	880	121 (13.8)	3.450	(2.574,	4.625)	0.000
<b>Monthly household income (Yuan)</b>						
0-3499 (reference)	987	191 (5.4)				
3500+	2554	464 (13.1)	1.202	(0.972,	1.486)	0.089
<b>Prior exposure to emergency events*</b>						
Yes	1332	155 (11.6)	1.280	(1.042,	1.571)	0.019
No (reference)	2209	197 (8.9)				
<b>Participation in emergency training* last year</b>						
Yes	957	158 (16.5)	2.299	(1.902,	2.779)	0.000
No (reference)	2584	194 (7.5)				
<b>Emergency knowledge score*</b>						
> average	3127	333 (10.6)	2.043	(1.460,	2.859)	0.000
≤ average (reference)	414	19 (4.6)				
<b>Risk awareness score</b>						
> average	1302	145 (11.1)	1.047	(0.866,	1.265)	0.638
≤ average (reference)	2239	207 (9.2)				
<b>Attitudes toward emergency preparedness*</b>						
> average	1947	216 (11.1)	1.286	(1.067,	1.575)	0.011
≤ average (reference)	1594	136 (8.5)				
<b>Self-reliance*</b>						
> average	2378	263 (11.1)	1.349	(1.059,	1.562)	0.018
≤ average (reference)	1163	86 (7.4)				
<b>Fate submissiveness*</b>						
> average (reference)	431	31 (7.2)				
≤ average	3110	321 (10.3)	1.385	(1.028,	1.868)	0.033
<b>Constants</b>			0.015			0.000

\*  $p < 0.05$  in univariate chi-square tests



1  
2  
3 The perceived barriers reported by the respondents for hindering household preparedness echoed well with  
4 the findings of the regression models. More than half (53.6%) of the respondents cited knowledge shortage  
5 as a major barrier. This was followed by inertia: 31.6% did not want to think about it; 28.1% believed that  
6 emergency professionals would do the rescue job for them; 21.5% did not believe an emergency would  
7 happen to the family. In addition, 24.4% of respondents blamed the government and the public media for  
8 the limited availability of information. Resource restrictions were not perceived as a major barrier for  
9 household emergency preparedness: less than 20% respondents cited the lack of time, money and personal  
10 ability as a barrier (Figure 2).  
11  
12  
13  
14  
15  
16  
17

## 18 **DISCUSSION**

### 19 **Low level of household preparedness in China**

20  
21  
22 Overall, the level of household emergency preparedness in China is low, with less than 10% of households  
23 acting on nine or more emergency indicators out of a possible 14. This result is consistent with the findings  
24 of studies conducted elsewhere in China. Poor household preparedness for emergency events is common in  
25 many developing countries, such as Turkey and Iran.<sup>29</sup> The performance of developed countries, although  
26 better than in developing countries, is also far from satisfactory. In Australia, about one-fifth of households  
27 have sufficient supplies of items for emergency events such as a torch, radio, mobile phone, first aid kit,  
28 appropriate batteries and an emergency contact list. A study in the US revealed that 12.3% of American  
29 households possessed a three-day supply of water and nonperishable food, an evacuation plan, a working  
30 flashlight and radio. Similarly, 30% of households in Japan stockpiled food and drinking water for  
31 emergency events.<sup>15</sup>  
32  
33  
34  
35  
36  
37  
38

### 39 **Factors contributing to the low level of household preparedness**

40  
41 Findings of the logistic regression model and ranking of perceived barriers reported by the respondents  
42 point to the same conclusion: knowledge is a major determinant of household emergency preparedness  
43 (Figure 3). The odds of well-preparedness doubled in the respondents with a higher than average level of  
44 knowledge. Training would also double the odds of well-preparedness, possibly through filling knowledge  
45 gaps. This is echoed by over half of the respondents who reported knowledge shortage as the major barrier  
46 to preparing for emergency events. The association between knowledge and preparedness for emergency  
47 events is further supported by the link between education in general and preparedness. Prior exposure to  
48 emergency events may also improve the knowledge and attitudes of people, resulting in better preparedness  
49 for emergency events. These findings are consistent with previous studies.<sup>30, 31</sup>  
50  
51  
52  
53  
54  
55

56 Fate-submissiveness and a lack of recognition of self-reliance were identified as a significant predictor of  
57 poor-preparedness in the logistic regression model. Similarly, a lack of motivation to act (“do not want to  
58 think about it” and “leave it to professionals”) was reported as the second most significant barrier in  
59  
60

1  
2  
3 household emergency preparedness.  
4

5  
6 Surprisingly, the most developed region, Beijing, was found to be the worst performer. The underlying  
7 reasons warrant further studies. Clearly, the results cannot be fully explained by individual differences.  
8

9  
10 Similar to the results of this study, gender and age were not found to be associated with disaster  
11 preparedness in several previous studies.<sup>32,33</sup>  
12

### 13 **Policy implications**

14  
15  
16 Large improvements can be made in relation to emergency preparedness in China. Public knowledge on  
17 emergency responses is universally poor in China. Educational campaigns, if designed and implemented  
18 properly, can effectively improve public knowledge. However, this has to be done through multiple  
19 avenues. Governmental agencies can coordinate the timely provision of adequate information about  
20 emergency events. Emergency training can be offered through specifically designed drill exercise,<sup>34</sup> or as  
21 part of the national essential education system. In Japan, a disaster-prone country for example, disaster  
22 mitigation has been integrated into its national school curriculum.<sup>35</sup>  
23

24  
25 However, knowledge improvement by itself is not enough. The mentality of inertia in the public needs to  
26 be addressed. A positive correlation between the recognition of self-reliance and better household  
27 preparedness is evident as confirmed in this study and others.<sup>36</sup> But unfortunately, many traditional cultures  
28 encourage fate submissiveness. A study in Saudi Arabia found that most (93%) respondents believed that  
29 floods, earthquakes and other natural disasters are signs of God.<sup>37</sup> Fatalism is an attitude of self-defeatism  
30 which may lead individuals into helpless, undermining their efforts of individual preparedness.<sup>38-39</sup> The  
31 Chinese society also embraces an auspicious culture, encouraging people to pursue luck and avoid ominous  
32 things. It is taboo to talk about bad things, such as disaster and death. People prefer to pin their hopes on  
33 illusory things, rather than be prepared for real threats.<sup>40-41</sup>  
34  
35

36  
37 Lessons learned from past disaster experiences may help change the mentality of inertia and risk perception.  
38 In Australia, for example, bush fires impose a regular risk for many households. The preparedness of  
39 individual households can make a difference between life and death. The National Partnership Agreement  
40 on Natural Disaster Resilience in Australia therefore emphasizes the significance of involving multiple  
41 parties including individuals.<sup>42</sup> Emergency response systems are often complex and adaptive. A highly  
42 participatory strategy would encourage individuals to take more responsibility, become less dependent on  
43 the government, and leave more resources for others.<sup>43</sup> Trust in the government is important given that it is  
44 most likely to play a coordinating role in emergency events.<sup>44</sup> However, over-reliance on the government  
45 and professional workers could dampen household efforts for future disasters.<sup>45</sup> A study of post-earthquake  
46 survivors in China showed that high expectations of the public on the government are associated with high  
47 trust in the government, leading to increased complacency in individual efforts in preparedness.<sup>16</sup> In China,  
48 governmental response to disasters from the military force has often been extraordinarily rapid and efficient.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 For example, an earthquake-relief headquarter was established by the army 18 minutes after the earthquake  
4 strike in Ya'an and 5000-6000 rescue workers were deployed on the same day. But people need to realize  
5 that there is always a gap before the full functioning of external rescue assistance, a gap which needs to be  
6 filled by the survivors of disasters.<sup>7</sup> Poor cooperation from those being rescued can also jeopardize  
7 professional efforts.  
8  
9

### 10 11 **Limitation**

12  
13  
14 There are several limitations in this study. Although this study drew large samples from four representative  
15 regions in China, the participants were not completely randomly selected. One adult respondent was invited  
16 to represent each household in this study. But opinions from family members may not always been  
17 consistent. Household preparedness can involve many aspects. The 14 emergency items included in this  
18 study may not be exhaustive. Although the 14 items are not equally important, their importance varies with  
19 different emergency events. This makes it difficult to attach a fixed weight to each item in terms of their  
20 importance. For example, in a fire emergency, "escape rope" and "gas mask" are more important  
21 than having food and water. But this is not necessarily the case in an event when the survivors are isolated  
22 from the outside world. Therefore, we did not differentiate the importance of the emergency items. The  
23 dichotomization of the dependent variable is somehow arbitrary. Although it enabled easy interpretation of  
24 the results, certain information might get lost in the statistical analyses. However, the linear regression  
25 analysis generated consistent results. It is important to note that the study adopted a cross-sectional design,  
26 no causal relationships should be assumed.  
27  
28  
29  
30  
31  
32  
33

### 34 35 **Conclusion**

36  
37 The overall level of household emergency preparedness in China is extremely low. A lack of knowledge  
38 presents a great barrier to household preparedness. Although training can be an effective measure for  
39 improving knowledge, a more comprehensive strategy needs to be adopted to address issues associated  
40 with the lack of motivation. Emergency response systems should emphasize individual responsibilities as  
41 well as those from the government and professional workers.  
42  
43  
44  
45

46 **Data sharing statement** All data relevant to the study are included in the article or uploaded as  
47 supplementary information.  
48  
49

### 50 51 **Open access**

52 This is an Open Access article distributed in accordance with the Creative Commons Attribution Non  
53 Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this  
54 work non-commercially, and license their derivative works on different terms, provided the original work is  
55 properly cited and the use is non-commercial.  
56  
57  
58  
59  
60

### Author contributions

CY , WX , YJD, and WLX analyzed the data and drafted the manuscript. YH and NN took overall responsibility for the study design, coordinated and conducted the survey, and participated in writing and modifying this manuscript. QHW, LJG, and ZK participated in the design of the study, data collection, and writing of the manuscript. Chaojie Liu interpreted the results of statistical analyses, articulated the storyline, and wrote the manuscript.\* CY, WX,WLX these three authors contributed equally.

### Acknowledgement

The authors are grateful to the support of local officials including three senior researchers(Tie Song, Wei Sun, Ruoxiang Cao in data collection in the sampled municipalities) lead the investigation in different parts of China. Additionally, we thank Mingli Jiao, Hong Sun and Libo Liang for their advice in this study. We are grateful to the participants of the study and the postgraduate students who helped collection and preparation of the data.

### Conflicts of interests statement

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service or company that could be construed as influencing the position presented in our study.

**Patient and public involvement:** Patients and the public were not involved in the design or planning of the study.

### Funding

This work was supported by the National Natural Scientific Fund of China grant number (71673072, 71173064, 71473065), and the Ministry of Health Public Benefit Fund for Health Sector (201002028), Heilongjiang Province philosophy & Social Science Fund (18GLD302, QMSI2017B-01).

**Competing interests :** None declared

**Participant consent:** Obtained in this study.

## References

1. World Bank. Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention;2010
2. World Health Organization. Health needs from humanitarian emergencies at an all-time high, [www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/](http://www.who.int/mediacentre/news/releases/2016/humanitarian-emergencies/en/). Accessed June 6, 2016.
3. China National Commission for Disaster Reduction. The Briefing of China's natural disasters in 2016. Bei Jing, China, Emergency Office. <http://www.mca.gov.cn/article/zrzh/201606/index.htm>. Accessed October 11, 2016.
4. Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations Office for Disaster Risk Reduction (UNISDR). <https://www.unisdr.org/we/inform/publications/43291> Accessed March 18, 2015.
5. Serrao-Neumann, Silvia, F. Crick, and D. L. Choy. Post-disaster social recovery: disaster governance lessons learnt from Tropical Cyclone Yasi. *Natural Hazards*. 2018;1-18. <https://doi.org/10.1007/s11069-018-3345-5>
6. United Nations, Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, January 22, 2005, available at: <https://www.refworld.org/docid/42b98a704.html> [accessed 31 August 2019]
7. Liu CJ, Robinson P. The role of volunteers in disaster settings: better organization is needed. *Australian and New Zealand Journal of Public Health*. Dec, 2013;37(6):595-6. <https://doi.org/10.1111/1753-6405.12139>
8. Kim, Y. C., and J. Kang. "Communication, neighborhood belonging and household hurricane preparedness." *Disasters*. 2010;34(2). <https://doi.org/10.1111/j.1467-7717.2009.01138.x>
9. Levac, J, D. Toal-Sullivan, and T. L. O'Sullivan. "Household Emergency Preparedness: A Literature Review." *Journal of Community Health*. 2012;37(3):725-733. <https://doi.org/10.1007/s10900-011-9488-x>
10. United Nations Office for Disaster Risk Reduction (UNISDR). 2009 UNISDR terminology on disaster risk reduction (2009). <https://www.unisdr.org/we/inform/publications/7817> Accessed 2009.
11. Heidenstrøm, Nina & Kvarnlöf, Linda. Coping with blackouts: A practice theory approach to household preparedness. *Journal of Contingencies and Crisis Management*. 2017;26(1). <https://doi.org/10.1111/1468-5973.12191>
12. Greenberg MR, Dyen S, and Elliott S. "The public's preparedness: self-reliance, flashbulb memories, and conservative values." *American Journal of Public Health*. 2013;103(6):E85-E91. <https://doi.org/10.2105/AJPH.2012.301198>.
13. Xu, Dingde, et al. Influences of Risk Perception and Sense of Place on Landslide Disaster Preparedness in Southwestern China. *International Journal of Disaster Risk Science*. 2018;9(2):1-14. <https://doi.org/10.1007/s13753-018-0170-0>
14. Hung, Li San. "Gender, Intra-Household Dynamics, and Household Hurricane Preparedness: An Exploratory Study Employing a Dyadic Interview Approach." *International Journal of Disaster Risk Science*. 2018;(1):1-12. <https://doi.org/10.1007/s13753-018-0158-9>
15. Onuma, Hiroki, J. S. Kong, and S. Managi. "Household preparedness for natural disasters: Impact of disaster experience and implications for future disaster risks in Japan." *Mpra Paper*. 2016;(21). <https://doi.org/10.1016/j.ijdr.2016.11.004>
16. Han X, Ding YB, Zhang HW, et al. Prevention of sudden disaster risk and public participation in megacity. *Shanghai J Prev Med*. 2015;(5):248-255
17. Han, Ziqiang, et al. "The effects of trust in government on earthquake survivors' risk perception and preparedness in

- China." *Natural Hazards*. 2017;1(86):437-452. <https://doi.org/10.1007/s11069-016-2699-9>
18. Debastiani, S. D., et al. "Preparedness Perceptions, Sociodemographic Characteristics, and Level of Household Preparedness for Public Health Emergencies: Behavioral Risk Factor Surveillance System, 2006-2010." *Health Secure*. 2015;13(5):317-326. <https://doi.org/10.1089/hs.2014.0093>
19. FEMA. Emergency Supply Kit Checklists for Parents and Kids-Ready Kids. Available at: <https://www.fema.gov/media-library/assets/documents/34326>. Publication date: August 21, 2013
20. Alrousan, T. M., L. M. Rubenstein, and R. B. Wallace. Preparedness for natural disasters among older US adults: a nationwide survey. *American Journal of Public Health*. 2014;104(3):506. <https://doi.org/10.2105/ajph.2013.301559>
21. Corwin K A , Brand B D , Hubbard M L , et al. Household preparedness motivation in lahar hazard zones: assessing the adoption of preparedness behaviors among laypeople and response professionals in communities downstream from Mount Baker and Glacier Peak (USA) volcanoes. *Journal of Applied Volcanology*. 2017;6(1):3. <https://doi.org/10.1186/s13617-017-0055-8>
22. Li, L., et al. Intervention effects of knowledge and skills of the public to respond to public health emergencies in Sichuan province, China. *Eval Rev* 2013;37(2):140-57. <https://doi.org/10.1177/0193841x14523619>
23. Glanz K , Rimer B K , Viswanath K . *Health Behavior: Theory, Research, and Practice*;2015.
24. Debastiani S D, Strine T W, Vagi S J, et al. Preparedness Perceptions, Sociodemographic Characteristics, and Level of Household Preparedness for Public Health Emergencies: Behavioral Risk Factor Surveillance System, 2006-2010. *Health Security*, 2015, 13(5):317-326. <https://doi.org/10.1089/hs.2014.0093>
25. House J S , Herzog R C K R. Age, Socioeconomic Status, and Health. *The Milbank Quarterly*. 1990; 68(3):383-411. <https://doi.org/10.2307/3350111>
26. Mincer J A . Schooling, Experience, and Earnings. *Industrial and Labor Relations Review*, 1976;29(3). <https://doi.org/10.2307/2521600>
27. Anita C, Malcolm W, Alonzo P ,et al. Getting actionable about community resilience: the Los Angeles County Community Disaster Resilience project. *American Journal of Public Health*, 2013;103(7):1181-1189. <https://doi.org/10.2105/AJPH.2013.301270>
28. Blessman, J, Skupski, J, Jamil, M, et al. Barriers to at-home-preparedness in public health employees: Implications for disaster preparedness training. *Journal of Occupational and Environmental Medicine*, 2009;(49)3:318-326. <https://doi.org/10.1097/jom.0b013e31803225c7>
29. Mahdaviazad, H, and G. Abdolahifar. "Assessing Household Natural Disaster Preparedness in Shiraz, Iran, 2011: Results of a Knowledge, Attitude, and Practices Survey." *Disaster Medicine & Public Health Preparedness*.2014;8(4):349. <https://doi.org/10.1017/dmp.2014.61>
30. Siegrist M, Gutscher H. Natural Hazards and Motivation for Mitigation Behavior: People Cannot Predict the Affect Evoked by a Severe Flood. *Risk Anal*.2008;28(3):771-778. <https://doi.org/10.1111/j.1539-6924.2008.01049.x>
31. Chan, Emily & Yue, Janice & Lee, Poyi & Shuxin Wang, Susan. (2016). Socio-demographic Predictors for Urban

- 1  
2  
3  
4 Community Disaster Health Risk Perception and Household Based Preparedness in a Chinese Urban City. *PLoS*  
5 *Currents*. 8. <https://doi.org/10.1371/currents.dis.287fb7fee6f9f4521af441a236c2d519>  
6  
7 32. Chaney, Philip & S. Weaver, Greg & A. Youngblood, Susan & Pitts, Kristin. Household Preparedness for Tornado  
8 Hazards: The 2011 Disaster in DeKalb County, Alabama. *Weather, Climate, and Society*. 2013,5(4):345-358.  
9 <https://doi.org/0.1175/WCAS-D-12-00046.1>  
10  
11  
12 33. Edwards, M.L. 1993. Social location and self-protective behavior: Implications for earthquake preparedness.  
13 *International Journal of Mass Emergencies and Disasters* 11(3): 293-303.  
14  
15 34. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis* 1998;(18)3:243-252.  
16 <https://doi.org/110.1111/j.1539-6924.1998.tb01291.x>  
17  
18 35. Iemura, Hirokazu, et al. "Earthquake and tsunami questionnaires in Banda Aceh and surrounding areas." *Disaster*  
19 *Prevention & Management* 2006;15(1):21-30. <https://doi.org/10.1108/09653560610654211>  
20  
21 36. Khunwishit S. Community resilience in Thailand: A case study of flood response in Nakhonsawan City Municipality.  
22 University of North Texas, 2013.  
23  
24 37. Alshehri, Saud Ali, Y. Rezgui, and H. Li. "Public perception of the risk of disasters in a developing economy: the case  
25 of Saudi Arabia." *Natural Hazards*. 2013;65(3):1813-1830. <https://doi.org/10.1007/s11069-012-0445-5>  
26  
27 38. Kouabenan, Dongo Rémi. "Beliefs and the Perception of Risks and Accidents." *Risk Analysis*.1998;18(3):243-252.  
28 <https://doi.org/10.1111/j.1539-6924.1998.tb01291.x>  
29  
30 39. Baytiyeh, Hoda, and M. Naja. "The effects of fatalism and denial on earthquake preparedness levels." *Disaster*  
31 *Prevention & Management*. 2016;25(2):154-167. <https://doi.org/10.1108/DPM-07-2015-0168>  
32  
33 40. Nie Lin. A Summary of China's Emergency Preparedness Culture Theory. *Science and Technology Forum* (the second  
34 half of the month), 2012(7): 189-190. <https://doi.org/10.3969/j.issn.1007-3973.2012.07.111>  
35  
36 41. Peng Zongchao, Nie Lin. Analysis of the Status Quo and Development Path of Urban Emergency Preparedness Culture  
37 in China. *China Emergency Management*, 2012(5): 37-40.  
38  
39 42. Governments, Council Of Australian. "National Strategy for Disaster Resilience." *Australian Journal of Emergency*  
40 *Management*. 2011;27. <https://doi.org/10.1111/1467-8500.12299>  
41  
42 43. C C. Household preparedness for public health emergencies--14 states, 2006-2010.[J]. *Mmwr Morbidity & Mortality*  
43 *Weekly Report*.2012;61(36):713. <https://doi.org/10.1001/jama.2012.13026>  
44  
45 44. Basolo V, Steinberg LJ, Burby RJ, Levine J, Cruz AM, Huang C. The Effects of Confidence in Government and  
46 Information on Perceived and Actual Preparedness for Disasters. *Environment and Behavior*. 2009;41(3):338-364.  
47 <https://doi.org/10.1177/0013916508317222>  
48  
49 45. Terpstra T. Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior. *Risk*  
50 *Analysis*.2011;31(10):1658-1675. <https://doi.org/10.1111/j.1539-6924.2011.01616.x>  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Figure legend/caption**

Table 1. Socio-demographic characteristics of respondents

Table 2. Number and percentage (%) of households acting on emergency items

\* $p < 0.05$  in urban-rural comparisons.

Table 3. Factors associated with emergency preparedness: results of logistic regression models (n=3541)

\*  $p < 0.05$  in univariate chi-square tests

Figure 1. Distribution (%) of households preparedness of 14 emergency items

Figure 2. Barriers reported by respondents (%) for not preparing for emergencies

*Figure 2 Note: Q1 “do not know what to do”; Q2 “do not want to think about it”; Q3 “nothing can be done”; Q4 “it takes too much time”; Q5 “it takes too much money”; Q6 “do not have the ability to prepare”; Q7 “professionals will do the rescue job”; Q8 “do not believe emergency will happen to the family”; Q9 “do not have enough information from the government and the public media”.*

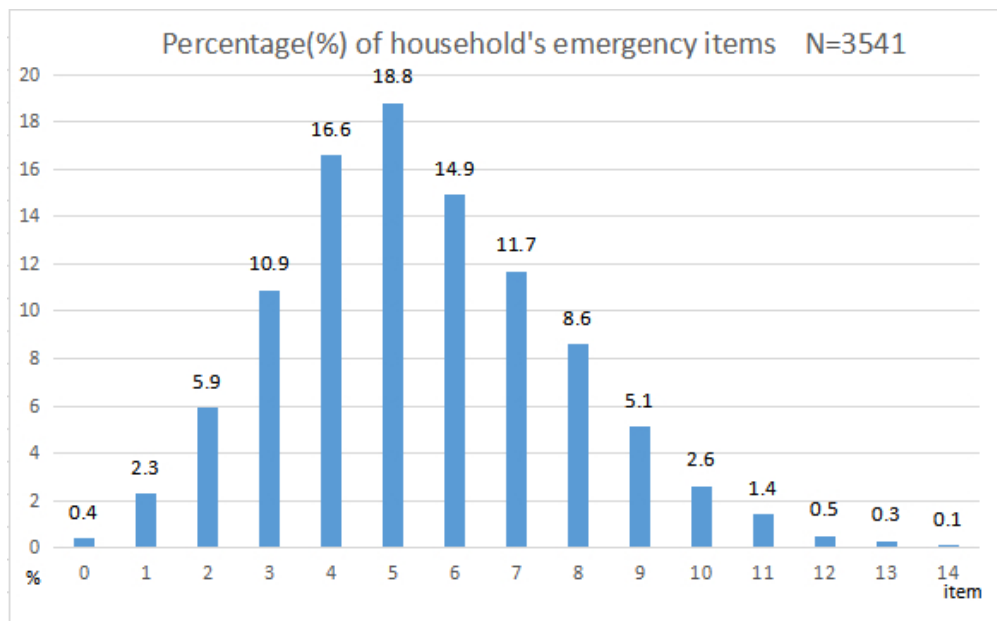
Figure 3. Link between perceived barriers and factors predicting well-preparedness



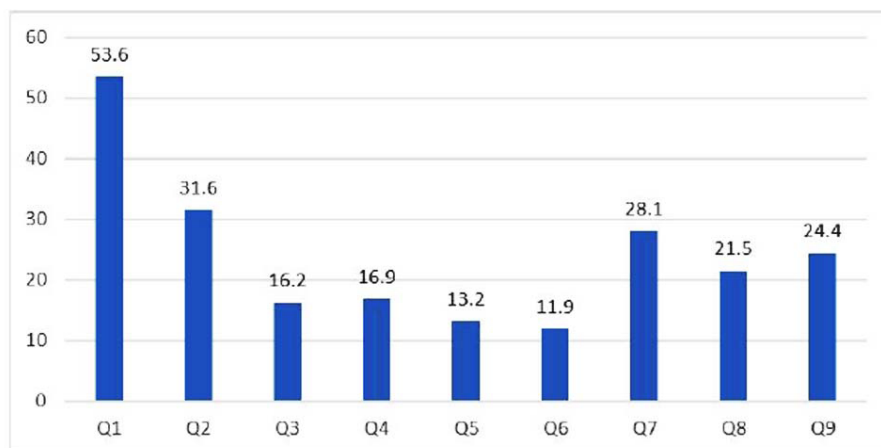
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



**Figure 2. Barriers reported by respondents (%) for not preparing for emergencies**



*Note: Q1 "do not know what to do"; Q2 "do not want to think about it"; Q3 "nothing can be done"; Q4 "it takes too much time"; Q5 "it takes too much money"; Q6 "do not have the ability to prepare"; Q7 "professionals will do the rescue job"; Q8 "do not believe emergency will happen to the family"; Q9 "do not have enough information from the government and the public media".*

Figure 2

Figure 3. Link between perceived barriers and factors predicting well-preparedness

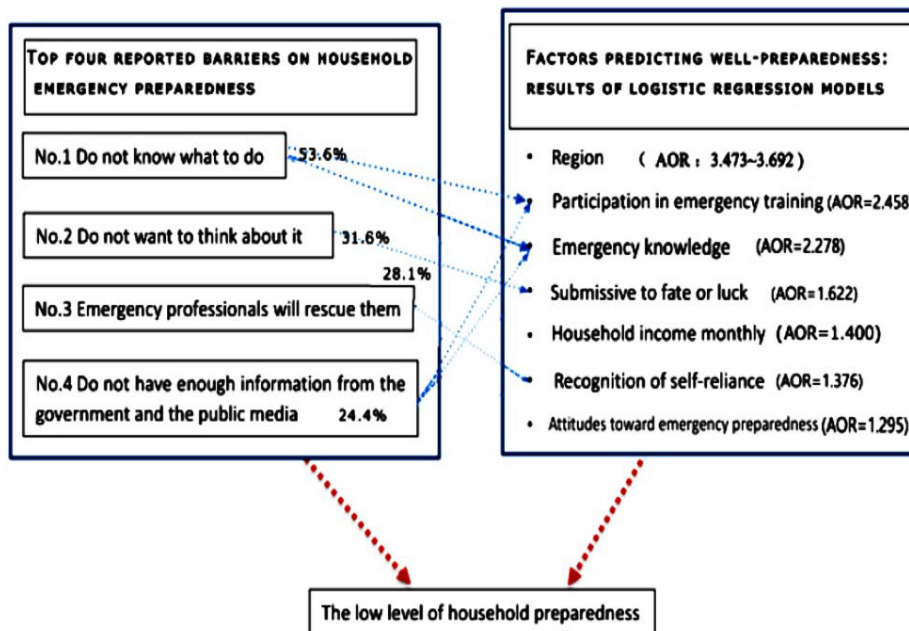


Figure 3

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Page No	Recommendation
<b>Title and abstract</b>	1 ✓	2	(a) Indicate the study's design with a commonly used term in the title or the abstract
		2	(b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>			
Background/rationale	2 ✓	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3 ✓	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>			
Study design	4 ✓	4	Present key elements of study design early in the paper
Setting	5 ✓	4	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 ✓	4	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7 ✓	5	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/measurement	8* ✓	6	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9		Describe any efforts to address potential sources of bias
Study size	10 ✓	6	Explain how the study size was arrived at
Quantitative variables	11 ✓	6	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 ✓	6	(a) Describe all statistical methods, including those used to control for confounding
		6	(b) Describe any methods used to examine subgroups and interactions
		6	(c) Explain how missing data were addressed
		6	(d) If applicable, describe analytical methods taking account of sampling strategy
			(e) Describe any sensitivity analyses
<b>Results</b>			
Participants	13* ✓	7	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			(b) Give reasons for non-participation at each stage
			(c) Consider use of a flow diagram
Descriptive data	14* ✓	7	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			(b) Indicate number of participants with missing data for each

			variable of interest
Outcome data	15* ✓	8	Report numbers of outcome events or summary measures
Main results	16 ✓	8-9	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		9	(b) Report category boundaries when continuous variables were categorized
		9	(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>			
Key results	18 ✓	10-11	Summarise key results with reference to study objectives
Limitations	19 ✓	12	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20		Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21 ✓	12	Discuss the generalisability (external validity) of the study results
<b>Other information</b>			
Funding	22 ✓	13	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).