

1 **Impact of an educational program on earthquake awareness and preparedness in Nepal**

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10  
11 **ABSTRACT**

12 Scientific education of local communities is key to help reduce the risk associated with natural  
13 disasters, such as earthquakes. Western Nepal has a history of major seismic events and is highly  
14 prone to further earthquakes; however, the majority of the population is not aware about or  
15 prepared for them. To increase earthquake awareness and improve preparedness, a seismology  
16 education program was established at 22 schools in Nepal. In each school, educational activities  
17 were performed by teaching earthquake related topics in classrooms, offering training to teachers  
18 and through installing a low-cost seismometer network which supported both teaching and  
19 awareness objectives. To test the effects of this program we conducted two surveys with school  
20 children, one before and one after the initiation of the program, with several hundred participants  
21 in each. The survey findings highlighted that educational activities implemented at schools are  
22 effective in raising awareness levels of children, promoting broader social learning in the  
23 community thus improving the adaptive capacities and preparedness for future earthquakes.  
24 However, perceptions of risk did not change so much. The high and positive impact of program  
25 on the students and the community is encouraging to continue and expand the program.

## 27 INTRODUCTION

28 It is becoming increasingly important to educate people in the era of global change about  
29 environmental hazards to ensure they are well prepared to face the rising number of challenges.  
30 Education may play a central role for the risk management of natural hazards and help to reduce  
31 vulnerability and improve adaptability though allowing people to anticipate and prepare for  
32 hazards (Godschalk, 2003; IRGC, 2005).

33 Exact earthquake prediction is currently not possible, but responses to such events can be prepared  
34 for in advance to mitigate the effects they can have on society and human well-being (Turner,  
35 1976). The impacts of earthquake disasters can be minimized by learning what to do before, during  
36 and after earthquakes, and by taking a variety of personal safety measures (Lehman & Taylor,  
37 1987). Whether people prepare for future earthquakes or not can be significantly influenced by  
38 their education and their engagement on the topic (Tanaka, 2005). All-inclusive public awareness  
39 and education is fundamental to reducing casualties, personal injuries, and property damage from  
40 natural disasters (NRC, 1991; Torani et al., 2019). Researchers can contribute and play a key role  
41 in the education of society; not just to engage more people in research, but also to provide scientific  
42 explanations for natural hazards and related consequences to local communities and help to  
43 develop policies for mitigation of effects.

44 Earthquakes are the most common and deadliest natural hazard in Nepal with a long history of  
45 impacts in the country (Bollinger et al., 2016). Historical records indicate that many houses and  
46 temples in Nepal collapsed during the 1255 earthquake, and one third of the population including  
47 the King, Abhaya Malla, was killed. There are also records of an earthquake with a moment  
48 magnitude  $> 8$  in 1505 (Ambraseys and Jackson, 2003) and indications that even larger  
49 earthquakes are plausible in the Himalayas (Stevens and Avouac, 2016). In 1934, during an  
50 earthquake (Fig. 1) with a moment magnitude ( $M_w$ ) of 8.2 over 8'500 people lost their lives,  
51 200'000 houses were severely damaged and more than 80'000 buildings completely collapsed  
52 (Dixit et al., 2013). The most recent major earthquake ( $M_w$  7.8), in 2015, hit central Nepal  
53 resulting in about 9'000 casualties, and nearly 800'000 buildings were damaged or destroyed,  
54 leaving millions of people homeless. The resulting losses were equivalent to 50 % of total national  
55 GDP (Chaulagain et al., 2018). In addition, 19'000 classrooms were destroyed and 11'000  
56 damaged (NPC, 2015b). It is suggested that if people had better awareness, preparations could  
57 have been more adequate and the negative impacts might have been lower (Hall & Theriot, 2016).

58 In Nepal, the National Seismological Center under the Department of Mines and Geology has been  
59 conducting seismic monitoring since 1978. The Dept. of Education is responsible to develop  
60 different educational activities across the nation, and the Dept. of Urban Development and  
61 Building Construction has been working for building codes design and implementation. After the  
62 2015 earthquake, the National Reconstruction Authority has been established and works for  
63 reconstruction of buildings damaged during the Gorkha earthquake. Despite these efforts, the topic  
64 of earthquakes is not included at any level of the official school curriculum in the Nepali education  
65 system. However, recently the National Society for Earthquake and Technology (NSET) initiated  
66 the Public-School Earthquake Safety Program in Nepal, but only in a few districts of the country  
67 (Dixit et al., 2014). This program focuses mainly on the retrofitting of school buildings to restore  
68 and minimize future damage following the 2015 earthquake; however, educational efforts are still  
69 very limited.

70

71 Following the devastating 2015 Gorkha event, and considering the history of major earthquakes  
72 and the likelihood of many more as well as poor educational effort on the topic, we initiated and  
73 implemented a seismology education program in schools in Western Nepal (Fig. 1; Subedi et al.,  
74 2020) including the area affected by the 2015 earthquake and expanding towards the West (Fig.  
75 2). The aim of the program is to increase the earthquake awareness levels in Nepal, starting from  
76 the schools, with the hope that this knowledge will be spread into the community through social  
77 learning, and partly through the establishment of a low-cost seismic network (Figs. 1, 3). In this  
78 study, the effects of the education program for earthquake awareness and preparedness are  
79 evaluated. The evaluation was performed by collecting data from students through two surveys,  
80 one before and one after the initiation of the education program.

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82

### 83 **METHODS**

84 The data for this study were collected using two questionnaire surveys on paper, conducted in  
85 Nepali language: in 2018, before the initiation of the education program, and in 2020, nearly a year  
86 after the full implementation of the program.

87 Before the initiation of the education program, we undertook fieldwork to help inform our strategy  
88 and the educational materials, and to ensure the education program was well adapted to the Nepali

89 education system. In 2018, during the first visit, we talked with the school leaders about the  
90 program and its benefits, and gave sample lectures (ca. 1-2 hours including questions) to students  
91 between the ages of 14-16, providing key information on earthquakes. Before the sample lecture  
92 and in each school, students were requested to fill in a paper questionnaire survey on earthquake  
93 related questions. In special lectures we also taught students how to prepare before an earthquake,  
94 how to save lives during an earthquake, and what to do after an earthquake. We also provided a  
95 flyer containing detailed information and pictures (Fig. 4), of which we distributed 500 copies.  
96 Similarly, we designed a sticker to remind people about earthquake hazards (Fig. 3), and  
97 distributed this to students and teachers (3'000 so far).

98 In April-May 2019, during the second visit, the program was fully implemented with the  
99 installation of an educational, low-cost seismometer in every school. The seismometer's record is  
100 displayed on a computer, which is easily accessible to students in their physics class, or through  
101 an online application. During the visit, we also identified the open place near the school where  
102 students should meet in case of earthquake and installed an Emergency Meeting Point sign in  
103 Nepali. To increase the efficiency of the learning and to ensure long-term uptake, we organized a  
104 2-day workshop for nearly 100 school teachers, which was very well received. The full details of  
105 the program are documented in an earlier paper (Subedi et al., 2020) and all the material is  
106 accessible on the program website ([www.seismoschoolnp.org](http://www.seismoschoolnp.org)).

107  
108 In this article, we focus on evaluating the efficiency of our program in terms of knowledge and  
109 behavior change of students related to earthquakes. Out of 22 schools participating in the program,  
110 15 schools were chosen for the survey, covering a range of socio-economical contexts. Students  
111 for the surveys were selected randomly from grades 9 and 10, representing the 14-16-year-old age  
112 group. The total number of responses collected was 318 in 2018 and 480 in 2020, respectively.  
113 For logistical reasons, some responses in the pre- and post-survey (27 %) came from different  
114 schools, but this is not expected to affect the results as they were independent samples. While the  
115 first set of students surveyed had no earthquake education whatsoever, those who filled out the  
116 second survey were exposed to information and lectures frequently about earthquakes from the  
117 teachers who were trained in our program.

118 When the exact same question was asked before and after our program's implementation, we  
119 quantify the change using  $\chi^2$  test analysis. In doing so, our null hypothesis ( $H_0$ ) is that our program

120 had no effect on the students. If this null hypothesis is unconfirmed (i.e., the  $\chi^2$  value is above the  
121 threshold for the corresponding number of possible answers, and the respective p-value is below  
122 5%), then we interpret that the program had an effect on the students as their answers show a clear,  
123 statistically significant change. The complete set of questionnaires are available in the  
124 Supplementary materials file.

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## 128 **RESULTS**

129 The first measurement of this study, performed in the 2018 survey, was about the experience of  
130 the 2015 Gorkha earthquake. The majority of respondents, 94 %, felt the shaking. As the  
131 earthquake was on Saturday, schools were closed and students were at home; 71 % of students  
132 answered that they ran out of a building, and only 15 % hid under a table, 8 % did not know what  
133 to do, 3% stood next to the wall or the doorframe, 3% had other reaction.

134

### 135 **Knowledge about the causes and possibility of earthquakes in Nepal**

136 Before the implementation of the program, 7 % students believed that earthquakes were caused by  
137 a moving fish carrying the Earth (a Hindu belief and myth). However, 64 % still chose the correct  
138 scientific answer: plate tectonics. The majority of students, 84 %, chose the “plate tectonics”  
139 answer in 2020, and the percentage of responses relating to the cultural/religious reasons dropped  
140 to 2 % (Fig. 5).

141 Regarding the probability of a future earthquake greater than in 2015, more students knew that  
142 such an earthquake in their region was quite likely after the education program (Fig. 6a). At the  
143 same time, there was a clear drop in the number of responses for very unlikely (17 % in 2018 to 5  
144 % in 2020) and a slight drop in the percentage answering that a future great earthquake is  
145 impossible.

146 Relating to the effects of a  $M_w > 8$  earthquake, after the program, the answer *I could die* has  
147 increased by a factor of 1.8, and all other answers (*I could be buried alive, I could get hurt, I could*  
148 *lose friend* and *My home could collapse*) are increased by a factor of at least 1.3 compared to 2018  
149 (Fig. 6b; multiple answers were possible).

150 In 2018, 31 % students answered they know when an earthquake will occur, which is reduced to  
151 11 % in 2020. The answer itself is not true, and this mis-information could drive people to  
152 incorrectly prepare for or act during an earthquake. While our efforts clearly decreased this mis-  
153 conception among the students, we could not yet reach each and every student to teach them about  
154 the unpredictability of earthquakes. The students answer agreeing on the impossibility of  
155 preventing an earthquake was 86 % in 2020, showing an absolute increase of 18 % from 2018.  
156 This question also shows that by 2020, more than double of the respondents have participated in  
157 disaster risk education training compared to 2018 (Fig. 7).

158

### 159 **Knowledge and perceptions about how to behave during and after an earthquake**

160 Three quarters (75 %) of students in 2020 responded that their family knows what to do and where  
161 to go during an earthquake, an increase of 55 % from 2018. Only 37 % of students in 2020 believed  
162 that their home could resist a large earthquake. For comparison, 65 % students were scared and 22  
163 % panicked during the Gorkha earthquake in 2015 (10 % had calm reactions, 3 % did not care)  
164 according to answers in 2018.

165 In 2018, 62 % respondents didn't know that they should not call others after an earthquake to leave  
166 the phone lines available for rescue operation, but in 2020 nearly 80 % students knew this useful  
167 practical point (Fig. 8).

168 After the implementation of our program, 65 % of the students believed that they can survive if a  
169 large earthquake occurred at night, whereas 43 % felt they could survive in 2018. This information  
170 reflects more confidence of students as they become familiar with earthquake topics and heard  
171 more information about them.

172 In 2020, 93 % of children knew that during an earthquake, the majority of injuries and deaths are  
173 caused by people being hit by objects, through the collapse of constructions; the proportion of  
174 people not knowing this dropped by 2/3 after the educational program was implemented. More  
175 than 2/3 of the students in 2020 were aware about the additional hazards, such as fires, landslides  
176 and floods that can be triggered by an earthquake. There is a 7% decrease for this answer since the  
177 2018 survey, but as students who claimed partial knowledge increased by 7 % as well, a net change  
178 in knowledge is not really perceptible on this point.

179 The proportion of students who regularly discuss earthquake related topics within their families  
180 has increased by 18 % (absolute increase; see Table 1). This shows that the education program at

181 schools has led to widespread social learning within communities. This is reinforced by the finding  
182 that nearly all students (98 %) are interested to learn more about earthquakes in detail, which will  
183 aid communities towards better earthquake preparedness in the long run.

184

### 185 **Earthquake preparedness and adaptation**

186 In 2018, 36 % of students perceived that to remain alive during an earthquake depends on luck,  
187 while this number has decreased by a relative 60 % after our program started and is a concern for  
188 only 21 % of students (Fig. 9). All possible answers regarding adaptation options to earthquakes  
189 record an increase from 2018 to 2020 (Fig. 11). The majority (72 %) of respondents answered that  
190 they are aware of the shelter areas and open spaces where they can go in case of an earthquake.  
191 The same proportion of people are aware of evacuation areas in 2020, but the increase here is much  
192 more important (from 38 to 69 %), potentially thanks to the Nepali Emergency Meeting Point signs  
193 we installed in schools. The information about which governmental authority to contact after an  
194 earthquake is relatively low, but has increased by 10 % (absolute). Information about earthquake  
195 prone areas and the reception of knowledge on earthquake disaster adaptation have increased by  
196 the factor of 2.5, from 12 % in 2018 to 31 % in 2020 after the education program.

197 The relatively small number of respondents who claimed that the government will provide help  
198 after an earthquake increased by a factor of almost 3: from 8 % in 2018 to 23 % in 2020. This  
199 percentage is not yet sufficient in general, but the improvement following our program's  
200 implementation is noteworthy. Moreover, the level of confidence in the government's  
201 reconstruction activities has also grown, from 13 to 30 %, which is a good sign and shows  
202 increasing level of trust. In 2020, 68 % of the respondents knew about the importance of talking  
203 about earthquakes with neighbours, friends and colleagues, a nearly two-fold increase in two years.  
204 Furthermore, we found that all students discussed their new knowledge and learning about  
205 earthquakes with the people around them in the community. Ninety-one percent of the students  
206 talk at least with some people in the community, only 9 % discuss this with their parents only, and  
207 there is no student who had not had a discussion in her/his surrounding (Fig. 10).

208

### 209 **Perception of risk**

210 More than 60 % of the answers showed that students considered the level of seismic risk in their  
211 city as medium, which means their risk perception is underestimated with respect to the actual

212 seismic risk level in the region (Stevens et al., 2018). Only every 6<sup>th</sup> person claims to perceive high  
213 risk, which is clearly less frequent than people declaring low risk. As opposed to our expectation,  
214 there is very little change in the level of risk perception in the group of students from 2018 to 2020:  
215 the medium risk level group is the same, and there is minor change in low and high-risk level  
216 groups (Fig. 12). This result is a surprise, especially when compared to the 72 % of responses in  
217 2020 who believe that there is more than 70 % chance of experiencing an earthquake larger than  
218 the 2015 Gorkha earthquake in their life (Fig. 6a).

219

### 220 **Project acceptance and future education**

221 To measure the program's acceptance level, some questions regarding the program itself were also  
222 included in the 2020 questionnaire. It is found that 91 % of the students know that a seismometer  
223 is installed in their school for earthquake education purposes. A total of 61 % of the students have  
224 observed waveforms recorded by the seismometer, either at the school computer (39 %), on the  
225 teacher's mobile phone (18 %) or/and on their parents' or own mobile phone (8-8 %). Furthermore,  
226 85 % of the students answered that teachers teach about earthquakes in the classroom regularly  
227 (weekly, monthly, on demand, and/or following an earthquake). In 2020, 99 % of the students  
228 expressed that they like the earthquake information we have provided them. Regarding future  
229 plans, almost all students are very much (69 %) or simply (29 %) interested to learn about  
230 earthquakes by inserting the theme in the official curriculum, which can be instituted by the Local,  
231 Provincial and Federal Government of Nepal as they have all have some field of possible action.  
232 Hence, our program and the methods we use for teaching about earthquakes are well accepted.

233

### 234 **Statistics**

235 All questions except the last (Question 12 in Table 1, level of interest to learn is 98% in both  
236 surveys) record a clear change in the pattern of answers given following our program's  
237 implementation (see Supplementary Table 1). The biggest statistical change was seen for Question  
238 6 (avoid post-earthquake use of mobile communications) suggesting a big increase in knowledge  
239 and a very new information. Each question (excluding those with multiple choice answers) and  
240 their corresponding  $\chi^2$  and p-values are reported in the Supplementary Table 1.

241

242



243 **DISCUSSION**

244 **Have earthquake awareness levels increased?**

245 As a result of the novel school-based education program, themes related to earthquakes are more  
246 familiar to the students now than in the past, and their awareness level have increased since the  
247 program was initiated. Students know more about the earthquake phenomena and have changed  
248 their behavior to better prepare and adapt to forthcoming earthquakes. Earthquake related  
249 knowledge learnt by students at schools has also reached across the broader community, though  
250 social learning processes (Reed et al. 2009).

251

252 **Why have the awareness levels increased?**

253 Beyond the prescribed school education, our program has provided an opportunity for informal  
254 and free-choice education forms, in which people can learn about topics outside of formal  
255 educational settings, which has been well supported by enthusiastic teachers (Falk & Dierking,  
256 2002). This form of social learning enables an increase in knowledge, and through further  
257 communication with others, it spreads knowledge in communities, which may lead to changes in  
258 attitudes, behavior, and building of trust in society (Reed et al., 2010). This method is widely  
259 applied for the study of natural hazards and its management (e.g., Brody, 2003; O’Keefe et al.,  
260 2010). During our program’s implementation, despite being in contact only with the school  
261 children, the knowledge has spread much more widely in local communities through social  
262 learning, thus reaching and impacting the original and intended target group.

263 People’s behavior can also be developed through education. The idea is that if people are made  
264 knowledgeable of earthquakes, they are more likely to adopt and perform behaviors that will  
265 increase their earthquake awareness and preparedness (Hungerford and Volk, 1990). This has  
266 similarly been shown for other environmental issues like invasive species, where campaigns  
267 building knowledge and awareness changed behaviors therefore minimizing risk (e.g. Cole et al.  
268 2019).

269 As a result of our educational program, earthquake related knowledge has increased and the  
270 behavior to cope with earthquakes has also changed. Despite this, the earthquake risk perception  
271 of students has not fully changed yet. Our results show that a realistic and appropriate distribution  
272 of earthquake related knowledge and increased awareness level are not (or not yet) sufficient to  
273 influence the perception of risk. Perceptions are a complex phenomenon and can take a long time

274 to change (De Dominicis et al., 2015; Estévez et al., 2015; Cole et al., 2019; Shackleton et al.,  
275 2019). Education and awareness raising is the key factor for changing long-term risk perceptions  
276 – although programs need to be well tailored to appropriate audiences (Lee et al., 2015). Although,  
277 some studies discuss that increased knowledge does not always relate to increased risk perceptions,  
278 and increasing perceived risk does not necessarily result in the reduction of risk behavior (e.g.  
279 Noroozinejad, 2013; Petros, 2014). In addition, knowing more of a given topic makes people more  
280 certain, self-confident, which may lead to underestimate the related risk (e.g. Stringer, 2004).  
281 Moreover, increased knowledge and behavior to adapt and feel more secure during an earthquake  
282 should reduce the fear of associated risk and therefore reduce the risk perception. The limited  
283 change in risk perception in this study may be due to better knowledge of the hazard and how to  
284 mitigate it (Ndugwa Kabwama and Berg-Beckhoff, 2015).  
285 Hence, how people perceive risk is not necessarily related to the actual risk. We cannot draw a  
286 definitive conclusion as the related knowledge can contribute to the amplification or the  
287 attenuation of the related risk; as such, it could be one of the potential reasons for the low risk  
288 perception of people having more knowledge (Reintjes, 2016). Risk perception is thus important  
289 for preventative actions, but risk perceptions are often biased (Weinstein, 1988). It could be that  
290 more time is needed to change students' risk perceptions, and it is also likely that there are other  
291 factors such as economic status, gender, age group, location of home in city, etc. that may influence  
292 the level of risk perception of people. A repeated survey in the same age category in a few years'  
293 time may give an answer to this question. We suggest that further monitoring and adaptation of  
294 the education system might be needed to better link awareness raising, behavior change and risk  
295 perception change.

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### 298 **Further action needed**

299 Since other sources of information, such as newspapers and television, are not easily available to  
300 people in the Nepali countryside, we believe that the school is the best platform to transfer  
301 knowledge to the community. The proper education at school reaches deep across the families and  
302 into the community, and the discussions in those circles are essential to prepare the whole society  
303 for future earthquakes. The proportion of students who regularly discuss earthquake related topics  
304 within their families has increased by 18 % (absolute increase; see Table 1). This shows that the

305 education program at schools has led to widespread social learning within communities, and  
306 possibly beyond our program's current area. We therefore, advocate for a continuity of this  
307 program and to get education about environmental hazards more deeply embedded in the Nepali  
308 education system.

309

310 Although this program has increased the earthquake awareness level among students and the  
311 broader community in the program area, it is alone not sufficient for seismic risk reduction. Further  
312 monitoring and adaptation of the program to promote changes in risk perception and improved  
313 learning is advised. Education will help communities to prepare for future earthquakes, but the  
314 local, national and regional governments are responsible for the rescue, support and reconstruction  
315 operations in the case of a severe earthquake and well as developing and implanting policy to  
316 mitigate against threats. People's situation after an earthquake depends on how well they are  
317 prepared for the event, so developing policy, for example, on construction quality depending on  
318 expected shaking intensities is advised. Since the shaking level of an earthquake cannot be  
319 controlled, the impact of an earthquake on the community is strongly dependent on the actions  
320 taken by the government for its preparedness, such as education (so far our program's effort) as  
321 well as, for example, a suitable, locally calibrated and enforced building code. For both aspects,  
322 the provincial governments could overtake some of the efforts drawing on our bottom-up  
323 approach, and adapt them to continue earthquake education in schools, which is an efficient way  
324 to make earthquake safer communities. In parallel, local initiatives are encouraged to strengthen  
325 these efforts.

326

## 327 **CONCLUSIONS**

328 The Seismology at School in Nepal program has been successfully implemented and achieved the  
329 aim of raising earthquake awareness and preparedness by educating students in their schools. The  
330 program itself and the methods we used for teaching about earthquakes and demonstrating with  
331 low-cost seismometers are well accepted by students and teachers. The new knowledge learned by  
332 the students at school reaches their parents and is transferred into the local community. The results  
333 we observed through two surveys, before and after initiation of the education program, are  
334 measurable, statistically significant and with positive changes for earthquake related knowledge  
335 and preparedness level, but not (yet) for the perception of the related risk. A high and positive

336 impact of the program on the students and their communities is encouraging for the continuation  
337 and expansion of the program in the region. Governmental institutions are encouraged to build on  
338 this experience as well as develop further policy to mitigate the risk of future earthquakes in Nepal.

339

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350 translation and typesetting of the survey questionnaire in Nepali language.

351

352 Figure 1: Map of Nepal, with the locations of schools participating in the Seismology at School in  
353 Nepal program. Background represents population density data (CIESIN and CIAT, 2005). The  
354 Main Frontal Thrust (MFT), the surface trace of the fault underlying most of Nepal and hosting all  
355 great earthquakes in the region, is indicated in red solid line. Three colored segments represent the  
356 rupture extent of the corresponding major and great earthquakes with moment magnitude ( $M_w$ ) as  
357 indicated (after Bollinger et al., 2016). For the 2015 Gorkha earthquake the rupture area is also  
358 plotted (blue contour). Letters P and K refer to cities Pokhara and Kathmandu, respectively,  
359 marked with black circles.

360

361 Figure 2: Students gathered at the morning assembly in the *Shree Himalaya Secondary School,*  
362 *Barpak, Gorkha* district. The school building was damaged during the 2015 earthquake and  
363 students were in temporary shelters. The construction of the new building is visible at the top of  
364 the picture. (Photo: S. Subedi, in May 2018, with permission of the school).

365

366 Figure 3: Left: The Raspberry Shake 1D low-cost seismometer, installed in 22 schools across  
367 Central Nepal (Fig. 1). Right: Earthquake awareness sticker, as a reminder, in English and Nepali  
368 language (artwork of M. Dessimoz). The sticker image is available for download from our  
369 program's webpage: [www.seismoschoolnp.org](http://www.seismoschoolnp.org).

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371 Figure 4: Educational flyer in Nepali language on what to do before, during and after an  
372 earthquake. The flyer has been translated and adapted from an English version, compiled by and  
373 available from the CPPS earthquake education centre in Sion, Switzerland ([www.cpps-vs.ch](http://www.cpps-vs.ch)). The  
374 Nepali flyer is available for download from our program's webpage: [www.seismoschoolnp.org](http://www.seismoschoolnp.org).

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376 Figure 5: Student opinions on what causes earthquakes (Q1), before and after the initiation of our  
377 education program. ( $\chi^2 = 78.15$ , p-value =  $< .00001$ , the change is significant).

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379 Figure 6: (a) Student views on how likely the occurrence of a next earthquake bigger than the 2015  
380 Gorkha earthquake is (Q3), before and after the initiation of our education program. ( $\chi^2 = 43.59$ ,  
381 p-value =  $< .00001$ , the change is significant). (b) Student answer on the outcome of a potential  
382 Mw>8 earthquake in Nepal (Q2), before and after the initiation of our education program.  
383 \*Multiple answers were possible.

384

385 Figure 7: Students' personal knowledge about earthquakes (Q13), before and after the initiation of  
386 our education program. \*Multiple answers were possible.

387

388 Figure 8: Student's knowledge on the recommendation to avoid making phone calls after an  
389 earthquake to leave lines available for rescue operations (Q6), before and after the initiation of our  
390 education program. ( $\chi^2 = 138.72$ , p-value =  $< .00001$ , the change is significant).

391

392 Figure 9: Student's own opinion on earthquake preparedness (Q14), before and after the initiation  
393 of our education program. \*Multiple answers were possible.

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395 Figure 10: Student activities to transfer the knowledge to the community (question e), after  
396 initiation of our education program.

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Figure 11: Student ideas about earthquake adaptation (Q15), before and after the initiation of our education program. \*Multiple answers were possible.

Figure 12: Students' perception of the level of seismic risk in their respective location (Q10), before and after the initiation of our education program. ( $\chi^2 = 6.33$ , p-value = 0.042, the change is slightly above significant level).

No	Question	Answer in 2020 survey			Answer in 2018 survey		
		Yes	Partially	No	Yes	Partially	No
Q7	If a large earthquake occurred at night, could you save yourself?	65%	-	35%	43%	-	57%
Q8	Do you know that the majority of injuries that occur in earthquakes are caused by people being hit by or stumbling over fallen objects?	93%	-	7%	76%	-	24%
Q9	Do you know that earthquakes can make additional damage such as fire, landslides and floods?	68%	21%	11%	75%	14%	11%
Q11	The preparedness for a major earthquake is the most important thing. Are you	71%	-	29%	53%	-	47%

	regularly discussing this topic with your family?						
Q12	Are you interested to know more about earthquakes and its preparedness in details?	98%	-	2%	98%	-	2%

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411 Table 1: Questions and respective answers about earthquake preparedness among students who  
 412 participated in the surveys, before and after our education program was initiated in Central Nepal.

413 Respective statistical indicators are reported in Supplementary Table 1.

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### 537 **CONFLICT OF INTEREST AND ETHICS**

538 The authors declare that the research was conducted in the absence of any commercial or financial  
539 relationships that could be construed as a potential conflict of interest. The authors declare that an  
540 ethical approval was not required as per local legislation. The authors declare that they have no  
541 conflict of interest.

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### 544 **AUTHOR CONTRIBUTIONS**

545 The project concept and implementation details were developed by S.S. and G.H. Most of the  
546 fieldwork was carried out by S.S. with some help by G.H. The preparation of the manuscript,  
547 figures, tables and the calculations were done by S.S. and guided and verified by G.H and R.S. All  
548 authors discussed the results, and contributed to the final manuscript.

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### 550 **SUPPLEMENTARY MATERIAL**

551 The Supplementary Material for this article can be found in supplementary material file.

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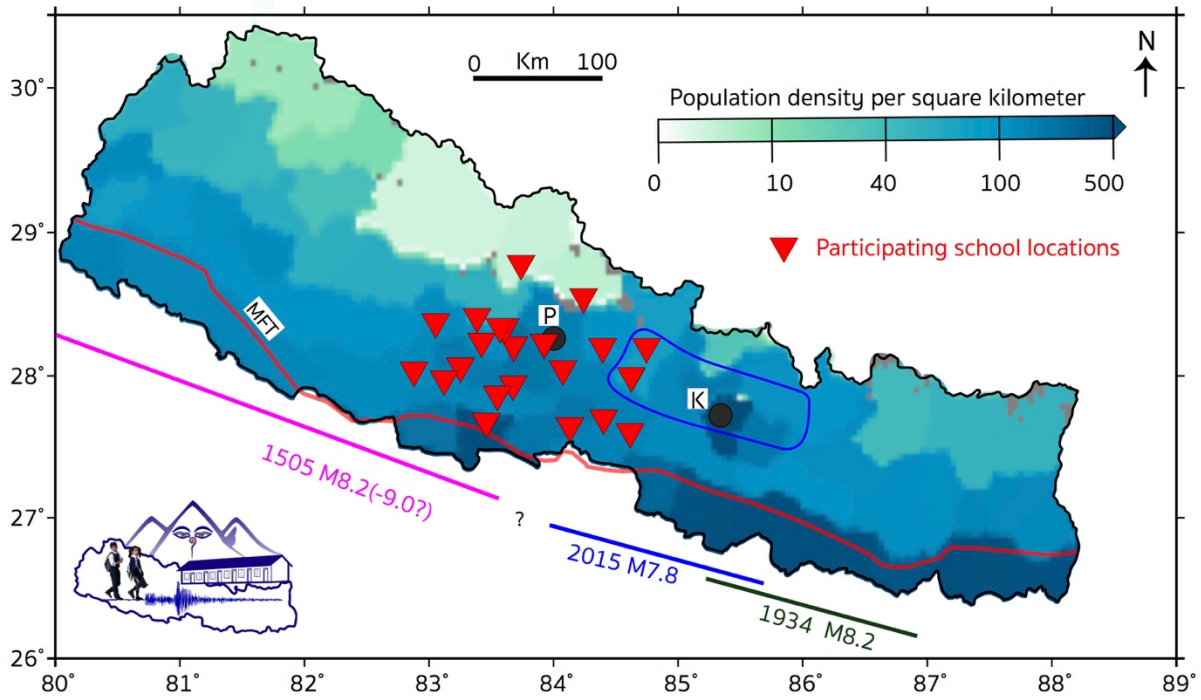
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### 554 **DATA AVAILABILITY STATEMENT**

555 The datasets used for this study can be available on request to corresponding author.

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557 Figure 1



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559 Figure 2



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565 Figure 3



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**1 भुकम्प जानुपूर्वका तयारी**

**सुरक्षित ठाउँ पत्ता लगाउनु**

तपाईं आफैलाई सुरक्षित गर्नको लागि सुरक्षित ठाउँहरू खोज्नुहोस् - टेबलमुनी अथवा बेन्चमुनी वा ढोकाको फ्रेम आदी !

**वरीपरी हेर्नुहोस्**

दराज वा झुण्डाइएका समानहरू राम्रोसँग पखालामा (मितामा) अडिएको छ छैन चेक गर्नुहोस् । अल्लो ठाउँमा भएका गह्रौं सामानहरू हटाउनुहोस् । पानीका भाडा, ग्यास चुलो र बिजुलीका स्विचहरू कहाँ छन् याद गर्नुहोस् ।

**अत्यावश्यक सामग्रीको तयारी**

अत्यावश्यक सामग्रीको किट (Kit) तयार गर्नुहोस् र सजिलै उपलब्ध हुने ठाउँमा राख्नुहोस् ।  
अत्यावश्यक सामग्रीहरू  
पानी/ लामो समयसम्म नकहिने खानेकुरा / फस्ट एक किट/  
सानो ब्याट्री/ टर्चलाइट ब्याट्री सहित/ तातो कपडाहरू/ ब्यान्डेज/ आँफ्नो परिचय दिने कागजको प्रतिलिपी/ केही पैसा आदी ।

**आफैले अभ्यास गर्नुहोस्/ तालीम लिनुहोस्**

आधारभूत जीवन रक्षा विधिसँग अभ्यास हुनुहोस् । यदी परिवारका सदस्यहरू फरक फरक ठाउँमा हुनुहुन्छ भने आपतकालिन अवस्थामा भेट्ने ठाउँ दुबैको लगाउनुहोस् ।

**2 भुकम्प जाँदै गर्दा**

**कहिले र कहाँ जाने ?**

पहिलो झट्टका अनुभव भएको जतिसक्दा छिटो पहिले छनोट गरेको सुरक्षित ठाउँमा जानु होस् । भयाङ्क र लिफ्ट प्रयोग नगर्नुहोस् । यदी भवनको बाहिर हुनुहुन्छ भने अलिक टाढा जानुहोस् ।

**आश्रयस्थल पत्ता लगाउनु**

यदी तपाईं विद्यालयमा हुनुहुन्छ भने तुरुन्तै टेबलमुनी आश्रय लिनुहोस् । टेबलका खुट्टाहरू बलियोसँग समात्नुहोस्, भुकम्प जाँदै गर्दा टेबलहरू सरेन सक्छन ।

**भवन बाहिरको जोखिम**

यदी तपाईं भवनबाहिर हुनुहुन्छ भने बाहिरी बस्तुहोस् र भवनभन्दा टाढा जानुहोस्, उच्च विद्युतिय लाइन वा अन्य घस्तुहरू खल्न सक्ने ठाउँभन्दा टाढा जानुहोस् । भिरालो ठाउँबाट टाढा जानुहोस् भुकम्पले पहिरो जान सक्छ, ढुङ्गा खल्न सक्छन् ।

**कारभित्र/बसभित्र**

यदी तपाईं कार/बसभित्र हुनुहुन्छ भने खुल्ला ठाउँमा रोक्नुहोस् सवारी भित्र नै बस्नुहोस् । पुलमाथी तथा आकाशो पुलमुनी पाकिड नगर्नुहोस् ।

**3 भुकम्प पछाडी सतर्क रहनुहोस्**

**भुकम्पको झड्का सकिदा बित्तिकै**

जब पहिलो झड्का रोकिन्छ, यदी सम्भव छ भने पानी/ग्यास र बिजुली बन्द गर्नुहोस् । अत्यावश्यक सामग्री लिनुहोस् र भवनबाट बाहिर निस्कनुहोस् ।

**सावधानीपूर्वक बस्नुहोस्**

चेतावनी ! पछ्टा भुकम्प पछाडी अरु कम्पनहरू पनि आउने सक्छन, जसलाई पराकम्पन भनिन्छ । कम्पनको कारणले उत्पन्न हुने अन्य जोखिमहरू जस्तै पहिरो, बाढी, आगोलागीको बारेमा सचेत हुनुहोस् ।

**मेडिकल केयरको सुनिश्चित गर्नुहोस् ।**

तपाईं आफ्नो चोट जाँच गर्नुहोस्, तपाईंको वरिपरी यदी कोही जटिल र अच्यारो अवस्थामा देख्नभयो भने सहयोग गर्नुहोस् । अन्य जानकारीका लागि र निर्देशनहरूका लागि रेडियो/टेलिभिजन सुनुहोस् ।

**अत्यावश्यक सेवाहरू**

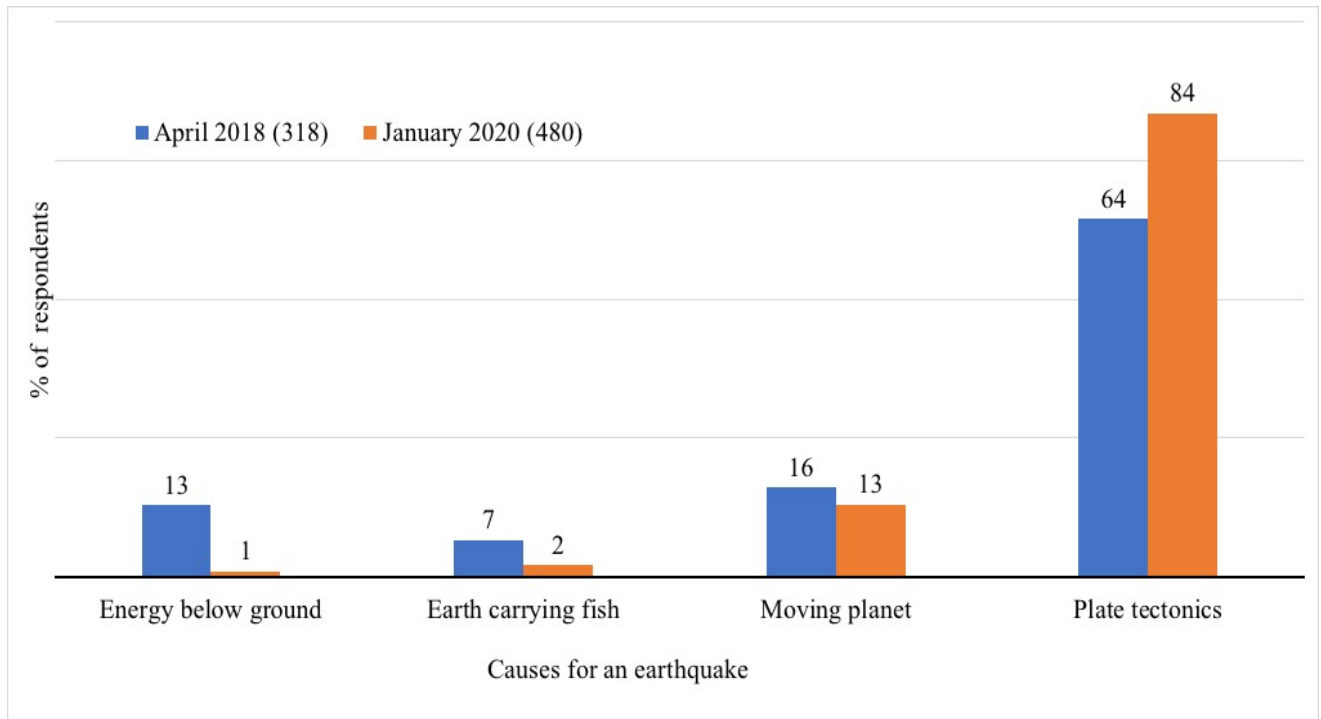
आफना साथी र परिवारलाई बारम्बार सम्पर्क गरेर टेलीफोन लाइन व्यस्त नबनाउनुहोस् । अत्यावश्यक सेवालाई प्राथमिकता दिनुहोस् ।

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600 Figure 5



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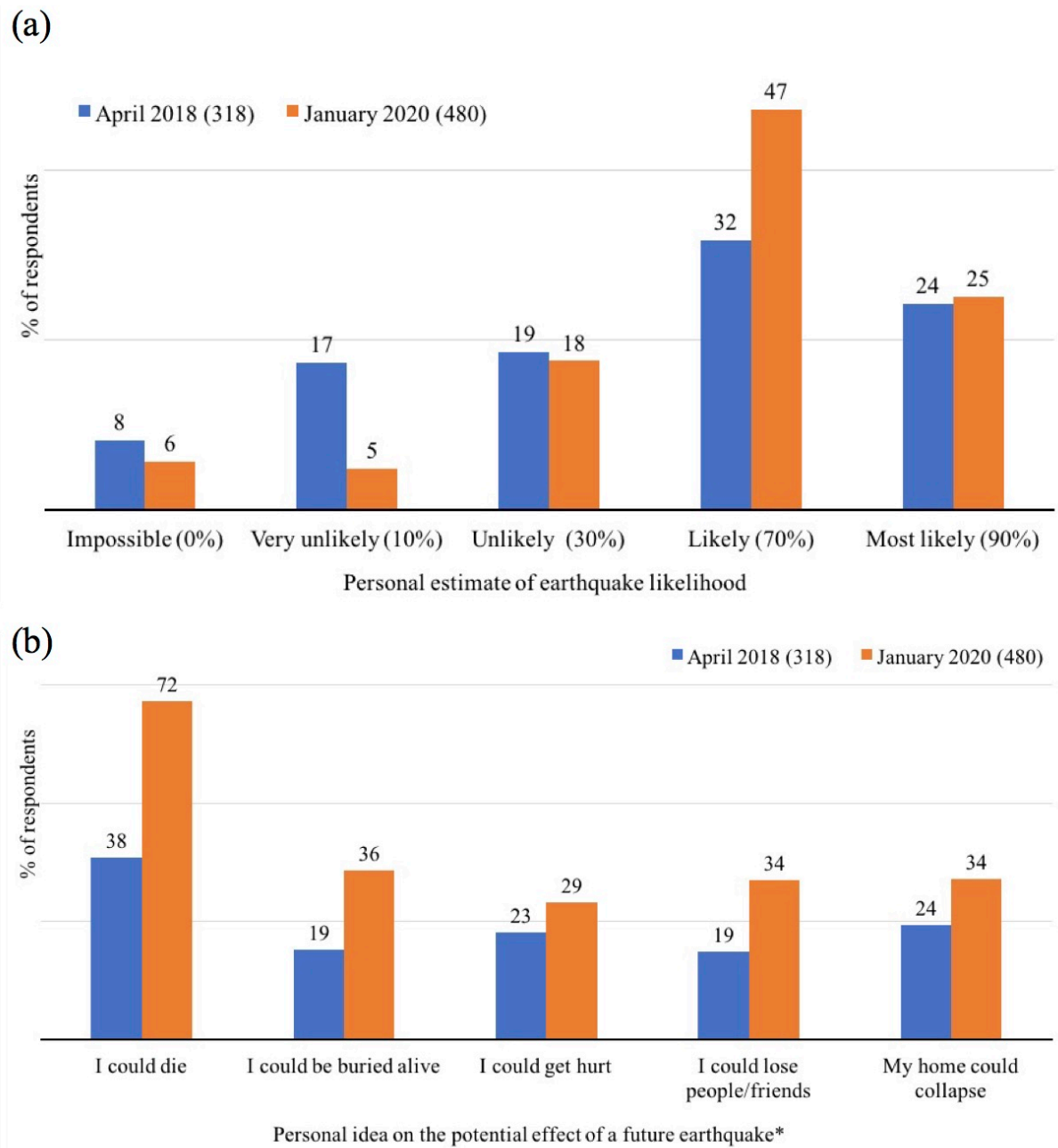
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Figure 6

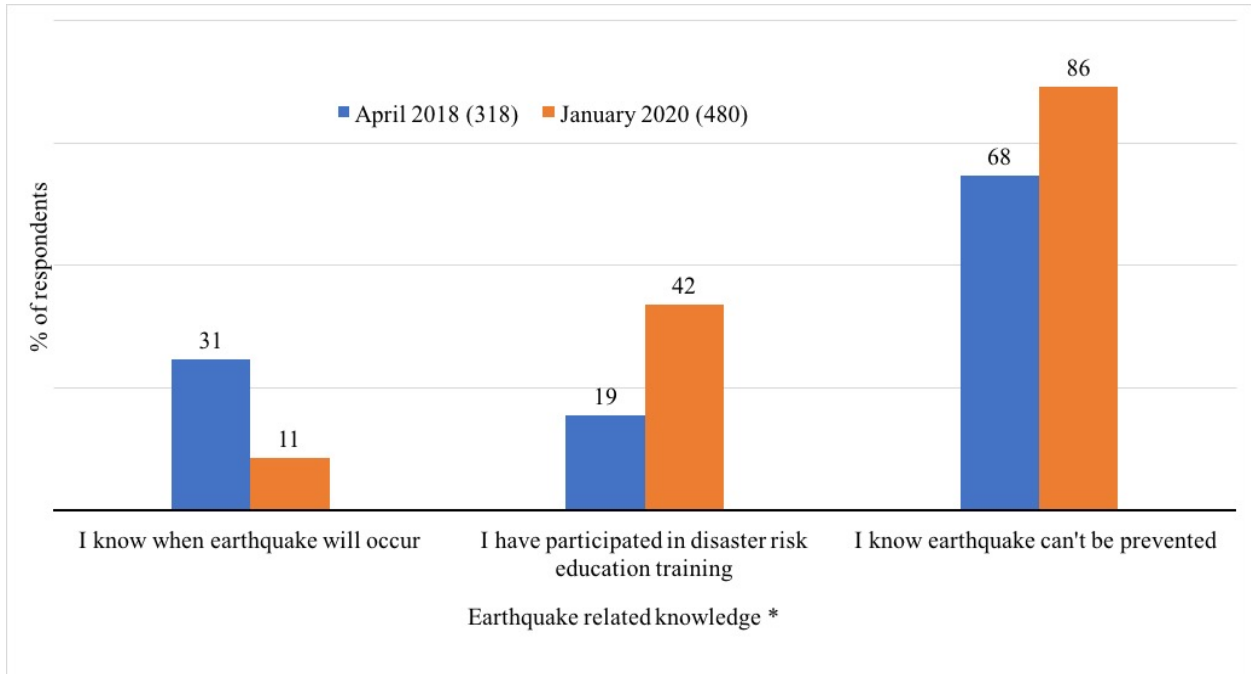


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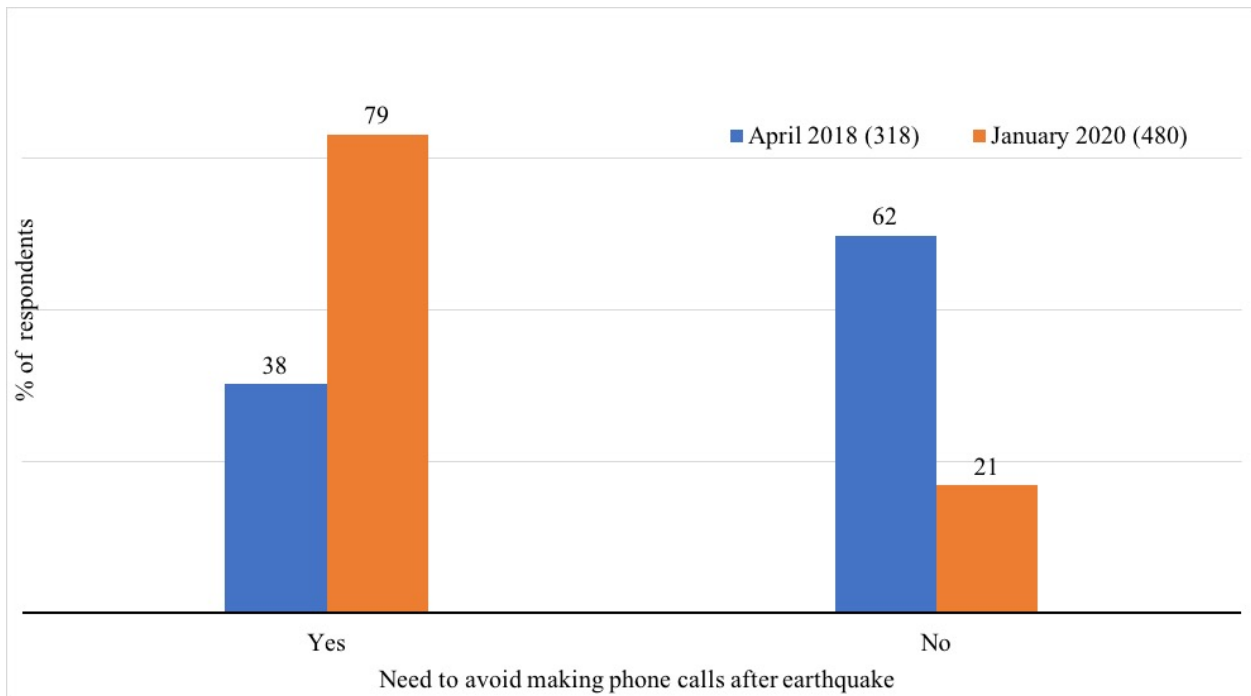
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Figure 7



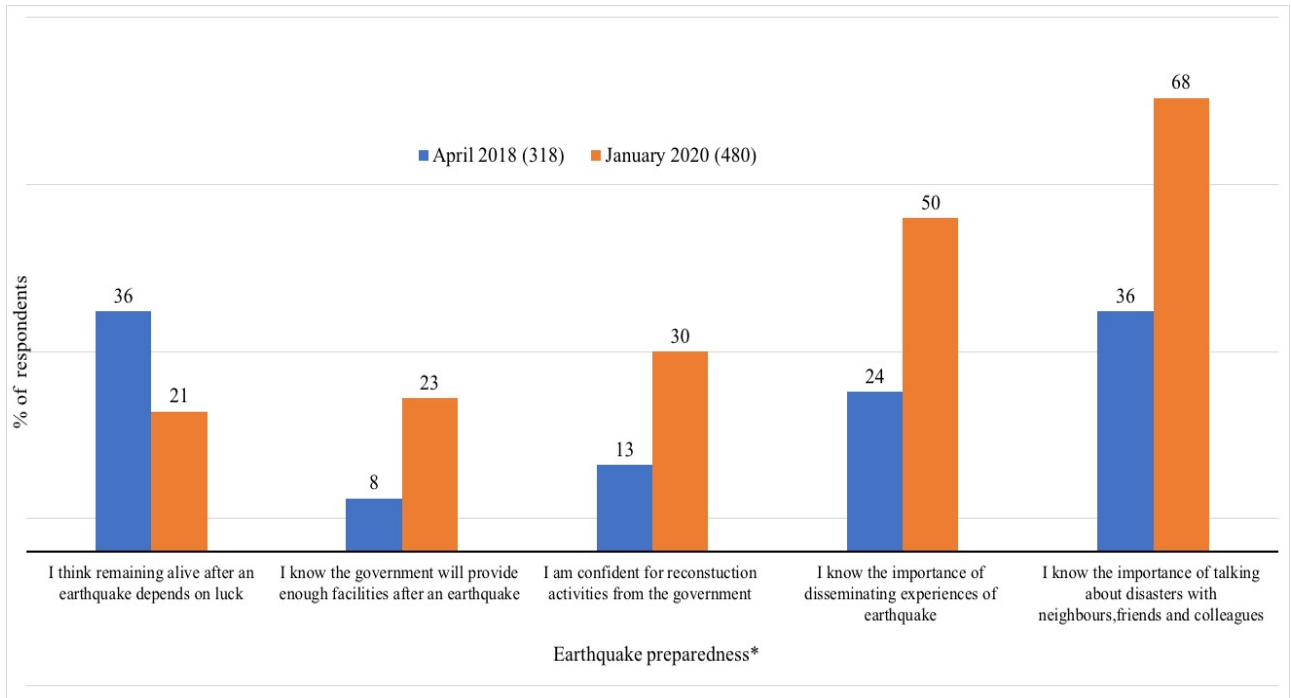
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Figure 8



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633 Figure 9

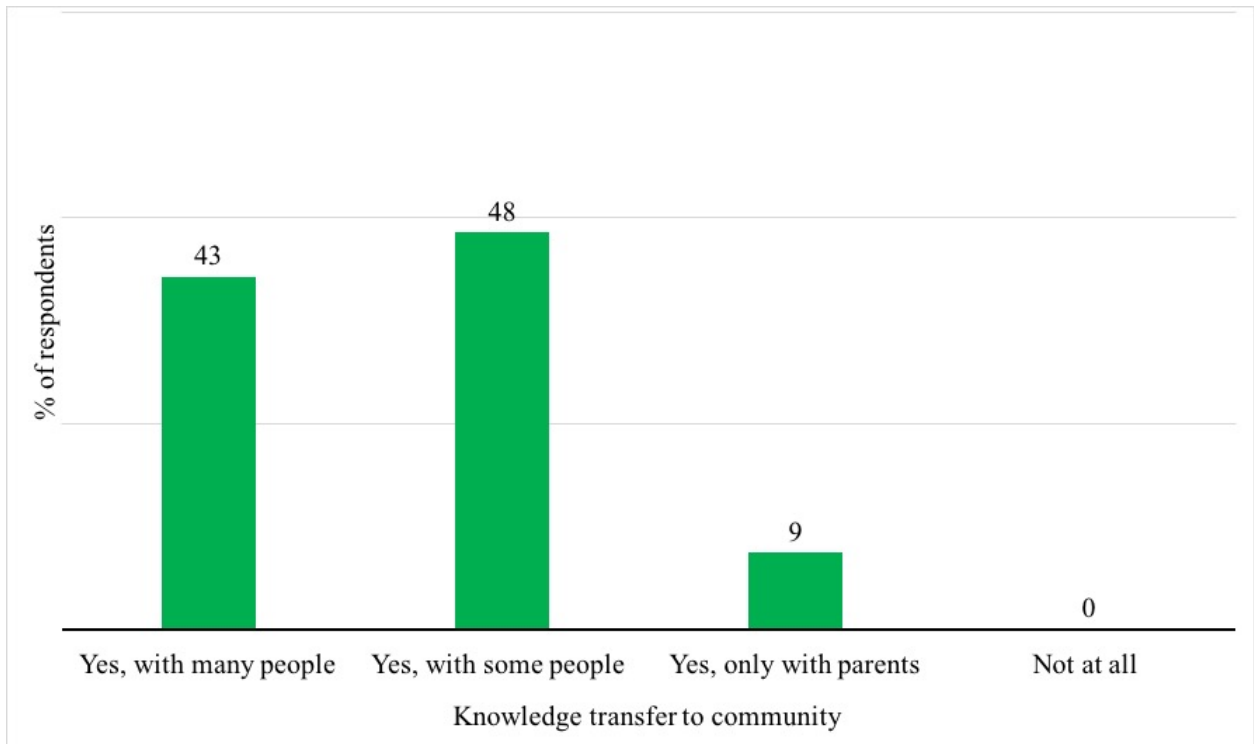


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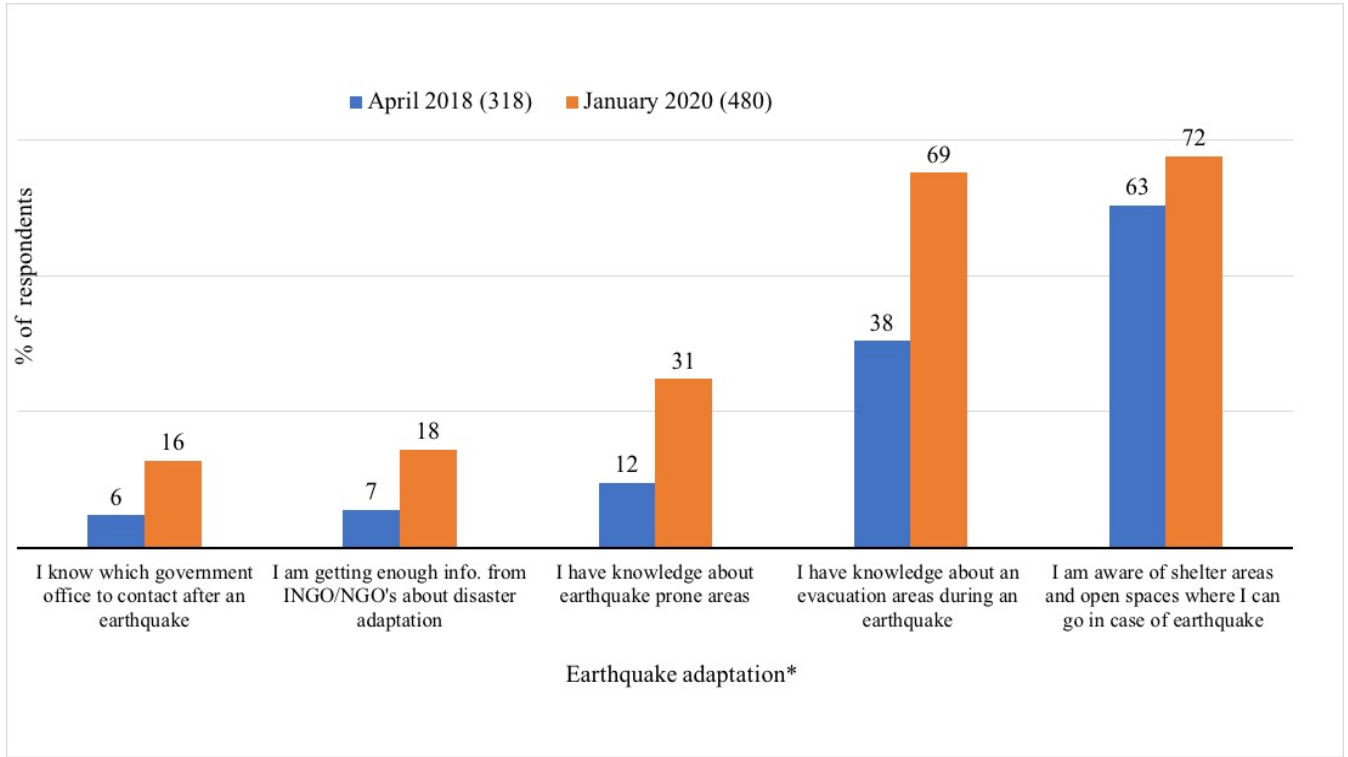
637 Figure 10



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640 Figure 11

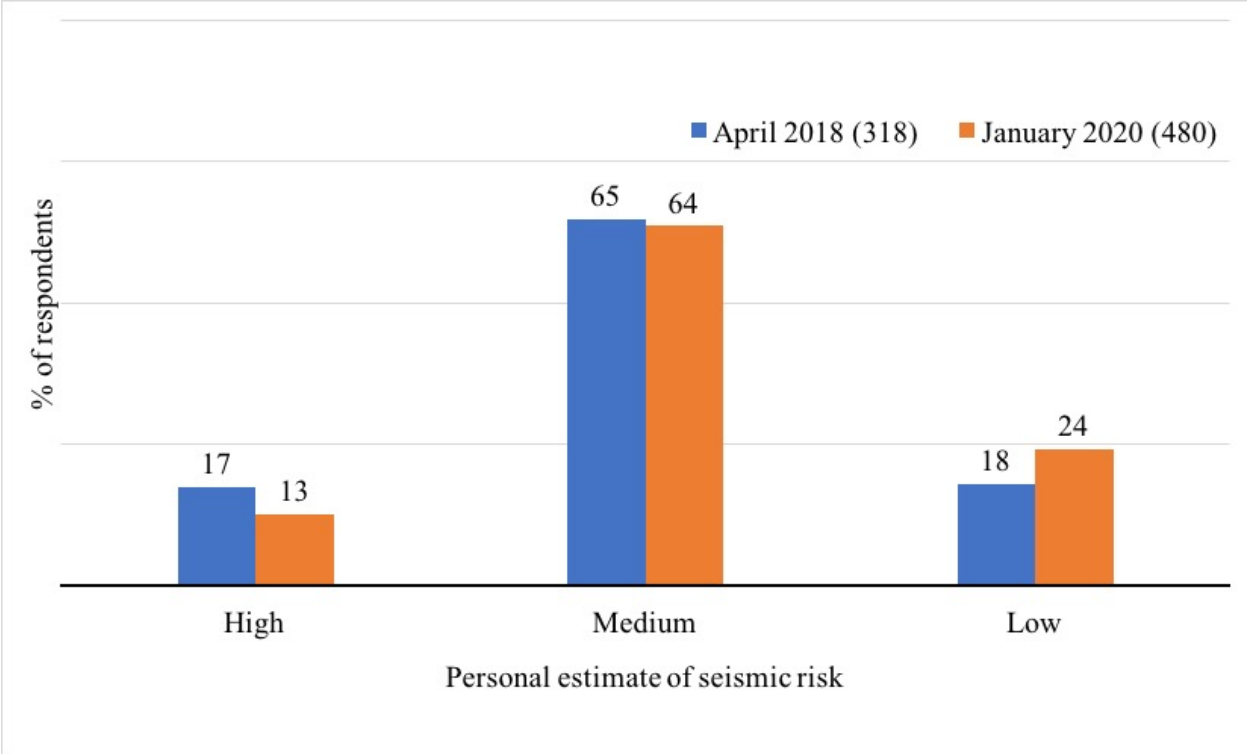


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644 Figure 12



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