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

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11   **ABSTRACT**

12   Scientific education of local communities is key to help in reducing 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 very much. The high and positive impact of the

25   program on the students and the community is encouraging in the continuation and expansion of

26   the program.

INTRODUCTION

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

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

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

58 have been more adequate and the negative impacts might have been reduced (Hall & Theriot,
59 2016).

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

72

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

83

84

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

89   Before the initiation of the education program, we undertook fieldwork to help inform our strategy

90   and the educational materials, and to ensure the education program was well adapted to the Nepali

91   education system. In 2018, during the first visit to schools, we talked with the school leaders about

92   the program and its benefits, and gave sample lectures (ca. 1-2 hours including questions) to

93   students between the ages of 14-16, providing key information on earthquakes. Before the sample

94   lecture and in each school, students were requested to complete in a paper questionnaire survey on

95   earthquake related questions. In special lectures we also taught students how to prepare before an

96   earthquake, how to save lives during an earthquake, and what to do after an earthquake. We also

97   provided a flyer containing detailed information and pictures (Fig. 4), of which we distributed 500

98   copies. Similarly, we designed a sticker to remind people about earthquake hazards (Fig. 3), and

99   distributed this to students and teachers (3'000 so far).

100   In April-May 2019, during the second school visit, the program was fully implemented with the

101   installation of an educational, low-cost seismometer in every school. The seismometer's record is

102   displayed on a computer, which is easily accessible to students in their physics class, or through

103   an online application. During the visit, we also identified the open place near the school where

104   students should meet in case of earthquake and installed an Emergency Meeting Point sign in

105   Nepali. To increase the efficiency of the learning and to ensure long-term uptake, we organized a

106   2-day workshop for nearly 100 school teachers, which was very well received. The full details of

107   the program are documented in an earlier paper (Subedi et al., 2020) and all the material is

108   accessible on the program website (www.seismoschoolnp.org).

109

110   In this article, we focus on evaluating the efficiency of our program in terms of the knowledge and

111   behavior change of students related to earthquakes. Out of 22 schools participating in the program,

112   15 schools were chosen for the survey, covering a range of socio-economical contexts. Students

113   for the surveys were selected randomly from grades 9 and 10, representing the 14-16-year-old age

114   group. The total number of responses collected was 318 in 2018 and 480 in 2020, respectively.

115   For logistical reasons, some responses in the pre- and post-survey (27 %) came from different

116   schools, but this is not expected to affect the results as they were independent samples. While the

117   first set of students surveyed had received no earthquake education whatsoever, those who filled

118   out the second survey were exposed to information and lectures frequently about earthquakes from

119   the teachers who were trained in our program.

120 When the exact same question was asked before and after our program's implementation, we
121 quantify the change using χ^2 test analysis. In doing so, our null hypothesis (H_O) is that our program
122 had no effect on the students. If this null hypothesis is unconfirmed (i.e., the χ^2 value is above the
123 threshold for the corresponding number of possible answers, and the respective p-value is below
124 5%), then we interpret that the program had an effect on the students as their answers show a clear,
125 statistically significant change. The complete set of questionnaires are available in the
126 Supplementary materials file.
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130 **RESULTS**
131 The first measurement of this study, performed in the 2018 survey, was about the experience of
132 the 2015 Gorkha earthquake. The majority of respondents, 94 %, felt the shaking. As the
133 earthquake was on Saturday, schools were closed and students were at home; 71 % of students
134 answered that they ran out of a building, and only 15 % hid under a table, 8 % did not know what
135 to do, 3% stood next to the wall or the doorframe, 3% had other reactions.
136

137 **Knowledge about the causes and possibility of earthquakes in Nepal**
138 Before the implementation of the program, 7 % students believed that earthquakes were caused by
139 a moving fish carrying the Earth (a Hindu belief and myth). However, 64 % still chose the correct
140 scientific answer: plate tectonics. The majority of students, 84 %, chose the "plate tectonics"
141 answer in 2020, and the percentage of responses relating to the cultural/religious reasons dropped
142 to 2 % (Fig. 5).
143 Regarding the probability of a future earthquake greater than in 2015, more students knew that
144 such an earthquake in their region was quite likely after the education program (Fig. 6a). At the
145 same time, there was a clear drop in the number of responses for very unlikely (17 % in 2018 to 5
146 % in 2020) and a slight drop in the percentage answering that a future great earthquake is
147 impossible.
148 Relating to the effects of a Mw > 8 earthquake, after the program, the answer *I could die* has
149 increased by a factor of 1.8, and all other answers (*I could be buried alive*, *I could get hurt*, *I could*

150 *lose friend* and *My home could collapse*) are increased by a factor of at least 1.3 compared to 2018

151 (Fig. 6b; multiple answers were possible).

152 In 2018, 31 % students answered they know when an earthquake will occur, which is reduced to

153 11 % in 2020. The answer itself is not true, and this mis-information could drive people to

154 incorrectly prepare for or act during an earthquake. While our efforts clearly decreased this mis-

155 conception among the students, we could not yet reach each and every student to teach them about

156 the unpredictability of earthquakes. The students' answer agreeing on the impossibility of

157 preventing an earthquake was 86 % in 2020, showing an   absolute increase of 18 % from 2018.

158 This question also shows that by 2020, more than double of the respondents have participated in

159 disaster risk education training compared to 2018 (Fig. 7).

160

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

162 Three quarters (75 %) of students in 2020 responded that their family knew what to do and where

163 to go during an earthquake, an increase of 55 % from 2018. Only 37 % of students in 2020 believed

164 that their home could resist a large earthquake. For comparison, 65 % students were scared and 22

165 % panicked during the Gorkha earthquake in 2015 (10 % had calm reactions, 3 % did not care)

166 according to answers in 2018.

167 In 2018, 62 % respondents didn't know that they should not call others after an earthquake to leave

168 the phone lines available for rescue operation, but in 2020 nearly 80 % students knew this useful

169 practical point (Fig. 8).

170 After the implementation of our program, 65 % of the students believed that they could survive if

171 a large earthquake occurred at night, whereas 43 % felt they could survive in 2018. This

172 information reflects more confidence of students as they become familiar with earthquake topics

173 and have heard more information about them.

174 In 2020, 93 % of children knew that during an earthquake, the majority of injuries and deaths are

175 caused by people being hit by objects, through the collapse of constructions; the proportion of

176 people not knowing this dropped by 2/3 after the educational program was implemented. More

177 than 2/3 of the students in 2020 were aware about the additional hazards, such as fires, landslides

178 and floods that can be triggered by an earthquake. There is a 7% decrease for this answer since the

179 2018 survey, but as students who claimed partial knowledge increased by 7 % as well, a net change

180 in knowledge is not really perceptible on this point.

181   The proportion of students who regularly discuss earthquake related topics within their families
182   has increased by 18 % (absolute increase; see Table 1). This shows that the education program at
183   schools has led to widespread social learning within communities. This is reinforced by the finding
184   that nearly all students (98 %) are interested in learning more about earthquakes in detail, which
185   will aid communities towards better earthquake preparedness in the long run.
186

187   **Earthquake preparedness and adaptation**
188   In 2018, 36 % of students perceived that to remain alive during an earthquake depends on luck,
189   while this number has decreased by a relative 60 % after our program started and is a concern for
190   only 21 % of students (Fig. 9). All possible answers regarding adaptation options to earthquakes
191   record an increase from 2018 to 2020 (Fig. 11). The majority (72 %) of respondents answered that
192   they are aware of the shelter areas and open spaces where they can go in case of an earthquake.
193   The same proportion of people are aware of evacuation areas in 2020, but the increase here is much
194   more important (from 38 to 69 %), potentially thanks to the Nepali Emergency Meeting Point signs
195   we installed in schools. The information about which governmental authority to contact after an
196   earthquake is relatively low, but has increased by 10 % (absolute). Information about earthquake
197   prone areas and the reception of knowledge on earthquake disaster adaptation have increased by
198   the factor of 2.5, from 12 % in 2018 to 31 % in 2020 after the education program.
199   The relatively small number of respondents who claimed that the government will provide help
200   after an earthquake increased by a factor of almost 3: from 8 % in 2018 to 23 % in 2020. This
201   percentage is not yet sufficient in general, but the improvement following our program's
202   implementation is noteworthy. Moreover, the level of confidence in the government's
203   reconstruction activities has also grown, from 13 to 30 %, which is a good sign and shows
204   increasing level of trust. In 2020, 68 % of the respondents knew about the importance of talking
205   about earthquakes with neighbours, friends and colleagues, a nearly two-fold increase in two years.
206   Furthermore, we found that all students discussed their new knowledge and learning about
207   earthquakes with the people around them in the community. Ninety-one percent of the students
208   had talked to at least with some people in the community, only 9 % had discussed this with their
209   parents only, and there is no student who had not had a discussion in her/his surroundings (Fig.
210   10).
211

Perception of risk

More than 60 % of the answers showed that students considered the level of seismic risk in their city as medium, which means their risk perception is underestimated with respect to the actual seismic risk level in the region (Stevens et al., 2018). Only every 6th person claims to perceive high risk, which is clearly less frequent than people declaring low risk. As opposed to our expectation, there is very little change in the level of risk perception in the group of students from 2018 to 2020: the medium risk level group is the same, and there is minor change in low and high-risk level groups (Fig. 12). This result is a surprise, especially when compared to the 72 % of responses in 2020 who believe that there is more than 70 % chance of experiencing an earthquake larger than the 2015 Gorkha earthquake in their life (Fig. 6a).

Project acceptance and future education

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

Statistics

All questions except the last (Question 12 in Table 1, level of interest to learn is 98% in both surveys) record a clear change in the pattern of answers given following our program's implementation (see Supplementary Table 1). The biggest statistical change was seen for Question 6 (avoid post-earthquake use of mobile communications) suggesting a big increase in knowledge

242 and very new information. Each question (excluding those with multiple choice answers) and their

243 corresponding χ^2 and p-values are reported in the Supplementary Table 1.

244

245

246 **DISCUSSION**

247 **Have earthquake awareness levels increased?**

248 As a result of the novel school-based education program, themes related to earthquakes are more

249 familiar to the students now than in the past, and their awareness levels have increased since the

250 program was initiated. Students know more about the earthquake phenomena and have changed

251 their behavior to better prepare and adapt to forthcoming earthquakes. Earthquake related

252 knowledge learnt by students at schools has also reached across the broader community, though

253 social learning processes (Reed et al. 2009).

254

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

256 Beyond the prescribed school education, our program has provided an opportunity for informal

257 and free-choice education forms, in which people can learn about topics outside of formal

258 educational settings, which has been well supported by enthusiastic teachers (Falk & Dierking,

259 2002). This form of social learning enables an increase in knowledge, and through further

260 communication with others, it spreads knowledge in communities, which may lead to changes in

261 attitudes, behavior, and building of trust in society (Reed et al., 2010). This method is widely

262 applied for the study of natural hazards and its management (e.g. Brody, 2003; O'Keefe et al.,

263 2010). During our program's implementation, despite being in contact only with the school

264 children, the knowledge has spread much more widely in local communities through social

265 learning, thus reaching and impacting the original and intended target group.

266 People's behavior can also be developed through education. The idea is that if people are made

267 more knowledgeable about earthquakes, they are more likely to adopt and perform behaviors that

268 will increase their earthquake awareness and preparedness (Hungerford and Volk, 1990). This has

269 similarly been shown for other environmental issues like invasive species, where campaigns

270 building knowledge and awareness changed behaviors therefore reducing risk (e.g. Cole et al.

271 2019).

272 As a result of our educational program, earthquake related knowledge has increased and the
273 behavior necessary to cope with earthquakes has also changed. Despite this, the earthquake risk
274 perception of students has not yet greatly changed. Our results show that a realistic and appropriate
275 distribution of earthquake related knowledge and increased awareness level are not (or not yet)
276 sufficient to influence the perception of risk. Perception is a complex phenomenon and can take a
277 long time to change (De Dominicis et al., 2015; Estévez et al., 2015; Cole et al., 2019; Shackleton
278 et al., 2019). Education and awareness raising is a key factor for changing long-term risk
279 perceptions – although programs need to be well tailored to appropriate audiences (Lee et al.,
280 2015). Although, some studies discuss the fact that increased knowledge does not always relate to
281 increased risk perceptions, and increasing perceived risk does not necessarily result in the
282 reduction of risk behavior (e.g. Noroozinejad, 2013; Petros, 2014). In addition, knowing more of
283 a given topic makes people more certain, self-confident, which may lead to underestimate the
284 related risk (e.g. Stringer, 2004). Moreover, increased knowledge and behavior to adapt and to feel
285 more secure during an earthquake should reduce the fear of associated risk and therefore reduce
286 the risk perception. The limited change in risk perception in this study may be due to better
287 knowledge of the hazard and how to mitigate it (Ndugwa Kabwama and Berg-Beckhoff, 2015).
288 Hence, how people perceive risk is not necessarily related to the actual risk. We cannot draw a
289 definitive conclusion as the related knowledge can contribute to the amplification or the
290 attenuation of the related risk; as such, it could be one of the potential reasons for the low risk
291 perception of people having more knowledge (Reintjes, 2016). Risk perception is thus important
292 for preventative actions, but risk perceptions are often biased (Weinstein, 1988). It could be that
293 more time is needed to change students' risk perceptions, and it is also likely that there are other
294 factors such as economic status, gender, age group, location of home in city, etc. that may influence
295 the level of risk perception of people. A repeated survey in the same age category in a few years'
296 time may give more insight into this question. We suggest that further monitoring and adaptation
297 of the education system might be needed to better link awareness raising, behavior change and risk
298 perception change.
299
300
301 **Further action needed**

302 Since other sources of information, such as newspapers and television, are not easily available to
303 people in the Nepali countryside, we believe that the school is the best platform to transfer
304 knowledge to the community. The proper education at school reaches deep within the families and
305 into the community, and the discussions in those circles are essential to prepare the whole society
306 for future earthquakes. The proportion of students who regularly discuss earthquake related topics
307 within their families has increased by 18 % (absolute increase; see Table 1). This shows that the
308 education program at schools has led to widespread social learning within communities, and
309 possibly beyond our program's current area. We therefore, advocate for a continuity of this
310 program and to get education about environmental hazards more deeply embedded in the Nepali
311 education system.

312

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

329

330 **CONCLUSIONS**
331 The Seismology at School in Nepal program has been successfully implemented and achieved the
332 aim of raising earthquake awareness and preparedness by educating students in their schools. The

333 program itself and the methods we used for teaching about earthquakes and demonstrations using

334 low-cost seismometers are well accepted by students and teachers. The new knowledge learned by

335 the students at school reaches their parents and is transferred into the local community. The results

336 we observed through two surveys, before and after initiation of the education program, are

337 measurable, statistically significant and with positive changes for earthquake related knowledge

338 and preparedness level, but not (yet) for the perception of the related risk. A high and positive

339 impact of the program on the students and their communities is encouraging for the continuation

340 and expansion of the program in the region. Governmental institutions are encouraged to build on

341 this experience as well as develop further policy to mitigate the risk of future earthquakes in Nepal.

342

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354

355 Figure 1: Map of Nepal, with the locations of schools participating in the Seismology at School in

356 Nepal program. Background represents population density data (CIESIN and CIAT, 2005). The

357 Main Frontal Thrust (MFT), the surface trace of the fault underlying most of Nepal and hosting all

358 great earthquakes in the region, is indicated in red solid line. Three colored segments represent the

359 rupture extent of the corresponding major and great earthquakes with moment magnitude (Mw) as

360 indicated (after Bollinger et al., 2016). For the 2015 Gorkha earthquake the rupture area is also

361 plotted (blue contour). Letters P and K refer to cities Pokhara and Kathmandu, respectively,

362 marked with black circles.

363

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

368

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

373

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

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379 Figure 5: Student opinions on what causes earthquakes (Q1), before and after the initiation of our
380 education program. ($\chi2 = 78.15$, p-value = < .00001, the change is significant).

381

382 Figure 6: *(a)* Student views on how likely the occurrence of a next earthquake bigger than the 2015
383 Gorkha earthquake is (Q3), before and after the initiation of our education program. ($\chi2 = 43.59$,
384 p-value = < .00001, the change is significant). *(b)* Student answer on the outcome of a potential
385 $Mw>8$ earthquake in Nepal (Q2), before and after the initiation of our education program.
386 *Multiple answers were possible.

387

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

390

391 Figure 8: Student's knowledge on the recommendation to avoid making phone calls after an
392 earthquake to leave lines available for rescue operations (Q6), before and after the initiation of our
393 education program. ($\chi2 = 138.72$, p-value = < .00001, the change is significant).

394

395 Figure 9: Student's own opinion on earthquake preparedness (Q14), before and after the initiation

396 of our education program. *Multiple answers were possible.

397

398 Figure 10: Student activities to transfer the knowledge to the community (question e), after

399 initiation of our education program.

400

401 Figure 11: Student ideas about earthquake adaptation (Q15), before and after the initiation of our

402 education program. *Multiple answers were possible.

403

404 Figure 12: Students' perception of the level of seismic risk in their respective location (Q10),

405 before and after the initiation of our education program. ($\chi2 = 6.33$, p-value = 0.042, the change is

406 slightly above significant level).

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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	68%	21%	11%	75%	14%	11%

	such as fire, landslides and floods?						
Q11	The preparedness for a major earthquake is the most important thing. Are you regularly discussing this topic with your family?	71%	-	29%	53%	-	47%
Q12	Are you interested to know more about earthquakes and its preparedness in details?	98%	-	2%	98%	-	2%

Table 1: Questions and respective answers about earthquake preparedness among students who participated in the surveys, before and after our education program was initiated in Central Nepal. Respective statistical indicators are reported in Supplementary Table 1.

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CONFLICT OF INTEREST AND ETHICS

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

AUTHOR CONTRIBUTIONS

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

SUPPLEMENTARY MATERIAL

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

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DATA AVAILABILITY STATEMENT

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

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Figure 1

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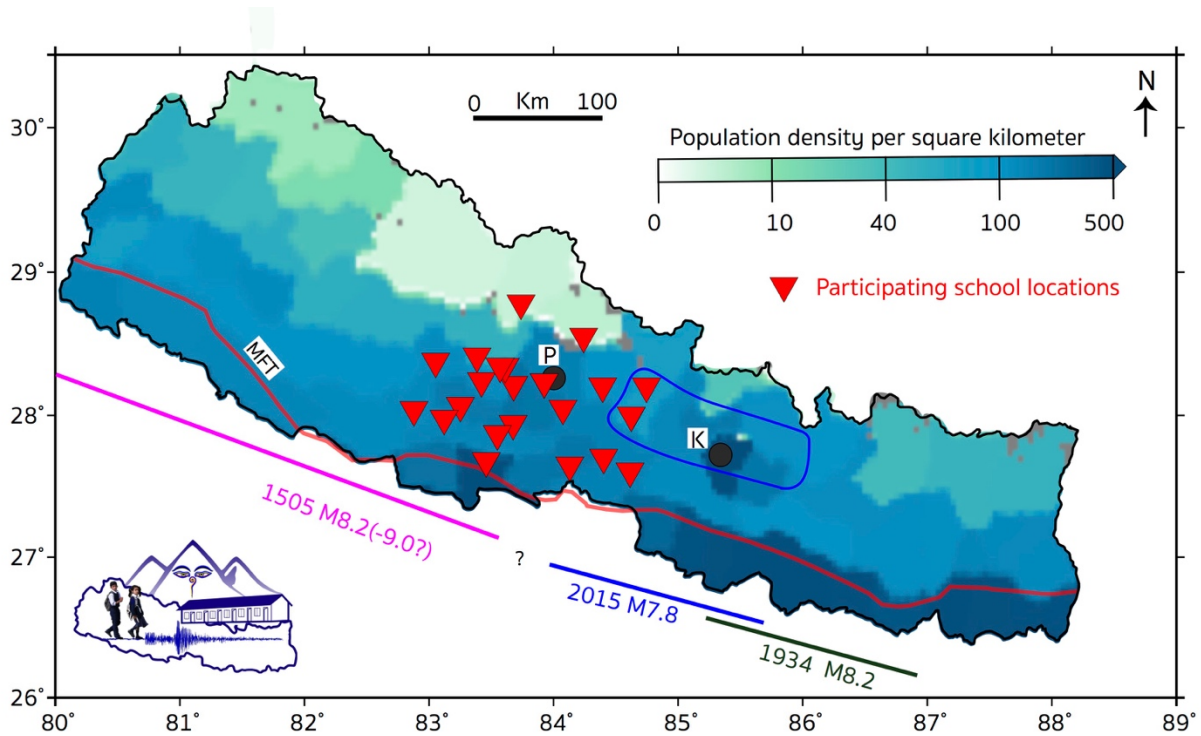
Figure 2

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568   Figure 3

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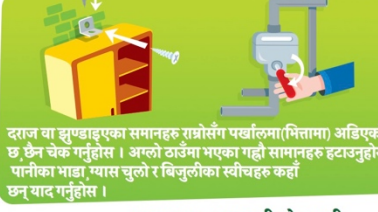
592   Figure 4

1 भुकम्प जानुपुर्वका तयारी

सुरक्षित ठाउँ पत्ता लगाउनु

तपाई आफैलाई सुरक्षित गर्नको लागी सुरक्षित ठाउँहरु खोज्नुहोस – टेवलमुनी अथवा बेन्चमुनी या ढोकाको फ्रेम आदी !

वरिपरी हेर्नुहोस्

दराज वा झुण्डाइएका समानहरु राम्रोसँग पर्खालमा (भित्तामा) अडिएको छ, छैन चेक गर्नुहोस । अग्लो ठाउँमा भएका गह्रौ सामानहरु हटाउनुहोस । पानीका भाडा, ग्यास चुलो र बिजुलीका स्वीचहरु कहाँ छन् याद गर्नुहोस ।

अत्यावश्यक सामाग्रीको तयारी

अत्यावश्यक सामाग्रीको किट (Kit) तयार गर्नुहोस र सजिले उपलब्ध हुने ठाउँमा राख्नुहोस ।
अत्यावश्यक सामाग्रीहरु
पानी/ लामो समयसम्म नकुहिने खानेकुरा / फस्ट एक किट/ सानो ब्याट्री/ टर्चलाइट ब्याट्री सहित/ तातो कपडाहरु/ब्ल्याङ्केट/ आफ्नो परिचय दिने कागजको प्रतिलिपी/ केही पैसा आदी ।

आफैले अभ्यास गर्नुहोस/ तालीम लिनुहोस

आधारभुत जीवन रक्षा विधिसँग अभ्यस्त हुनुहोस । यदी परिवारका सदस्यहरु फरक फरक ठाउँमा हुनुहुन्छ भने आपतकालिन अवस्थामा भेट्ने ठाउँ टुङ्गो लगाउनुहोस ।

2 भुकम्प जाँदै गर्दा

कहिले र कहाँ जाने ?

पहिलो झट्का अनुभव भएको जतिसक्दो छिटो पहिले छनोट गरेको सुरक्षित ठाउँमा जानु होस । भर्याङ र लिफ्ट प्रयोग नगर्नुहोस । यदी भवनको बाहिर हुनुहुन्छ भने अलिक टाढा जानुहोस ।

आश्रयस्थल पत्ता लगाउनु

1 तल जानुहोस **2** आश्रय लिनुहोस **3** बलियोसँग समाल्नुहोस

यदी तपाई विद्यालयमा हुनुहुन्छ भने तुरुन्तै टेबलमुनी आश्रय लिनुहोस । टेबलका खुट्टाहरु बलियोसँग समाल्नुहोस,भुकम्प जाँदै गर्दा टेबलहरु सर्न सक्छन ।

भवन बाहिरको जोखिम

यदी तपाई भवनबाहिर हुनुहुन्छ भने बाहिरै बस्नुहोस र भवनभन्दा टाढा जानुहोस, उच्च विद्युतिय लाइन वा अन्य वस्तुहरु खस्न सक्ने ठाउँभन्दा टाढा जानुहोस । भिरालो ठाउँबाट टाढा जानुहोस भुकम्पले पहिरो जान सक्छ, ढुङ्गा खस्न सक्छन् ।

कारभित्र/बसभित्र

यदी तपाई कार/बसभित्र हुनुहुन्छ भने खुल्ला ठाउँमा रोक्नुहोसर सवारी भित्र नै बस्नुहोस । पुलमाथी तथा आकाशे पुलमुनी पार्किङ नगर्नुहोस ।

3 भुकम्प पछाडी सतर्क रहनुहोस्

भुकम्पको झड्का सकिदा बित्तिकै

जब पहिलो झड्का रोकिन्छ, यदी सम्भव छ भने पानी/ग्यास र बिजुली बन्द गर्नुहोस । अत्यावश्यक सामाग्री लिनुहोस र भवनबाट बाहिर निस्कनुहोस् ।

सावधानीपूर्वक बस्नुहोस

चेतावनी ! एउटा भुकम्प पछाडी अरु कम्पनहरु पनि आउन सक्छन, जसलाई पराकम्पन भनिन्छ ।
कम्पनको कारणले उत्पन्न हुने अन्य जोखिमहरु जस्तै पहिरो, बाढी, आगोलागीको बारेमा सचेत हुनुहोस ।

मेडिकल केयरको सुनिश्चित गर्नुहोस ।

तपाई आफ्नो चोट जाँच गर्नुहोस ,तपाईको वरिपरी यदी कोही जटिल र अप्ठ्यारो अवस्थामा देख्नुभयो भने सहयोग गर्नुहोस ।
अन्य जानकारीका लागी र निर्देशनहरुका लागी रेडियो/टेलिभिजन सुन्नुहोस ।

अत्यावश्यक सेवाहरु

आफ्ना साथी र परिवारलाई बारम्बार सम्पर्क गरेर टेलीफोन लाइन व्यस्त नबनाउनुहोस । अत्यावश्यक सेवालाई प्राथमिकता दिनुहोस ।

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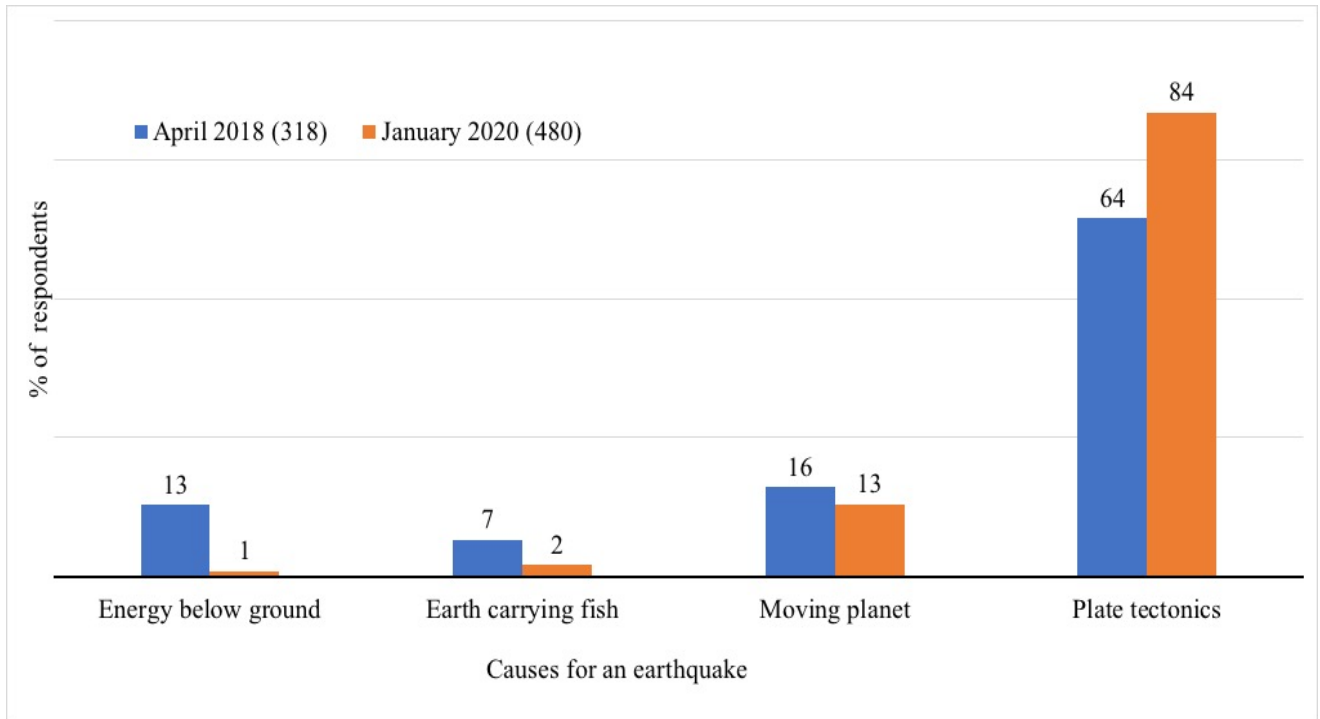
603   Figure 5

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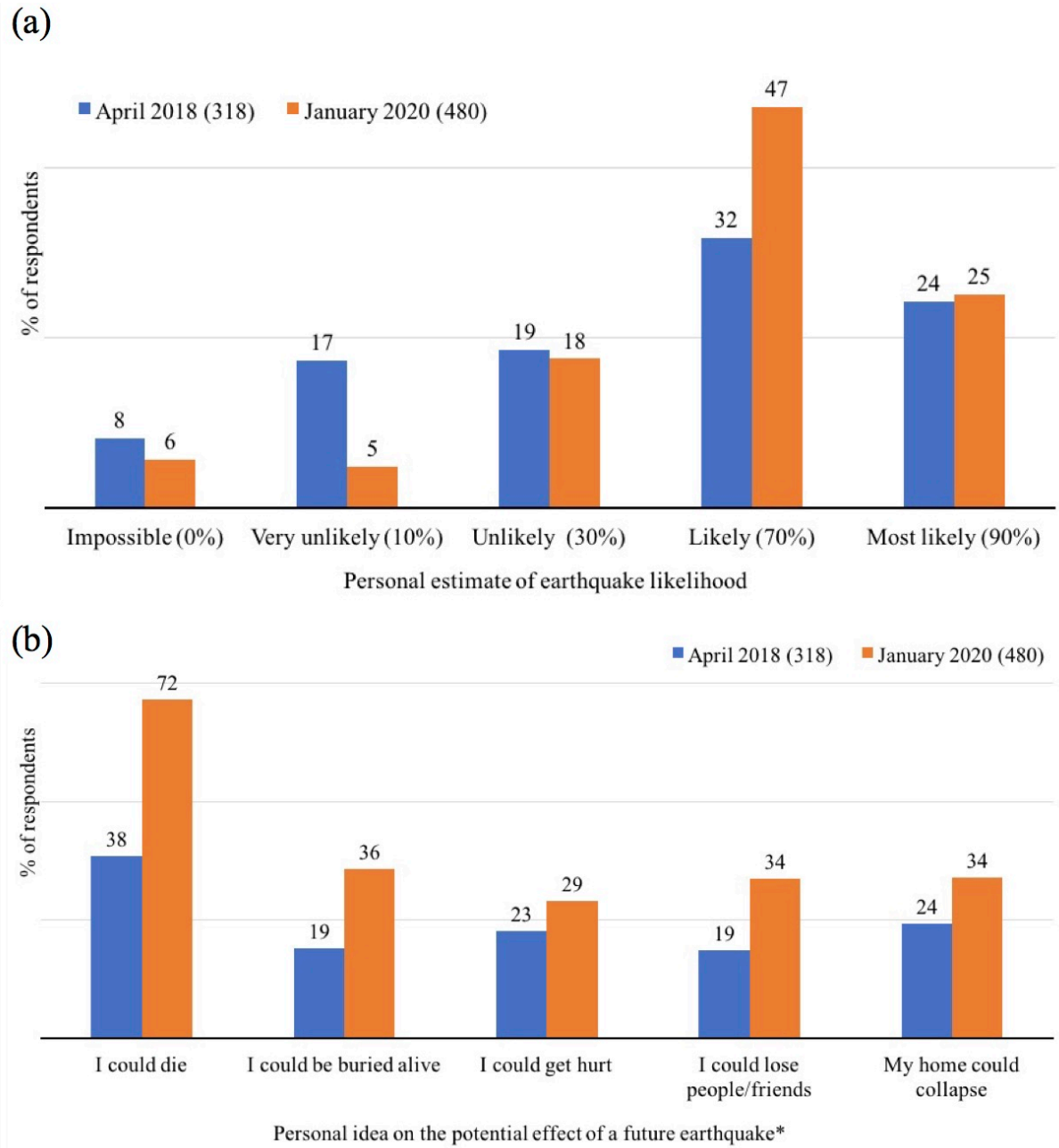
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630   Figure 7

Earthquake related knowledge *

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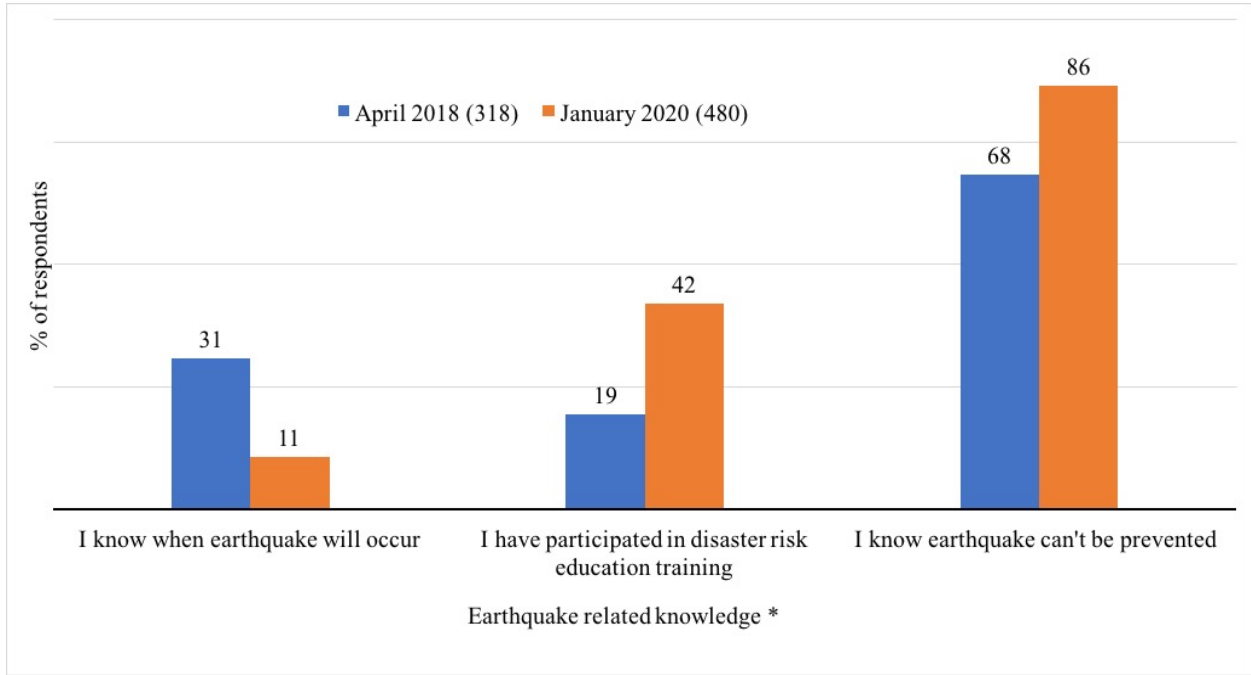
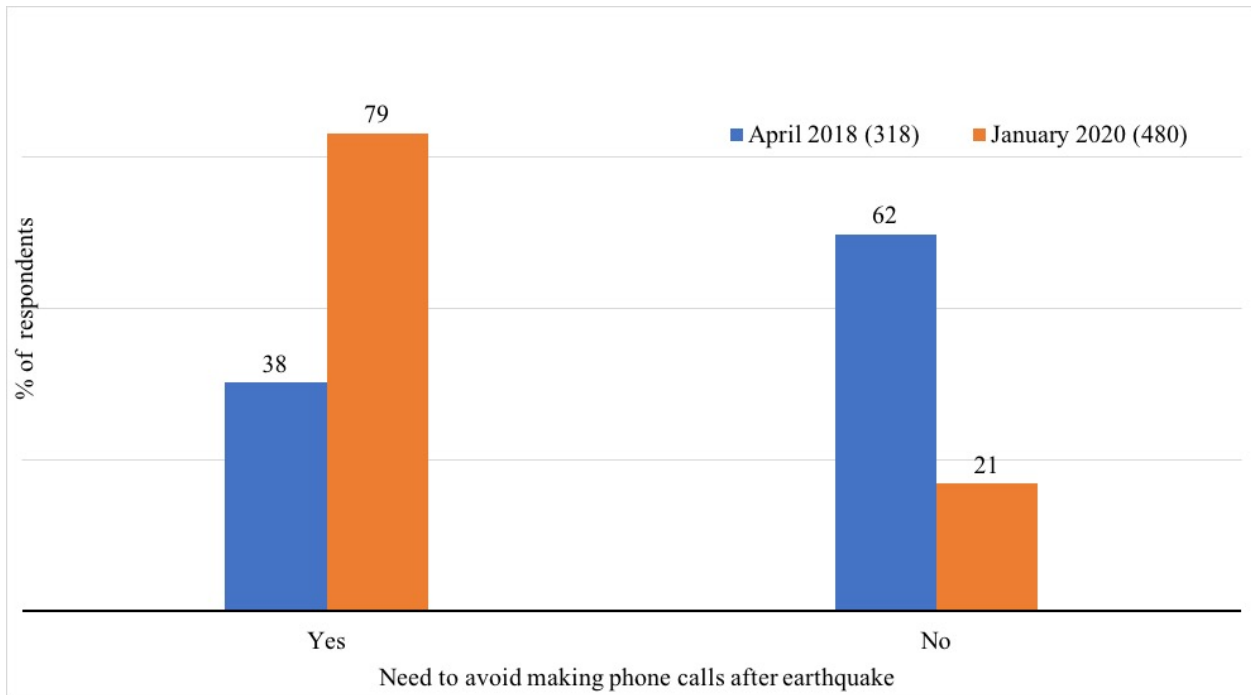
633   Figure 8

Need to avoid making phone calls after earthquake

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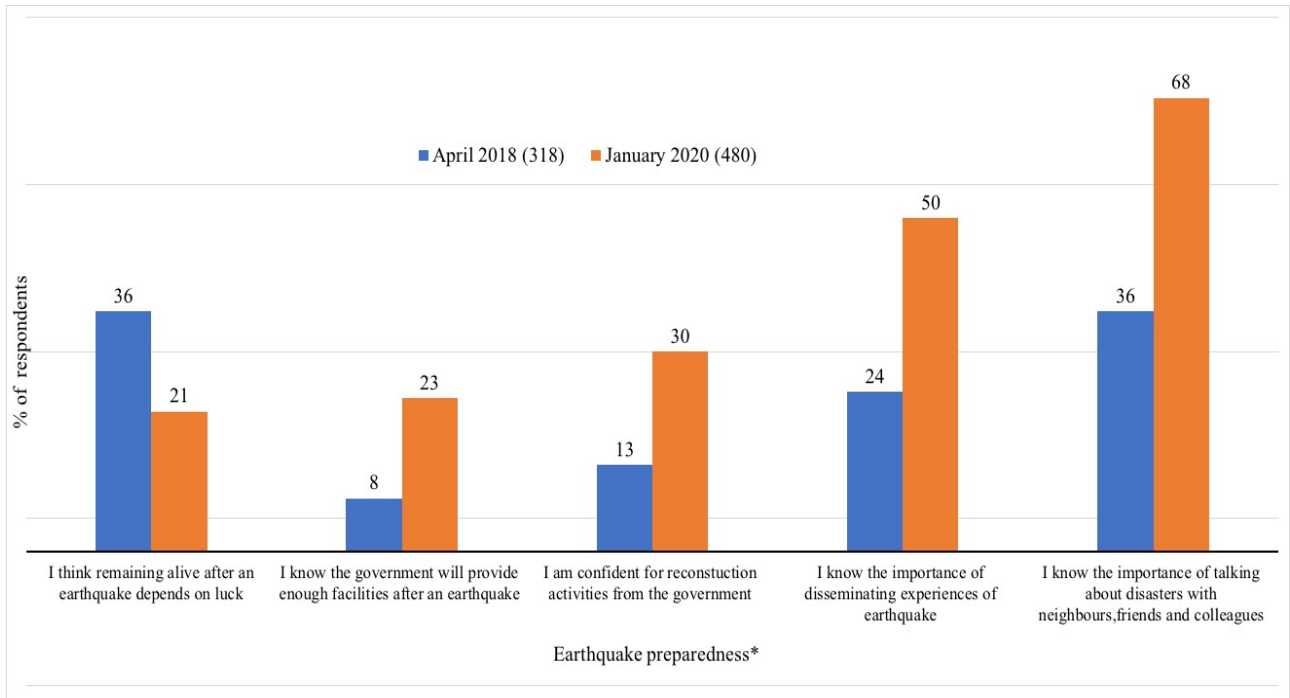
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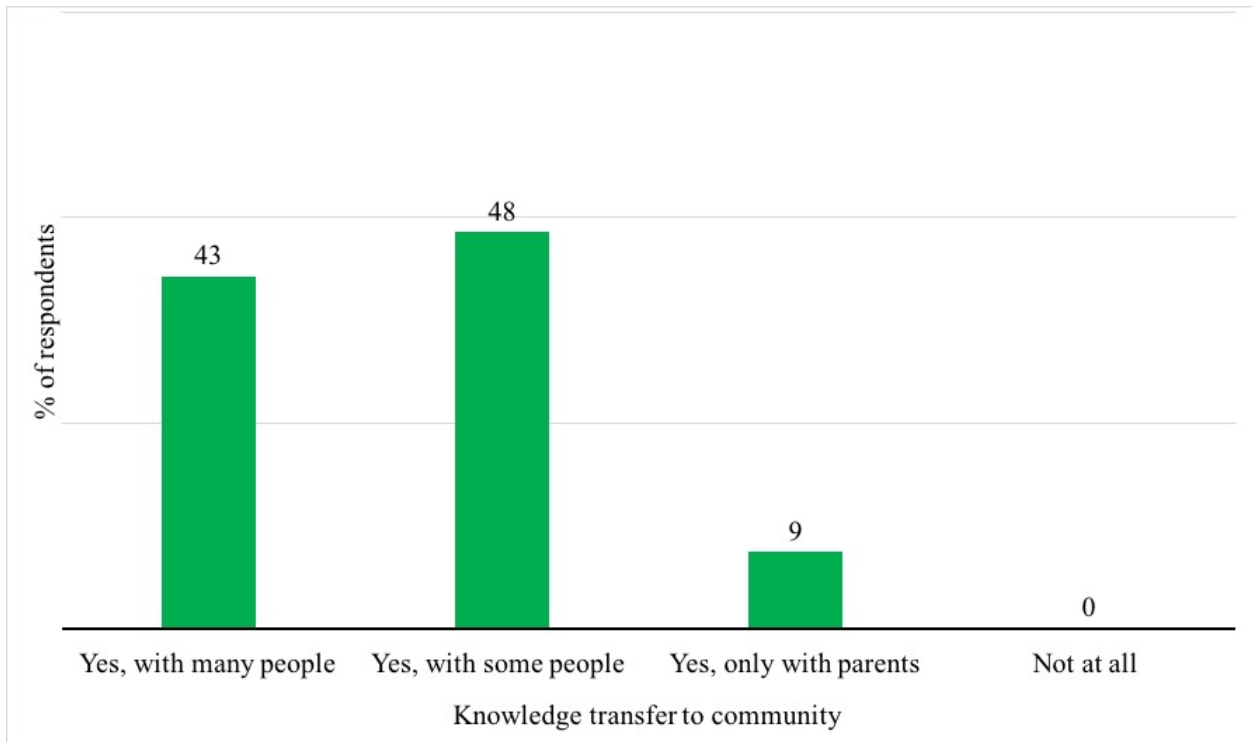
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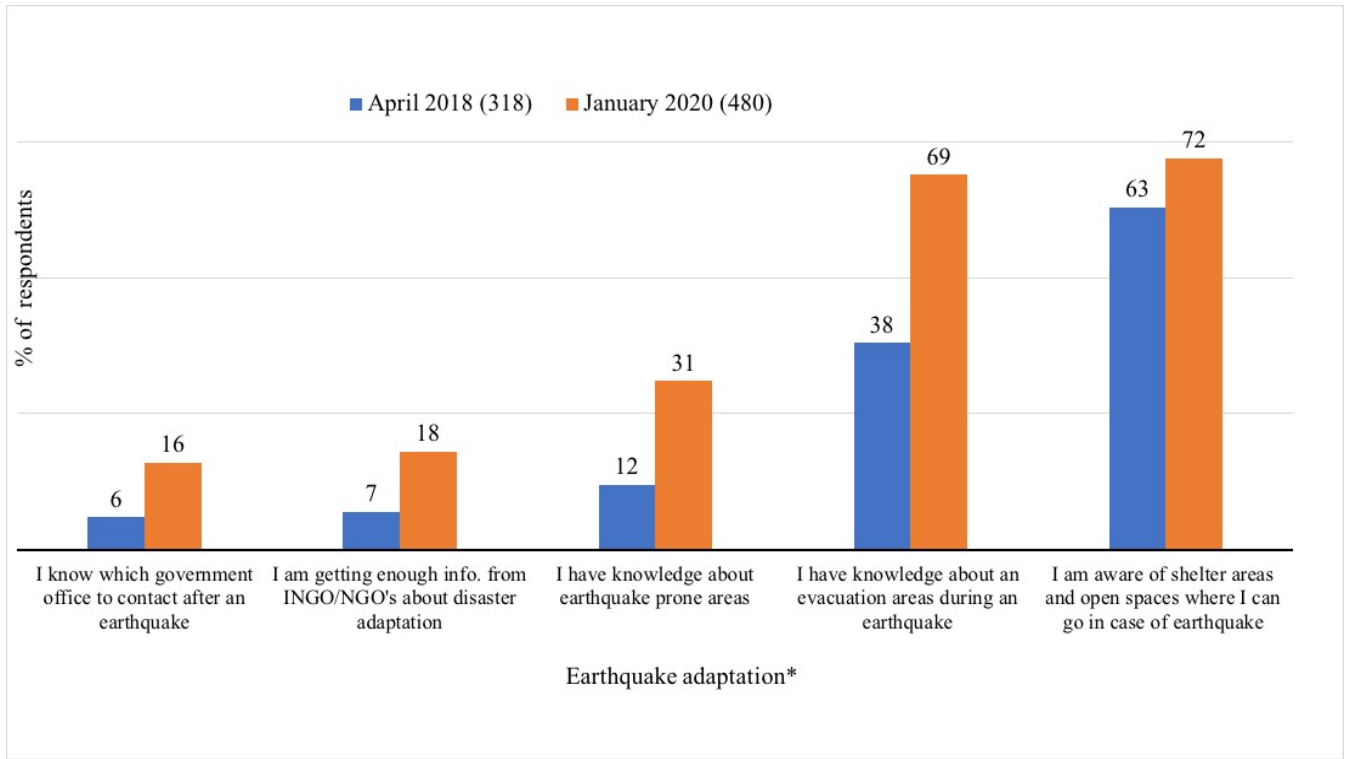
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647   Figure 12

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