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ORIGINAL ARTICLE

Children's disaster knowledge, risk perceptions, and preparedness: A cross-country comparison in Nepal and Turkey

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Abstract

While children are one of the groups at risk in disasters, they can also take an active part in disaster management, provided that the opportunity is given. This research examined the effect of disaster experience, disaster education, country, and city socioeconomic status on children's perceived risk and preparedness with a survey of 1335 children between 11 and 14 years old, in Nepal and Turkey. The survey used questionnaires and the pictorial representation of illness and self measure (PRISM) tool. Results showed that (1) children's risk perceptions were in line with their country-specific objective risks; (2) there were differences between the countries in relation to perception of risk for all the hazards except wildfire; (3) socioeconomic status had a statistically significant effect on children's perceptions of risk and preparedness for earthquakes, wildfires, that is, children who live in wealthier places had higher perceived risk and preparedness; (4) children in both countries showed similar trends in their knowledge of the correct protective actions to take in the event of a hazard occurrence. However, there is still room to enhance children's knowledge, in terms of safety behaviors, as the children selected many incorrect protective actions. There are important implications in terms of child-centered disaster management which hopefully will make life safer and help to create more resilience to disaster in society as a whole.

KEYWORDS
children, disasters, objective risk, risk perception, preparedness

1 | INTRODUCTION

Natural disasters affect millions of children every year and can compromise or disrupt children's future development (Masten & Osofsky, 2010; Mooney et al., 2017). As disaster trends increase around the world, the risks to children will continue to rise, whether directly or indirectly (Norris et al., 2002). Children can be most at risk in an emergency event because of their psychological and behavioural development level, physical size, and complete or partial reliance on adults (Zahran et al., 2008). Disasters not only disrupt children's lives in the short term but also their personal growth and development.

While children represent one of the most vulnerable groups in a disaster, they can actively play an important role in communicating risks, taking actions, and participating in decision-making processes to prevent disasters for their families and communities (Anderson, 2005; Tanner, 2010). The more a child knows about the hazards and risk in their local area, the greater the opportunity for that child to share information at home, so that their adult relatives become more aware of the hazards and risk in their living environment (Finnis et al., 2004; Shaw et al., 2004). Back et al. (2009) indicated that children's creative and practical thoughts and their hazard experiences have made a significant contribution to risk reduction efforts.

Exploring children's risk perception is considered essential for learning how and why children respond to hazard events, as well as how they interpret hazard events (Finnis et al., 2004; Peek, 2008; Santos-Reyes et al., 2017). It is also critical to explore how age influences outcomes across the disaster lifecycle, especially in terms of risk perception and

risk communication (Peek, 2008; 2013). There are many factors that affect an individual's judgment and thinking about the acceptability and seriousness of risks, including experience, knowledge, attitudes, values, and emotions (Wachinger et al., 2013). In the sections that follow, important factors that can influence risk perception and preparedness are presented: culture, hazard experience, education, and objective risks.

1.1 | Cultural and socioeconomic factors

The unique features of potential danger sources and a range of sources of information shape risk perception (Enders, 2001; Gierlach et al., 2010). Cultural issues, in particular, influence risk perception (Gierlach et al., 2010) and how people and governments react to natural hazards (Lavigne et al., 2008). For example, collectivism–individualism, uncertainty avoidance, and power distance (Hofstede, 2001) have been found to be related to behavior associated with risk perception (e.g., Gaganis et al., 2019; Li et al., 2013; Noort et al., 2016).

Children's social activities, such as their participation and contribution to the phases of a disaster, are influenced by the communities they live in (Finnis et al., 2004; Taylor & Peace, 2015). Their experience, vulnerability, and resilience, as well as factors affecting risk perception, preparedness, and response, vary across groups, context, and culture (Peek, 2008; Ronan & Johnston, 2001).

Complementing cultural factors, risk perception and preparedness are also related to socioeconomic factors, in so far as perceptions of risk vary between richer and poorer countries (Fothergill & Peek, 2004; Sokolowska & Tyszka, 1995) though the findings are mixed. Some researchers have found that poor societies perceive environmental risk as higher (Lo, 2016; Pilisuk et al., 1987), while others have found that lower socioeconomic societies perceive the risk less (Vaughan, 1995) and other studies found no effect of income on risk perception (White, 1974). In terms of preparedness, people from low socioeconomic status tend to invest less in prevention and mitigation (Fothergill & Peek, 2004; Hallegatte et al., 2016; Russell et al., 1995) and suffer increased risk of injury and death (Shapira et al., 2018). We might also anticipate that children's risk perception and preparedness would vary between cities that differ in level of wealth.

1.2 | Objective and subjective risk

Disaster risk is defined as "The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period" (United Nations, 2009, p. 10). The literature suggests two contrasting, yet complementary, concepts of risk: (i) an objective view of risk as determined by physical facts (Hansson, 2010); (ii) the subjective judgment of people about the severity and characteristics of risk, known as risk perception (Slovic, 2000). Objective risk can be defined as "an accurate and reasonably complete characterization of risk that can be made by stating (only) objective facts about the physical world" (Hansson, 2010, p. 232). Objective risks are generally based on expert judgments and statistics (Kellens et al., 2011; Knuth et al., 2014). Subjective risk, or risk perception, has become a focus of interest for researchers and policymakers because it gives an idea about the hazards that concern people, as well as their coping capacity for potential environmental hazards (Paek & Hove, 2017).

Johnston et al. (1999) identified a number of elements related to preparedness. Perceived risk is one of these factors, as is the amount of relevant information, level of past damages, level of knowledge about the threat, and salience of the hazard. Accurate risk perceptions can help individuals make correct decisions about risks and appropriate preparedness, minimizing the risk (Andersson, 2011). Knuth et al. (2014) argued that perceived risk for a given hazard tended not to perfectly match the objective risk for those hazards. They also indicated that there might still be a relationship between perceived risk and objective risk. For example, some researchers have found a positive correlation between objective risk and flood risk perception (Siegrist & Gutscher, 2006). The present study contributes to this conversation, examining children's subjective risk in their living environment.

1.3 | Hazard experience

Hazard experience deserves more investigation in the disaster risk reduction context, as highlighted by the Sendai Framework for Disaster Risk Reduction (2015) The experience of hazard can be direct, experiencing a hazard event with one's own eyes, or indirect, for example, through news media or education (Wachinger et al., 2013). Previous researchers indicated that the direct experience of a hazardous event influences risk perception (Barnett & Breakwell, 2001; Plapp & Werner, 2006; Siegrist & Gutscher, 2006). Ho et al. (2008) compared participants' risk perceptions of earthquakes, floods, landslides, fires, pollution, and contagious disease, with their actual experience of those hazards. They found that participants who had experienced floods and landslides had a higher risk perception for those hazards, with the participants' perceived likelihood of occurrence of those hazards being strongly related to their direct experience. Other researchers also found a relationship between direct experiences of earthquakes (Knuth et al., 2014), floods (O'Neill et al., 2016; Siegrist & Gutscher, 2006), landslides (Damm et al., 2013), wildfires (Gow et al., 2008), volcanic eruptions (Paton et al., 2008), and perceived risk of the experienced hazards. Furthermore, some researchers indicate that previous hazard experience has an effect on the preparedness process (Becker et al., 2017; Ejeta et al., 2015; Lindell & Perry, 2012; Maddux & Rogers, 1983).

There is a dearth of research-based literature on children's hazard experience, and their risk perception and preparedness. Some researchers have shown that disasters can cause worry, stress, fear, and frustration to children (Babugura,

2008; La Greca et al., 2002; Mudavanhu et al., 2015). However, there is still not enough evidence to ascertain whether or not disaster experiences have an effect on children's risk perception and preparedness. This research directly addresses this question by examining if children's previous disaster experiences had an effect on their risk perception and preparedness.

1.4 | Disaster education

One of the aims of this research is to understand the effects of disaster education on children's risk perception and preparedness. It is widely recognized that education plays a significant role in disaster management phases (Shaw et al., 2011; Shiwaku, 2009). Petal (2008) indicated that the success of the disaster resilience of communities highly depends on the success of disaster education. The importance of education was also highlighted by the UNISDR program. ''*Education for disaster risk reduction is an interactive process of mutual learning among people and institutions. It encompasses far more than formal education at schools and universities, and involves the recognition and use of traditional wisdom and local knowledge for protection from natural hazard*'' (UNISDR, 2005). A study involving 560 children (Ronan & Johnston, 2001), shows that disaster education, related to children's realistic risk perceptions, increased hazard mitigation knowledge and activities. A similar study in Japan, also shows that school-based hazard education has an effect on increasing community preparedness (Shaw et al., 2004). Research to date suggests that education tends to increase risk awareness (e.g., Ronan & Johnston, 2001) which is also the case for children, although this awareness does not necessarily translate into action (Ronan et al., 2001; Shiwaku et al., 2007). We contribute to this body of research by exploring if children's previous exposure to disaster education has an effect on their risk perception and preparedness.

1.5 | Aim and objectives

This research aims to better understand how children interpret and respond to hazardous events. The following topics are addressed: children's objective risk in the compared countries; children's exposure to previous hazards and to hazard education programs; children's risk perceptions, hazard awareness, and preparedness. The objectives are as follows:

1. To compare specific objective risks and how they relate to children's risk perceptions.
2. To investigate and compare children's hazard awareness, preparedness, and risk perception in Nepal and Turkey.
3. To investigate the following factors that affect children's risk perception and their level of preparedness: disaster experience, disaster education, country and city socioeconomic status.

TABLE 1 The number of affected people across years and countries between 1960 and 2017 (based on data from EMDAT, 2019)

		Occurrence	The number of affected people
Earthquake	Turkey	56	6,866,063
	Nepal	7	6,372,100
Flood	Turkey	37	1,785,020
	Nepal	48	5,513,583
Landslide	Turkey	13	13,587
	Nepal	25	450,630
Storm	Turkey	10	13,909
	Nepal	7	359
Wildfire	Turkey	4	1,500
	Nepal	3	54,000

2 | STUDY AREAS

In this research, the selection of the countries was primarily based on the countries' risk index score, and the selection of the cities was based on their socioeconomic conditions.

Turkey is prone to a range of natural hazards due to its geological setting and its climate; notably earthquakes, floods, landslides, wildfires, and storms. Earthquakes have caused the greatest impact on Turkey's population and infrastructure (see the number of affected people in Table 1).

Two Turkish cities were selected for this study on the basis of contrasting socioeconomic conditions: Van and Kocaeli (Figure 1). They are both located on active geological fault lines, and have experienced devastating earthquakes: the 2011 Van Earthquake (M_w 7.1) and the 1999 Marmara (Kocaeli) Earthquake (M_w 7.4), which caused many fatalities, especially among children (Sarisozen & Durak, 2003) and significant economic damage (AFAD, 2018). According to the SEGE (2011) socioeconomic development ranking statistics of provinces in Turkey, Kocaeli is ranked fourth, while Van is 75th.

Nepal is one of the world's most disaster-prone countries and has experienced many natural disasters because of its natural environment, as well as its political, economic, and social systems. Consequently, Nepal has suffered high levels of human loss and economic damage (Watson, 2017). In terms of global risk, the country is ranked 11th for earthquakes, 30th for flood risk, and 20th of the most multihazard prone countries (MoHA & DPNet-Nepal, 2015).

Two locations were selected in Nepal: Kathmandu and Janakpur (Figure 2). Kathmandu, the capital of the country, is located in the hill region of Nepal. The city has experienced many disasters, the most recent being the 2015 Gorkha earthquake which caused over 8000 fatalities (Carpenter & Grünewald, 2016). Janakpur is located in the Terai region of Nepal (Burghart, 1988). Janakpur experienced a storm disaster on March 31 2019, in which 20 people died and more than 700 were injured (UNICEF, 2019). In July 2019 incessant rainfall caused flooding and landslides, killed 29 people

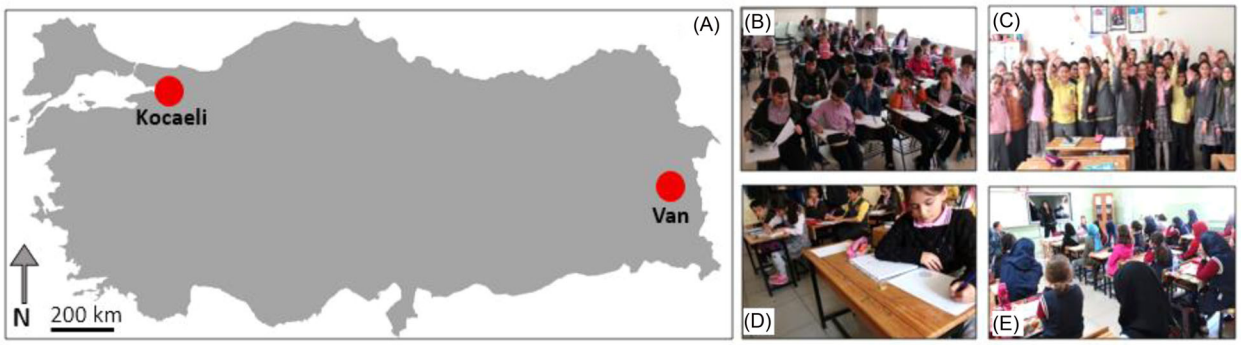

FIGURE 1 Location of the Turkish study areas (A) map of Turkey. (B, D) Photographs of children in Kocaeli and (C, E) in Van. Credit: All images by the first author

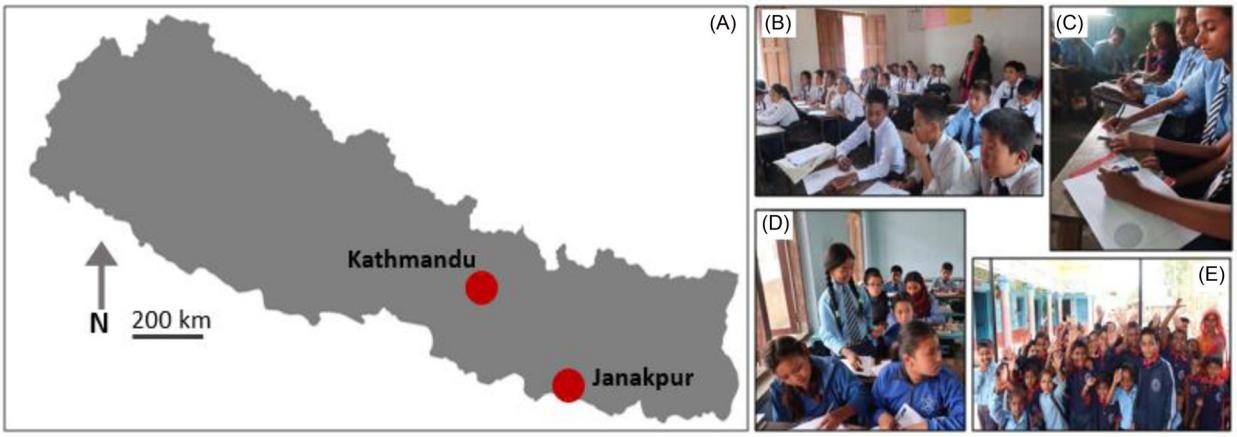

FIGURE 2 Location of the Nepalese study areas. (A) Map of Nepal; (B, D) Photographs of children in Kathmandu and (C, E) in Janakpur. Credit: All images by the first author

and displaced 2065 households in the Janakpur region (UN RC/HC Nepal, 2019).

According to the INFORM risk index (2018), Nepal and Turkey have similar risk scores: 5.1 and 5.0, respectively. Table 1 shows the number of people affected by five natural hazards (earthquake, flood, landslide, storm, and wildfire) and occurrences of those hazards in both countries. Nepal and Turkey have similar types of hazards affecting people's lives, mostly earthquakes and floods (Table 1). However, the study areas in this research differ in their cultures, economic development, religion, and many other aspects of their lives.

According to the Credit Suisse Global Wealth Databook (2019), Turkey was ranked 84 in the world by wealth per adult, while Nepal was ranked 136, thus differences in risk perceptions between the countries might be influenced by differences in wealth. The Turkish population is predominantly Islamic (Poyrazli, 2003), and its general traits have been described as authoritarian, traditional, patriarchal (Fisek, 1982), and collectivist (Hofstede et al., 2010). Nepal is a multilingual, multiracial, multicultural country, and the only Hindu nation in the world (Thapa, 2010). Nepalese society is also characterized by traditional norms and values, dominated by patriarchal ideology (Bhushal, 2008) and collectivism (Cole et al., 2006). This qualitative comparison suggests that Turkey and Nepal are culturally quite similar, apart from differences in religion, although Schwartz (2008) found that Nepal is higher on embeddedness (collectivism) and lower on autonomy (individualism) than Turkey. These contrasts provide an opportunity to evaluate children's risk perception and preparedness in a cross-country perspective.

3 | METHODOLOGY

The methodology used in this research involves a mixed method approach, with questionnaires and use of the PRISM tool, as described by Yildiz et al. (2020, 2021).

3.1 | Participants and setting

Eleven schools from Turkey (six in Kocaeli, five in Van) and eight schools from Nepal (five in Kathmandu, three in

Janakpur) agreed to take part in the survey and represented a range of demographic backgrounds. The data from Turkish school children were collected in October–November 2018, and from Nepalese school children in April 2019. A total of 1335 children aged between 11 and 14, from both countries, participated in the survey. This age range was considered with a twofold rationale: first, developmentally, it ensured that children had the ability to engage in abstract thinking (Inhelder & Piaget, 1958); second, we sought representation of children within compulsory education in both countries, which ends by grade 8 (around 15 years). The number of participants was 425 from Kocaeli, (234 girls, 191 boys); 384 from Van, (187 girls, 197 boys); 389 from Kathmandu, (203 girls, 186 boys); and 137 from Janakpur, (60 girls, 77 boys). Gender did not show significant differences between groups χ^2 (3) = 6.652, $p = 0.84$, however there were significant differences in relation to cities and exposure to disaster education χ^2 (3) = 89.93, $p < 0.01$. The survey languages were Turkish and Nepali. Data collection in Turkey was undertaken by the Turkish speaking first author, while in Nepal an English–Nepali speaking translator administered the questionnaire with the first author in attendance.

3.2 | Measures

The pictorial representation of illness and self-measure (PRISM) technique, three-point Likert scale, multiple-choice questions, and close-ended *yes–no* questions were applied to address the research questions.

3.2.1 | What is PRISM?

The PRISM is a visual representation of gathering personal information which is based on defining the subject, object(s), and context (Büchi et al., 1998). PRISM was adopted to measure the risk perception and importance of preparedness. This technique, with a good test–retest reliability (Yildiz et al., 2020; 2021), was employed in this study as it enables a wide range of responses, providing a sound understanding of children's risk perception and preparedness. A paper and pencil version of PRISM was used, and the children were shown an A4 (210 × 297 cm) sheet of white paper, with a fixed circle in the corner of the paper (Figure 3). They were asked to imagine the A4 sheet as representing their current life, with the circle on the corner of the paper representing a subject's "self" in her/his current life situation. They were asked "*Where would you put (mentioned) hazard to reflect its threats to your life at the moment?"* and *"Where would you like to put (mentioned) hazard to reflect its importance of preparedness to your life at the moment?"*. They were then asked to draw a cross (X) symbol on the A4 sheet, for each listed hazard (earthquake, flood, landslide, storm, wildfire), relative to the center of the "self" disk with a range of 0–27 cm. The distances between the "self" disk center and each hazard cross were used for statistical analysis.

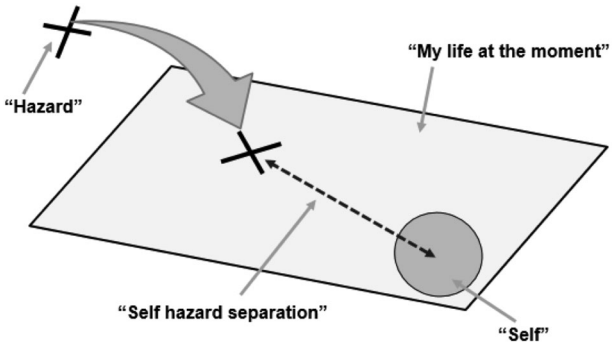

FIGURE 3 An example of PRISM template (Yildiz et al., 2020)

3.2.2 | Objective risks

The objective risk formula used was adopted from the research of Knuth et al. (2014) "risk perception, experience, and objective risk." Country-specific objective risk was computed from the data of different hazard incidents across years and countries (EMDAT, 2019), as shown in Table 1. The objective risk was calculated using the number of affected people by a hazard event. For Nepal and Turkey, the number of affected people during a specific time period was multiplied by 100, then divided by the number of years in the respective time period, then multiplied by the mean of life expectancy of the country. Following Knuth et al. (2014), for both countries, the result was then divided by the mean of the population during a specific time to determine the country's objective risk. Data for the mean of the population and life expectancy were retrieved from the United Nations, Department of Economic and Social Affairs, Population Division (2019).

3.2.3 | Hazard awareness and risk perceptions

Participating children were asked to rate the likelihood of hazard occurrence in the future in their living environment, and the likelihood of the hazard causing injury on a three-point Likert scale for earthquakes, floods, landslides, storms, and wildfires on a given paper questionnaire before the PRISM measure. The PRISM technique is used to measure children's perceived risk for those five natural hazards. They were asked "*Where would you put (one of the mentioned) hazard to reflect its threats in your life at the moment?"*. The closer the distance to the center of the self disk that children placed their answer on the PRISM template, the higher their risk perception (Figure 3).

3.2.4 | Preparedness

In terms of the factual knowledge for preparedness, children were asked to select the responses they felt were suitable actions, and they were allowed to select more than one

TABLE 2 Hazards perceived as likely to occur and likely to cause future injury in Nepal and Turkey for earthquake, flood, landslide, storm, and wildfire hazard (% within cities), and country-specific objective risks (in % of the mean population 2019)

	% likely to occur[a]						% likely to cause injury[b]						Country-specific objective risk	
	Kocaeli	Van	*Turkey*	Kathmandu	Janakpur	*Nepal*	Kocaeli	Van	*Turkey*	Kathmandu	Janakpur	*Nepal*	*Turkey*	*Nepal*
Earthquake	48.2	56.0	51.9	60.9	23.4	51.1	60.5	66.9	63.5	79.2	53.3	72.4	14.38	31.58
Flood	35.1	10.9	23.6	74.6	64.2	71.9	20.9	21.4	21.1	27.2	38.7	30.2	3.73	27.32
Landslide	8.5	18.0	13.0	53.2	35.8	48.7	10.8	16.7	13.6	28.0	29.2	28.3	0.02	2.23
Storm	11.8	6.8	9.4	49.4	63.5	53.0	7.1	4.7	5.9	26.2	49.6	32.3	0.02	0.00
Wildfire	8.5	11.7	10.0	17.7	21.9	18.8	9.9	12.5	11.1	15.2	16.1	15.4	0.00	0.26

[a]Likelihood of disaster occurrence: 1 = *unlikely*, 2 = *chance*, 3 = *likely*.
[b]Likelihood of causing injury: 1 = *unlikely*, 2 = *chance*, 3 = *likely*.

action that represents the appropriate response for each hazard. What we consider to be "correct actions" in this section are actions recommended by AFAD (2020) and Finnis et al. (2004) (see Table 4).

With regard to the importance of preparedness, with the PRISM template children were asked "*Where would you like to put the (mentioned) hazard to indicate the importance of preparedness in your life at the moment?*" The lowest number indicates the more perceived importance for children.

3.2.5 | Previous exposure to hazards and education

Children were asked if they had experienced any specific hazard or not (see Table 6). Using close-ended yes/no questions, they were asked to report whether they had received disaster education formally through the school curriculum or informally outside of their school.

3.3 | Pilot study

Pilot studies were conducted with randomly selected school classes in Turkey with a sample of 64 children and 43 in Nepal. The participating children completed all the pilot questions, and they were observed while they completed the questionnaire. No difficulties were faced during the survey, and children clearly understood the questions. The assessment of the reliability of the questions was performed by using the test–retest method. The paired students' test–retest mean for each value were not significantly different from each other.

3.4 | Data analysis

The effects of the independent variables on perceptions of risk and importance of preparedness were examined by analysis of variance with country, city socioeconomic status (city status), gender, disaster education, and hazard experience as the independent variables and likelihood of occurrence as a covariate. The distribution of the PRISM scores for perceptions of risk and preparedness for earthquakes and, to a lesser extent, floods, and landslides were positively skewed as most children felt these hazards posed a threat. Inequality of variance was also observed as variance was correlated with the mean scores for the dependent variables, such that low scores on PRISM measures (indicating higher perceptions of risk and need for preparedness) were associated with lower variance. ANOVA is relatively robust to violations of normality and variance (Field, 2018), but bootstrapping was carried out for the analyses of variance to safeguard against the risk of a type 1 error.

4 | RESULTS

4.1 | Objective risk

The objective risks of Nepal and Turkey for earthquakes, floods, landslides, storms, and wildfires were calculated using data provided by EMDAT (2019) and the UN Department of Economic and Social Affairs Population Division (2019). Table 2 shows that in both countries earthquake and flood risks are greater than other hazard types; the earthquake risk in Nepal is twice that of Turkey, while the flood risk in Nepal is seven times higher than in Turkey. Among the listed natural hazards, the lowest risk corresponds to wildfires in Turkey and storms in Nepal.

4.2 | Hazard awareness and risk perception

Table 2 shows the hazards perceived to be most likely to happen and most likely to cause injury for the five natural hazards, as well as country-specific objective risks. The findings indicate that children's perception of future hazard occurrence reflect the objective risk of their living areas.

The results in Table 3 indicate that children in Turkey perceive earthquake risk higher than other risks in their local environment, while in Nepal, flood was the highest perceived risk. In total, children's highest perceived risk in both countries is for earthquakes ($M = 6.47$, $SD = 4.95$), and floods

TABLE 3 Mean and standard deviation of the children's natural hazard risk perception on PRISM

			Earthquake		Flood		Landslide		Storm		Wildfire	
		N	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Turkey	Kocaeli	425	5.1	3.4	7.8	4.7	9.9	5.7	9.9	6.2	10.1	6.1
	Van	384	7.1	5.8	9.8	6.8	10.5	6.3	9.8	6.1	10.8	6.4
	Total	809	6.1	4.8	8.7	5.9	10.2	6.0	9.9	6.1	10.4	6.2
Nepal	Kathmandu	389	6.3	4.9	6.6	3.7	6.7	3.6	8.5	5.3	10.4	5.9
	Janakpur	137	8.8	5.1	5.5	2.6	7.2	4.3	6.0	3.3	9.5	4.5
	Total	526	7.0	5.1	6.3	3.5	6.8	3.8	7.9	5.0	10.2	5.6

TABLE 4 Correct actions knowledge for earthquake, flood, landslide, storm, and fire safety

	Turkey		**Nepal**	
	Kocaeli	**Van**	**Kathmandu**	**Janakpur**
(% within city)	***N* = 425**	***N* = 384**	***N* = 389**	***N* = 137**
*Correct actions knowledge for **earthquakes** (shaded)*				
Stay inside and take cover in a doorway, under beds or tables	68.7	57.3	48.6	40.9
Curl into a turtle shape and protect your head (duck, cover, hold)	83.8	78.6	54.6	48.9
If you are outside, find a tree or something sturdy to grab on to	33.6	39.6	33.7	31.4
Stay right where you are and wait for it to be over	17.2	36.7	36.8	35.0
Run outside	53.7	65.6	57.6	57.7
*Correct actions knowledge for **floods** (shaded)*				
Move to an area higher than the flood level	78.1	71.9	73.0	81.0
Listen to the radio	60.0	71.1	56.3	42.3
Enter the flood area	38.6	44.0	56.8	62.0
Go outside and look water	30.6	57.8	56.0	68.6
*Correct actions knowledge for **landslides** (shaded)*				
Stay inside if you do not have enough time to get out the building	66.6	65.6	55.3	56.9
Call the authorities	77.6	83.6	35.5	27.7
Create a triangle of life and apply "drop, cover and hold"	39.8	33.6	36.2	20.4
Enter the damaged building to get your stuff	14.1	19.0	18.0	14.6
Be close the path of landslide or sludge stream at the time of danger	4.7	5.5	4.9	3.6
*Correct actions knowledge for **storms** (shaded)*				
Stay inside	87.1	83.9	73.5	90.5
Listen for warnings on radio	73.6	81.5	65.6	58.4
Shut all external doors and windows	78.8	80.5	87.7	96.4
Run outside	3.1	4.4	6.2	2.9
Go outside and try to find family/friends	15.1	27.1	22.4	19.0
*Correct actions knowledge for **fire safety** (shaded)*				
Leave the fire area by the shortest route	85.4	84.9	85.9	91.2
Close any doors that you pass through	49.6	41.1	29.3	20.4
Do not leave glass and glass breaks in the forest	88.7	85.2	83.5	85.8
Stay inside and wait to be told what to do	4.2	3.9	3.1	2.9
If you are outside go inside	3.8	3.4	2.8	2.2

TABLE 5 Mean and standard deviation of the children's perceived importance of preparedness on the PRISM template

			Earthquake		Flood		Landslide		Storm		Wildfire	
		N	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Turkey	Kocaeli	425	7.5	6.4	7.5	5.1	9.0	6.0	9.9	6.0	10.2	5.6
	Van	384	9.1	6.4	9.3	6.3	9.4	6.4	9.8	6.6	10.0	5.3
	Total	809	8.3	6.4	8.4	5.8	9.2	6.2	9.9	6.3	10.1	5.5
Nepal	Kathmandu	389	6.6	3.7	6.8	4.7	7.0	4.9	8.2	5.9	9.9	6.7
	Janakpur	137	8.3	4.8	6.3	4.1	8.8	6.4	8.2	6.0	10.2	6.8
	Total	526	7.1	4.1	6.7	4.5	7.4	5.4	8.2	5.9	10.0	6.7

TABLE 6 Previous exposure to hazards

(%within city)	Turkey		Nepal	
	Kocaeli	Van	Kathmandu	Janakpur
	N = 425	*N* = 384	*N* = 389	*N* = 137
Felt an earthquake	33.4	93.5	95.9	22.6
Had their house flooded	7.3	4.2	41.4	51.8
Seen a landslide	8.0	12.2	30.8	25.5
Been in a storm	17.2	15.6	45.2	86.9
Had a fire in your place	2.8	3.4	4.6	6.6

($M = 7.8$, $SD = 5.2$). The results indicate that children's risk perceptions (Table 3), reflects the objective risks of their living areas.

4.3 | Preparedness

4.3.1 | Factual knowledge for preparedness

Table 4 shows the correct actions selected by participating children for earthquake, flood, landslide, and fire safety.

4.3.2 | Using PRISM to assess importance of preparedness

Table 5 shows that earthquakes were perceived as being the most important hazard to be prepared for among children in each location, except Janakpur. Children in Janakpur perceived flooding as the most important hazard to be prepared for. Furthermore, the importance of preparedness from children's views showed the same trends in Kocaeli, Van, and Kathmandu. The hazard preparedness ranking was from the most important to the least important: earthquake, flood, landslide, storm and wildfire. In Janakpur, however, the order was as follows: flood, storm, earthquake, landslide, and wildfire.

4.4 | Previous exposure to hazards and disaster education

Table 6 shows children's previous exposure to hazards. Note that 43% of children in Turkey reporting participating in hazard education, compared with 28% in Nepal (Kocaeli, 54.4%; Van, 43.2%; Kathmandu, 27.2%; Janakpur, 19.0%). Kocaeli had the highest percentage of hazard education participation ($N = 231$, 54.4%), and Janakpur had the lowest ($N = 26$, 19%).

4.5 | Factors predicting risk perception and preparedness

Table 7 shows the correlations between the variables and Table 8 reports the findings of the ANOVA results.

Country had a significant effect on earthquake [$F(1,1302) = 7.463$, $p = 0.006$, partial $\eta^2 = 0.006$], flood [$F(1,1269) = 24.571$, $p < 0.001$, partial $\eta^2 = 0.019$] landslide [$F(1,1236) = 36.154$, $p < 0.001$, partial $\eta^2 = 0.028$], and storm [$F(1,1271) = 13.540$, $p < 0.001$, partial $\eta^2 = 0.011$] risk perception, with Turkish children giving higher ratings of earthquake risk and lower ratings of flood, landslide, and storm risk than Nepalese children.

Country also had an effect on ratings of the importance of flood [$F(1,1269) = 6.334$, $p = 0.012$, partial $\eta^2 = 0.005$] and landslide [$F(1,1236) = 12.88$, $p < 0.001$, partial $\eta^2 = 0.010$] preparedness, with Nepalese children providing higher ratings of the importance of preparedness in each case. Country status predicted the children's perceptions of the likelihood of all of the hazards except earthquakes, with children in Nepal predicting a higher likelihood for each hazard [floods: $F(1,1270) = 147.969$, $p < 0.001$, partial $\eta^2 = 0.104$]; landslides [$F(1,1302) = 131.816$, $p < 0.001$, partial $\eta^2 = 0.096$]; storms: [$F(1,1272) = 401.666$, $p < 0.001$, partial $\eta^2 = 0.240$]; wildfires: [$F(1,1302) = 25.362$, $p < 0.001$, partial $\eta^2 = 0.019$].

As Kocaeli and Kathmandu are considered wealthy cities, relative to Van and Janakpur, we were able to investigate the effects of city socioeconomic status on risk perception and importance of preparedness. The results show that city status had a significant effect on risk perception of earthquakes [$F(1,1302) = 10.153$, $p = 0.001$, partial $\eta^2 = 0.008$], storms [$F(1,1271) = 4.441$, $p = 0.035$, partial $\eta^2 = 0.003$], and wildfires [$F(1,1301) = 4.181$, $p = 0.041$, partial $\eta^2 = 0.003$]. An examination of the mean scores from the cities shows that residing in higher socioeconomic status cities predicted higher ratings of risk for earthquake and wildfires;

TABLE 7 Results of the analysis of the correlation coefficient

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Country [a]		−0.21**	0.02	0.24**	−0.15**	−0.46**	−0.29**	−0.42**	−0.03	0.09**	−0.22**	−0.29**	−0.16**	−0.02	−0.10**	−0.15**	−0.14**	−0.13**	−0.01	0.08**	0.58**	0.55**	0.67**	0.38**
2. City status [b]		0.06*		0.04	−0.12**	0.14**	0.07**	−0.02	0.02	0.18**	0.13**	0.11**	−0.03	0.02	0.15**	0.12**	0.09**	0.02	−0.00	−0.07**	−0.34**	−0.07**	−0.14**	−0.02
3. Gender [c]				0.06*	−0.01	0.00	0.02	−0.01	−0.02	0.01	−0.00	−0.00	−0.01	0.01	0.00	−0.01	−0.02	−0.04	0.03	−0.00	−0.03	0.04	−0.01	.04
4. Participated disaster education [d]					−0.07**	−0.11**	−0.04	−0.09**	−0.03	0.02	−0.04	−0.06*	−0.09**	0.00	−0.00	−0.00	−0.34	−0.06*	−0.03	−0.00	0.09**	0.11**	0.17**	0.13**
5. Felt an earthquake [e]						0.00	0.05*	−0.06*	−0.00	−0.04	−0.05*	0.09**	−0.00	−0.01	0.04	−0.05	0.03	0.05	0.03	−0.88**	0.02	−0.16**	−0.04	−0.07**
6. Had their house flooded [e]							0.17**	0.26**	0.07**	−0.05	0.14**	0.15**	0.08**	0.02	0.04	0.09**	0.10**	0.03	0.00	−0.04	−0.29**	−0.23**	−0.30**	−0.15**
7. Seen a landslide [e]								0.13**	−0.04	0.01	0.07**	0.10**	0.05	−0.01	0.03	0.07**	0.01	0.00	−0.01	−0.01	−0.17**	−0.20**	−0.19**	−0.11**
8. Been in a storm [e]									0.02	−0.08**	0.12**	0.16**	0.10**	0.04	0.01	0.07**	0.02	0.06*	−0.01	0.02	−0.26**	−0.18**	−0.31**	−0.14**
9. Had a fire in their place [e]										−0.00	0.00	−0.01	0.03	−0.01	−0.02	−0.02	−0.01	−0.01	0.00	0.02	−0.03	−0.03	−0.03	0.01
10. Earthquake risk perception											0.19**	0.15**	0.13**	0.17**	0.02	0.05*	0.04	0.02	0.02	0.02	0.06*	0.06*	0.06*	0.04
11. Flood risk perception												0.31**	0.22**	0.19**	.09**	0.16**	0.09**	0.08**	0.04	0.01	−0.17**	−0.07**	−0.19**	−0.06*
12. Landslide risk perception													0.29**	0.29**	0.02	0.10**	0.16**	0.09**	0.01	0.02	−0.17**	−0.15**	−0.20**	−0.07**
13. Storm risk perception														0.18**	0.02	0.11**	0.11**	0.16**	0.02	−0.01	−0.05*	−0.11**	−0.11**	−0.02
14. Wildfire risk perception															0.01	0.08**	0.04	.05*	0.12**	0.08**	−0.03	0.02	−0.01	0.03
15. Importance of earthquake preparedness																0.12**	0.02	0.07**	0.06*	−0.05*	−0.12**	−0.09**	−0.07**	−0.00
16. Importance of flood preparedness																	0.21**	0.17**	0.12**	−0.03	−0.11**	−0.03	−0.07**	−0.04
17. Importance of landslide preparedness																		0.23**	0.15**	−0.01	−0.09**	−0.02	−0.08**	−0.03
18. Importance of storm preparedness																			0.15**	−0.05*	−0.04	−0.05*	−0.08**	−0.05*
19. Importance of wildfire preparedness																				−0.00	0.04	0.05	0.02	−0.03
20. Likelihood of earthquake occurrence [f]																					0.06*	0.07*	0.03	−0.00
21. Likelihood of flood occurrence [f]																						0.31**	0.39**	0.17**
22. Likelihood of landslide occurrence [f]																							0.37**	0.19**
23. Likelihood of storm occurrence [f]																								0.28**
24. Likelihood of wildfire occurrence [f]																								

[a]Country: 1 = Turkey,2 = Nepal.

[b]City status: 1 = richer, 2 = poorer.

[c]Gender: 1 = girl, 2 = boy.

[d]Participated disaster education: 1 = yes, 2 = no.

[e]Disaster experience: 1 = yes, 2 = no.

[f]Likelihood of disaster occurrence: 1 = unlikely, 2 = chance, 3 = likely.

[g]Emergency actions: 1 = correct, 2 = incorrect.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

TABLE 8 Estimated marginal means for the effects of the independent variables on disaster risk perception, importance of preparedness and likelihood of disaster occurrence for each hazard[a]

Variables	Groups	*n*	Earthquakes	Floods	Landslides	Storms	Wildfires
Disaster risk perception							
Country	Turkey	809	6.12 (0.28)**	8.99 (0.44)†	10.49(0.32)†	9.64 (0.38)†	11.17 (0.70)
	Nepal	526	7.85 (0.57)	6.15 (0.35)	6.95 (0.40)	7.39 (0.40)	10.27 (0.73)
City Status	Richer	814	5.98 (0.43)**	7.20 (0.29)	9.16 (0.32)	9.57 (0.35)*	11.75 (0.69)*
	Poorer	521	8.00 (0.47)	7.93 (0.46)	8.99 (0.39)	7.85 (0.43)	9.70 (0.73)
Gender	Girl	684	6.75 (0.50)	7.68 (0.38)	9.21 (0.36)	8.93 (0.39)	10.34 (0.70)
	Boy	651	7.23 (0.39)	7.45 (0.39)	8.94 (0.35)	8.57 (0.39)	11.11 (0.72)
Disaster	Yes	529	7.30 (0.56)	7.51 (0.42)	8.74 (0.40)	9.22 (0.42)	10.16 (0.77)
Education	No	806	6.67 (0.29)	7.62 (0.34)	9.41 (0.31)	8.33 (0.37)	11.29 (0.65)
Disaster	Yes	*n*[c]	6.96 (0.39)	7.50 (0.26)	8.49 (0.47)	8.39 (0.33)	11.12 (0.98)
Experience[b]	No		7.02 (0.50)	7.63 (0.26)	8.68 (0.22)	8.80 (0.34)	10.33 (0.23)
Importance of preparedness							
Country	Turkey	809	8.57 (0.31)	8.02 (0.46)*	9.58 (0.38)†	9.79 (0.33)	9.00 (0.78)
	Nepal	526	7.23 (0.62)	6.49 (0.37)	7.39 (0.46)	8.58 (0.47)	10.75(0.73)
City Status	Richer	814	7.03 (0.47)*	6.63 (0.31)*	8.77 (0.34)	8.96 (0.27)	8.54 (0.74)*
	Poorer	521	8.77 (0.51)	7.88 (0.49)	8.21 (0.47)	9.46 (0.45)	11.11(0.78)
Gender	Girl	684	7.36 (0.55)	7.58 (0.41)	8.83 (0.41)	9.51 (0.33)	9.72 (0.75)
	Boy	651	8.45 (0.43)	6.94 (0.41)	8.14 (0.42)	8.91 (0.40)	9.93 (0.77)
Disaster	Yes	529	7.43 (0.62)	7.22 (0.45)	8.03 (0.47)	9.44 (0.41)	9.87 (0.84)
Education	No	806	8.38 (0.32)	7.29 (0.36)	8.14 (0.42)	8.98 (0.33)	9.77 (0.65)
Disaster	Yes	*n*[c]	7.45 (0.43)	6.93 (0.51)	8.03 (0.47)	8.93 (0.36)	9.71 (0.98)
Experience[b]	No		8.35 (0.55)	7.59 (0.28)	8.94 (0.34)	9.49 (0.38)	10.11(0.23)
Likelihood of occurrence							
Country	Turkey	809	2.30 (0.04)	1.75 (0.06)†	1.57 (0.04)†	1.34 (0.03)†	1.33 (0.08)†
	Nepal	526	2.36 (0.09)	2.67 (0.05)	2.33 (0.05)	2.53 (0.04)	1.88 (0.08)
City Status	Richer	814	2.43 (0.06)*	2.31 (0.04)**	1.95 (0.04)	1.91 (0.03)	1.54 (0.07)
	Poorer	521	2.23 (0.07)	2.10 (0.06)	1.95 (0.05)	1.92 (0.04)	1.66 (0.08)
Gender	Girl	684	2.34 (0.08)	2.20 (0.05)	1.94 (0.05)	1.92 (0.03)	1.57 (0.08)
	Boy	651	2.32 (0.06)	2.20 (0.05)	1.96 (0.05)	1.91 (0.04)	1.64 (0.08)
Disaster	Yes	529	2.35 (0.09)	2.25 (0.06)	1.92 (0.05)	1.88 (0.04)	1.61 (0.08)
Education	No	806	2.31 (0.04)	2.16 (0.05)	1.97 (0.04)	1.95 (0.03)	1.60 (0.07)
Disaster	Yes	*n*[c]	2.29 (0.06)	2.29 (0.06)*	1.99 (0.06)	1.95 (0.04)	1.56 (0.11)
Experience[b]	No		2.37 (0.08)	2.12 (0.04)	1.91 (0.03)	1.88 (0.04)	1.66 (0.03)

[a]Standard errors in parentheses.
[b]Disaster experience variables were relevant to the type of disaster (felt an earthquake, had their house flooded, seen a landslide, been in a storm, had a fire in their place).
[c]Sample sizes for experience of each type of hazard (yes/no): earthquakes: 905/430, floods: 270/1023, landslides: 236/1033, storms: 428/875, wildfires: 52/1282.
*$p < 0.05$.
**$p < 0.01$.
†$p < 0.001$.

while inhabiting lower socioeconomic status cities predicted higher ratings of risk for storms. However, the difference in predictions of storm risk was largely due to high ratings of risk from the children in Janakpur ($M = 5.86$) compared with the other cities (Kathmandu $M = 8.59$; Kocaeli $M = 9.81$; Van $M = 9.60$). Country × city status interaction effects were found for perceptions of flood risk [$F(1,1269) = 8.242$, $p = 0.004$, partial $\eta^2 = 0.006$] and storm risk [$F(1,1271) = 5.455$, $p = 0.020$, partial $\eta^2 = 0.004$]. The children in Janakpur also gave the highest ratings for flood risk ($M = 5.73$), followed by Kathmandu ($M = 6.56$), Kocaeli ($M = 7.85$), and Van ($M = 10.125$).

City socioeconomic status had a significant effect on ratings of the importance of preparedness for earthquakes [$F(1,1302) = 6.235$, $p = 0.013$, partial $\eta^2 = 0.005$], floods [$F(1,1269) = 4.674$, $p = 0.031$, partial $\eta^2 = 0.004$], and

wildfires [$F(1,1301) = 6.535$, $p = 0.011$, partial $\eta^2 = 0.005$], with higher socioeconomic status predicting higher importance for preparedness in each case. There was a significant interaction between country and city status for preparedness for floods [$F(1,1269) = 7.897$, $p = 0.005$, partial $\eta^2 = 0.006$] reflecting differences between the two lower socioeconomic status cities. Children in Janakpur provided the highest rating of the importance of preparedness for floods ($M = 6.31$), closely followed by those in Kocaeli ($M = 6.59$) and Kathmandu ($M = 6.68$) and then Van ($M = 9.46$).

City status also predicted estimates of the likelihood of disaster occurrence for earthquakes [$F(1,1303) = 4.568$, $p = 0.033$, partial $\eta^2 = 0.003$] and floods [$F(1,1270) = 7.268$, $p = 0.007$, partial $\eta^2 = 0.006$] with higher ratings of likelihood being given by children in the wealthier cities. Interactions between country and city status predicted estimates of the likelihood of earthquakes [$F(1,1303) = 9.615$, $p = 0.002$, partial $\eta^2 = 0.007$], landslides [$F(1,1237) = 10.903$, $p = 0.001$, partial $\eta^2 = 0.009$], and storms [$F(1,1272) = 8.194$, $p = 0.004$, partial $\eta^2 = 0.006$] with the findings reflecting deviations from the country and city patterns. For instance, children in Kathmandu gave the highest ratings of likelihood of earthquakes followed by children in Van. Disaster experience predicted estimates of the likelihood of disaster occurrence for floods [$F(1,1270) = 5.320$, $p = 0.021$, partial $\eta^2 = 0.004$] with children who had experienced flooding predicting greater likelihood of flooding.

The children's estimates of the likelihood of disaster occurrence did not predict their perceptions of risk from any of the hazards and preparedness for them with the exception of preparedness for landslides [$F(1,1236) = 5.704$, $p = 0.017$, partial $\eta^2 = 0.005$]. The relationship was counterintuitive as perceptions of a higher likelihood of landslides predicted less importance placed on preparedness. However, the finding may reflect less thought given to preparedness for landslides by the children in Kocaeli, Van, and Janakpur who thought they were unlikely to happen. The children in Kathmandu placed high importance on the need for preparedness for landslides, regardless of whether they thought they were likely.

5 | DISCUSSION

5.1 | Objective and subjective risk

Children's risk perceptions (Table 3) were in line with their country's specific objective risk (Table 2), and reflected the objective risks of their local environments especially for Kocaeli, Van, and Kathmandu. The participating children in Janakpur mostly perceived floods and storms as the most threatening event in their life. This matches their previous disaster experience as 86.9% of participating children in Janakpur reported that they experienced storms previously, and 51.8% reported that their house flooded (Table 6). It is important to note that the objective risk calculated for this research was based on the country specific objective risk, not objective risk at the local level due to the lack of the available data.

In accordance with the present results, previous studies have demonstrated a positive relationship between objective risk and risk perception for earthquakes (Knuth et al., 2014) and floods (Siegrist & Gutscher, 2006). However, the findings of Knuth et al. (2014) did not support the evidence of a positive relationship between objective risk and flood risk perception. This result may be because the country level objective risk for floods might not be accurate for local objective risk estimation. In addition, in contrast with earlier studies, participants of this study were children, not adults, and the study areas were different to those in similar previous research. Furthermore, these differences could be related to children's disaster education, for example, they might have discussed the risk and hazards in their living environment in their geography class, which could have raised their awareness.

5.2 | Hazard experience

We investigated the effects of hazard experience on children's risk perception and their preparedness, because the relationships between these variables is unclear, especially within the context of children's perceptions. The results showed that whilst there were small but significant positive correlations between flood, landslide, and storm experience and the perceived risk of the experience of those hazards (Table 7), hazard experience did not predict risk perceptions in the ANOVA analyses (Table 8). Similarly, the correlation results showed that children who experienced storms and floods think that preparedness for those hazards is more important than for other hazards. However, the ANOVA results did not show any significant relation between disaster experience and importance of preparedness. Consequently, whilst there were some correlations between disaster experience and perceptions of risk and preparedness, disaster experience was not a unique predictor of either perceptions of risk or the importance of preparedness.

Previous research has found that participants who experienced flood and landslides have a higher risk perception for these hazards (Damn et al., 2013; Ho et al., 2008; O'Neill et al., 2016; Siegrist & Gutscher, 2006). Our findings were different, as disaster experience did not predict risk perception or preparedness in the ANOVA analysis. Children who had experienced a flood predicted a higher likelihood of future floods, but otherwise hazard experience did not predict the children's perceptions of the likelihood of future events. The lack of an effect for disaster experience in our study could reflect the fact that hazard experience is associated with country (Turkish children rarely experience floods, landslides, and storms) and varies dramatically between towns (more than 90% of the children in Van and Kathmandu had experienced an earthquake compared with only 33% or less of the children in Kocaeli and Janakpur), perhaps obscuring any independent effects that might be due to disaster experience. However, hazard experience was not closely correlated

with the other independent variables. Another reason could be that the effects of disaster experience were obscured because the items that measured disaster experience focused on the children's personal experience (e.g., had their house flooded). Simply witnessing the effects of disasters in their living area might not be enough to sensitize children to the threat of particular events.

5.3 | Disaster education

One of the key aspects of this research was to understand the effects of disaster education on children's risk perception and their preparedness. The data presented here indicate that formal disaster education did not predict the children's disaster risk perception and importance of preparedness. Our results also showed that disaster education does not relate to children's perceived likelihood of future hazard occurrence. There may be many reasons underlying this result. A possible explanation is that children might get the information about risk and hazard in their living environment indirectly in their daily lives (e.g., family, television, radio). For example, children can learn the history of destructive earthquakes naturally in their society, without any specific disaster education. During data collection by the first author in Kocaeli, some of the children were willing to share their family's stories about the devastating 1999 Marmara earthquake, even though those children did not experience that earthquake—this is an example of family stories that could assist disaster risk reduction, passing down from one generation to the next by word of mouth.

It is also important to note that in this research, the ways by which children received disaster education and the quality of that education were not assessed, due to time and resource constraints. It is recommended that future researchers consider such research, in order to get more fine-grained results.

5.4 | Effects of country and socioeconomic status on perceptions of risk and preparedness

One of the most robust findings of this research was that country status predicted children's perceptions of the risk to themselves for four of the hazards (earthquakes, floods, landslides, and storms), as well as their perceptions of preparedness for two of the hazards (floods and landslides). Country status also predicted children's perceptions of the likelihood of all hazards, except earthquakes. On the face of it, the country differences appear to reflect the children's awareness of the objective risk of the hazards in each country, even though the children's estimates of the likelihood of disaster occurrence do not predict either perceived risk or preparedness. There were stronger correlations between hazard experience and estimates of likelihood than between hazard experience and perceived risk, suggesting that the children's perceptions of the likelihood of hazard events but not their personal risk could have been swayed by their own experience.

Another important finding of this study was that the city socioeconomic status had a statistically significant effect on children's perceptions of risk from earthquakes, storms, and wildfires and preparedness for earthquakes, floods, and wildfires. For the most part, children who live in wealthier places had higher perceived risk and preparedness. Where the opposite was the case, it was probably either because the risk was not seen as particularly high (risk from wildfires) or recent experience increased perceptions of risk in a poorer town (i.e., perceptions of risk from storms in Janakpur that had recently experienced a storm disaster). These results are consistent with those of previous research (Enders, 2001; Gierlach et al., 2010; Sokolowska & Tyszka, 1995), which indicated that cultural and socioeconomic issues had been found to heavily influence risk perception. However, these results should be interpreted with caution because these findings are limited to two locations in each country, and further child-centered studies are needed to understand cultural and socioeconomic factors.

5.5 | Comparison of children's preparedness levels

In terms of the protective actions to take in the event of a hazard occurrence (Table 4), in most cases, more than half of the participating children selected correct actions. For instance, in the event of a flood, more than 71% of the surveyed children were aware of moving to a relatively safe area higher than the flood level. For storm events, more than 73% of the surveyed children were aware of staying inside during a storm with high winds, shutting all external doors and windows. For fire safety actions, more than 82% of the surveyed children were aware of the "leave the fire area by the shortest route."

While the majority of the participating children in both countries were aware of the correct protective actions, many of the children were not aware enough of some other protective actions. For example, in the event of earthquakes, more than 53% of children identified the wrong action of "run outside" during an earthquake shake. Also, it is of concern that around 41% of children in Turkey and 60% of the children in Nepal incorrectly reported entering flood water as the correct answer. Only small minorities of children reported the wrong responses for avoiding landslides and staying inside in the event of a fire.

It is of note that only 33.5% of the Nepalese children reported that they would call the emergency authorities, compared to 80.5% of the Turkish children. A possible explanation for this might be that Nepalese disaster and emergency systems are insufficiently active in the region, or children do not trust their emergency systems. Shrestha and Pathranarakul (2018) highlighted the current weaknesses of Nepalese government institutions (e.g., Nepal Army, Nepal Police, public hospitals) in terms of effective responses after the 2015 Nepal earthquake, even though those institutions made a significant contribution and saved many lives. Another possible explanation, if the differences in

collectivism and tradition between Nepal and Turkey (Schwartz, 2008) are correct, is that Nepalese children may feel it is not their role to call the authorities, with Turkish children being more likely to behave autonomously than their Nepalese counterparts. Further research is needed to explore perceptions of the usage of emergency systems in Nepalese communities.

5.6 | Limitations of this study

One of the limitations already mentioned is the difficulty of separating the effects of disaster experience from more general effects of country and place of residence, where relative affluence and historical family experience of hazards may condition perceptions of risk and the need for preparedness, as much as direct personal experience. The problems of isolating and measuring disaster experience in our study illustrate how the relationship between hazard experiences and preparedness is a complex process which requires further research, as highlighted by Becker et al. (2017), Ejeta et al. (2015), and Lindell and Perry (2012).

Another limitation of this study is that there was insufficient online data for the surveyed municipalities in both countries regarding, previous hazard occurrences and number of people affected by those hazards. Thus, we calculated each country's objective risk, rather than the surveyed areas' objective risk at the local level.

Sampling issues produced some further limitations in this study. During data collection in Janakpur, some of the schoolchildren were not available for the survey and, due to time and logistics constraints, it was not possible to visit the area for a second time. These aspects limited the overall sample for Janakpur.

6 | CONCLUSION

This research has sought to provide novel information about various aspects of objective risk, hazard experience, awareness, perception, and preparedness with a large sample of school children in Nepal and Turkey. There are important outcomes in terms of child-centered disaster management which hopefully will make life safer and help to create more resilience to disaster in society as a whole. The main findings of this research are:

1. Children's risk perceptions were in line with their country-specific objective risks, and reflected the objective risks of their local environments.
2. Country status was related to perception of risk for all the hazards, except for wildfire.
3. Higher city socioeconomic status was generally associated with increased risk perception and importance of preparedness, but recent experience of hazards or perceived low risk from hazards could reverse this effect.
4. Children in both countries showed similar trends in their knowledge of the correct protective actions to take in the event of a hazard occurrence. However, there is still room to enhance children's knowledge in terms of safety behaviors as many children selected a high volume of incorrect protective actions.

This research shows that children have great potential for assisting the development of disaster management and creating disaster-resilient communities. Children engage with knowledge about hazards and risk by informal means in their everyday life. To enhance their participation in community's disaster risk reduction, this knowledge must be accompanied by disaster education programs. It is recommended that disaster education should be an integral part of school curricula: it is a child's right to learn about the risks that might affect their life.

Further longitudinal research studies are needed to better understand children's risk perception and preparedness levels. Although child-centered disaster management studies have increased in recent years, there remains a need for more research to provide insights into why and how children respond to hazardous events. Regarding countries' objective risk, it would be beneficial to have an online platform for each city's previous hazard incidents, including data on loss parameters (e.g., affected people, economic loss, damaged buildings) for future researchers working in disaster risk reduction.

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REFERENCES

AFAD. (2018). *Disaster management and natural disaster statistics in Turkey*. The Disaster and Emergency Management Presidency of Turkey. https://www.afad.gov.tr/upload/Node/35429/xfiles/Turkiye_de_Afetler.pdf

AFAD. (2020). *Turkey's disaster preparedness project*. (In Turkish). https://www.afad.gov.tr/afete-hazir-turkiye

Anderson, W. A. (2005). Bringing the children into focus on the social science disaster research agenda. *International Journal of Mass Emergencies and Disasters*, *23*, 159–175.

Andersson, H. (2011). Perception of own death risk: An assessment of road-traffic mortality risk. *Risk Analysis: An International Journal*, *31*(7), 1069–1082.

Babugura, A. A. (2008). Vulnerability of children and youth in drought disasters: A case study of Botswana. *Children Youth and Environments*, *18*(1), 126–157.

Back, E., Cameron, C., & Tanner, T. (2009). Children and disaster risk reduction: Taking stock and moving forward. Research report. Children in a changing climate research. p. p20. UNICEF.

Barnett, J., & Breakwell, G. M. (2001). Risk perception and experience: Hazard personality profiles and individual differences. *Risk Analysis*, *21*(1), 171–178.

Becker, J. S., Paton, D., Johnston, D. M., Ronan, K. R., & McClure, J. (2017). The role of prior experience in informing and motivating earthquake preparedness. *International Journal of Disaster Risk Reduction*, *22*, 179–193.

Bhushal, S. (2008). Educational and socio-cultural status of Nepali women. *Himalayan Journal of Sociology and Anthropology*, *3*, 139–147.

Büchi, S., Sensky, T., Sharpe, L., & Timberlake, N. (1998). Graphic representation of illness: A novel method of measuring patients' perceptions of the impact of illness. *Psychotherapy and Psychosomatics*, *67*(4–5), 222–225.

Burghart, R. (1988). Cultural knowledge of hygiene and sanitation as a basis for health development in Nepal. *Contributions to Nepalese Studies*, *15*(2), 185–211.

Carpenter, S., & Grünewald, F. (2016). Disaster preparedness in a complex urban system: The case of Kathmandu Valley, Nepal. *Disasters*, *40*(3), 411–431.

Cole, P. M., Tamang, B. L., & Shrestha, S. (2006). Cultural variations in the socialization of young children's anger and shame. *Child Development*, *77*(5), 1237–1251.

Credit Suisse Global Wealth Databook. (2019). *Why wealth matters. The Global wealth report*. https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html

Damm, A., Eberhard, K., Sendzimir, J., & Patt, A. (2013). Perception of landslides risk and responsibility: A case study in eastern Styria, Austria. *Natural Hazards*, *69*(1), 165–183.

Ejeta, L. T., Ardalan, A., & Paton, D. (2015). Application of behavioral theories to disaster and emergency health preparedness: A systematic review. *PLoS Currents*, 7.

EMDAT. (2019). The emergency events database. Universite Catholique de Louvain (UCL) - CRED, D. Guha-Sapir. www.emdat.be

Enders, J. (2001). Measuring community awareness and preparedness for emergencies. *Australian Journal of Emergency Management, The*, *16*(3), 52–58.

Field, A. P. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Finnis, K., Standring, S., Johnston, D., & Ronan, K. (2004). Children's understanding of natural hazards in Christchurch, New Zealand. *Australian Journal of Emergency Management*, *19*(2), 11.

Fisek, G. O. (1982). Psychopathology and the Turkish family: A family systems theory analysis. *Sex Roles, Family and Community in Turkey*, 295–321.

Fothergill, A., & Peek, L. A. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards*, *32*(1), 89–110.

Gaganis, C., Hasan, I., Papadimitri, P., & Tasiou, M. (2019). National culture and risk-taking: Evidence from the insurance industry. *Journal of Business Research*, *97*, 104–116.

Gierlach, E., Belsher, B. E., & Beutler, L. E. (2010). Cross-cultural differences in risk perceptions of disasters. *Risk Analysis: An International Journal*, *30*(10), 1539–1549.

Gow, K. M., Pritchard, F., & Chant, D. (2008). How close do you have to be to learn the lesson? *The Australasian Journal of Disaster and Trauma Studies*, *2*.

Hallegatte, S., Vogt-Schilb, A., Bangalore, M., & Rozenberg, J. (2016). *Unbreakable: Building the resilience of the poor in the face of natural disasters*. World Bank Publications.

Hansson, S. O. (2010). Risk: Objective or subjective, facts or values. *Journal of Risk Research*, *13*(2), 231–238.

Ho, M. C., Shaw, D., Lin, S., & Chiu, Y. C. (2008). How do disaster characteristics influence risk perception? *Risk Analysis: An International Journal*, *28*(3), 635–643.

Hofstede, G. (2001). *Cultures consequences*. (2nd ed.) SAGE.

Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind*. (Revised and expanded, 3rd ed.) McGraw-Hill.

INFORM Global Risk Index Results. (2018). *Disaster Risk Management Knowledge Centre-INFORM*. http://www.inform-index.org/

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence: An essay on the construction of formal operational structures* (Vol., 22). Psychology Press.

Johnston, D. M., Bebbington, M., Lai, C.-D., Houghton, B. F., & Paton, D. (1999). Volcanic hazard perceptions: Comparative shifts in knowledge and risk. *Disaster Prevention and Management: An International Journal*, *8*(2), 118–126.

Kellens, W., Zaalberg, R., Neutens, T., Vanneuville, W., & De Maeyer, P. (2011). An analysis of the public perception of flood risk on the Belgian coast. *Risk Analysis: An International Journal*, *31*(7), 1055–1068.

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2014). Risk perception, experience, and objective risk: A cross-national study with European emergency survivors. *Risk Analysis*, *34*(7), 1286–1298.

La Greca, A. M., Silverman, W. K., Vernberg, E. M., & Roberts, M. C. (2002). *Helping children cope with disasters and terrorism* (pp. xvii–446). American Psychological Association.

Lavigne, F., De Coster, B., Juvin, N., Flohic, F., Gaillard, J. C., Texier, P., Morin, J., & Sartohadi, J. (2008). People's behaviour in the face of volcanic hazards: Perspectives from Javanese communities, Indonesia. *Journal of Volcanology and Geothermal Research*, *172*(3–4), 273–287.

Li, K., Griffin, D., Yue, H., & Zhou, L. (2013). How does culture influence corporate risk-taking? *Journal of Corporate Finance*, *23*, 1–22. https://doi.org/10.1016/j.jcorpfin.2013.07.008

Lindell, M. K., & Perry, R. W. (2012). The protective action decision model: Theoretical modifications and additional evidence. *Risk Analysis: An International Journal*, *32*(4), 616–632.

Lo, A. Y. (2016). National income and environmental concern: Observations from 35 countries. *Public Understanding of Science*, *25*(7), 873–890.

Maddux, J. E., & Rogers, R. W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of Experimental Social Psychology*, *19*(5), 469–479.

Masten, A. S., & Osofsky, J. D. (2010). Disasters and their impact on child development: Introduction to the special section. *Child Development*, *81*(4), 1029–1039.

MoHA, & DPNet-Nepal. (2015). *Nepal disaster report 2015*. The Government of Nepal, Ministry of Home Affairs and Disaster Preparedness Network-Nepal http://www.drrportal.gov.np/uploads/document/329.pdf

Mooney, M., Tarrant, R., Paton, D., Johal, S., & Johnston, D. (2017). Getting through: Children's effective coping and adaptation in the context of the Canterbury, New Zealand, Earthquakes of 2010–2012. *Australasian Journal of Disaster and Trauma Studies*, *21*(1), 19.

Mudavanhu, C., Manyena, S. B., Collins, A. E., Bongo, P., Mavhura, E., & Manatsa, D. (2015). Taking children's voices in disaster risk reduction a step forward. *International Journal of Disaster Risk Science*, *6*(3), 267–281.

Noort, M. D., Reader, T. W., Shorrock, S., & Kirwan, B. (2016). The relationship between national culture and safety culture: Implications for international safety culture assessments. *Journal of Occupational and Organizational Psychology*, *89*(3), 515–538. https://doi.org/10.1111/joop.12139

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry: Interpersonal and Biological Processes*, *65*(3), 207–239.

O'Neill, E., Brereton, F., Shahumyan, H., & Clinch, J. P. (2016). The impact of perceived flood exposure on flood-risk perception: The role of distance. *Risk Analysis*, *36*(11), 2158–2186.

Paek, H. J., & Hove, T. (2017). Risk perceptions and risk characteristics. In *Oxford research encyclopedia of communication*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228613.013.283

Paton, D., Smith, L., Daly, M., & Johnston, D. (2008). Risk perception and volcanic hazard mitigation: Individual and social perspectives. *Journal of Volcanology and Geothermal Research*, *172*(3–4), 179–188.

Peek, L. (2008). Children and disasters: Understanding vulnerability, developing capacities, and promoting resilience—An introduction. *Children Youth and Environments*, *18*(1), 1–29.

Peek, L. (2013). Age. In D. S. K. Thomas, B. D. Phillips, W. E. Lovekamp, & A. Fothergill (Eds.), *Social vulnerability to disasters* (2nd ed., pp. 167–198). CRC Press.

Petal, M. (2008). Disaster risk reduction education. Disaster Management. In: Shaw, R. and Krishnamurthy, R. (Eds.) *Global Challenges and Local Solutions*, University Press, Forthcoming.

Pilisuk, M., Parks, S. H., & Hawkes, G. (1987). Public perception of technological risk. *The Social Science Journal*, *24*(4), 403–413.

Plapp, T., & Werner, U. (2006). Understanding risk perception from natural hazards: Examples from Germany. In L. Vulliet, S. Dannenmann, & W. J. Ammann (Eds.), *RISK21-coping with risks due to natural hazards in the 21st century* (pp. 111–118). CRC Press.

Poyrazli, S. (2003). Validity of Rogerian therapy in Turkish culture: A cross-cultural perspective. *The Journal of Humanistic Counseling, Education and Development*, *42*(1), 107–115.

Ronan, K. R., Johnston, D. M., Daly, M., & Fairley, R. (2001). School children's risk perceptions and preparedness: A hazards education survey. *Australasian Journal of Disaster and Trauma Studies*, *2001-1*, http://www.massey.ac.nz/Btrauma/issues/2001-1/ronan.htm

Ronan, K. R., & Johnston, D. M. (2001). Correlates of hazard education programs for youth. *Risk Analysis*, *21*(6), 1055–1064.

Russell, L. A., Goltz, J. D., & Bourque, L. B. (1995). Preparedness and hazard mitigation actions before and after two earthquakes. *Environment and Behavior*, *27*(6), 774–770.

Santos-Reyes, J., Santos-Reyes, G., Gouzeva, T., & Velazquez-Martinez, D. (2017). Schoolchildren's earthquake knowledge, preparedness, and risk perception of a seismic-prone region of Mexico. *Human and Ecological Risk Assessment: An International Journal*, *23*(3), 494–507.

Sarisozen, B., & Durak, K. (2003). Extremity injuries in children resulting from the 1999 Marmara earthquake: An epidemiologic study. *Journal of Pediatric Orthopaedics B*, *12*(4), 288–291.

Schwartz, S. H. (2008). *The 7 Schwartz cultural value orientation scores for 80 countries*. Research Gate Publication. https://www.researchgate.net/publication/304715744_The_7_Schwartz_cultural_value_orientation_scores_for_80_countries

SEGE. (2011). *Kalkınma Bakanlığı İllerin ve Bölgelerin Sosyo-Ekonomik Gelişmişlik Sıralaması Araştırması*. Bölgesel Gelişme ve Yapısal Uyum Genel Müdürlüğü, Ankara.

Sendai Framework for Disaster Risk Reduction. (2015). *The Sendai framework for disaster risk reduction 2015–2030*. http://www.wcdrr.org/uploads/Sendai_Framework_for_Disaster_Risk_Reduction_201502030.pdf

Shapira, S., Aharonson-Daniel, L., & Bar-Dayan, Y. (2018). Anticipated behavioral response patterns to an earthquake: The role of personal and household characteristics, risk perception, previous experience and preparedness. *International Journal of Disaster Risk Reduction*, *31*, 1–8.

Shaw, R., Kobayashi, S. H. K., & Kobayashi, M. (2004). Linking experience, education, perception and earthquake preparedness. *Disaster Prevention and Management: An International Journal*, *13*(1), 39–49.

Shaw, R., Takeuchi, Y., Gwee, Q. R., & Shiwaku, K. (2011). Disaster education: An introduction. *Disaster Education*, *7*, 1–22.

Shiwaku, K. (2009). Essentials of school disaster education: Example from Kobe, Japan. *Disaster Management: Global Challenges and Local Solutions*, 321–337.

Shiwaku, K., Shaw, R., Kandel, R. C., Shrestha, S. N., & Dixit, A. M. (2007). Future perspective of school disaster education in Nepal. *Disaster Prevention and Management: An International Journal*, *16*(4), 576–587.

Shrestha, B., & Pathranarakul, P. (2018). Nepal government's emergency response to the 2015 earthquake: A case study. *Social Sciences*, *7*(8), 127.

Siegrist, M., & Gutscher, H. (2006). Flooding risks: A comparison of lay people's perceptions and expert's assessments in Switzerland. *Risk Analysis*, *26*(4), 971–979.

Slovic, P. (2000). Introduction and overview. In P. Slovic (Ed.), *The perception of risk* (pp. xxi–xxxvii) Taylor & Francis.

Sokolowska, J., & Tyszka, T. (1995). Perception and acceptance of technological and environmental risks: Why are poor countries less concerned?. *Risk Analysis*, *15*(6), 733–743.

Tanner, T. (2010). Shifting the narrative: Child-led responses to climate change and disasters in El Salvador and the Philippines. *Children & Society*, *24*(4), 339–351.

Taylor, H., & Peace, R. (2015). Children and cultural influences in a natural disaster: Flood response in Surakarta, Indonesia. *International Journal of Disaster Risk Reduction*, *13*, 76–84.

Thapa, K. B. (2010). Religion and law in Nepal. *BYU Law Review*, *2010*(3), 921.

UN RC/HC Nepal. (2019). *Nepal: Monsoon flooding*. Office of the United Nations resident coordinator Nepal. https://un.org.np/sites/default/files/RCO_Monsoon%20Flash%20Update1_13072019.pdf

UNICEF. (2019). *Bara and Parsa Storm*. UNICEF responds to the disaster with immediate relief. https://www.unicef.org/nepal/stories/bara-and-parsa-storm?fbclid=IwAR0nwvoGUtsGeD7_d7aijAAOMNCmRFhrekXqsppYFgaO5sfu8VKPPtJfWpI

UNISDR. (2005). *Thematic cluster/platform on knowledge and education*. http://www.unisdr.org/eng/task%20force/working%20groups/knowledgeeducation/knowledgeeducation.htm

United Nations. (2009). *UNISDR terminology on disaster risk reduction*. United Nations Office for Disaster Risk Reduction, Report. https://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf

United Nations, Department of Economic and Social Affairs, Population Division. (2019). World population prospects 2019. UNDESA.

Vaughan, E. (1995). The significance of socioeconomic and ethnic diversity for the risk communication process. *Risk Analysis*, *15*(2), 169–180.

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox—implications for governance and communication of natural hazards. *Risk analysis*, *33*(6), 1049–1065.

Watson, I. (2017). Resilience and disaster risk reduction: Reclassifying diversity and national identity in post-earthquake Nepal. *Third World Quarterly*, *38*(2), 483–504.

White, G. F. (1974). *Natural hazards, local, national, global*. Oxford University Press.

Yildiz, A., Teeuw, R., Dickinson, J., & Roberts, J. (2020). Children's earthquake preparedness and risk perception: A comparative study of two cities in Turkey, using a modified PRISM approach. *International Journal of Disaster Risk Reduction*, *49*, https://doi.org/10.1016/j.ijdrr.2020.101666

Yildiz, A., Teeuw, R., Dickinson, J., & Roberts, J. (2021). Children's perceptions of flood risk and preparedness: A study after the May 2018 flooding in Golcuk, Turkey. *Progress in Disaster Science*, *9*, 100143.

Zahran, S., Peek, L., & Brody, S. D. (2008). Youth mortality by forces of nature. *Children Youth and Environments*, *18*(1), 371–388.

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