School Children's Risk Perceptions and Preparedness: A Hazards Education Survey

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Abstract

We investigated the risk perceptions and preparedness in a sample of 440 Auckland area school children using a risk perceptions and preparedness-based survey. Children generally were aware of both problem-focused and emotion-focused coping strategies related to a future hazard: findings indicated that children in this sample demonstrated reasonably accurate risk perceptions, a generalised awareness of essential risk mitigation protectiveness factors, and a moderate to strong belief in their ability to cope emotionally with future hazard. Importantly, various factors interrelated with one another. Children with more unrealistic risk perceptions were found to demonstrate increased hazard-related upset, a decreased belief in their ability to cope with a future hazard, and a reduced awareness of hazard-related protective behaviours compared to children with more realistic risk perceptions. Perhaps more importantly, children involved in hazards education programmes demonstrated more stable risk perceptions, reduced hazard-related fears, and a much greater awareness of important hazard-related protective behaviours compared to children who reported not being involved in a hazards education programme. In addition, children involved in two or more education programmes were significantly more aware of these protective behaviours than children involved in only one education programme. On the other hand, no differences were noted in home-based preparedness as a function of education. Implications and caveats are discussed.

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Introduction

An individual's perceptions are simply intuitive judgements about a subject. Researchers over the past three decades have attempted to explain the differences in individual perceptions of hazards and risk, and develop techniques of assessing the complex opinions that individuals have about risk (Drabek 1986, Lindell 1994). There are often subtle variations in perceptions found between individuals and groups in our society. The public's perception of risk is often found to be biased with people often overestimating small probability events and underestimating large ones (Slovic 1987). Typically individuals do not reason about risk by weighing and combining available evidence in a rational and logical way but employ a number of mental strategies (heuristics) which sometimes yield reasonable judgments and sometimes lead to severe systematic errors (Kahnemen & Tversky 1973). People appear not to be motivated solely to be accurate or correct. Accuracy may be sacrificed to some extent in favour of other motivations (e.g. self-esteem maintenance, interpersonal goals) (Higgins & Bargh 1987). It is thought that these perceptions, whether based on fact or not, then have a moderating effect on the types of protective or preparedness behaviours that people choose to undertake (Slovic, 1987).

Numerous studies of risk have attempted to isolate associated risk perception factors. Slovic et al. (1981) measured 18 risk characteristics and found they relate to three factors - 1) dread (controllability, fatal or non-fatal consequences, high or low catastrophic potential), 2) familiarity (known or unknown, rapid or delayed manifestations) and 3) exposure (numbers exposed, personal exposure). Lindell (1994) suggests perceived risk to be a function of characteristics of the hazard agent (e.g., acute and catastrophic versus chronic and low level) that then relates to perceived personal consequences (e.g., physical and psychological effects). These perceived personal consequences, in turn, are thought to relate to the level of control one has over available physical and emotional coping resources. Physical resources would include factual knowledge related to preparedness behaviours (i.e., knowing what to do and what not to do in the event of a hazard) as well as more performance- or behaviourally-based forms of preparedness (e.g., emergency plans, past practice in a simulated hazard). Psychological resources would include reduced fear levels prior to a hazard as well as confidence in one's available coping resources (i.e., perceived coping ability). Familiarity and salience of a threat are also significant determinants of people's responses to a hazard and may be correlated with factors including media exposure (Tv or movies), catastrophic potential, and geographic vulnerability (Perry 1995). Factors affecting risk perception are usually not independent and vary across different hazard types and across different people (Lindell 1994).

Although there is an obvious link between hazard knowledge and the perceived degree of risk, there is often a denial or diminished perception of risk even when the hazard is well understood. An example is found in residents of Los Angles surveyed

after a 1989 earthquake, who readily acknowledged the threat of earthquakes but generally appeared to have a reduced perception of personal risk (Burger & Palmer 1992). People also tend to divide hazardous events into controllable and uncontrolled groups. Consequently, they may deal with the uncontrollable events by the emotional response of denial. Lehman and Taylor (1987) suggest that individuals at risk from catastrophic events whose occurrence is highly likely but whose timing is unknown may cope with the threat by ignoring or denying the seriousness of the situation. This biased perception of risk has been explained by several possible underlying mechanisms. In a motivational framework, lack of knowledge or understanding (Weistein 1980) and need for personal control (Perloff 1983) is suggested. Cognitive explanations develop the concept of "illusions of unique invulnerability" or downward comparisons (Perloff & Fetzer 1986). Individuals create a stereotype for the type of person who is likely to be victimized by an event. If they believe they do not fit that stereotype they perceive that the risk to them is less than that of the stereotype. A key individual dimension that relates to affective reactions to the hazard is locus of control, which refers to people's belief in the extent to which they can control their environment. People with internal locus of control believe that the situation they find themselves in is largely a consequence of their own actions, whereas those with an external locus of control believe external forces, such as nature, luck or society have the dominant control over their situation. A positive relation between internal locus of control and taking action to reduce risk has been shown in several studies (Sims & Baumann 1972, Baumann & Sims 1978, Simpson-Housley & Bradshaw 1978). Socioeconomic factors and the availability of resources have a significant influence on a person's locus of control (Vaughan 1995). Of course, hazard education programmes are designed often explicitly to help give the recipient an increased sense of personal control through provision of relevant information (e.g., appropriate risk mitigation behaviours).

How people respond to natural hazards is determined by their individual and community vulnerability and how they perceive and cope with them (Lazarus, 1966; Lazarus & Folkman, 1984). Lazarus proposes that a person engages in a process of cognitive appraisal when faced with a threatening event. Two concurrent coping efforts then occur; 1) attempts to control the threatening situation (problem-focused coping) and 2) endeavours directed towards regulating emotional reactions to the threatening situation (emotion-focused coping). The current survey aimed to assess elements of both of these forms of coping.

In fact, the ways in which individuals and communities perceive hazards and their perceived ability to cope with them have been hypothesized or shown to affect a variety of earthquake-relevant prevention and preparedness behaviours: for example, a lack of awareness and unrealistic risk perceptions negatively impacting preparedness

and responses to warnings (Drabek, 1986; Lindell, 1994; Lindell & Perry 1992; Mileti & Fitzpatrick, 1992, 1993; Mileti & O'Brien 1993; Mileti & Sorensen 1987). The importance of the links between a person's perception of the hazard agent, impacts, perceived personal consequences and affective reactions, and subsequent behaviour has been shown to vary across different populations of people (Perry 1987, Vaughan 1995). It is important to highlight that perceptions of risk have been found to impact protective public action in adult populations. Another related factor that has been shown to predict public preparedness in adults is "personal information searching" (Mileti & Fitzpatrick, 1992). That is, the more information one either seeks and has available has also been shown to positively impact protective behaviours. Thus, in assessing people's current levels of risk perceptions and preparedness, it is also crucial to understand whether people have available factual information and whether or not increased risk perceptions are related to a searching for information related to hazard preparedness (Mileti & Fitzpatrick, 1993). For children, "information receiving" may be as important, if not more so, than information searching as children are often reliant on adults for information. This survey was aimed to gather information on these issues.

Risk Perception and Preparedness Children's Research

Simply stated, there is a dearth of research-based literature in this area. Where any data exists, it is in the form of children's reactions to the occurrence of a disaster. The general findings are that children's reactions to hazards are based on a combination of factors that include (a) direct exposure to the hazard combined with the perception of increased physical risk, (b) pre-existing characteristics (e.g., demographic factors including asthma status, age, gender, ethnicity; pre-existing emotional problems), (c) availability of adaptive coping resources, (d) access to social support, (e) the occurrence of major life stressors (e.g., parental divorce, family death) following the hazard (e.g., LaGreca et al., 1997; Ronan, in press; Ronan & Johnston, 1996; Vernberg et al., 1997). In addition, recent data have supported the use of hazard-relevant education programmes in the aftermath of a hazard for helping children report reduced fears and increased ability to cope with stimuli related to the hazard (Ronan & Johnston, 1996; Ronan & Johnston, 1997). No research to date has yet assessed factors related to children's risk perceptions and preparedness prior to a hazard's occurrence.

Indeed, theoretical perspectives and research in this area are adult-based as discussed in the previous section. In addition, findings with adult populations can often inform and may have a beneficial influence on theoretical perspectives related to childhood-based risk perceptions, preparedness, and community-level education programmes (e.g., Mileti & Fitzpatrick, 1993). On the other hand, children are not adults. Importantly, they often do not have the same level of independence of action that can

allow for consistent, ongoing, and adult-based risk mitigation. As a salient example, preparedness in the home or school setting is more often a function of adult activities (e.g., how to handle warning systems, evacuation plans, provision of needed resources, shelter). While children can take individual protective actions (e.g., becoming a "turtle" during an earthquake, emotional "stress inoculation"), adults necessarily have more systemic control over important environmental contingencies. Consequently, when educating children about natural and other hazards, it may be important to include information that helps a child understand what he or she can do relatively independently to be prepared physically and emotionally and those areas where soliciting or receiving information from adults (e.g., parents, teachers) may be more worthwhile (Ronan & Johnston, 1996). Related to these issues, the more a child is aware of hazards and the realistic risks associated, the more potential there is for important adults (particularly parents) to be better educated though the child sharing this newly learned information.

Overview of the Survey

The current survey has been designed to provide information concerning various aspects of hazard awareness, perceptions, and preparedness in a large sample of Auckland school children. The following areas are to be addressed: risk perceptions, psychological factors (level of hazard-related upset in children and parents, coping ability), physical preparedness (both factual and behaviourally-based), exposure to previous hazards, exposure to previous hazards education programmes, hazard-related communication with parents and teachers, information searching on the part of the child, and perceptions of social support.

The primary purpose of this survey was to gather information concerning children's current levels of awareness, risk perceptions, and physical and emotional preparedness that can then be used to maximize the effectiveness of current educational programmes.

Thus, the goals of this survey were the following:

1. To document the current level of awareness and perceptions of hazards of Auckland children.
2. To assess discrepancies between fact and perceptions.
3. To document the effectiveness of current educational programmes.

Method

Participants and Setting

Five schools agreed to take part in the survey and represented a range of demographics and areas (both urban and rural). Participants were from the Auckland region--440 participants. Thirty-one surveys were not useable (responses not intelligible, primarily 5-7 year-olds) leaving a total of 409 participants (203 girls, 198 boys, 8 did not report gender) for statistical analyses. The ages of the children ranged from 5- to 13-years (Mean age = 10.2; SD = 1.9; Modal age = 10). Children came from a variety of cultural and ethnic backgrounds: Asian (n = 40), Maori (n = 55), Pacific Islander groups (n = 65), Pakeha (n = 193), and "Other" (e.g., "New Zealander"; n = 43) (13 children did not report cultural/ethnic background). Of the total sample, 16.9 % (n = 69) of the children reported problems with asthma; 8.1 % (n = 33) reported some other medical condition.

Survey Instrument: Auckland School Children's Perception Survey

This survey-based instrument was designed to assess children's level of awareness, risk perceptions, factual knowledge, physical preparedness, and psychological issues related to hazards and mass emergencies (i.e., floods, storms with high winds (e.g., cyclones), fires, earthquakes, volcanic eruptions, tsunamis, chemical spills/gas leaks, tornadoes). It also assessed children's prior exposure to (a) specific hazards and (b) educational programmes designed to increase awareness, knowledge, and preparedness that were provided either by Civil Defence or by school-based personnel (primarily teachers).

This section provides an overview of each major section of the survey. The following areas were assessed in addition to demographic data (see also Appendix C):

1. **Risk perceptions**. Children were asked a series of questions that addressed: (a) identifying the two most likely hazards to might affect them at home (b) identifying the two most likely hazards to affect them at school, (c) the likelihood of occurrence of each hazard on a three-point likert scale (unlikely, a chance, likely), and (d) the child's perception of physical risk in the event of each hazard (unlikely, a chance, likely).
2. **Psychological issues**. (a) did children become scared or upset when discussing hazards on a three-point scale (not at all, sometimes, often), and, if so, (b) which specific hazards were upsetting to think about or discuss, (c) child's perception of any parental upset when discussing hazards (yes, not sure, no). and (d) child's perception of emotional and behavioural coping ability in the event of a hazard on a seven-point scale (not at all able to completely able "to help self feel comfortable/less upset").

3. **Home- and school-based hazard-related communication**. Children were asked whether they had talked about any of the specific hazards with parents or teachers. If they discussed them with parents or teachers, they were then asked to indicate who broached the topic (self, adult, or both).
4. **Previous exposure to hazards**. Children were asked whether or not they had directly experienced any of the specific hazards.
5. **Preparedness: factual knowledge**. For each hazard, children were asked to endorse the item or items they felt were appropriate responses in the event of that hazard. Children were reminded that more than one item could be endorsed if it represented the appropriate response to that hazard.
6. **Preparedness: performance-based and physical preparedness:** Children were asked a series of questions related to actual preparedness concerning whether or not the following were in place: (a) family emergency plan, (b) family plan or map of the house showing exits, utility switches, etc., (c) role play or practise about what to do in the event of an emergency, (d) procedure for contacting a family member in the event of an emergency, (e) procedure for being collected from school in the event of an emergency, and (f) availability of a torch, transistor radio, and spare batteries in a known place.
7. **Social Support**. Children were asked to indicate whom they felt to be helpful in assisting them be prepared for an emergency (parents, teachers, Civil Defence, friends, others).

Procedure

The survey was administered within each of the five schools by a trained doctoral-level child researcher. Each item was read aloud to ensure comprehension. It was noted that very young children (5- and 6-year-olds) participating had a difficult time filling out the survey (including providing straightforward information concerning demographics and so forth). The implications of this will be discussed later as it relates to current educational programming. Children were encouraged to ask questions if they did not understand a particular item. Another researcher circulated throughout the room to answer questions. Total time necessary to administer each survey was approximately 35-45 minutes.

Results

Hazard Awareness and Risk Perceptions:

Rank ordering of hazards according to children's endorsement of the "two most likely hazards to occur".

As may be seen in Tables 1 and 2, the hazards children felt most likely to affect them at both home and school were fires and storms with high winds followed by earthquakes and floods. Perceived as less likely were tornadoes, volcanic eruptions, chemical spills, and tsunamis. In addition, 358/409 (88 %) children endorsed either fire, storm with winds, or flood as one of their two choices.

Of the 286/409 (70%) of children who endorsed fire as one of their two likely choices for future occurrence at home, other data are presented regarding the second choice of these 286 children as follows:

1. storm with winds (112/286),
2. flood (44/286)
3. earthquake (41/286)
4. chemical spill (34/286)
5. tornado (25/286) and
6. volcanic eruption (17/286).

Overall, these children appear to display reasonably realistic risk perceptions. However, with respect to risk perceptions in relation to earthquakes versus floods, of children perceive these two hazards in similar frequencies. Data related to the actual occurrence of these two hazards indicates that some of this sample of children appears to overestimate the likelihood of earthquakes relative to other more frequently occurring hazards.

In terms of the number of children who endorsed both fire and storms with high winds, at home 112/409 (27 %) and at school 81/409 (20 %) endorsed both.

Table 1. Perceptions of risk at home and school

Perceptions of Risk:
Rank order of hazards perceived to be most likely at home.

Hazard	Percentage endorsed as likely to occur
1. Fire	(70 %)
2. Storm w/winds	(42 %)
3. Earthquake	(22 %)
4. Flood	(21 %)
5. Tornado	(18 %)
6. Volcanic eruption	(12 %)
7. Chemical spill	(11.5 %)

8. Tsunami	(2 %)

Level of perceived physical vulnerability and risk

In the event of each hazard's occurrence, children ranked the likelihood of physical risk ("how likely is it that it could hurt you?") on a 3-point scale (likely = 1, a chance = 2, unlikely = 3). As may be seen in Table 2, all hazards were rated as having better than "a chance" of doing physical harm to the children (i.e., all means less than 2). Ranked in the top four, only one of the hazards (fire) is a higher frequency event--tornadoes, earthquakes, volcanic eruptions are lower frequency events. Ranked in the bottom four, tsunami, chemical spill, flood, storm with high winds all had quite similar means and approximately similar frequencies of children who rated associated physical risk as "likely." These findings have implications for hazard education programmes particularly when combined with other data to be described in the next two sections (see Discussion and Recommendations for integrated findings).

Table 2. Perceptions of physical risk in the event of a hazard's occurrence.

Hazard	% endorsing "likely"	Mean	SD
1. Fire	63.0 %	1.42	0.59
2. Tornado	46.9 %	1.67	0.71
3. Earthquake	45.0 %	1.67	0.68
4. Volcanic eruption	42.5 %	1.71	0.69
5. Tsunami	35.4 %	1.84	0.72
6. Chemical spill	30.1 %	1.87	0.67
7. Flood	29.9 %	1.86	0.64
8. Storm w/winds	27.7 %	1.87	0.64

Psychological Issues: Emotional Issues and Perceived Ability to Cope

Table 3 presents data that speaks to factors related to psychological issues. The summary data on Table 3 relates to children's level of fear in relation to hazards, children's perceptions of parental upset in relation to hazards, and the children's perceived ability to cope with a hazard in the event of its occurrence.

In terms of level of fear that children report, about 1/4 of the children report no upset when talking or thinking about hazards; approximately 3/5 report some level of fear; and about 1/7 report often feeling upset when hazards are thought about or discussed. The mean score was 1.89 (SD = .62) out of a total of 3 (1 = not at all; 3 = often). This means that children on average report feeling upset or scared sometimes when

discussing hazards. However, as the frequency data illustrates, some children report no fear, others a great deal of fear.

In terms of fear related to specific hazards, Table 3 lists the percentages of children who endorsed specific fears as upsetting to think about or discuss. Of note, both the top four and bottom four ranked hazards were also the top four and bottom four ranked in terms of perceived physical risk reported in the previous section. That is, the higher the perception of physical risk associated with a hazard, the more likely it is that that hazard will be identified as upsetting to think about or discuss. This finding has implications for hazard education programmes.

In terms of parental level of upset, children rated whether they perceived their parents to be upset when discussing hazards (1 = yes; 2 = not sure; 3 = no). The mean score here was 2.10 (SD = .55) meaning that on average children were not sure whether their parent(s)/caregiver(s) was upset in relation to hazard discussion. Frequency data presented in Table 3 confirms this trend but also indicates that about 1/5 of the children reported their parents not to be upset during hazard talk; about 1/10 reported parental upset. In addition, there was a significant correlation ($r = .16$, $p < .01$) between children's self-reported fear and children's report of parental upset meaning that, for some children, their was some relationship between their own fear level and the level of fear they perceived in their parents. If they perceived their parents or caregivers to be upset, it was more likely they reported increased fear. In fact, additional analyses indicated that for those children who reported their parents to be upset during hazard discussion, they also reported a level of self-upset that was significantly greater than the self-upset reported by children who either reported (a) no parental upset or (b) "didn't know" ($F (2, 372) = 6.88$, $p < .01$). See Table 3 for more information.

In terms of children's reported ability to cope with a hazard's occurrence, children rated ability to cope on a 7-point scale (1 = not at all able; 4 = somewhat able; 7 = completely able to cope). The mean score was 4.40 (1.50) out of a total of 7 meaning that children on average reported feeling a little better than "somewhat able" to cope in the event of a hazard. Frequency data presented in Table 3 shows that a little under 2/5's of the children reported more than somewhat of an ability to cope (i.e., scored either 5, 6, or 7); about 1/2 reported somewhat of an ability (i.e., scored 4); a little under 1/6 of the children reported less than adequate coping ability (i.e., scored 1, 2, or 3). For these ratings, no significant correlations were found with either child's self-reported level of upset or with parental level of upset. This means that perceived coping ability didn't relate consistently to level of fear and, as a result, may be a particularly suitable area for inclusion in education programmes (see Discussion and Recommendations).

Table 3. Psychological factors related to hazards.

a. Percentage of children who are often , sometimes or never scared when thinking/talking about any hazard

Often	Sometimes	Not at all
13.2 %	56.7 %	23.5 %

b. Percentage of children *often or sometimes* scared when talking/thinking about specific hazards.

Hazard	% sometimes or often scared
1. Fire	54.6 %
2. Tornado	46.2 %
3. Earthquake	44.0 %
4. Volcanic eruption	43.2 %
5. Flood	24.7 %
6. Tsunami	22.6 %
7. Storm w/winds	21.8 %
8. Chemical spill	19.8 %

c. Perceptions of parental upset ("does talking about hazards upset your parents?"):

Yes	Not sure	No
11.1 %	68.6%	20.3%

d. Children's self-reported upset in relation to their parent's level of upset.

Perceived Parental Upset Level	Child's Level of Upset (1 = none; 3 = often) Mean (SD)
= 1 (yes)	2.17 (.64)
= 2 (don't know)	1.89 (.59)
= 3 (no)	1.74 (.64)

e. Perceived Coping Ability in the Event of a Hazard (1 = not at all; 4 = somewhat; 7 = completely able to cope).

Low Coping Ability (1-3)	Moderate to Strong Coping (4-7)
15.7 %	84.3 %

Preparedness: Factual Knowledge of Risk Mitigation and Safety Behaviours

Table 4 presents data related to children's awareness of protective behaviours in the event of a hazard occurrence. In terms of frequency of endorsement of singular protective behaviours, the data presented show that in most instances well over half of the children are aware of the single most protective behaviour(s) for each hazard, those protective behaviours often highlighted in hazard education programmes as well as Civil Defence brochures (exception: fire safety--not covered by Civil Defence by statute). Thus, 3/4 of children are aware of the need to move to higher ground in the event of a flood or tsunami. Just over 3/4 of children are aware that "staying inside" is a protective behaviour in the event of storms with high winds. Between over 1/2 to over 3/5 's of children are aware that staying inside is protective in the event of a volcanic eruption (c. 56 %) unless that building is in immediate danger (c. 62 %). In the event of an earthquake, approximately 3/5's (58 %) of children know to curl into a turtle shape or "duck, cover, hold"; over 85 % of children know to stay inside and take cover under doors, beds or tables. In the event of a chemical spill, 3/4's of the children know that they should "evacuate (leave area) as advised on radio, TV, or by people in charge." For fire safety, just under 8 in 10 children (c. 79 %) know to "leave the house by the shortest route." These data support the idea that children are learning about hazard-related preparedness. More data will be presented on the specific value of education programmes in this area in the upcoming section on education.

While most children showed an awareness of primary protective behaviours, many did not show an awareness of some other protective behaviours (e.g., storm with winds, chemical spills, fires). In addition, some children showed an awareness of singular protective activities while also endorsing incorrect forms of protective behaviours. As may be seen in Table 4, the frequencies of children who reported completely correct preparedness answers (i.e., correct endorsement of protective behaviours and non-endorsement of non-protective behaviours) were substantially lower than the frequencies reported on in the previous paragraph relating to singular or most salient protective behaviour(s). For example, and as presented in Table 5, in a storm with high winds, only 1 in 10 children (10.8 %) know both what to do and what not to do; in a chemical spill, 1 in 5 children (17.4 %) knew what to do and what not to do; in a flood or volcanic eruption, approximately 1 in 4 (22% and 27%, respectively) children

were aware of both protective and non-protective behaviours; in a fire, approximately 1 in 3 (34 %); in an earthquake or tsunami, approximately 1 in 2 (47% and 51%, respectively). While some of the variation in correct responding across hazards may have been a function of the number of possible responses from which to choose (e.g., storm w/winds and volcanic eruptions each had 6 possibilities from which to choose; tsunami and earthquakes each had 4 choices from which to choose), it is also the case that the chemical spill's preparedness item had only 3 responses from which to choose and, in this instance, only 17 % of children were able to get a completely correct answer. The point will be raised again in the Discussion and Recommendation about the issue of singular versus multiple levels of children's responding to hazards and how this might impact educational intervention.

In terms of characteristics of children who consistently reported correct protective forms of behaviours, further analyses were done in terms of age, sex, and educational status. In terms of sex, more girls (52/203, 26 %) than boys (32/198 or 16 %) consistently knew primary protective responses (i.e., endorsed all responses with asterisks next to them in Tables 5-11). In terms of age, a slight age trend was indicated with correct answers increasing as a function of age: 19 % (26/137) 7-9 year-olds, 23 % (23/101) of 10 year-olds, and 26 % (41/158) of 11-13 year-olds reported consistently correct preparedness responses. Other differences were noted (e.g., as a function of school). However, inspection of the data also revealed that differences in correct response endorsement were mediated by whether or not children had been exposed to one or more hazards education programmes. That is, for example, more girls than boys reported being exposed to a hazard's education programme (84 % versus 76 %, respectively). In addition, more older children reported being involved in one or more education programmes. Thus, differences of this sort--whether based on gender, age, area, etc.--may be illusory and mediated by a third variable--in this instance, hazard education background is a mediating variable and its relationship to correct response endorsement is are now reported.

As presented on Tables 6 and 7, whether children were exposed to a hazards education programme had a bearing on correct response frequency: 68/296 (23 %) of children involved in an education programme versus 11/75 (15%) not involved in education consistently endorsed correct responses. Similarly, the more education a child was involved in, the more correct responses were endorsed: 23/ 61 (38 %) children who reported being involved in 2 or more hazard education programmes versus 45/235 (19 %) who reported being involved in one education programme versus 11/75 (15%) who reported being involved in no education consistently endorsed safety-related behaviours. More data will be presented on the effects of education in a later section.

Table 4. Children's awareness of protective behaviours in the event of a hazard occurrence.

Percentage of children endorsing the following items:

a. Preparedness knowledge: Floods

	Percentage endorsing
Correct Responses	
2. Stay inside, wait to be told what to do	39%
3. Listen to the radio	61%
4. Move to an area higher than flood level	75%***
Incorrect Response	
1. Go outside and look at water	10%
Completely Correct Response	
ie. endorsed #'s 2, 3, and 4 and not # 1	22% (92/409)

***- most safety-related singular response and encouraged on Civil Defence brochures.

b. Preparedness knowledge: Volcanic eruptions

	Percentage endorsing
Correct Responses	
2. Listen to the radio	67.5 %
3. Close all doors and windows	74.9 %
5. If building in danger, evacuate	62.3 %***
6. If building not in danger, stay inside	55.6 %***
Incorrect Response	
1. Go outside and look at eruption	8.2 %
4. Open all windows and doors	5.4 %
Completely Correct Response	
ie. endorsed #'s 2, 3, 5, and 6 and not #'s 1 and 4	27.3 % (112/409)

***- best safety-related responses and encouraged on Civil Defence brochures.

c. Preparedness knowledge: Fire safety

	Percentage endorsing
Correct Responses	
1. Leave the house by the shortest route	79.1%***
3. Close any doors that you pass through	49.5%
Incorrect Response	
2. Stay inside and wait to be told what to do	12.4 %
4. Open all doors and windows	29.4 %
Completely Correct Response	
ie. endorsed #'s 1 and 3 and not #'s 2 and 4.	34.0 % (139/409)

***- most safety-related singular response.

d. Preparedness knowledge: Earthquakes

	Percentage endorsing
Correct Responses	
2. Stay inside, taking cover under beds, etc.	85.8 %***
3. Curl into turtle shape(Duck, cover, hold)	57.9 %***
Incorrect Response	
1. Run outside	5.2 %
4. Stay right where you are and wait for it to be over	12.2 %
Completely Correct Response	
i.e. endorsed #'s 2 and 3 and not #'s 1 and 4.	46.5 % (190/409)

***- most safety-related responses and encouraged on Civil Defence brochures.

e. Preparedness knowledge: Storm w/winds

	Percentage endorsing
Correct Responses	
3. Stay inside	77.7 %***

4. Open window on .... (sheltered side)	36.6 %
Incorrect Response	
1. Do nothing...	21.3 %
2. Run outside ...	7.2 %
5. Open window on ... (unsheltered side)	9.9 %
6. Close all windows	58.4 %
Completely Correct Response	
i.e. endorsed #'s 3 and 4 and not #'s 1, 2, 5, and 6.	10.8 %

***- most safety-related response and encouraged on Civil Defence brochures.

f. Preparedness knowledge: Chemical spill

	Percentage endorsing
Correct Responses	
1. Evacuate... as advised....	75.2 %***
3. Stay inside....	28.7 %***
Incorrect Response	
2. Run outside and take cover	14.6 %
Completely Correct Response	
i.e. endorsed #'s 1 and 3 and not # 2.	17.4 % (71/409)

***- most safety-related responses and encouraged on Civil Defence brochures.

g. Preparedness knowledge: Tsunamis

	Percentage endorsing
Correct Responses	
3. Go at least 1 km inland....	75.7 %***
Incorrect Response	
1. Stay inside	28.8 %
2. Run outside and take cover	10.9 %
4. Watch for the sea wave to come	5.0 %

Completely Correct Response	
i.e., endorsed # 3 and not #'s 1, 2, and 4	50.9 % (208/409)

***- response encouraged on Civil Defence brochures.

Table 5. Percentages of children who got completely correct responses.

Hazard	% children w/completely correct prep responses
1. Tsunami	51 %
2. Earthquake	47 %
3. Fire	34 %
4. Volcanic eruption	27 %
5. Flood	22 %
6. Chemical spill	17 %
7. Storm w/winds	11 %

Table 6. Percentage of children who endorsed correct responses for each hazard.

Hazard Education Status	% with consistently correct responses
Previous hazard education	23%
No previous hazard education	15%

Table 7. Hazard education background vs correct responses

Hazard Education Background	% with completely correct responses
Two + hazard education programmes	38%
One hazard education programme	19%
No previous hazard education	15%

Preparedness: Exposure to Hazard Education

Table 8 presents information on the numbers of children who participated in education programmes aimed at hazard awareness and preparedness and certain follow-up

behaviours of these programmes. Approximately 7 in 10 children reported participating in a hazard education programme generally carried out by the child's teacher or by Civil Defence personnel. Approximately 4 in 10 children reported being encouraged by that education programme to discuss what they learned with parents; approximately 3 in 10 reported actually talking with their parents about what they learned in such a programme.

Table 8. Information on Hazard Education Programme Participation

"Have you ever participated in an education programme ....about hazards... and what to do....?"	**% endorsed**
1. Participation in any hazard education: total	70.2 %
2. Participation: hazard education by teacher	49.3 %
3. Participation: hazard education by civil defence	46.9 %
4. Participation: hazard education by "other"	17.3 %
5. Did programme encourage child to talk with parents about what they learned?	43.4 %
6. Did child actually talk with parents about this programme?	29.2 %

Preparedness: Performance-based & Physical Preparedness

As seen on Table 9, between 1/4 and 1/2 of the children report increased physical and performance-based preparedness. The exception is whether children have practised for emergencies in any setting, 8 in 10 children reported to practising how to respond to an emergency in some setting. Of course, this could include school fire drills in which at least 8 in 10 children would have participated (as reported by various school personnel and the children themselves in the participating schools).

Preparedness category	**% yes responses**
1. Family have an emergency plan	29.3 %
2. Practice for emergency: any setting	79.4 %
3. Practice for emergency: home setting	26.1 %
4. Does family have a plan of house showing exits, assembly areas, where to turn off utilities?	23.5 %
5. In emergency, does child know where to meet or leave message for family?	33.7 %

6. In emergency, does child know who will collect from school?	52.5 %
7. Does family have torch, transistor radio, spare batteries?	53.6 %

Social Support

Who does the child report to have been helpful to the current date in helping her or him be prepared for a hazard-related emergency?

The numbers of children reporting who reported particular parties as "helpful in helping you feel prepared for an emergency: is as follows: Parents received the most endorsements (77%) followed by teachers (71%) followed by Civil Defence (47%) followed by friends (30%) followed by "others" (e.g., extended family members, neighbours) (16%). Of note, the same percentage who reported participation in a Civil Defence education programme (46.9 %) reported Civil Defence as having been helpful in helping them feel prepared for an emergency (i.e., 46.9 %).

Relationship Between Risk Perceptions, Preparedness, and Other Factors

Factual Knowledge and Risk Perceptions.

Risk perceptions were found to impact on knowledge of correct preparedness behaviours. As seen in Table 10, those children with increasingly unrealistic risk perceptions (i.e., those who endorse low frequency events at a higher rate, n = 65) consistently were less aware of primary preparedness responses. The one exception was "stay inside" for chemical spills where both groups showed low rates of awareness (see Table 10).

Table 10. Factual knowledge of those with increasingly unrealistic risk perceptions.

Primary protective behaviour for:	unrealistic sample	whole sample (n = 409)
Flood (higher ground)	59 %	75 %
Volcanic eruption		
if danger, evacuate	42 %	62 %
if not danger, stay inside	35 %	56 %
Fire (shortest route)	55 %	79 %
Eathquakes		

take cover under ...	74 %	86 %
duck, cover, hold	54 %	58 %
Storm w/winds (stay inside	68 %	78 %
Chemical spill		
evacuate as advised	52 %	75 %
stay inside ...,	34 %	29 %
Tsunami (higher gound)	60 %	76 %

Psychological preparedness and risk perceptions

As presented in Table 11, risk perceptions were found to have a consistent relationship with psychological preparedness. For example, those children who had increasingly unrealistic risk perceptions (i.e., those who consistently endorsed low frequency events at a higher frequency, n = 65) also had higher rates of upset and reduced perceptions of coping ability compared to sample base rates. In addition, as reported earlier, those hazards where children perceived increased physical risk were also the hazards rated more frequently as causing the child upset. Thus, if the children perceived a hazard as more likely to hurt them physically, it was also more likely that he or she reported feeling upset or scared of that hazard when thinking about it or discussing it with others.

Table 11. Psychological preparedness for those with increasingly unrealistic risk perceptions.

Psychological factor	Children w/unrealistic perceptions (n = 65)	Whole sample (n = 409)
"Often scared" discussion hazards	29.5 %	14.1 %
Low perceived coping ability	26.0 %	15.7 %
High perceived coping ability	74.0 %	84.3 %

Psychological preparedness and hazard knowledge.

For those children who rated themselves as often upset during hazard discussions (n = 54), Table 12 presents information relating to level of preparedness. Children who reported higher levels of upset consistently report fewer endorsements of correct primary protective behaviours compared with the total sample (see Table 23). Regarding actual physical preparedness, similar though slightly greater rates of

performance-based preparedness were reported by the psychologically vulnerable group of children compared to the whole sample (table available upon request).

Table 12. Factual knowledge of those high in upset.

Primary protective behaviour for:	upset sample (n = 54)	whole sample (n = 409)
Flood (higher ground)	65 %	75 %
Volcanic eruption		
if danger, evacuate	51 %	62 %
if not danger, stay inside	45 %	56 %
Fire (shortest route)	57 %	79 %
Eathquakes		
take cover under ...	64 %	86 %
duck, cover, hold	59 %	58 %
Storm w/winds (stay inside	61 %	78 %
Chemical spill		
evacuate as advised	56 %	75 %
stay inside ...,	43 %	29 %
Tsunami (higher gound)	56 %	76 %

Hazard-Related Communication and Preparedness: Effects of Information Searching/Sharing and Information Receiving

A robust relationship was found between hazard-related communication with parents and teachers and increased awareness of factual knowledge related to primary protective behaviours. At home, whether children broached the topic (that is, sought or shared information) or parents broached the topic (that is, received information), there were consistently significant correlations between hazard-related communication and correct preparedness responses (in each instance, correlations were significant in 8 out of 10 cases at $p = .01$ or better and ranged between $r = .15$ and $r = .29$).

At school, the more consistent relationship was found for received information: that is, every correlation between a correct preparedness response and hazard

communication broached by the teacher was not only significant, but also significant in a robust manner (i.e., $p < .001$ (one exception, correlation between teacher broaching a hazard-related communication and the response to "close window on sheltered side" during a wind storm was significant at the .01 level, $r = .14$). These .001 correlations ranged between $r = .22$ and $r = .47$.

No consistent relationships were found between hazard-related information-searching or information-receiving and actual physical preparedness with the exception of a relationship between information searching and emergency-related practice in any setting (at home, $r = .14$; at school $r = .15$, p's $< .01$). That is, if children sought information about hazards at home or school it was also more likely that they reported having practised what to do in the event of an emergency. All other correlations were nonsignificant.

Hazard related communication and psychological factors: The effects of information searching and information receiving

Relationships were found between communication and psychological factors. Children who reported receiving hazard-related information from teachers reported significantly reduced hazard-related fears ($M = 2.14$, $SD = .73$) compared to children who reported not receiving information from a teacher ($M = 1.87$, $SD = .60$) ($F (1, 349) = 7.50$, $p < .01$); similarly, these children reported a trend towards greater perceived ability to cope with a future hazard ($M = 4.42$, $SD = 1.45$) compared to those who did not receive hazard communication ($M = 3.92$, $SD = 2.21$), ($F (1, 336) = 2.58$, $p < .11$). By direct contrast, children who reported broaching a discussion with teachers (i.e., sharing or seeking information), reported a significantly lower perceived ability to cope with a future hazard ($M = 3.99$, $SD = 1.65$) compared to those children who did not seek or share information ($M = 4.48$, $SD = 1.50$). No significant relationships were found between children seeking or receiving information at home and level of upset or perceived coping.

Education Programmes: Effects on risk perceptions, psychological and physical preparedness and hazard communication

Generally, children who have been exposed to hazard education as well as those who have not participated in hazards education had similar perceptions of risk in terms of endorsement of the most likely hazards at home and school. Both educated and non-educated groups rated fires and storms with winds as the most likely hazards to occur at both home and school. In addition, tsunamis were ranked last by both groups in terms of frequency of perceived risk at home and school.

In terms of the relationship between education status and perceived likelihood of each hazard's occurrence in the future, a relationship was found between education and an decreased tendency to perceive the future occurrences of chemical spills ($r = -.17$), tsunamis ($r = -.18$), and tornadoes ($r = -.15$), all p's $< .01$.

In terms of physical risk perceptions, education status was related to increased perceptions of physical risk associated with volcanic eruptions ($r = .14$) and chemical spills ($r = .17$), both p's $< .01$. That is, if children participated in an education programme, they felt that volcanic eruptions and chemical spills were more likely to hurt them physically than if they did not have education. In addition, children who have been exposed to education generally reported a greater frequency of endorsements of "likely" in relation to physical risk ("how likely is it that it could hurt you?") across hazards compared to non-educated children (exception, floods were perceived as more physically risky by non-educated (36 %) versus educated children (28%)). That educated children have increased perception of physical risk may have implications for education programmes (see Discussion and Recommendations). See Table 13 for these frequencies.

Table 13. Physical risk perceptions by education status.

Hazard	ED Group	Non-ED Group
Flood	36 %	28 %
Fire	65 %	51 %
Volcanic eruption	44 %	33 %
Chemical spill	34 %	15 %
Storm w/winds	28 %	23 %
Earthquake	47 %	34 %
Tsunami	37 %	31 %
Tornado	42 %	48 %

In terms of emotional and coping factors, as seen on Table 14, children involved in education programme reported significantly less upset when thinking or talking about eruptions compared to children not involved in hazard education (12 versus 28 % reporting "often scared/upset", respectively); similarly, educated children reported a much lower frequency of perceived parental upset compared to non-educated children (9 versus 22 %, respectively; see Table 14). No great differences emerged in perceived ability to cope with a future emergency with a slightly reduced frequency of educated versus non-educated children reporting low perceived coping ability (15

versus 17 %, respectively) and a slightly greater frequency of moderate or better coping ability (85 versus 84%, respectively). Thus, while educated children reported higher levels of physical risk associated with hazards, they were less scared and upset when thinking about them compared to the non-educated group.

Table 14. Self-upset and perceived parental upset by education status.

	Education Group	Non-education group
Often scared	11.9 %	27.6 %

Perceptions of parental upset: Do your parents get upset talking about hazards?

	Yes	Not sure	No
Non-Ed Group	22.4 %	53.7 %	23.9 %
Ed Group	8.7 %	71.6 %	19.7 %

In terms of factual knowledge related to preparedness, Table 15 presents a clear pattern. Education has a demonstrable effect on the frequency of correct preparedness responses endorsed by children. In all instances, children exposed to hazard education endorsed correct responses significantly more frequently compared to non-educated children (see Table 15). Tables 16 and 17 (also reported in an earlier section on preparedness: factual knowledge) confirm that children (a) who had education versus no-education and (b) had 2 or more years of education versus 1 year or no education had increasingly greater frequencies of correct responses endorsed. The robust finding here is that education matters in helping children discern correct preparedness responses.

On the other hand, it is also the case that children exposed to education programmes also had higher frequencies of incorrectly endorsed responses. This was particularly true in instances where increasingly differentiated knowledge is necessary (e.g., in storms whether to open windows and, if so, which ones). Thus, educated children clearly know better what to do in terms of safety-related behaviours but, in some instances, are not as clear on what behaviours "not to do".

These findings clearly have implications for education programmes.

Table 15. Factual Knowledge by Education Status

Percentage of children endorsing the following items:

a. Preparedness: Floods

	Ed Group	Non-Ed Group
Correct Responses		
2. Stay inside, wait to be told what to do	43.2 %	28.4 %
3. Listen to the radio	68.7 %	36.5 %
4. Move to an area higher than flood level	84.6 %***	45.9 %***
Incorrect Response		
1. Go outside and look at water	12.2 %	1.5 %

***- most safety-related singular response and encouraged on Civil Defence brochures.

b. Preparedness: Volcanic eruptions

	Ed Group	Non-Ed Group
Correct Responses		
2. Listen to the radio	74.5 %	38.6 %
3. Close all doors and windows	81.3 %	49.3 %
5. If building in danger, evacuate	72.1 %***	34.7 %***
6. If building not in danger, stay inside	60.9 %***	37.3 %***
Incorrect Response		
1. Go outside and look at eruption	7.8 %	2.7 %
4. Open all windows and doors	5.4 %	6.7 %

***- best safety-related responses and encouraged on Civil Defence brochures.

c. Preparedness: Fire safety

	Ed Group	Non-Ed Group
Correct Responses		
1. Leave the house by the shortest route	87.1 %***	48.0 %***
3. Close any doors that you pass through	53.7 %	33.3 %

4. Move to an area higher than flood level	84.6 %***	45.9 %***
Incorrect Response		
2. Stay inside and wait to be told what to do	13.3 %	10.7%
4. Open all doors and windows	34.0 %	13.3 %

***- most safety-related singular response.

d. Preparedness: Earthquakes

	Ed Group	Non-Ed Group
Correct Responses		
2. Stay inside, taking cover under beds, etc.	94.5 %***	54.7 %***
3. Curl into turtle shape(Duck, cover, hold)	64.2 %***	33.3 %***
Incorrect Response		
1. Run outside	5.1 %	4.0 %
4. Stay right where you are and wait for it to be over	13.6 %	8.0 %

***- most safety-related responses and encouraged on Civil Defence brochures.

e. Preparedness: Storm w/winds

	Ed Group	Non-Ed Group
Correct Responses		
3. Stay inside	86.5 %***	48.0 %***
4. Open window on .... (sheltered side)	38.2 %	24.0 %
Incorrect Response		
1. Do nothing...	21.6 %	18.7 %
2. Run outside ...	7.1 %	4.0 %
5. Open window on ... (unsheltered side)	10.8 %	9.3 %

6. Close all windows	63.2 %	42.7 %

***- most safety-related response and encouraged on Civil Defence brochures.

f. Preparedness: Chemical spill

	Ed Group	Non-Ed Group
Correct Responses		
1. Evacuate... as advised....	83.4 %***	42.7 %***
3. Stay inside....	31.5 %	21.3 %
Incorrect Response		
2. Run outside and take cover	13.9 %	10.7 %

***- most safety-related responses and encouraged on Civil Defence brochures.

g. Preparedness: Tsunamis

	Ed Group	Non-Ed Group
Correct Responses		
3. Go at least 1 km inland....	83.1 %***	44.0 %***
Incorrect Response		
1. Stay inside	29.8 %	21.3 %
2. Run outside and take cover	11.2 %	10.7 %
4. Watch for the sea wave to come	5.8 %	1.3 %

***- response encouraged on Civil Defence brochures.

Table 16. Percentage of children who endorsed correct responses (those with *) for every hazard by education status.**

Hazard Education Status	% with consistently correct responses
Previous hazard education	23%
No previous hazard education	15%

Table 17. Percentage of children who endorsed correct responses (those with *) for every hazard by years of education.**

Hazard Education Background	% with completely correct responses
Two + hazard education programmes	38%
One hazard education programme	19%
No previous hazard education	15%

In terms of performance-based preparedness, Table 18 presents frequency data (percentages) concerning the number of educated children who have reported actual preparedness behaviours. These frequencies do not differ greatly from base rates (see Table 9). Consequently, these data have implications for education programmes.

Table 18. Frequency of Children in Hazard Education Programmes Reporting Actual and Practice-based Preparedness

Preparedness category	% of children reporting yes
Family have an emergency plan	26.6 %
Practice for emergency: any setting	80.5 %
Practice for emergency: home setting	26.3 %
Does family have a plan of house showing exits, assembly areas, where to turn off utilities	21.6 %
In emergency, does child know where to meet or leave message for family	50.9 %
In emergency, does child know who will collect from school	50.9 %
Does family have torch, transistor radio, spare batteries	51.7 %

In terms of hazard communication, a greater frequency of children who were involved in education programmes reported hazard-related communication with parents in terms of information-searching/sharing. Of particular importance, 69 % of children in education reported broaching a hazard discussion with parents compared to 46 % of non-hazard-educated children.

Discussion

Summary of Findings

Taken together, the findings of the current study demonstrate consistent relationships between hazard-related risk perceptions, awareness of factual knowledge related to protective behaviours, physical and psychological hazard preparedness, and the effects of participation in hazard-related education programmes. In general, children in this sample demonstrated reasonably accurate risk perceptions, a general awareness of the most important protective behaviours, and most children were not adversely impacted psychologically as a result of talking or thinking about hazards. In addition, over 8 in 10 children reported a moderate to strong belief in their perceived ability to cope in the event of a future hazard. Over 7 in 10 (72%) children who participated in this survey reported having been involved in a hazards education programme. Importantly, each of these factors showed relationships with each other. For example, children with more unrealistic risk perceptions were found to have increased hazard-related upset, lower perceived coping ability, and reduced awareness of protective behaviours compared to children with more realistic risk perceptions. Perhaps more importantly, children who were involved in a hazards education programme clearly had an advantage over those who reported not being involved in a hazards education programme. Hazards-educated children had more stable risk perceptions, reduced hazard-related fears, and a much greater awareness of the most appropriate hazard-related protective behaviours compared to non-educated children. In addition, children who reported being involved in two or more education programmes were significantly more aware of essential protective behaviours compared not only to non-educated children but also to children who reported being involved in only one hazards education programme. The findings of this study are strongly supportive of the continuing value of hazard education for children. In fact, as some children from every school involved in this survey reported not being involved a primary recommendation here is for schools to consistently implement education programmes on a regular basis: some education was clearly better than no education and findings are also suggestive that more education appears to be better than some. Specific findings are now addressed more fully with a focus on how these findings might be translated within current education programmes to increase effectiveness.

Risk Perceptions

Children were found to have risk perceptions that in relative terms were accurate. This was particularly true for those most frequently occurring hazards and for some hazards that occur at a much lower frequency. The two hazards consistently perceived

to occur with the most frequency at home and at school and across various rating methods were fires and storms with high winds. The hazard consistently rated as unlikely to occur at both home and school across various rating methods was tsunamis. Hazards rated as having moderate to low chances (i.e., slightly less than "a chance" to greatly less than "a chance") included in this order: floods, chemical spills, earthquakes, tornadoes, volcanic eruptions, and earthquakes, tsunamis. As indicated in Appendix A, data related to frequency of events notes that fires and storms with winds, along with floods, to be relatively the most common. As a group, children in this survey were found to be more accurate in their frequency-based risk perceptions than has been found in studies using adult samples (Slovic, 1987). That is, children were able to identify higher frequency events at a higher frequency and lower frequency events at a relatively lower frequency. Adult samples have been found to identify high impact/low frequency events at a higher frequency than low impact/high frequency events.

It was also the case that for those minority of children in this survey who did report unrealistic risk perceptions (i.e., rating lower frequency events at a higher frequency), they also demonstrated less awareness of preparedness behaviours and increased hazard-related upset compared to the whole sample. Thus, education programmes that promote realistic risk perceptions through presentation of simple physical data and related discussion are recommended (see Recommendations).

In terms of physical risk perceptions, children rated every hazard as having better than "a chance" of hurting them physically in this order: fires, tornadoes, earthquakes, volcanic eruptions, tsunamis, chemical spills, floods, storms with high winds. Fires were rated as significantly more dangerous by children than tornadoes, earthquakes, and volcanic eruptions all of which had similar physical danger ratings. In turn, these three hazards were rated as more dangerous than tsunamis, chemical spills, floods, and storms with high winds all of which had similar ratings of physical danger. Generally this same order was noted when children were asked to indicate which hazards they had (a) discussed with parents, (b) discussed with teachers, and (c) were upset about when thinking or discussing. In addition, children involved in education programmes generally perceived increased physical risk across hazards. Thus, physical danger appears to mediate relationships between hazard communication, education, and hazard-related emotional arousal. If children believed a hazard to be more lethal, they also generally reported being more scared of it as well as talking about it more often. It is also the case that children who rated themselves as more scared also demonstrated reduced awareness of essential preparedness behaviours as well as more unrealistic risk perceptions. In addition, while children in hazard education programmes reported more physical danger compared to non-hazard-educated children, it was also the case that these children reported feeling less scared,

had more realistic risk perceptions, communicated about hazards more often with parents and teachers, and were simply more aware of essential preparedness behaviours than the children who reported not being involved in hazard education.

The story here appears to be that education mediates the relationship between perceptions of physical danger and level of hazard-related negative emotional arousal. Children in education programmes report more physical danger and, in doing so, may be more realistic as they may feel generally more in control (and less fear) about what to do in the event of a particular hazard to mitigate personal risk. On the other hand, children who reported not being involved in education may be more tentative about risk mitigation and, consequently, more upset in the face of hazard-related cognitions or discussions. In fact, a defining feature of fear and anxiety is avoidance of fear-arousing stimuli and a perceived lack of control (Ronan, 1996). Thus, non-hazard educated children may avoid or not endorse the possibility of increased physical risk at the same frequency as educated children because they don't feel as much control or confidence (and increased fears) in their ability to enact safety-related behaviours that can effectively mitigate personal risk (see also, Lehman & Taylor, 1987). Thus, hazard-related communication and education programmes need to be mindful that increased perceptions of physical risk appear are not by themselves a "bad" thing, particularly if the communication and education is geared towards equipping them with increased control and confidence in their ability to keep themselves safe when a hazard occurs. The issue is one of promoting the relationships found in this study between realistic risk perceptions, increased awareness of control-enhancing behaviours, and reduced levels of negative emotional arousal.

Psychological preparedness

Some issues related to psychological preparedness have been discussed in the two previous sections. Generally, most children in this sample (over 80%) reported normal levels of emotional arousal and a moderate to strong belief in their perceived ability to cope with a future hazard. However, if children were not involved in education programmes, they were consistently more likely to endorse increased levels of negative arousal (and slightly more likely to have lower levels of perceived coping abilities). It is also the case that increased upset generally related to reduced awareness of essential safety behaviours (and non-education involvement related to increased upset and reduced awareness). Interestingly, children involved in education programmes reported their parents to be upset/anxious during hazard-related communication significantly less often than children who reported not being involved in education. In addition, children were more likely to report increased levels of hazard-related upset if they also observed that their parents demonstrate hazard-related upset. Thus, the message here is that if hazard-related communication from adults is perceived as having an element of anxiety, children may be more likely to

experience anxiety as well (see also Ronan, 1997). Education programmes and adult communication should be designed to impart messages with a sense of control and confidence (see Recommendations). In addition, data is suggestive of the possibility that children in education programmes may impart information to parents that has the subsequent effect of reducing parental fears (or at least, perceptions of parental fears). Strengthening the link between effective child and parent communications and particularly those secondary to a child-based hazard education programme is warranted (see Recommendations).

Physical Preparedness

Awareness of safety-related behaviours. Previous sections contain additional information related to physical preparedness. Generally, most children in this survey were aware of the most essential risk mitigation behaviours that are recommended by Civil Defence and other agencies. At least 3 in 4 children knew the most essential safety-related behaviour(s) associated with floods (higher ground), fires (direct exit), earthquakes (stay inside & take cover under...,), storm with high winds (stay inside), chemical spill (evacuate as advised by ...,), volcanic eruptions (close all doors and windows) and tsunamis (go at least 1 km inland...,). In addition, a much greater frequency of children involved in education programmes were aware of these behaviours compared to children who reported no hazard education. In fact, a much greater frequency of children involved in two or more education programmes were aware of these behaviours compared to both (a) the no education group, and importantly (b) children who reported being involved in only one hazard education programme. Consequently, the more education programmes in which a child reports involvement, the more likely it is that they will be more sure of essential safety-related behaviours. The more likely it is that they know safety-related behaviours, the less likely they will be scared when talking about hazards, the more likely their risk perceptions are realistic, and so on. Education programmes applied with regularity are warranted in light of these data as well as the fact that there were some children from each school who reported no hazard education.

Some findings indicated that children weren't as aware of some other risk mitigation behaviours as those described in the previous paragraph. A few examples are proved (see Results for more detail). While most children knew that in a flood they were supposed to move to a higher area and listen to the radio, only 39 % of the children reported an awareness that to "stay inside and wait to be told what to do" represented a safety-related response. While over 85 % of children knew that in an earthquake, one should stay inside and take cover under beds, doorways, etc, only 58 % knew that curling into a turtle shape or ducking, covering, and holding were safety-related responses. While 77% of children knew to stay inside during a storm with winds, only 37 % knew to open a window on the sheltered side of the house.

In addition, some behaviours that are incorrect or not endorsed by Civil Defence or other agencies were endorsed by some children. For example, 58 % of children thought that it was appropriate to "close all doors and windows" during a wind storm and 29 % thought it appropriate to "open all doors and windows" during a house fire. In fact, even for children involved in hazard education, 63 % thought "closing all doors and windows" appropriate wind storm behaviour and 34 % thought opening doors and windows during fires as appropriate. In addition, smaller percentages of educated children thought it appropriate to go outside at look at the rising water during a flood (12 %) or go outside and look at a volcanic eruption (8%) (see Results for more information).

The issue here appears to be one of clear differentiation between appropriate responses. Clearly, most children involved in hazard education report awareness of most of the essential safety-related behaviours. However, even the educated children show a general inability to differentiate when it comes to some other secondary behaviours. This may be because current education programmes in the schools may gear programmes to ensure children understand the most important hazard mitigation behaviours. There were some tentative indications that older children might be able to handle more differentiated information (i.e., they were consistently more aware of a variety of essential behaviours than younger children). As a result, education programmes geared to age level in terms of the amount of differentiated information imparted may enhance at least older children's understanding of what to do and, sometimes just as importantly, what not to do in the event of a hazard.

Physical and practice-based preparedness. Compared to the larger numbers of children who were aware of essential safety and risk mitigation behaviours, smaller percentages of children in this survey reported physical activities and practice-based routines designed to prepare them for more efficient risk mitigation during an actual hazard. Fewer than 35 % of children in the sample as a whole a similar percentage of children involved in hazards education reported (a) a family emergency plan to be in place (b) home-based practice for an emergency, (c) a family plan of their house showing exits and utility switches, and (d) a family plan of where to meet or leave messages in the event of a hazard. About 50 % of the children reported (a) being aware of who was responsible for collecting them or meeting them at school during an emergency as well as having a (b) torch, transistor radio, and spare batteries in an identifiable place. It was the case that about 8 in 10 children did report being involved in hazard-related practice in "any setting"--most of these children appear to have been involved in school fire or emergency drills.

The issue here appears to be one of a relative dearth of home-based physical preparedness plans and related practice. It is also the case that only 29 % of the children involved in education reported taking that information home and discussing it

with their parents. The idea of teaching parents through children has appeal. However, data indicate that the majority of hazard-educated children are not discussing a specific education programme with parents though they are talking more about hazards compared to non-educated children (see also later section). The issue here appears to be one of helping children and parents focus some of these discussions on practice-based preparedness routines. It is again stressed that these data support the idea that continued attempts to strengthen the link between children's education and parent's learning are worthwhile (see Recommendations).

Social Support

This particular scale did not generally show reliable relationships with other factors. However, in terms of simple frequency data, it is the case that over 7 in 10 children found parents and teachers to be helpful and about 1 in 2 children reported Civil Defence as having helped them feel more prepared for coping with emergencies. This data reflects well on Civil Defence education programmes. It is also the case that the same percentage of children who reported Civil Defence to have been helpful also reported having been involved in a Civil Defence hazard education course. Finally, 3 in 10 children reported peers (friends) to be helpful and between 1 and 2 in 10 found "others" to be helpful (e.g., extended family).

Hazard Related Communication and Information Searching/Information Receiving

As discussed earlier, children tended to discuss more often those hazards where the perception of physical risk was greater (see the Summary and Risk Perceptions sections for a detailed discussion of the relationship between this and other factors).

A robust relationship was found between hazard-related communication with parents and teachers and increased awareness of factual knowledge related to primary protective behaviours. At home, whether children broached the topic (that is, child sought or shared information) or parents broached the topic (that is, child received information), there were consistently significant correlations between hazard-related communication and correct preparedness responses. In fact, increased hazard-related communication was also more likely if children participated in an education programme. Thus, while only 29 % of children reported discussing a specific education programme with parents, the great majority of hazard-educated children reported engaging in some form of apparently beneficial hazard-related communication with parents. This discussing specific information appears to be a necessary step in strengthening the link between children's learning and potentially increased home-based preparedness. At school, the more consistent and robust relationship was found for received information: those children who reported

receiving information from teachers consistently reported a greater level of awareness of essential preparedness behaviours.

It was also the case that there were differences in level of emotional arousal and perceived coping ability as a function of seeking/sharing or receiving information in the school setting. Children who reported receiving information from a teacher reported a significantly stronger belief in their ability to cope with a future hazard and significantly reduced hazard-related fears compared to children who reported not receiving information from a teacher. By contrast, children who reported seeking information from a teacher had a reduced belief in their ability to cope with a future hazard compared to those who did not seek information from teachers. The issue here appears to be one of children potentially feeling more reassured when teachers broach hazard-related communication and less in control when they themselves broach topics. Of course, the nature of the study precludes making definitive conclusions due to the cross-sectional design of the study. However, when combined with previous findings, the implications of these findings are clear for education and adult hazard communications: initiate discussions with children that are aimed at instilling them with a sense of control and confidence that future hazard mitigation is not only possible, it is also more likely the more we know and the more we practice. Such discussions can help equip the children with needed skills but, just as importantly, help them feel reassured that adults can cope with and sort out these issues with control and confidence (see Recommendations).

Effects of Education Programmes

These effects have been detailed throughout the Discussion. In short, and to emphasize, hazard education is beneficial for children in a variety of related domains as reflected in more realistic risk perceptions, increased awareness of hazard preparedness and mitigation strategies, reduced negative emotional arousal, and increased hazard-related communications with parents and caregivers (and teachers).

From the results of the current survey, a potential future direction for these hazard education programmes to help make them even more effective than they already appear to be is through devising strategies designed to help increase the levels of physical and practice-based preparedness reported by children very possibly through creative attempts at strengthening the link between children's hazard education and adult-based learning. The issue then becomes one of helping children and their parents translate any increased discussions into preparedness activities. It is particularly important to link in parents and caregivers to children's hazards education because children at times need to rely on adults to enact certain behaviours that can mitigate future risk. With increased adult control, children too can feel an increased sense of

safety, control, and confidence that future hazards can be potentially dangerous (and even a little scary), but essentially and simply, represent problems that have solutions.

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Appendix A
Factual Information:
Data Related to Hazards in Auckland

Appendix A: Data Related to Hazards in Auckland

A range of geological, meteorological and technological hazards pose a significant threat to the population and infrastructure of Auckland.

Tsunami
At least 12 tsunamis have been recorded in Auckland between 1840-1993, with the largest a 1.8 m surge caused by the Krakatau eruption, Indonesia, in 1883. An assessment of the tsunami hazard (de Lange and Hull 1994) concludes that the most likely tsunami is a small event (0.25 m wave height) generated in or near the Tonga-Kermadec Trench, to the north, with an annual probability of occurrence of around 25% (return period 4 years). The most likely damaging tsunami is a far-field event generated from Southern America, with an annual probability of 1.33% (return period 75 years) and an expected wave height in the outer Hauraki Gulf of 1 to 3 m. Displacement of the Kerepehi fault, in the Firth of Thames, is regarded as significant future near-field tsunami sources. Historical data suggests that 5-10 m above the highest astronomical tides should be regarded as a safe elevation.

Earthquakes
Auckland lies in one of the lowest earthquake activity regions in New Zealand (Hull et al. 1995). Only one earthquake over the past 150 years, the 1891 Waikato Heads earthquake (mag. 5.7-5.9), is known to have caused significant damage in the Auckland region. Return periods for moderate to strong shaking are estimated by Hull et. al. (1995) at a 91 year return period for a shaking intensity of MM6 (Modified Mercalli), 640 year return period MM7 and 5400 year return period for MM8.

Auckland Volcanic Field
The city has developed across the Auckland Volcanic Field in which small eruptions have occurred from 49 scattered vents during the past 140 000 years (Allen and Smith 1994). The most recent, and largest, eruptions formed Rangitoto Island within the last 800 years. The Auckland Volcanic Field may be in an early stage of its evolution and further eruptions can be expected from new and apparently random vent locations within the Field. Past eruptions have been usually small (< 0.1 km3), although there is an apparent trend towards increasing size of eruptions with time. In the past 20 000 years the return period of eruptions has been in the order of 1000 - 3000 years.

Effects of distant volcanism
Auckland is vulnerable to ash falls from volcanoes outside the region, notably from the Taupo Volcanic Zone and Taranaki. Eruptions of sufficient magnitude to deliver ash to Auckland occur on average every 50-100 years from Ruapehu, 200-300 years from Taranaki, 1000 years from Taupo and 2000 years from Okataina. During the 1996 Ruapehu eruption the volcanic ash cloud reached Auckland, closing the international airport.

Landslides
A preliminary slope instability hazard map (Williams 1996) identifies four major areas of instability hazard:

1. slopes comprised of Onerahi Chaos-Breccia (e.g. Silverdale area),
2. coastal areas (e.g. Whangaparaoa Peninsula; Leigh - Pakiri coast),
3. sensitive pumiceous deposits (e.g. Te-Atatu North, Hobsonville, East Tamaki-Manurewa and
4. steep inland slopes of 20° + (e.g. Whitford - Brookby area). Landslides are frequently triggered by high intensity rain storms.

Meteorological hazards

Meteorological hazards vary across the region (Salinger et al. 1996). Storm events are common, usually of short duration and cause only minor damage but occasionally larger cyclonic events cause greater impacts. Heavy rainfalls frequently result in localised flooding and occur most often in the north and west. Extreme winds produce hazards to buildings, marines and other infrastructure and also occur most frequently in the north and west (up to 8% of the time in the west). Hail and extreme temperature do not pose a major hazard to the region but localised severe hail storms can be extremely damaging to crops and property. Low barometric pressure and resulting storm surges are a significant hazard to some low lying coastal areas.

Fire

Fires are among the most common hazards encountered by people in their homes.

Technological hazards

Auckland has the potential for a number of technological accidents. These can occur during the manufacturing, storage or transportation of hazardous or dangerous substances. For example; in 1973 spillage of a cotton defoliant in Parnell lead to the declaration of a Civil Defence Emergency, with 643 people taken to hospital and 4 000 families evacuated. In 1984 the ICI chemical fire caused the evacuation of parts of south Auckland. The collision and fire involving a petrol tanker in Manukau City in 1990 also illustrates the risk.

Rank ordering of hazards in the Auckland Area

An attempt was made at rank ordering the return periods of events. There needs to be some caution in the comparisons because the area of impact and the level of damage varies between hazards. A storm, earthquake or volcanic eruption will affect everyone in the city whereas a fire may only affect one household.

1. Fires, wind-storms and floods are annual events. Fires affected a limited area. Floods local impacts. Wind-storms have widespread impacts. Small tornadoes (not the "Twister" movie type) occur during wind-storm events maybe once a year on average.

2. Chemical spills also occur annually but major incidents involving evacuation occur once every 5-10 years.
3. Significant tsunamis every 75 years,
4. Earthquakes of MM6 every 91 years
5. Light volcanic ash falls from distant volcanoes every 50 - 100 years
6. Earthquakes of MM7 every 640 years
7. Thicker ash falls (10 cm) from distant volcanoes every 1000 - 2000 years
8. Local volcanic eruption every 1000 - 3000 years.
9. Large earthquake (MM8) every 5400 years.

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