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Interactive Hazards Education Program for Youth in a Low SES Community: A Quasi-Experimental Pilot Study

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A pilot study of an interactive hazards education program was carried out in Canberra (Australia), with direct input from youth participants. Effects were evaluated in relation to youths' interest in disasters, motivation to prepare, risk awareness, knowledge indicators, perceived preparedness levels, planning and practice for emergencies, and fear and anxiety indicators. Parents also provided ratings, including of actual home-based preparedness activities. Using a single group pretest-posttest with benchmarking design, a sample of 20 youths and their parents from a low SES community participated. Findings indicated beneficial changes on a number of indicators. Preparedness indicators increased significantly from pre- to posttest on both youth ($p < 0.01$) and parent ratings ($p < 0.01$). Parent ratings reflected an increase of just under six home-based preparedness activities. Youth knowledge about disaster mitigation also was seen to increase significantly ($p < 0.001$), increasing 39% from pretest levels. While personalized risk perceptions significantly increased ($p < 0.01$), anxiety and worry levels were seen either not to change (generalized anxiety, $p > 0.05$) or to reduce between pre- and posttest (hazards-specific fears, worry, and distress, *p*s ranged from $p < 0.05$ to < 0.001). In terms of predictors of preparedness, a number of variables were found to predict posttest preparedness levels, including information searching done by participants between education sessions. These pilot findings are the first to reflect quasi-experimental outcomes for a youth hazards education program carried out in a setting other than a school that focused on a sample of youth from a low SES community.

KEY WORDS: Disaster preparedness; hazards education; risk perceptions; youth and families

1. INTRODUCTION

Natural hazards are a part of living in Australia. For example, Canberra, the site for the current study, experienced multiple bushfires throughout its suburbs in 2003.(1) Owing to various conditions, including added wind, very dry conditions, and unprepared community members, combined with the close proximity of a petrol station in relation to a forest, the fires were turned from a somewhat containable hazardous condition into an uncontainable disaster, with four deaths in the worst hit suburb of Duffy.(2–4) In addition to lives lost and other social costs, in economic terms, this one event cost Australians $A350,000,000.(5) More generally, based on economic estimates, between 2000 and 2009, the annual average cost of natural disasters in Oceania was estimated to be $1.27 billion per year.[1] Disasters impart very high costs to the community, not only in dollar terms but also in terms of a range of other impacts, including injuries and lives lost,

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[1]Comparison figures from other areas in that same timeframe include Africa ($1.15 billion/year), Americas ($43.69 billion/year), Asia ($39.36 billion/year), Europe ($13.41 billion/year), and globally ($98.87 billion/year).(49)

damage to infrastructure (e.g., roads, buildings, properties), health-related effects, breakdown in social networks, and effects on vulnerable populations, including children and families.[18,19] When coupled with other systemic problems identified in research (e.g., lack of adequate warning systems; lack of coordinated government response after some disasters), activities designed to promote a community self-help approach to preparedness and response are increasingly emphasized.[16,18,19] Children and families are a vulnerable population, particularly those in lower socioeconomic (SES) groups.[21] On the other hand, activities aimed at increasing family-based preparedness can empower and assist households to mitigate risk and to respond and recover more effectively from a hazardous event.[16] Research has demonstrated that increased household preparedness designed to mitigate vulnerability and impacts, and increase response capacity, can be influenced by various interventions.[1,6–17]

Despite the call for community-level preparedness, particularly in vulnerable populations and high hazard areas, many researchers report low preparedness levels including in both vulnerable populations and in high hazard areas.[18,19] A large body of research has demonstrated that the majority of community members do not participate to any substantial extent in disaster mitigation or preparedness. However, a growing body of evidence supports the idea that including children and youth in community preparedness efforts can yield benefits. One suggested reason is that children (and their families) have been identified as both a vulnerable group but also as a community-level "motivational reservoir."[16]

1.1. Children and Families as High-Risk Groups: Increasing Community Resilience[2]

Census figures indicate that 42% of family households in Australia contain a resident child ages 0-17,[20] with similar statistics in other countries.[16] According to Norris *et al.*,[21] children appear to be the demographic group most vulnerable to severe psychosocial effects following a disaster. In addition, those who come from lower SES strata are also at higher risk both before and following a disaster.[18][3] Thus, children and families from low SES backgrounds represent a particularly vulnerable group.

The impact of a natural hazard on different population groups, including children and families, has been studied extensively (e.g., the Norris *et al.* review[21] has "60,000 Disaster Victims Speak" in the title). Norris *et al.* reviewed in depth vulnerability factors, some of which include: additional acute/chronic stressors, gender (i.e., females), low disaster coping experience, prior psychological problems, and other emotional and coping problems.[21] Other vulnerability factors identified in previous studies include: low socioeconomic status and poor educational backgrounds.[12,16,17] Children, and families with a child, also experience higher psychological distress levels during and after a natural hazardous event.[21] In addition, when there is distress in a family following a disaster, this then can lead to additional (secondary) stressors.[12,16,17,22] Therefore, families and youths are considered to be high-risk groups, with those from low SES groups being more vulnerable yet.

On the other hand, a number of researchers[16,23–25] have identified children as a "community motivational reservoir." For instance, Peek highlights a role for youths' energy, creativity, resourcefulness, knowledge, social networks, and enthusiasm.[23] She discusses the increasing field evidence indicating specific actions taken by young people before, during, and after a natural disaster that helped not only themselves, but also helped others, in some instances, saving the lives of others. Given such documented instances, Peek then points out how children are not questioned about their thoughts and opinions, and suggests that systems be established to include the voices of children. However, research on hazards education programs to date have been on those largely devised and carried out by adults, generally either emergency management personnel or teachers.[26–29] Anderson[22] and others[23,25,29,30] emphasize youths' capabilities and

[2]Community resilience refers to a community's ability to cope effectively with, and "bounce back" from, adverse events, including natural disasters. More resilient communities are thought to include an increased number of protective factors (e.g., increased preparedness indicators; increased participation of citizens; economic development) and a decreased number of risk factors (e.g., decreased preparedness indicators; reduced connectivity across community and social networks; low SES).[16,18,19] A framework by Norris and colleagues speaks to both structural and process models of community resilience to disasters, including supportive research.[50]

[3]SES status may be related to enhanced risk for being more exposed to disaster effects, given various vulnerabilities including poorer quality housing, living in higher hazard zones where housing is sometimes more affordable (e.g., flood plains; less stable areas), poorer emergency resource provisions, including preparedness.[18]

the importance of listening to the thoughts and opinions of children.

In addition, there is also the common sense notion, supported by much science, that behavior is strongly governed by habits that develop over a period of time.[30,31] In other words, when the same behavior is repeated in response to the same situation, a habit is formed. Thus, encouraging natural hazard habits in vulnerable sections of communities would potentially increase the future resilience of communities. Habits formed in childhood are more likely to continue into adulthood. Following such ideas, one approach to developing these habits, referred to as the *Strengthening Systems 4R Prevention Model (SS4R)*, discusses encouraging and strengthening links between and within "networks" in a community in relation to disaster readiness.[16] Using a motivational enhancement framework, the SS4R approach identifies the school–child–family linkage as an important community network: one that connects a school, or educational program, with families and households through a child's learning and enthusiasm. In targeting recovery and response through readiness, such programs can promote, and help inculcate, skills linked to both adaptive emotion- and problem-focused coping in relation to future risk and uncertainty. The idea here is that educational programs that involve children can assist both the children, and their families, to be better equipped to solve a range of problems linked to future risk and uncertainty in life, including preparedness for disasters. These programs then can also be part of a foundation for increasing community resilience. That is, approximately half of a community's households have a young person under 18 years.[20] As a function of educational programs, these households can not only increase their own preparedness, they can also additionally "spread the preparedness word" through other networks in a community into which those households, and educational facilities, are connected.

Research to date supports the value of youth-based education programs in promoting increased preparedness for hazardous events and other related benefits in both correlational[26,28,32] and quasi-experimental research.[27,29] However, educational programs for more vulnerable youth and family groups (i.e., those from limited educational backgrounds and from low SES groups) have not been specifically evaluated. In addition, research to date has been focused on hazards education programs carried out in school settings by teachers and other adults. By contrast, the current research was designed to apply principles of the SS4R model to a more vulnerable group of youth through a local community youth center. Through a community-based participatory action research approach, one main idea from this model included the active involvement of participating youth in important elements of program design and practice.

1.2. Aims of the Study

The overall aim of this study was a pilot evaluation of a youth interactive natural hazard educational program. The study had three specific aims focused on replication, extension, and benchmarking, respectively. The first aim of the study was replication, including assessing the effectiveness of youth hazards education through the use of a quasi-experimental design.[27,29] Following previous research,[27,29] pre-post evaluation assessed changes in basic awareness, risk perceptions, knowledge, and preparedness following a hazards education program for youth. In relation to the second aim of extension, more specific and expanded constructs were also included to expand the knowledge base. These additional or expanded child-focused constructs were as follows: natural hazard interest levels, expanded preparedness indices, greatly expanded knowledge indicators, and more comprehensive general and hazard-specific anxiety indicators for youth. For parent measures, a take-home inventory for parents to fill out included preparedness indices that, compared to previous research,[27] included an expanded list of preparedness indicators and, for the first time, indices for parents to note their own anxiety levels. A final extension of the study followed recommendations for involving youth more directly in community preparedness.[23–25,30] Unlike previous studies,[24,26–29,32] youth were directly involved in planning and carrying out the hazards education program and related competition.

2. METHOD

2.1. Participants

The total sample consisted of 20 participants, and their parents, recruited from a local Canberra youth center. There were 10 females and 10 males, whose ages ranged from 12 to 18 years ($M = 14.8$, $SD = 2.24$). One parent for each of these youth also participated in the research. All participants came from the same section of the community, identified as

being in a lower SES area. The youth center itself was there to assist with wider community needs, including being available to cater to those not attending school or involved in any vocational training. Sixty percent of youth participants attended any form of schooling or vocational training ($n = 12$) and 40% did not. School-year levels were as follows: Year 6 ($n = 3$), Year 7 ($n = 3$), Year 8 ($n = 3$), Year 10 ($n = 2$), Year 11 ($n = 1$). The ethnic background of participants was as follows: Australian/Caucasian ($n = 19$, 95%) and Spanish/Hispanic-Latino ($n = 1$, 5%).

2.2. Materials

Pre- and posttests comprised a battery including a number of separate paper-and-pencil indices. The youth participants filled out all but one of these. The final measure (Natural Hazard Home Survey; see below) was taken home and filled out by parents.

2.2.1. Demographic Variables

A brief questionnaire assessed the following demographic information: ethnicity, gender, schooling and/or vocational activity, school year, and age.

2.2.2. The Revised Children's Manifest Anxiety Scale Second Edition

The 49-item Revised Children's Manifest Anxiety Scale (RCMAS-2)[33] is a psychometrically sound self-report measure designed to measure generalized anxiety in children. Participants were asked to agree or disagree (i.e., *yes* or *no*) to each of the statements. Items are designed to measure physiological anxiety, worry, and social anxiety. Each anxiety subscale score is then added together to get an overall total anxiety score. In the current sample, the alpha reliability for the RCMAS was 0.93.

2.2.3. Children and Youth Natural Hazard School Survey

The Child and Youth Natural Hazard School Survey, adapted from the Auckland School Children's Perceptions Survey,[32,34] measures children's cognitive, behavioral, and emotional factors in relation to natural hazards preparedness. This measure has been found to be reliable, reflect convergent validity, and has demonstrated treatment sensitivity.[26–29,32] Prior to items measured at pre- and posttest, participants were asked if they had participated in any past hazards education programs and another item asked whether they had attended a prominent local natural hazard and disaster program and exhibition (i.e., Questacon). Participants selected either 1 (*yes*) or 2 (*no*). Scores for these two items were reversed (i.e., 1[*no*] or 2 [*yes*]). Thus, natural hazard education scores could range from 2 (low) to 4 (high) ($M = 2.50$, $SD = 0.76$). The rest of the items on this measure reflected pre-post outcome indicators and included risk perceptions, emotional factors, and preparedness-related perceptions and activities.

Risk perceptions. Five items measured risk awareness. Participants circled two out of 10 natural hazards that would most likely affect them (1) at home as well as (2) at school. Natural hazard awareness scores could range from 0 (low) to 4 (high) ($\alpha = 0.67$).[4] Another three items measured personalized risk perceptions (i.e., personal risk). Participants rated the chances of a specific natural hazard (i.e., bushfire, earthquake, flood, storm, cyclone, storm surge, landslide, tsunami, meteorite strike, or tornado) occurring in the future and causing a damage or injury to them or their family in the future. Participants rated their personal risk on a three-point Likert scale (1 = *unlikely* to 3 = *likely*). Natural hazard personal risk scores could range from 10 (low) to 30 (high) ($\alpha = 0.89$).

Emotional factors. Two items measured generalized distress in relation to natural hazards. Participants rated (1) how scared/upset they felt discussing/thinking about a natural hazard and (2) if they had trouble trying to stop thinking about natural hazards. Participants rated their natural hazard distress levels on a Likert scale from 1 (*not at all*) to 3 (*often*). Natural hazard distress scores could range from 2 (low) to 6 (high) (intercorrelation between these two items = 0.72).

Thirteen items extended an earlier eight-item version originally designed to measure negative emotion (i.e., fear) in relation to eight natural hazards.[26,32,34] This expanded index included items that reflect 13 different hazardous events. In terms of content, the items were expanded to include both negative and positive emotional factors. Recommendations to include positive emotional items

[4] Alpha reliabilities in the 0.7 and above range are typically considered adequate.[38]

reflect recent research and theory.[16,35–37] Participants here were instructed to indicate how (1) interested, (2) scared, or (3) worried they were regarding each of the 13 different natural hazards. Participants rated their relevant levels on a Likert scale, from 1 (*not very*) to 3 (*very*). Natural hazard interest, fear, and worry scores could range from 13 (low) to 39 (high) ($\alpha = 0.97$).

2.2.3.1. Preparedness-related activities and perceptions. Seven items measured behavior focused on hazards emergency planning and practices. Participants were asked questions relating to specific emergency plans and practices (e.g., "Does your family have an emergency plan that tells you what to do to be ready for an emergency?"). Participants circled either 1 (*no*) or 2 (*yes*), depending on their practices. For yes responses, further details were then requested (i.e., where, who, where are they, who is responsible for checking items) as a means for verifying responses. If this information was not provided, their response was changed to 1 (*no*). Natural hazard emergency plans and practice scores could range from 7 (low) to 14 (high).

Participants were next instructed to indicate how prepared they thought they were regarding each of 13 different natural hazards (i.e., bushfire, earthquake, flood, wind storm, electrical storm, snow storm, hail storm, cyclone, storm surge, landslide, tsunami, meteorite strike, and tornado). Participants rated their perceived preparedness levels on a Likert scale, from 1 (*not very*) to 3 (*very*). Natural hazard preparedness perceptions scores could range from 13 (low) to 39 (high) ($\alpha = 0.88$).

Finally, as an indicator of motivation, an information searching record log was given to each participant to log the amount of time she or he spent researching natural hazards and preparedness each week in between sessions. Based on youth input at the initial session (see below for more information), the group agreed to try to spend two hours per week on information searching. This variable was then used to predict preparedness levels. Over the five session program, the average total amount of information searching time was 4.20 hours ($SD = 2.82$).

2.2.4. Natural Hazard Knowledge Questionnaire

We constructed a 48-item Natural Hazard Knowledge Questionnaire by compiling factual information from various sources to measure natural hazards knowledge. The questionnaires combined both multiple-choice (41 questions) and short-answer questions (seven questions). All 48 questions were sourced from information obtained from three reputable organizations in Australia, including factual information gleaned from the Emergency Management Australia website (www.ema.gov.au); State Emergency Services' storm information pack (http://esa.act.gov.au/actses/); and information included in an educational DVD called "Hazards, Disasters, and Survival," produced as a joint effort by Emergency Management Australia (EMA) and the Australian Broadcasting Corporation.[1] The first item measured basic emergency knowledge (e.g., what to do if there is an emergency warning signal on TV or radio). Remaining items reflected natural hazards most prevalent in Canberra and community-service-related knowledge items. Thus, 21 items measured fire knowledge (Canberra is in a high bushfire hazard zone).[5] Fourteen items measured flood knowledge; seven items were designed to measure storm knowledge. Finally, five items measured community services knowledge. For the multiple-choice questions, participants were given a choice of four alternative answers and instructed to circle the correct answer. For the short-answer questions, each of these asked participants to provide a list. Participants listed as many activities that they could in order to prepare their homes and/or property against a bushfire (three items), storm (one item), or flood (one item) as well as list emergency kit items (one item) and protective clothing items (one item). For these questions, one mark was given for each correctly listed activity or item up to a maximum possible (ranging from 7 to 10 items being requested). Natural hazard knowledge scores could range from 0 (low) to 105 (high) ($\alpha = 0.79$).

2.2.5. Natural Hazard Home Survey

The Natural Hazard Home Survey extended a previous version of the measure[25,26] to assess a family's risk perceptions, hazards-related emotion, and hazards adjustment behavior.

One item measured actual home preparedness. Participants' parents/guardians were asked to endorse (i.e., circle) all the preparedness activities the family had previously undertaken out of a total of 37 activities (e.g., have a family emergency plan; have

[5]The senior author became interested in hazard readiness after experiencing the 2003 Canberra Bushfires.

a house plan showing exits, assembly areas, where to turn off water, electricity, gas; rake up dry leaves around the house; cut back overgrown shrubs/tree branches; have a smoke detector; have a first-aid kit; buy additional insurance; someone in family has learned to provide first aid; have a 14-day stay-in-home plan; stockpile food and water; have transistor radio and batteries). Natural hazard preparedness levels could range from 0 (low) to 37 (high).

Six items measured family-based negative emotion (i.e., anxiety). Participants' parents/guardians were asked separately if the child/ren or parent experienced or verbalized any (1) anxiety, (2) fear, or (3) negative thoughts regarding natural hazards (three items) or normal weather (three items). Total anxiety scores could range from 6 (low) to 24 (high) ($\alpha = 0.97$ for the natural hazards items and 0.77 for the weather-related items).

2.3. Procedure

A youth center in Canberra was approached by the senior author[6] to conduct this research on its premises, with current and potential youth members and their families provided access to information sheets advertising the study by center staff. If interested, center staff then passed along the name and contact details to the researcher who then contacted families to provide them with an overview and answer any questions. If families were then interested, an informed consent process was undertaken based on university ethics committee approval and required separate youth and parent consent forms to be filled out. Following standard informed consent procedures, youth and parent participants were informed that they had the right to withdraw themselves and their data at any time from the study. A week prior to commencement of the program, the pretest version of the Natural Hazard Home Survey for parents and an envelope were given to youth participants to take home. After being filled out by a parent, it was returned at the commencement of the natural hazard education competition program in the sealed envelope. The attrition rate of participating youth and parents between pre- and posttest was 0%. All 20 youth and their parents participated through the entire program, including pre- and posttesting. One parent was involved formally in the research in pre- and posttesting and in the final session (see next section for more detail). Youth were involved in the entire program, all five intervention sessions as well as the pre- and posttesting sessions. While the program was aimed at youth, the program stressed the idea of increased interaction, including youth going home and sharing what they learned and encouraging household preparedness activities with their parents. Testing and the program itself was carried out at the center in 2008. Participants were not compensated for their participation.

2.3.1. Natural Hazards Education Program

The natural hazard education component focused on the three main natural hazards that most typically occur in the local area: bushfires, storms, and flooding. The natural hazard education competition program went for a total duration of two hours per session over five consecutive weeks. Each individual session had a theme: (1) predata collection and program introduction and engagement, (2) storm and flooding program, (3) farm fire-wise program, and (4) a natural hazards and preparedness DVD and discussion. Following these four sessions, a final brief session included prize giving for the friendly competition element. Participants were also provided an "information searching log" to record information retrieved in between each session that would assist in developing their knowledge and their entry for the end-of-program competition (see later in this section for more detail).

For Session 1, the introductory and predata collection night consisted first of a PowerPoint presentation. Presented by the program coordinator, it gave a brief outline of what to expect, starting with pretesting. Pretesting was then carried out, taking approximately one hour to complete the battery. They also returned the home pretest packet that had been given out one week prior to the commencement of this session. Once pretest data were collected, the program coordinator continued with the introduction, designed to get participants thinking about what natural hazards were, how they could prepare, and how they might share their learning with their family. This included an open forum discussion to solicit youths' perceptions on how best to do these and other activities. Based on youth consultation, participants suggested and agreed to put aside two hours each week for their individual research

[6]The senior author lived also in Canberra but did not have a preexisting relationship with the center. The youth center was approached given that it catered to young people from a diversity of backgrounds, including low SES and those with educational or vocational difficulties.

(i.e., recording their efforts on the information searching record log) and for planning and creating their natural hazard "masterpiece" (i.e., a project made at home reflecting some aspect of their learning that was then entered into the "natural hazards competition").

For Session 2, the researcher organized Questacon and State Emergency Services (SES) in Canberra to present a program that focused on storms and floods, designed specifically for this age group. The program went for approximately one hour and covered the following topics: the geographical layout of Canberra, preparedness, emergency procedures for community members, emergency procedures for individuals/families, community awareness and response, personal safety, what to do in certain conditions, fire/storm kits, and volunteer packs for anyone interested in being an SES volunteer. Participants were given an opportunity to ask questions. Following the structured presentation, the presenters then left. Open-forum discussion between youth participants, facilitated by both the youth and program coordinator, followed and included the opportunity to eat and drink. Discussions went for one hour and focused on their thoughts and feelings about the program (i.e., what they liked best, what they did not like) and what changes they would make to the program to make it more interesting for them and others in the future.

For Session 3, ACT[7] Rural Bush Fire Services presented a "farm fire-wise program." The program went for approximately half an hour and covered the following: the geographical layout of Canberra, preparedness, emergency procedures for the community, emergency procedures for individuals/families, community awareness and response, personal safety, what to do in certain situations, how fire assessments are carried out, the nature and risk of Canberra bushfires, fire kits, rural communities, and satellite benefits. Bushfire information packs were also handed out. The value of obtaining first-aid training and certification was also emphasized. Participants then gained hands-on experience with a fire "tanker." All the equipment on board was explained, including a demonstration. The hands-on exercise went for approximately 20 minutes. Following the program, a one-hour open-forum discussion followed where participants also had the opportunity to eat and drink. As in the previous session, discussions focused on the program, their thoughts and feelings about the program (i.e., what they liked best, what they did not like), and what changes they would make to the program to make it more interesting for them and others in the future.

For Session 4, EMA provided the researcher with the "Hazards, Disasters, and Survival" educational ABC/EMA series DVD. The program coordinator played the three Canberra- and program-relevant sections on the DVD (i.e., storms, floods, and bushfires) to the participants. Each section went for approximately 15 minutes, with the DVD viewing taking a total time of 45 minutes. Participants then had a 15-minute break followed by the same one-hour open-forum food and drink discussion format used in previous sessions.

The fifth and final session of the program, the competition component, was held on the fifth consecutive week and went for approximately half an hour. All completed natural hazard "masterpieces"[8] were entered into the competition and were judged by the Youth Centre staff. Prizes were then given to first, second, and third places. A separate final testing session consisted of posttesting for both young persons and parents, following the same procedure used at pretest, with parents being provided a sealed envelope to return the Home Survey.

2.4. Data Management

The data set was first screened for errors visually, and then by investigating the score ranges using frequency tables for all variables, checking for any missing values, and checking for any outliers. There were no errors or missing values found. The data set contained a few outliers, and a decision was made to include outliers, as some measurements represented knowledge and preparedness, and as such demonstrated individual strengths and possible program effectiveness. SPSS Version 16.0 was used for all statistical analysis undertaken in this project. It has been suggested that an alpha level of 0.10 or 0.15 be used with samples sizes around 20.[38] While considered, a more conservative alpha level of 0.05 was ultimately chosen for each statistical procedure. However, findings falling between 0.05 and 0.10 are noted,

[7]Australian Capital Territory.

[8]These included poems, songs, posters, and models depicting themes having to do with natural hazards and preparedness activities. The winning piece was a model home depicting a home fire and a range of preparedness items to deal effectively with the fire including escape routes, fire extinguishers, fire blankets, and even a backpack for important family documents, photos, and other items.

Table I. Significant Demographic Correlations

Measure	r_s	ps^*
Age		
Prenatural hazard risk awareness	−0.45	0.05
Prenatural hazard education background	−0.46	0.04
Gender		
Prenatural hazard education background	−0.47	0.04
Total prefear	−0.53	0.02
Total preworry	−0.53	0.02

*Two-tailed.

following Steven's suggestion[38] and the convention in the literature for noting "statistical trends." Finally, findings from this study were benchmarked against a previous, larger quasi-experimental study in this area.[27][9]

3. RESULTS

3.1. Preliminary Analyses

A chi-square independence testing for all demographic variables—ethnicity, gender, school status, school years, and age—across all measurements was carried out. Owing to the sample size, the assumption of at least 80% of cells having expected frequencies of 5 or greater was found to be violated, and therefore demographic differences could not be reported. Spearman's rank order correlation tests were then performed with pretest scores on measures, and a few significant correlations were noted involving the demographic variables age and gender (see Table I). Thus, younger age and female status were significantly correlated with various indicators (see Table I).

3.2. Main Analyses

Given that assumption testing indicated on some indicators violations of necessary assumptions (in particular, normality), nonparametric tests were used as a result.[39] Table II displays the Wilcoxon signed-rank test results along with all the means and standard deviations for both the pre- and posttests across outcome indicators. Table III displays the significant correlations found between variables with youth-reported preparedness perceptions at pretest. Table IV displays all the significant correlations found between variables with youth-reported preparedness perceptions at posttest.

Statistically significant increases were found for youth-reported variables: hazard knowledge ($p < 0.005$), personalized risk perceptions ($p < 0.01$), and emergency plans and practices ($p < 0.01$). Parent-reported preparedness activities at home also increased significantly ($p < 0.01$). Statistically significant decreases were found for youth-reported natural hazard fear ($p < 0.01$), natural hazard worry ($p < 0.005$), and natural hazard distress ($p < 0.05$; see Table II). Other pre-post comparisons reflected trends toward significance, including the total RCMAS score, the RCMAS Worry subscale, and youth hazard preparedness perceptions ($p < 0.10$). All other pre-post comparisons were nonsignificant ($ps > 0.10$; see Table II).

As can be seen in Table III, perceptions of preparedness as rated by the youth at pretest were correlated with two variables: pretest knowledge and planning and practice. As can be seen in Table IV, perceptions of preparedness as rated by the youth at posttest were significantly correlated with (1) pretest fear and worry, (2) posttest fear, (3) posttest worry, and (4) posttest weather anxiety. Time spent searching for information during the program was also significantly, and strongly, correlated with youth posttest preparedness perceptions (see Table IV).

4. DISCUSSION

Taken together, findings from this pilot study provide tentative support for a brief interactive education program in assisting youth to become more prepared for future hazardous events. Beneficial changes were seen on a number of youth-reported indicators, including a 39% increase in hazard knowledge levels and increased preparedness activities, including youth reporting significant increases in planning and practice for an emergency. Parents reported a significant increase in home-based preparedness, reporting just under six additional adjustment activities done between pre- and posttest.

In addition to increased knowledge and preparedness activities, youth in this study reported reduced fear, anxiety, and distress, both generalized anxiety and hazards anxiety. This is important in light of the fact that this cohort would have

[9]Benchmarking is a process used in research to compare an aspect of that research with an external criterion or standard (i.e., the benchmark). In this and a previous study,[29] benchmarking was used to compare main findings with those of a previous study, the only one to date that used a group comparison strategy, randomization, and had a larger sample size.

Table II. Outcome Indicators: Pre- and Posttest Means and Standard Deviations

Measure	z_s	Pre		Post	
		*M*s	*SD*s	*M*s	*SD*s
The Revised Children's Manifest Anxiety Scale (RCMAS-2)					
RCMAS-2	-1.40^{+}	15.40	9.23	14.25	8.93
Defensiveness	−0.68	1.45	1.88	1.30	1.81
Physiological	−1.61	5.60	2.80	5.10	2.49
Social	−0.00	3.75	3.16	3.75	3.16
Worry	-1.73^{+}	6.05	4.55	5.40	4.58
Child and Youth Natural Hazard School Survey					
Risk awareness	−0.74	2.90	1.25	3.10	1.02
Personal risk	-2.56^{**}	57.50	9.51	63.15	12.69
Generalized hazard distress levels	-2.12^{*}	3.00	1.08	2.70	0.98
Specific natural hazards fear	-2.20^{**}	21.80	8.35	19.70	6.65
Specific natural hazards worry	-2.79^{***}	22.30	7.04	18.80	6.49
Specific natural hazards interest	−0.96	23.60	7.28	25.30	5.95
Natural hazard preparedness perceptions	-1.64^{+}	18.05	4.82	19.65	5.49
Emergency plans and practices	-2.45^{**}	10.95	1.57	12.80	2.48
Natural Hazard Knowledge Questionnaire					
Hazard knowledge	-3.14^{***}	37.45	10.69	52.00	13.41
Natural Hazard Home Survey					
Preparedness activities	-2.36^{**}	13.15	6.95	19.05	9.45
Total family anxiety	−0.06	11.35	4.80	11.70	5.18

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.005$; $^{+}$trend toward significance ($p < 0.10$).

experienced the Canberra bushfire in 2003, a bushfire that produced a range of traumatic reactions in children six months after the fires[40] and that continued for some many years afterwards.[41] It is noteworthy that, alongside reductions in a number of fear and distress indicators, personalized risk ratings were seen to increase significantly for current participants. An accumulation of research on hazards education programs for youth[26–29,32] has documented that an increase in risk perception for young people may not be sufficient to induce distress; however, other studies have shown that such an increase can in fact be distress producing.[51,52] Thus, future research might test more directly the possibility that education programs for youth can reduce this potential through an increase in a sense of preparedness and coping confidence. Coupled with significant increases in emergency planning and practices, and knowledge, this combination of findings bodes well for good decision making under stress and in the event of a hazard, in line with a psychological maxim referred to as the Yerkes-Dodson law.[42] This maxim speaks to the idea that anxiety at moderate levels facilitates cognitive and physiological configurations that can increase task performance under stress versus anxiety at either high or low levels that does not promote readiness to deal with stressful events. An increased sense of control through knowledge and preparedness activities would be thought to assist here. However, importantly, we would also suggest that increased interactions with others through education programs, and through planning and practice, would also be thought to confer an increased sense of control and confidence. With most research in the area of disaster preparedness being cross-sectional and correlational, including in this specific area,[24,26,28,32,43,44] it is noteworthy that this single group pretest-posttest study moves beyond a correlational approach. Findings here support findings from other research using pre-post designs that hazards education for youth can lead to increases in resilience indicators in relation to preparedness for disasters.[27,29]

Strengths of this study include measurement of and significant increases in (1) actual preparedness behaviors at home as rated by parents and (2) emergency plans and practices as rated by the youth. Another strength of this study was in its interactive

Table III. Significant Correlations with Youth Pretest Perceptions of Preparedness

Measure	r_s	ps^*
Preknowledge	0.60	0.01
Preemergency plans and practices	0.47	0.05

*Two-tailed.

Table IV. Significant Correlations with Youth Posttest Perceptions of Preparedness

Measure	r_s	ps^*
Information searching during the program	0.75	<0.01
Prefear	−0.45	<0.05
Postfear	−0.61	<0.01
Preworry	−0.49	<0.05
Postworry	−0.51	<0.05
Postweather anxiety	−0.53	<0.05

*Two-tailed.

nature, both during and in-between sessions. Another was that all youth who started the program also finished the program. This is particularly noteworthy in light of the fact that this program was carried out at a youth center in a low SES section of Canberra and 40% of the youth participants were not engaged in any form of schooling or vocational-related training. Low SES is a prominent risk factor for problems in disasters.[21] Thus, this program engaging with a group of youth from such a section of the community, including a substantial minority who were not engaging with education or training, is in itself one indicator of program success. Experiences with major bushfires prior to the program may have been one reason they had initial interest in the program. However, that explanation alone does not adequately explain no attrition over a multisession sequence nor does it explain participants engaging actively, including in-between session homework activities (i.e., information searching; preparation for the competition element). Thus, this study reflects promise related to involving, and engaging with, youth more actively in programs and research. For example, active solicitation of youth ideas, use of engaging, youth-friendly course materials, having an enthusiastic facilitator who is able to connect with young people, and being able to share experiences and solutions to a problem would all be thought to assist here. Research demonstrates that a future orientation is more often typically linked to fewer problems and better mental health indicators for adolescents,[45] particularly when they perceive positive family interactions and parental support.[46,47] Thus, the ability to share experiences from the 2003 Canberra bushfires while gaining a positive future orientation—enhanced through knowledge, information searching, and engaging in shared preparedness activities with others including parents[16,27]—would be thought to provide a sense of optimism and confidence for dealing with a hazardous event in the future.[10] However, these speculations are based on anecdotal observations and require more systematic scrutiny in future research. This would include testing various questions, including: "Are more interactive programs capable of producing a future orientation?" "Do they reduce distress and increase confidence, including in the event of a fire or other hazardous event?"

While findings here are encouraging, this study has several important limitations. First, in terms of preparedness patterns, research supports that benefits of education programs may have a "half life" as a function of the number of education programs in which a young person is involved.[26,28,32] In fact, children involved in two or more hazards education programs have been found to have much more knowledge retention compared to those involved in only one education program.[28,32] Program recency is also linked to increased benefits.[26,28] Thus, while findings suggest that this program was helpful, the effects of any education program would also be expected to reduce over time. By contrast, effects would also be thought to be enhanced through repetition[26,28,32] and continuing interaction.[13,27] In addition, integrating education programs within the whole of community programs also has evidence-supported promise[24] and is an area worth focusing on in future research.

Additional study limitations include the use of a single group pretest-posttest design and a small sample size reflecting the pilot nature of the study. Single group designs invite a number of known threats to validity. These include history, maturation, regression to the mean, retesting, and others.[48] For example, while the increase in youth's knowledge is not likely to be a result of maturation (i.e., the passage of time and youth getting older)

[10]It is worth noting that three youth participants followed up their participation in this program and joined the State Emergency Services volunteer section (i.e., volunteers who are deployed to assist with emergency events).

or some other threats (e.g., regression to the mean), the threat of history is more of a possibility (e.g., acquiring knowledge through means other than education campaigns) as is retesting. A small sample size invites problems linked to sampling bias and generalizability. Another limitation is related to the fact that youth and parent reports of increased preparedness are subject to reporting biases, including social desirability. At the same time, limited steps were taken to reduce some problems here. For example, if children reported actual planning and practice activities, they had to provide additional detail to "validate" that activity as documented in the Method Section 2. For youth-perceived preparedness ratings, a lack of awareness of what actually constitutes an adequate level of preparedness may lead to skewed responding. Future research would benefit from using larger sample sizes, including control/comparison groups and random assignment, coupled with increased preparedness validity indicators (e.g., home inspections for parent-rated preparedness activities; knowledge-based validity indicators around perceived preparedness).

4.1. Conclusions and Future Research

Future research should also try to document the "active ingredients" of education programs to see which element of a program is linked to success indicators. One way to do this is to assess program youth- and parent-reported "fidelity" indicators (i.e., are program elements being carried out as intended?) and correlate program elements with beneficial changes. Given that information searching significantly predicted beneficial changes, this is an area worth pursuing in future research. With support for hazards education programs for youth increasing, future research should also begin to provide evaluations of a sequence or combination of education programs, using larger sample sizes to increase generalizability. In terms of program content enhancement, there could also be more simulation activities, inclusion of parents in some sessions more directly, and linking the program within a larger community approach to disaster preparedness.[24] More generally, including enhanced content that frames programs like this as part of larger efforts to help children learn to problem solve in relation to a range of future risks and uncertainties might also have benefits. In addition, and quite critically, following cohorts over time would be useful to ascertain whether the benefits of education programs can transfer into helping youth and their families cope more effectively in the response and recovery phases of some future event.

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