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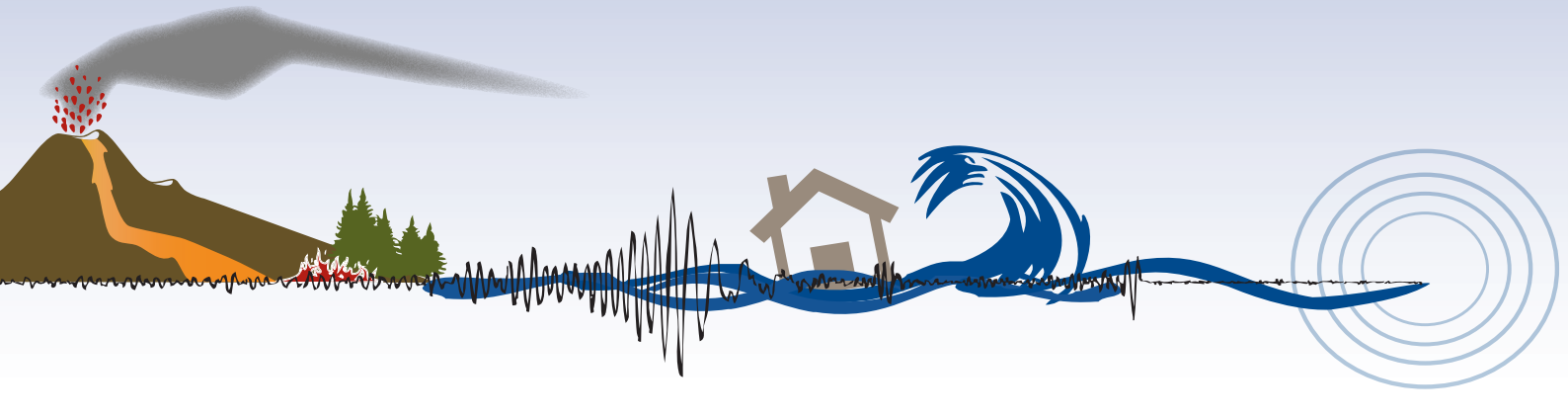

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Children and Disasters: A tribute to Professor Kevin Ronan

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Abstract

In 1997, Professor Kevin Ronan published a paper in the first ever edition of the Australasian Journal of Disaster and Trauma Studies, titled "The Effects of a "Benign" Disaster: Symptoms of Post-traumatic Stress in Children Following a Series of Volcanic Eruptions". Over the next 23 years, Kevin and his many colleagues pursued aspects of children and disasters to both improve practice and advance scholarship in this area. In March 2020 we were saddened by the untimely passing of Kevin. As a tribute to Professor Ronan this special issue of the Australasian Journal of Disaster and Trauma Studies brings together accounts of current research and practice initiatives inspired by, building upon, and directly influenced by Professor Ronan's work.

Keywords: *children, disaster, research, Australia, New Zealand, United States*

This special issue pulls together research inspired by, building upon, and directly influenced by Professor Kevin Ronan's extensive and impactful career ensuring that children are considered, involved, and empowered in the disaster context. It was with great sadness we learned of Kevin's passing in March 2020. In 1984, Kevin earned a Bachelor of Arts in Psychology at the University of Minnesota and then attended Temple University in Philadelphia, where he earned both a Master's degree and a PhD in Clinical Psychology. He started his professional career as a clinical psychologist in 1991 at the Napa State Hospital, before moving to North Carolina, where he took up a position in adolescent treatment services at Brunswick Hospital. In 1995 he took up a tenured lectureship in the School of Psychology at Massey University, Aotearoa New Zealand. In 2006, Kevin relocated to Australia, where he was appointed Head of the Department of Behavioural and Social Sciences at Central Queensland University (CQU) in Rockhampton. Over the course of his career, Kevin made an outstanding contribution to research on child and adolescent mental health, disaster risk reduction, and community resilience, as well as inspiring many others to research and grow knowledge in these areas.

The 1995-96 Ruapehu eruptions in Aotearoa New Zealand were pivotal for inspiring Kevin's interest in disaster research. In the wake of these eruptions, Kevin and his colleagues conducted research on the impact the eruptions had on children and interventions to reduce that impact. This research interest in natural hazards spread to other perils, such as earthquakes, tsunami, weather, and fire, with a focus on topics such as how to better prepare children and the general populace for future hazard events, particularly through educational initiatives. Kevin and his research team used to regularly meet in Ohakune, location of the Ruapehu eruptions, to recall the commencement of their research endeavours and spend time with colleagues and friends. Such get-togethers were also a theme over the coming years as Kevin regularly caught up with friends at conferences and workshops, enjoying robust discussion about disaster-related matters and enjoying people's company. He was also a keen formal contributor to such events, often as an organiser and speaker.

Kevin was an inspiration to up and coming researchers in the field of hazards and disasters. He was gracious in acknowledging the expertise that emerging researchers could contribute, beyond his own expertise. In many a conversation, Kevin was interested in hearing the perspectives of emerging researchers as he genuinely saw value in what they brought to the table. He also gave new researchers the space to explore new ideas and was constructive in his written contributions, leading to a number of co-authored papers with new colleagues.

The papers in this issue are testimony to Kevin's legacy, with contributions from both established and new colleagues. The contents include a discussion of how to responsibly, ethically, and meaningfully research

children and disasters (Gibb et al., 2022), research into how children and adults differ in the protective actions they take in response to earthquake shaking (Adams et al., 2022), and an overview of an ongoing research project exploring the role that firefighters can play in educating Australian students about bushfire safety and risk (Jarrett, 2022).

Across all research areas, there are specific logistical and ethical considerations to bear in mind when conducting research with children and young people, including making sure questions are understandable and relevant (e.g., Mooney et al., 2017) and that consent to participate is understood and given (typically by involving the parents; Gibbs et al., 2013). These challenges can be more pressing in the disaster context as researchers aim to empower rather than potentially traumatise or re-traumatise young people participating in the research, including when disasters are discussed generally or when a specific event is studied. The ongoing COVID-19 pandemic, which is continuing to affect all groups in society (although not equally), exacerbates some existing challenges and introduces others, but also presents opportunities for including children in disaster research.

Gibb et al. (2022) present an overview of methodologies for researching children and disasters, drawing on academic and non-academic literature as well as their own research experiences. They then discuss some of the ways in which these methods have changed, primarily due to limitations on in-person interaction for data collection. While shifts such as to more online recruitment and use of video calling software occurred mostly as an adaptation to the pandemic, the authors recognise that these changes can be seen as innovation, with ongoing and wider benefits to the inclusion of children in disaster research beyond the pandemic. Some of these changes align with pre-existing societal changes, such as the increasingly online nature of children's interactions, so that the pandemic is proposed to be accelerating, rather than initiating, the shift to a combination of in-person and virtual methods.

Also in this issue, a U.S.-based team explore differences in protective actions in response to earthquakes between children and adults (Adams et al., 2022). The authors interviewed administrators, teachers, students, parents, officials, practitioners, and professionals about behaviour during the 2018 Anchorage, Alaska and 2019 Ridgecrest, California earthquakes. Consistent with much of Professor Ronan's decades of research, they found that children tended to react appropriately by using the protective actions they had been taught and practised in drills (in this context, by using "drop, cover, and hold on"). Many adults also performed the actions they had been taught as children, but which is now considered outdated (e.g., sheltering in doorways), acted to protect those around them, or exited buildings during shaking. These differences between the behaviour of children and adults, the "generational gap", aligns with findings from Professor Ronan's work that getting children to participate in risk reduction programmes, such as earthquake drills, helps them to act better during actual events (Johnson, Johnston et al., 2014; Johnson, Ronan et al., 2014; Ronan et al., 2016; Ronan & Johnston, 2003). Further, the authors echo Professor Ronan's calls to provide holistic education about what to do during natural hazard events (e.g., Johnson, Ronan et al., 2014), such as by including parents and the wider community in school-based events (Ronan et al., 2015).

Finally, this issue includes a research update from one of Kevin's recent PhD students. Jarrett (2022) describes the influence Professor Ronan had on the development of his doctoral research. Jarrett's work explores the role that firefighters can play in bushfire education in schools; bushfires are a constant and pressing hazard in New South Wales specifically and in Australia generally (CSIRO & Australian Government Bureau of Meteorology, 2020). Disaster resilience education in schools presents a valuable opportunity to improve young people's understanding and skills, so that they can better contribute to the planning, preparing, response, and recovery which affects them (Ronan et al., 2016). Jarrett describes a research programme to explore the effectiveness of disaster risk education in the context of bushfire risk in New South Wales, and in particular the benefit of and barriers to fire experts contributing directly in the classroom. As well as the influence Professor Ronan had on the course of the research described by Jarrett, the author also provides some insight into Kevin as an advocate for inclusion and as a generous and supportive doctoral supervisor.

The editorial team would like to thank the authors who chose to contribute their work to this special issue as well as the peer reviewers who helped to ensure that that work was ready for and beneficial to our audience. Finally, we would like to acknowledge Professor Kevin Ronan for his dedication to ensuring children are not just not forgotten within disaster contexts and disaster research, but are empowered to be part of the solutions to the challenges which affect them. His work has had a profound and lasting effect on all of us.

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The generational gap: Children, adults, and protective actions in response to earthquakes

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Abstract

In addition to academic curricula, schools offer regular drills to train young people and adult staff on what to do in an emergency or disaster. Earthquake drills in the United States currently recommend the protective action "drop, cover, and hold on" in the event of shaking. Yet, little is known about whether this guidance is followed in schools and homes by children and adults. To fill this gap, this research examined protective actions taken by children and adults during the 2018 Anchorage, Alaska earthquake and the 2019 Ridgecrest, California earthquake sequence. Our research team conducted in-depth interviews with kindergarten to secondary school administrators, teachers, and students, as well with parents, emergency managers, building officials, and engineers (N = 118) in earthquake-affected communities. Our findings indicate that the most common action among children across the study locations was to drop, cover, and hold on. Adults, however, did not always follow current recommended guidance and exhibited more variability in the actions they took in response to shaking, such as trying to protect others, getting in doorways, freezing in place, or rapidly exiting buildings. This research suggests that a generational gap exists that could compromise the safety of young people as well as the adults who care for them. We recommend that earthquake training in schools be strengthened to better prepare both child and adult populations for the threat of earthquakes. Moreover, the emergence of new technologies, like ShakeAlert – the earthquake early warning system for the West Coast of the United States – can create new opportunities for disseminating alert and warning information and preparing populations for impending hazards. Recognising how children and adults may react in an earthquake can improve drills and messaging, refine risk communication strategies, and reduce injury and loss of life.

Keywords: *Earthquakes, protective actions, schools, children, earthquake education*

In earthquake prone regions across the United States (U.S.), schools regularly provide natural hazards preparedness education and require earthquake drills for students and staff (Johnson, Johnston et al., 2014; Ronan et al., 2015). Informational materials and protective action guidance have changed over the decades as building codes have improved and research on injury and loss of life in earthquakes has advanced (McBride et al., 2022). Current guidance in the U.S. recommends that individuals "drop, cover, and hold on" (DCHO) when shaking begins (McBride et al., 2022; Rapaport & Ashkenazi, 2019). Yet little is known about whether this guidance is understood and appropriately followed in schools and homes by children and adults (Johnson, Johnston et al., 2014; Vinnell et al., 2020).

Limited available evidence suggests that individuals take a variety of protective actions when an earthquake strikes (Baldwin, 2022; Vinnell et al., 2022). These actions are influenced by a complex array of factors that include past earthquake experience, preparedness training and education, protective instincts, physical mobility, performance of the built environment, milling, and the behaviours of people in close proximity (McBride et al., 2022; Peek, 2013; Vinnell et al., 2020; Wood et al., 2018).

With this variability in mind, risk communication researchers have reached consensus that clear and consistent messaging tailored to diverse audiences and delivered by trusted messengers through multiple credible sources can help save lives (Bostrom & Löfstedt, 2003; Glik, 2007; Mileti & Fitzpatrick, 1991; Mileti & Sorensen, 1990; Steelman & McCaffrey, 2013). Furthermore, a range of theories exist to describe why people from different backgrounds do or do not take

recommended protective actions when a disaster occurs. For example, the Protective Action Decision Model (Lindell & Perry, 2012) and Emergent Norm Theory (Aguirre, Wenger, & Vigo, 1998; Drabek & McEntire, 2003; Wood et al., 2018) help to explain why protective actions may differ between people and across cultural and geographic contexts.

In this paper, we suggest that, in addition to existing frameworks, it is critical to examine how *age*—a variable that affects outcomes across the disaster cycle from preparedness to emergency response to recovery—influences certain lifesaving behaviours (Fothergill, 2017; Fothergill & Peek, 2015; Peek, 2008, 2013). Specifically, better understanding how children and adults react in an earthquake can help improve drills and messaging, refine risk communication strategies, and reduce injury and loss of life.

In this research, we examined protective actions taken by children and adults during the 2018 Anchorage, Alaska earthquake and the 2019 Ridgecrest, California earthquake sequence. Our research team conducted in-depth interviews with kindergarten to secondary school administrators, teachers, and students as well as with parents, emergency managers, building officials, and engineers (N = 118) to explore the following questions:

(a) What protective actions did children and adults take during a damaging earthquake?
(b) Was there a difference in earthquake protective actions between children and adults?

In answering these questions, this research builds on existing protective action literature by examining age-related responses to earthquakes and contributes to practical applications regarding earthquake preparedness. This study is part of a larger research project examining perceptions of earthquake early warning systems and preparedness education and training in schools on the West Coast of the U.S.

Protective Actions, Risk Communication, and Milling

As noted, several prominent theories help to explain people's decision-making when processing information about a threatening hazard. The Protective Action Decision Model describes how people process risk using environmental cues, social cues, and warnings to make decisions about how to respond to an imminent or long-term threat (Lindell & Perry, 2012). Environmental cues are what people see, hear, smell, or otherwise sense that signals a threat. Social cues are the observations of the behaviours of others related to the threat. Warnings are socially transmitted risk communication messages that are influenced by both the communication channel and the characteristics of the receiver (Mileti & Sorensen, 1990; Sutton & Kuligowski, 2019). Together, environmental cues, social cues, and warnings trigger a series of pre-decisional processes that lead to three core perceptions: threat perceptions, protective action perceptions, and stakeholder perceptions. These perceptions guide protective action decision-making and, ultimately, the behavioural response. If an individual is still uncertain about whether a threat is real or if an unacceptable level of personal risk exists, they will actively search for additional information before engaging in protective actions (Lindell & Perry, 2012).

Emergent Norm Theory explains how behaviours emerge in unfamiliar circumstances involving a potential threat (Aguirre et al., 1998; Turner & Killian, 1957). This theory posits that when there is uncertainty in a situation, people interact with each other to seek information to clarify and make sense of the situation (Locher, 2002; Turner & Killian, 1957; Wood et al., 2018). The desire for socially sanctioned meaning and direction leads to the emergence of new group norms that can influence the protective actions in which people engage (Locher, 2002). Unlike other theories of collective behaviour, Emergent Norm Theory assumes that individuals are heterogeneous actors with varying backgrounds, perceptions, and motives that shape how a situation is interpreted and what behaviours are performed (Aguirre et al., 1998).

Central to both the Protective Action Decision Model and Emergent Norm Theory is the construct of milling, the act of searching for information from others to form new shared definitions in uncertain and risky circumstances (Wood et al., 2018). Research demonstrates that when faced with ambiguous situations, people need "time to define the situation, to survey the environment, give and receive cues from others, and determine how to respond," even when there may only be seconds to analyse their environment (Goltz, Park, Quitoriano et al., 2020, p. 1,598). Within the context of emergency warnings or in response to environmental cues of an impending hazard, processing information about an imminent threat can create ambiguity, leading people to mill about to try to make sense of an otherwise uncertain situation. This process of milling, which allows people to gather additional information, can lead to better understanding of the warning, confirmation of its content, and personalisation of its risk. Together these cognitive shifts prompt people to decide whether to engage in

specific protective actions, such as to flee or shelter in place (Wood et al., 2018).

Research examining behaviours during earthquakes supports the idea that people take part in milling when faced with an unusual threat. In a study examining closed circuit television footage after the 2011 Christchurch, New Zealand earthquake, Lambie and colleagues (2017) found that nearly one-third of a sample of 213 people inside the Christchurch Public Hospital stopped to look around at others during and immediately following the earthquake shaking. These findings have also been demonstrated in video recordings of responses to earthquakes in Italy, Japan, and China where people observed the behaviours of others in their surrounding environment before taking action (Bernardini et al., 2019; Zhou et al., 2018). During the 2019 Ridgecrest earthquake sequence, Goltz and colleagues found that the majority of the 87,000+ "Did You Feel It" survey respondents indicated that they took no action when the shaking started (Goltz, Park, Quitoriano et al., 2020). The authors explain that the lack of action could suggest that people took a moment to pause, reflect, and define what was happening as the event was unfolding. They did not, however, collect follow-up interview data from respondents to verify this assertion.

Although social science literature examining how people respond during an earthquake is limited, the available evidence makes clear that human behavioural response is varied, influenced by many factors, and does not always follow recommendations for protective actions (Baldwin, 2022; Borland, 2020; Goltz, Park, Nakano et al., 2020; Vinnell et al., 2022). Studies suggest that situational conditions, such as time of day and characteristics of the built environment, demographic characteristics, and geographic location may all influence the types of behaviours that emerge—from freezing in place to running out of buildings (Drabek & McEntire, 2003; Goltz, Park, Nakano et al., 2020). Shoaf et al. (1998) found that, of the earthquake injuries they studied, those who were moving during shaking were twice as likely to be injured than those who did not move. Moreover, research has shown that reacting out of fear can cause individuals to flee or try to escape from a building rather than staying in place and seeking cover (Alexander, 1990; Prati et al., 2012). In a study examining factors that influenced injury and death during the M7.8 Kaikōura Earthquake in New Zealand, Horspool and colleagues (2020) found evidence of gendered outcomes related to protective behaviours. Women were twice as likely to be injured as men, possibly because they often move to protect others, such as children, which could increase their risk of injury (Horspool et al., 2020).

Other studies have also noted the importance of one's social and geographic location in influencing protective actions and subsequent injuries during earthquakes. For instance, research has established that children experience a higher risk of injury during shaking because of their greater physical movement, potentially unsafe schools or home environments, and reliance on the actions of adults to prompt protective actions (Alexander, 1990; Borland, 2020; Peek, 2008; Shoaf et al., 1998). At the other end of the age spectrum, older adults may also be more likely to be injured due to lower mobility and slower response times, hindering their ability to protect themselves (Horspool et al., 2020; Lindell et al., 2016; Peek, 2013).

Official Recommendations for Earthquake Protective Actions

Countries around the world have published official recommendations on how their populations should protect themselves during an earthquake. In the U.S., the Federal Emergency Management Agency and U.S. Geological Survey, among other agencies, currently advocate for DCHO as the best life-saving protective action to take during an earthquake (McBride et al., 2022). This guidance recommends that as soon as people feel a tremor, they should immediately drop to their hands and knees, take cover under a sturdy piece of furniture, cover their head and neck, and hold on until the shaking stops.

Despite these official recommendations, research suggests that members of the American public are not fully prepared for disasters, nor have they completely processed what actions are most important to take during an earthquake (Adams et al., 2017). In a representative, random sample survey of Californians, Kano and colleagues (2009) found that some of the most common misconceptions reported included believing that a doorway is the safest place during an earthquake and that the "triangle of life," which promotes curling up next to an object that will form a triangular survival void around it when it collapses, is safer than DCHO. Historical recommendations that were later debunked by the scientific community, as well as alternative guidance in areas with older and less structurally safe buildings, could be contributing to these misconceptions both in the U.S. and abroad (Rapaport & Ashkenazi, 2019). A lack of familiarity with the recommended protective actions among those who have lived outside of earthquake

hazard regions or have not received protective action training can also influence knowledge, or lack thereof, of DCHO (Sutton et al., 2020).

Holistic education about recommended protective actions is critical to keeping the public safe during earthquakes and other hazard events (Johnson, Ronan et al., 2014; Ronan et al., 2015; Towers, 2015). Schools provide a variety of educational and social services to students and community members and are particularly important for training young people and adults about how to respond during an emergency or disaster. While there are no federal laws within the U.S. requiring school districts to have emergency management plans, the majority of states and school districts require disaster planning in schools (Applied Technology Council, 2017; U.S. Government Accountability Office, 2007). This type of planning often relies largely on regularly practiced drills that vary depending on geographic location and hazard risk. These include fire, active shooter, and hazard-specific drills, such as those for hurricanes on the East Coast, tornadoes in the Midwest, and earthquakes on the West Coast. In the earthquake-prone states of California and Oregon, for instance, there are laws requiring schools to establish an earthquake emergency system that includes a school disaster plan, regular earthquake drills, and earthquake preparedness education (Earthquake Emergency Procedures, 1988; Emergency Drills and Instruction, 2011). While these mandates help promote earthquake preparedness among students, there is still significant variation in the emergency preparedness education and drills offered across the nearly 14,000 public school districts throughout the U.S. (Applied Technology Council, 2017).

Child-centred disaster risk reduction programmes that promote group learning and active participation in drills have been shown to increase knowledge, improve household preparedness, and help develop independent thinking skills that encourage children to pause and consider what might be the best action to take in a threatening situation (Johnson, Johnston et al., 2014; Johnson, Ronan et al., 2014; Rapaport & Ashkenazi, 2019; Ronan et al., 2016; Ronan & Johnston, 2003). One such programme is the Great ShakeOut, an annual campaign that encourages schools, businesses, and other organisations to practice the DCHO drill on the third Thursday of every October (Jones & Benthien, 2011). In 2020 alone, more than five million students in the U.S. participated in the Great ShakeOut drill (Southern California Earthquake Center, 2021). The programme offers drill manuals and other educational resources, such as interactive online games and earthquake simulations, to promote DCHO as the recommended action to take during an earthquake.

Even as earthquake education materials and drills reach more students and school staff in regions at risk of earthquakes, there is still a dearth of research on how children and their caregivers, teachers, and other adults respond in an earthquake. To address this gap in knowledge, this study examined and compared the protective actions that children and adults took during two damaging earthquakes in the U.S.

Methods

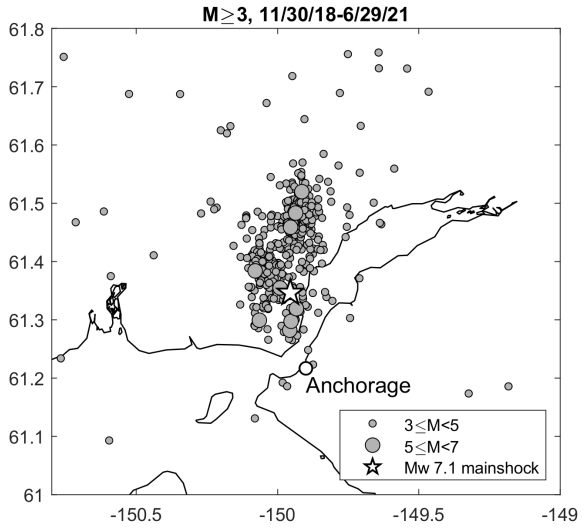
Our research team conducted a case study focusing on the experiences of children and adults following the 2018 Anchorage, Alaska earthquake and the 2019 Ridgecrest, California earthquake sequence. We chose to study these two events because the earthquakes led to widespread damage to local schools. Moreover, such events are relatively uncommon in the U.S. and are therefore important to study. The 2018 and 2019 earthquakes thus presented an opportunity to use a case study methodology, which is based on in-depth investigation and draws from multiple information sources such as observations, interviews, documents, and reports (Creswell, 2014; Yin, 2014).

Research Sites

Anchorage and the Matanuska-Susitna Borough, Alaska. On November 30, 2018, a M7.1 earthquake struck Point Mackenzie, Alaska, at 8:28 a.m. local time. The epicentre was approximately 10 miles north of Anchorage (Thompson et al., 2020). No deaths were reported due to the main earthquake, although at least 117 people were injured. Damage to roads, bridges, and other infrastructure was widespread. The earthquake activity continued for years, with more than 400 earthquakes of M3.0 and above recorded since the start of the earthquake sequence near the city of Anchorage (see Figure 1; U.S. Geological Survey, 2021).

The earthquake damaged all 92 of the Anchorage School District buildings and forced the closure of two schools due to severe damage. It impacted nearly 46,000 students and cost the district between US $25 and $50 million (Hanlan, 2018; Rodgers et al., 2021). In the neighbouring Matanuska-Susitna Borough School District, near the epicentre of the earthquake, 47 schools were damaged and an estimated 19,000 students were impacted. The district incurred more than $1.8 million

Figure 1
The Anchorage Earthquake Sequence, November 2018 to June 2021



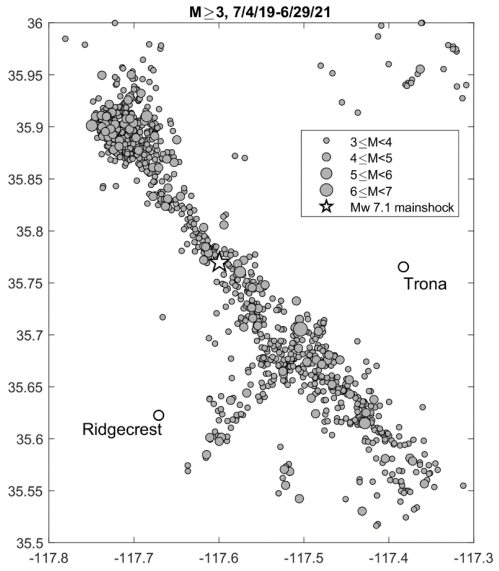
Note. In the U.S. Geological Survey Comprehensive Catalog (ComCat), there have been 449 M3-5, nine M5-7, and one M7.0+ earthquakes since the beginning of the sequence (see U.S. Geological Survey, 2021, for data on this event).

in costs, and one school was closed indefinitely (Early, 2019; Rodgers et al., 2021).

Alaska and the city of Anchorage have experienced large, damaging earthquakes in the past. The M9.2 1964 Great Alaskan earthquake, which was the second largest earthquake ever recorded on seismometers globally, destroyed infrastructure across the state (Wyss & Brune, 1967), including parts of Anchorage and surrounding areas (Kachadoorian, 1965). The earthquake, located in Prince William Sound, generated a tsunami which struck the coast of Alaska and also travelled thousands of miles to Hilo, Hawai'i, and other locations in the Pacific (Butler et al., 2017). This experience inspired more stringent building codes, which helps explain why the 2018 M7.1 earthquake caused much less structural damage than might have been expected if there had been less strenuous standards (West et al., 2020).

Ridgecrest and Trona, California. On July 4 and 5, 2019, a series of earthquakes occurred near Ridgecrest and Trona in California (see Figure 2). They included three initial main shocks of M6.4, M5.4, and M7.1, as well as many perceptible aftershocks (U.S. Geological Survey, 2019). One death was reported as were dozens of additional minor injuries. The earthquakes led to widespread infrastructure damage and power outages in the communities of Ridgecrest and Trona. Damages at the China Lake Naval Base alone were estimated to exceed US $5.3 billion (Los Angeles Times, 2019).

Figure 2
Ridgecrest/Trona Earthquae Sequence, July 4, 2019 to June 29, 2021



Note. In the U.S. Geological Survey Comprehensive Catalog (ComCat), there have been 1,002 M3-4, 99 M4-5, four M5-6, one M6-7, and one M7+ earthquakes since the beginning of the sequence (see U.S. Geological Survey, 2019, for a report on the July 4-5, 2019, events).

Schools across both the Sierra Sands Unified School District and the Trona Joint Unified School District were damaged. Of the 10 schools in the Sierra Sands Unified School District, which serves more than 5,000 students in Ridgecrest and surrounding areas, two sustained enough damage that the beginning of the school year was delayed (California Department of Education, n.d.; Neipp, 2019). The nearby Trona Joint Unified School District is comprised of one high school and one elementary school and served nearly 300 students with in-person learning opportunities before the July 4-5 earthquakes (California Department of Education, n.d.). Trona High School was forced to close indefinitely due to extensive damage to school facilities and gas and water lines. High school students were displaced to nearby Trona Elementary School after the earthquakes.

Our study area in south central California has a history of less damaging earthquake experiences than other parts of the state. However, the affected communities in the 2019 earthquake sequence are not unfamiliar with ground shaking. In fact, the area experienced another earthquake sequence in 1995, with a M5.4 being the largest recorded earthquake (Southern California Earthquake Data Center, 2022). Ridgecrest and Trona also both experienced shaking, although weak, from the 1992 Landers and 1999 Hector Mine earthquakes (Masterlark & Wang, 2002). In the two decades preceding

the 2019 Ridgecrest sequence, however, there had been little earthquake activity in the region.

Sampling, Recruitment, and Data Collection

Following approval from the Institutional Review Board (IRB) at the University of Colorado Boulder (Protocol #: 19-0803), we employed a purposive sampling technique to recruit participants for this study (for the published study protocols and research instruments, see: Adams et al., 2021; Tobin et al., 2021). Purposive sampling is the "intentional selection of informants based on their ability to elucidate a specific theme, concept, or phenomenon" (Robinson, 2014, p. 5,243). Following an in-depth search of news media coverage and reports about the events, we identified school district superintendents and other high-ranking administrators as well as other individuals who could help to inform our research, such as school principals, teachers, building officials, emergency management officials, and engineers involved in school damage assessments. We were able to identify publicly available emails for these individuals via school district websites.

We began our recruitment by first contacting school district leaders to get their approval for the study and to invite them to participate. In Alaska, we obtained a letter of support signed by the security and emergency preparedness director for the Anchorage School District and received verbal support from the safety manager at the Matanuska-Susitna Borough School District. The school districts we visited in California were smaller and did not have people employed in these equivalent roles at the district level. However, superintendents across the four school districts in our sample consented to participate in and support our research.

We then invited other school personnel to be a part of our study through personal emails sent to publicly available email addresses. We purposely sampled those with decision-making roles regarding earthquake preparedness, response, or recovery activities across the school districts. Before traveling to the study sites, we scheduled many interviews in advance, while also leaving available time to invite more participants through snowball sampling (Goodman, 1961): a convenience sampling technique where initial study participants provide names of other key informants based on their networks. We relied on snowball sampling to identify additional people who could inform our research, including parents and students who experienced the earthquakes.

Four members of our research team conducted in-depth interviews with 88 participants in Alaska from January 20 through 25, 2020, and 30 participants in California from February 17 through 20, 2020. Participants included adults and children in Alaska and California who experienced the earthquakes and/or who had extensive knowledge of the events. Of the 118 people in our sample, 35 were students. We obtained parental consent before inviting these young people to participate in the study, and these school-age children were also asked to consent before the interviews progressed.

We used IRB-approved semi-structured interview protocols to guide our conversations (Adams et al., 2021; Tobin et al., 2021). During the interviews, we asked study participants about their recent earthquake experiences, past preparedness education, protective action decision-making, and their perceptions of earthquake early warning systems. At the close of each interview, we asked participants to fill out a close-ended demographic information form (Adams et al., 2021; Tobin et al., 2021). All interview data were audio recorded after obtaining written consent from participants. During our time in the field, we also carried out observations at local community events, school board meetings, and in-school facilities for additional context. Hand-written notes and photographs were taken as well. All collected personally identifiable data were uploaded and stored on a password protected computer nightly while in the field and transferred to a secure location upon return to our university.

Data Analysis

Audio-recorded interview data were professionally transcribed and uploaded into ATLAS.ti (ATLAS.ti Scientific Software Development GmbH), which is a qualitative software analysis program. Qualitative data analysis is a multistep process that requires reading fieldnotes and transcripts, developing a preliminary codebook from themes and patterns that emerge, and coding written text to begin organising, grouping, and identifying important findings in the data (Rubin & Rubin, 2005). For this research, we created an initial codebook organised by the main themes from our interview protocols and initial codes that we knew were likely to emerge from the data after reviewing our field notes and the literature. Four of the authors then coded the interviews after testing the group coding process for intercoder reliability, which is "a measure to assess the agreement among multiple coders for how they assign codes to text segments" to reduce coder bias and increase reliability (MacPhail et al., 2016, p. 199).

Our data analysis process occurred in three stages: (1) open coding—searching for the most general themes and patterns that emerge in the data, (2) axial coding—searching for more generalisable thematic patterns, and (3) representative coding—selecting interview quotes that represent relevant findings (Marshall & Rossman, 2011). As we selected quotes for inclusion in the manuscript, we used pseudonyms and changed some minor identifying details to protect the identities of study participants.

Results and Discussion

Trends in Protective Actions

A clear generational trend emerged from our study. The most common action among school-aged children was to drop, cover, and hold on. Though there were some exceptions to DCHO, young children as well as adolescents and teens mostly followed the accepted recommended protective action, whereas adults either delayed action or followed an alternative behaviour, such as getting in a doorway or exiting the building. In general, adults frequently deviated from current guidance and exhibited more variability in the actions they took when compared to children.

Protective actions performed by children. The November 2018 Anchorage Earthquake occurred at 8:28 a.m., when students were either still at home, traveling to school in a personal vehicle or on a school bus, at a bus stop, arriving on campus, or already at school and settling into classrooms. When we asked teachers and school staff about what actions they saw the students who were already in school buildings perform during shaking, most of the respondents noted that they followed the recommended behaviours and crouched under the desks and held on until the shaking subsided. Interviews with students also confirmed these behaviours among their peers while at school.

> So it started shaking and I'm pretty sure everyone in the entire classroom was just like "duck and cover!" And everyone just ran under the tables. Everyone did it at the same time. I'm pretty sure everyone knew it was an earthquake, so everyone ducked and covered. (Student, Alaska)

To emphasise how well students performed in the Alaska earthquake, several adult and youth respondents referenced a viral video that was taken inside an Anchorage School District classroom and later placed on YouTube (https://www.youtube.com/watch?v=NJZqREPc9k0). The footage, which has been viewed millions of times, demonstrated the quick response by students to drop down under their desks and hold on, as is practiced in earthquake drills. As one respondent emphasised, the video was so powerful because it shows how drills can shape young people's reactions in an earthquake.

> I went to school here, so the earthquake drills are something that I grew up doing as well. "Get under your desk and stay there" type thing. You've probably seen the videos from ASD [Anchorage School District] that showed the students doing that. That was an amazing thing to see and has been an amazing outreach of "here's what well-trained students do." (Engineer, Alaska)

The series of large earthquakes that hit the Searles Valley in California in July 2019 took place during the summer and over a holiday weekend, when most children and staff were not in school. While a few schools were offering summer classes, the largest magnitude earthquakes occurred during the Fourth of July holiday weekend when most children were with their families. When we interviewed parents asking them how their children reacted to the trembling, a number of respondents emphasised that their children followed the recommended DCHO actions that they learned about in school. For example, a teacher and parent in California said, "My littlest one responded perfectly. Obviously, they're telling children in the elementary schools to take cover when the shaking starts. She did it without being told. So, at least at her school they told them." A school administrator related a similar situation with their child: "When the earthquake hit, little Johnny was the only one that did what he was supposed to do. The rest of us were freaking out and there he was under the dinner table."

Over the course of our interviews, we learned of a few deviations from current best practice guidance in terms of earthquake response among children. In Anchorage, for example, one of the high schools sustained structural damage when an improperly constructed wall on the second floor collapsed. We later viewed video footage that showed teens running out of the building as soon as the shaking stopped. During a subsequent interview, the principal of the school underscored that he thought the students and their teachers did the right thing in that instance, as they were unsure of the structural integrity of the building. In a middle school in the neighbouring district, an adolescent shared a story of a girl who he said "froze" and was unable to move when the shaking

started. In that case, other students helped her to get into the DCHO position.

Protective actions performed by adults. In contrast to the recommended protective actions performed by children, adult interviewees in both study sites often described widely varying reactions to shaking, including getting into a doorway, running outside, being unable to move, or doing nothing while assessing the situation and waiting for the shaking to stop. This variability among adults was in sharp contrast to the nearly uniform behaviour observed among young people, as emphasised by one of the emergency management officials in Alaska whom we interviewed:

> We saw in this earthquake that adults definitely did not know what to do. They're running out of buildings. They're standing in doorways. One place I went to said all four people stood in one doorway in their office, and I'm like, "Okay."

Even among adults who knew the recommended DCHO actions, they did not always follow the correct actions.

> We [were] sort of like "Oh my god, what's going on?" They tell you to drop underneath your desk, but what, six or seven seconds? You don't have enough time to process, "Oh it's an earthquake. Get under your desk." It's over before you even react, so we can prepare all we want. (Teacher, California)

Many adults also described practicing a combination of protective actions, such as seeking cover under a desk or table, but then once the shaking stopped, running out of the building and encouraging others to evacuate. Other respondents described how they initially froze while assessing the strength of the earthquake, but then engaged in DCHO once they had gathered adequate information about the risk level through their own personal experience or through milling and interacting with others.

> In a Magnitude 6, then you're getting under tables. But it's also how long it lasts too. I mean to be honest with you, when we had that 7.1 in November of the previous year, I was over there. I was having a video teleconference with folks. It took me about two to three seconds to kind of figure out, well, this is more than just a little tremor. And then it's like, "Oh man, should I get under the table?" And then about 15 seconds into it, it really got a little violent, and I was like, "Yeah, okay, maybe I should do something." (School District Administrator, Alaska)

Explanations for Generational Differences in Behaviour

Training. The most common explanation for children engaging in DCHO so consistently was training, with respondents attributing the behaviour to the success of school-based educational programmes and drills. Some participants described these actions as "ingrained," "almost instinctual," or "automatic," highlighting the value of developing muscle memory and procedural knowledge through regularly practicing earthquake drills. As one school administrator in Alaska said, "We used to do [drills] every month. I think honestly that probably aided in the practice piece because it's so automatic… They ducked, covered, and held on." An Alaskan student also highlighted the procedural nature of DCHO:

> Well in school the protocol is–we can't predict earthquakes. We don't know when they're going to hit, but when they do, we immediately get under our tables and hold on, cover our necks and heads, and protect ourselves as much as we can… We were starting to get to work that morning, and then the earthquake hit, and everyone just immediately got under the tables.

Similar to how children reacted based on what they learned from drills and educational programs in school, adults reverted to ingrained memory and training they had received when they were younger. When describing the protective actions they took, adult respondents were much more likely to reference outdated recommendations, such as getting in the doorway or running outside the building.

> I got in the doorway from the back room to the hallway because I was just like, "Oh yeah." It wasn't frightening. So my mind just was like, "Oh yeah, I'll go and stand where I'm supposed to be." This is how we were trained. Go stand in the doorway. That was old school. But now it's like… we need to know because things have changed and… my mind immediately went back to what you were supposed to do when I was a kid, not what you're supposed to do now that we have more information and know more. (School Staff, California)

Interestingly, many of the adults in our sample also described DCHO as "duck and cover," which was the guidance for nuclear bomb preparedness in the 1950s (McBride et al., 2022). It was not always clear whether those adults who referenced "duck and cover" used this language around children, and whether this might lead

to confusion among their charges regarding appropriate actions to take in an earthquake.

Following others. Another common explanation for how respondents reacted was following the lead of others. For instance, children in school classrooms followed the actions of their peers, which most often reinforced DCHO within the school environment. There were also descriptions of children helping each other and leading others to DCHO.

> Kids got underneath their desks. They sort of followed each other's leads on that… It was kind of fun to go back and watch the surveillance videos to see what was going on, to see people's reactions. Class was in session so there weren't a lot of kids out in the hallways, but the ones that were in the hallways basically just ran to whatever class was closest to them or the class they were returning to. So everybody acted like [snap] "Okay, this is the real deal." I think everybody acted accordingly to that. (Teacher, Alaska)

There were also several accounts of children following an adult's lead, such as listening to their teacher's instructions to drop to the floor and take cover under a desk, as one student from Anchorage noted, "We were starting to get to work on that and then it hit, and everyone just immediately got under the tables. Miss Jones yelled at everyone to get under their tables."

When children did not take appropriate recommended protective actions, they were influenced not only by their physical surroundings, but also by the adults in their homes or schools. Several adults in the study confirmed that they "grabbed" their children and attempted to flee to safety.

> But here's my thing. It's been so long since we've had an earthquake. I really didn't know what to do. I panicked, too. I grabbed my son out of bed and put him in the doorway with me. But when the other one hit, we ran out the door. (School District Employee and Parent, California)

In other instances, young children were partially or totally reliant on adults to guide them to safety. For instance, some of the parents of infants and toddlers shared with us how they reacted once the shaking began.

> And then we felt the big one starting, and it kept going and it kept getting stronger. So, we were like, "Oh, my daughter." I was like, "Come here," I grabbed her and my husband was like, "Get out!" So, we run to the door, he couldn't open the lock… So, I'm holding onto my daughter and the railing for the banister for going upstairs. My husband is trying to unlock the door and it kept locking on him, and he's getting thrown all over the place. And so, I'm like, "Take your time, calm down." … Finally, it opened and we ran outside. We see the car jumping up and down and moving down our little parking lot and everybody else coming out as well. (Parent, California)

Adults were also influenced by the actions of those around them, many of whom reinforced misguided behaviours both at work and in the home. Several respondents reported looking to others for additional information or milling before taking any action.

> So I remember I was up in the conference room up front, getting ready for a meeting and felt it. I just looked and I was like, "What's everybody else doing?" And then nobody else went under the table, we were just like, "Is it done? We're good?" Looked around, nothing fell, "Okay, we're good." (School Staff, California)

These quotes are consistent with Emergent Norm Theory, particularly as set out by Wood et al. (2018), where people will look for physical cues from those around them as to what the appropriate action is to take. These data also underscore, however, how much those actions can converge with or diverge from current recommended best practice guidance for protective actions in earthquakes, depending on the actions of peers, colleagues, friends, and family.

Responding to warning signals. At times, respondents noted confusion about how to act due to mixed messages related to warning signals. During the Anchorage earthquake, for example, the shaking triggered fire alarms in several of the school buildings, which led teachers and school staff to guide students to evacuate rather than following the DCHO actions they had practiced in earthquake drills.

> Kind of a different issue, and I don't think they've worked it out yet, is in a lot of schools the fire alarm went off, at the middle schools especially where kids think on their own a lot more. A lot of schools evacuated because of the fire alarm, but then they're evacuating through halls that have water and fallen light fixtures and things. They said they really should have stayed in place, but how do you know that? They've been discussing that with the fire department about what you do in a case like that. Is it safer to stay in the building and ignore the fire alarm assuming that it was just tripped by the earthquake, or how do you

know? Maybe there really is a fire. There's been some back and forth on that one. (Teacher, Alaska)

One school administrator in Alaska emphasised that having the fire alarm go off was a "blessing" as it allowed him to follow his instincts of wanting to evacuate the building out of fear that it would collapse.

I feel like it was sort of a blessing to have the fire alarms go off because without knowing what damage had been done to the building, whether we had a gas leak, a fire, whatever it may be, I felt like getting out of the building was the safest move, and I think a little bit of that is having that teacher that was like, "I suggest you follow me because I'm going to be the first one out the door, and I'm going to get outside."

Competing priorities. In some instances, adults ignored the recommended protective action to DCHO in response to some other competing responsibility or priority. For example, some of our adult respondents noted that the first actions they took involved helping others, such as a child or pet, or turning off utilities to protect the building.

My response was to look around for kids to see how the kids were doing. That's my primary focus, no matter what happens. My goal is to see to make sure. And there were a group of kids that had turned around, they didn't know what to do. They hadn't gotten to their class yet. So I just moved them away from glass and had them stand against the wall and stay as close to the wall as possible and told them not to move until we got some direction as to what to do. Well, it wasn't long, in fact it felt like forever, but it was after the quake had stopped shaking that the fire alarm went off. So then we evacuated the building. (School Administrator, Alaska)

Experience with local hazards. Some generational differences in protective actions could be explained by familiarity and experiences with other natural hazards or threats. Several of the adults we interviewed did not grow up in an earthquake-prone region and were therefore not properly trained on how to respond when they were in school.

There was a constant, maybe like between [Magnitude] 3s and 4s, like all the time just because of where we're at. He's just like, "Yeah, we grew up with them." I was like, "Yeah, I did not." … Like you grow up in West Palm [Beach, Florida], you know what a Category 1 hurricane is. You know that because that's what you grew up with. Well out here, they grew up with that stuff, but you don't necessarily know what that means. (Teacher, California)

Those who had moved to Alaska or California from another state were also less likely to have experienced a large earthquake before. While some had received training, such as teachers and staff who practiced the drills with students, the lack of familiarity impacted how they responded. One teacher, a native Alaskan, described how distressed her colleague was when she experienced her first major earthquake.

She was quite terrified. She grew up in Georgia. She came here from Hawaii. We have done duck, cover, holds and things before, but she was so flustered. She thought maybe a bomb had hit. She didn't know earthquakes could be that big, and she was terrified. I could hear her screaming my name as she ran down the hall, so I called her, and she managed to dive over everything on the floor and get under my desk with me. I think she wasn't prepared for how big an earthquake can be.

Emotional responses. Several respondents noted that they or people around them reacted out of fear, with the "fight or flight" response taking over. Adults shared accounts of letting fear, stress, or other emotions overwhelm them, which affected their ability to engage in the correct protective actions.

On the flip side, I found a staff member running down a hallway, and she's so frantic she literally pushes her way past kids and goes through a doorway. That's the not-pretty side of things from people that don't handle stress well. (School District Staff, Alaska)

The emotional reactions reported among children were more mixed. Some students expressed that they were not scared during the shaking, though several teachers described how frightened the children were. Despite these mixed reports, there were still descriptions of children managing their emotions and engaging in DCHO.

I will say from experience that everything from my own son, everything that was taught by his teachers, by his classroom, he did. Those kids that were there, everything they were taught, they did. If they couldn't get under, they found a wall. If they couldn't find a wall, they found a chair. They found something to protect themselves. They reacted and responded so appropriately, whether they were in kindergarten or sixth grade. Yes, they were scared, but everything they've been taught from families and teachers, they

did. They listened when they were supposed to, they went under the desk. (Teacher, Alaska)

Generational Trends Across Different Settings

Another pattern that emerged from the data regarding generational trends was that protective actions at school differ from what takes place at home. At school, children were predominantly engaging in the DCHO action that they had practiced in this setting, whereas at home, the influence of parents sometimes changed their behaviours. In addition to the instances cited above, where parents grabbed children and fled when shaking started, a school district official in Alaska shared how difficult it is for children to disagree with or change the behaviours of their parents.

> And if you watch videos, like home videos from Anchorage, every adult was running outside, which is the last thing you're supposed to do when it's shaking. Like as a community, we got lucky that no one got hurt because every single adult ran outside. All my friends ran outside. I mean, despite how much we talk about drop, cover, hold, in the Great Alaska Shakeout… They do a lot of radio stuff for that, drop, cover, hold on, and still people didn't do it. So even looking at that more so than the kids because they all knew exactly what to do. And it's sad when you see kids that are at home and they have a home video and the mom's like running down the stairs, grabbing the kid, pulling him outside. The kid's not going to [say], "No, Mom, we're supposed to get under the table." So that to me is also a big part of it. If it happened on a Saturday or a Sunday, like who knows? (School District Staff, Alaska)

Children were likely to defer to adults about what actions to take. At school, this often led to DCHO, whereas at home they were sometimes prompted to follow their parents out of the house or were told to get in a doorway. We recorded a few stories of parents telling their children not to listen to their teachers and to instead run outside of the building.

> We were at one of the schools and it was kindergarten through fifth grade out in the Mat-Su Borough… We would sit and talk with them about earthquakes and stuff. We were talking to them about drop, cover, and hold. I asked a kid, "What do you do during an earthquake?" He said to me, "At school you drop, cover, and hold on, but at home you get in the doorway." I said "What?" I talked to the kid and whatever. Throughout the summer, we heard that repeatedly across Anchorage and Mat-Su area that at home you do this. You get into the doorway. I was almost fighting with this fifth grader at one point. [Laughs] Like, "Come on, you know?" If everybody's doing this at school… But my parents tell me that. I think what I came to realise is we need to educate the parents more, but a lot of them are coming from that mindset back when that's what was taught to them when they were in school. The kids aren't going home and necessarily telling their parents. The kids are doing it, but they're not communicating to their parents the correct information, which I found very interesting. They know what the right thing to do at school is, but at home they do something different. So that was something that we realised this last year. We have a focus on youth right now, but we need to start focusing on that generation that's between 40 and 60 who still believe you're supposed to get in the doorway. (Emergency Manager, Alaska)

Discussion and Recommendations

Engaging in recommended protective actions during an earthquake is critical to reducing injury and loss of life. A growing body of research examining how people react during shaking suggests that behaviours often vary according to context and social demographic characteristics. In our study examining the protective actions taken by children and adults during the 2018 Anchorage earthquake and the 2019 Ridgecrest earthquake sequence, we identified a generational gap in behaviours performed. Our findings suggest that most children followed the recommended DCHO actions, particularly in the school setting. Adults, on the other hand, did not always follow current guidance and exhibited more variability in the actions they took.

Several explanations for the differences in behaviour by age emerged from the qualitative data. When it came to performing the recommended behaviours, school-based training and drills clearly had a strong influence among children. Earthquake-specific drills, including the Great ShakeOut, were regularly practiced in the participants' schools, allowing students to refine these behaviours as a skill. When actual ground shaking started, children reacted to the environmental cues and quickly performed the behaviours they learned in what many described as an "automatic" response. Social cues also reinforced these behaviours, with children following each other's actions and, in most cases, appropriate instructions from their teachers. Consistent with the theoretical relationships outlined in the Protective Action Decision Model, these environmental and social cues initiated a

series of pre-decisional processes and core perceptions of the environmental threat and influenced protective action decision making and, ultimately, the appropriate behavioural response (Lindell & Perry, 2012).

Conversely, the adults who participated in this study did not always follow current recommended guidance and exhibited more variability in the actions they took. Many of the adults described engaging in outdated protective behaviours that they had learned as children, such as getting in doorways. This suggests that education and drills can be effective but only when messaging is consistent over time or when recent guidance is more strongly reinforced and regularly practiced. Responding to competing warning signals and cues also influenced decision making among adults. For example, rather than following the recommended behaviours performed during earthquake drills, teachers and school staff decided to evacuate when they heard the fire alarm despite ongoing shaking. As has been documented in previous disasters, many adult respondents in our study engaged in milling by searching for additional information from others in their surroundings. Given the different behaviours performed by adults, at times this meant following others who were not performing DCHO.

Adults also experienced competing priorities and conflicting role demands as they attempted to prioritise the safety of children and pets. In the process, however, they may have placed themselves or others at risk of harm. We gathered several accounts of teachers making sure all the students were taking protective actions, while they were not able to DCHO themselves during the most active shaking. Parents who were at home with their children also described running to their children when shaking started. At times this meant grabbing their young children and running out of the house. Stories of ignoring behaviours learned in recent drills were particularly pronounced among adults who had little previous experience with earthquakes, had not grown up in earthquake country, and/or were overwhelmed or confused as to what action to take when the shaking began.

Recommendations for Improving Earthquake Education

The four school districts in this sample practiced regular earthquake drills several times per year and participated in the Great ShakeOut annually. On the one hand, it seems that these earthquake preparedness initiatives are working well for school-age children, who by and large engaged in appropriate protective actions during actual shaking. On the other hand, our research uncovered important generational gaps, with adults being much less likely to take currently recommended protective actions during the earthquakes that we investigated. We argue that these generational gaps are not the fault of the drill's design, messaging, or implementation, but rather are the result of complexities associated with generational changes in hazards education, geographic mobility, shifting responsibilities throughout the life course, and challenges with correcting long-held beliefs about protective actions among older age groups.

To remedy this issue, multiple recommendations could be considered. First, it is crucial that school-based drills actively involve students as well as adult school staff and, when possible, parents and other community members (Ronan et al., 2015). As is well recognised in disaster research, protective actions are not undertaken in isolation, but instead are inherently social (Wood et al., 2018). The process of social norming and milling means that we require cues from one another to take action when faced with alerts or physical threats. To expand on this, considerations for educating and involving the wider school and surrounding community in drills could improve outcomes for children as well as the adults who care for them. Community-wide drills, such as the Great ShakeOut or those practiced across Mexico on the anniversary of the 1985 M8.0 earthquake, can reach both adults and children in multiple settings where earthquakes take place (Santos-Reyes, 2020). These community events not only provide a meaningful opportunity for parents and children to practice DCHO together, they can also promote other interactive resources, such as earthquake simulations and video games, that may further enhance perceptions of self-efficacy to perform the recommended behaviours (Adams et al., 2017). Having parents, caregivers, and other members of the community practice DCHO can help make sure that they are prepared to protect themselves as well as the young people around them.

Second, it is important that DCHO drills are practiced in school as well as in the home and in other settings like workplaces and shopping areas. This study found that some parents were unaware of the fact that DCHO is the currently recommended best practice for earthquake protective action. Other adults actively undermined the message by telling children to take cover in doorways or to run out of buildings—actions that could lead to injury or even death in the event of falling objects. While meta-reviews of the children and disasters literature have suggested that children may be powerful risk messengers

and bring the risk information attained in school home to parents (Peek 2008; Peek et al. 2018; Ronan et al., 2016), we found little evidence of this in our interviews. This may be because written information is not sufficient to develop procedural knowledge in the caregivers of children, or because busy parents have little extra time to invest in hazard education and preparedness activities. To develop procedural knowledge, or muscle memory, education, drills, and consistent messaging (Bean et al., 2016) are required. At-home drills, modelled after the Great ShakeOut, with school children and their parents may be one way to address this issue. Another way could be to include drills at parent-teacher association meetings, school board meetings, or parent-teacher conferences.

Third, targeted and enhanced education for teachers, school staff, and other adults is vital. As our research revealed, adults who received earthquake education may have been taught to take protective measures—such as sheltering in a doorway or running outside—that are no longer recommended. When the recent earthquakes occurred, they reverted to what they were taught in their youth, and therefore did not always model appropriate behaviours for their students or children. Teachers and other adults who grew up outside of earthquake country had limited knowledge of protective actions or were unprepared for how frightened or stressed they would be in the event of an actual earthquake. Teachers, school staff, parents, and other caregivers hold powerful responsibilities for young people's health and well-being, and it is therefore imperative that they also see themselves as the focus of earthquake education materials and drills.

Fourth, in the regions of the U.S. that are most at risk to earthquakes, earthquake education should be integrated in classes beyond the earth sciences. Although K-12 school curricula vary widely in the U.S., Next Generation Science Standards (2017) require that students learn about earthquakes during the fourth grade and as part of their core science curriculum. We suggest that integrating earthquake case studies throughout curricula and across grade levels could help engage educators more deeply in earthquake preparedness and could help socialise more students and teachers in proper protective actions.

Fifth, future earthquake education programmes and drills could be more connected to recent scientific advancements surrounding earthquake early warning (Becker et al., 2020; McBride et al., 2022). Indeed, with the recent introduction in California, Oregon, and Washington of ShakeAlert, the earthquake early warning system for the West Coast of the U.S., some schools can potentially receive seconds of notice that earthquake shaking is imminent (McGuire et al., 2021). ShakeAlert warning messaging was crafted to focus on what is happening (earthquake) and protective actions (DCHO and protect yourself now), along with post-alert messaging (McBride et al., 2020). This technology may provide an opportunity for further dissemination of the DCHO message to more people in earthquake-prone regions of the U.S.

Limitations

As with all studies, this one has limitations that should be acknowledged. Our sample was non-representative and therefore we cannot speak to precisely how many children or adults engaged in appropriate or inappropriate protective actions in either case study setting, or just how wide was the generational gap we observed. While we sought out people from different demographic and organisational backgrounds, we also cannot detail specific patterns by race, gender, or geographic region of origin, for instance. Because major earthquakes are relatively rare in the U.S., our case study communities in Alaska and California were not necessarily representative of the states as a whole or the larger regions where they are located.

Conclusions

With these limitations in mind, this research has uncovered a potentially important pattern that warrants further investigation. In particular, it is important that researchers collect age and other demographically disaggregated data. It is also vital to include children as well as adults in study samples. To date, the vast majority of earthquake-focused research—as with other disaster research—has focused on adults and then has used adult voices to describe "people's" experiences (Peek, 2008). But children under the age of 18 make up close to one-quarter of the population in the U.S. and an even higher percentage in other nations around the world (Peek et al., 2018). As this research revealed, their actions and experiences may vary widely from the adults that surround them. It is vital to acknowledge this variability, and to ensure that our education programmes, drills, and warnings are implemented with an awareness of and sensitivity to this variability. The safety of current and future generations is at stake, and it is important that we see these differences and harness them to promote public safety and the broader collective good.

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Researching children and disasters: What's different in pandemic times?

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Abstract

The repercussions of the global COVID-19 pandemic are far-reaching and extend to the ways in which scholars conduct disaster research. Research on children and disasters is no exception. Focusing on methodologies, this paper explores the methodological constraints and innovations of studying children during the current crisis, and the implications for post-pandemic research on children and disasters. We begin by reviewing research methodologies to study children and disasters, drawing upon scholarly and grey literature as well as on our own research project on the pandemic experiences of children, adolescents, and older adults. We then discuss how these research approaches, tools, and spaces have changed during the pandemic. Methodological adaptation and innovation are necessary because traditional data collection methods are largely not feasible during the current pandemic; for example, many researchers cannot travel to the disaster site, hold in-person focus groups, interview children and their families face-to-face, or conduct extensive participant observation in places people would usually frequent. We pay particular attention to research ethics issues, including the challenges of navigating the research design process when children are involved. We contend that the massive adoption of online methods during the COVID-19 pandemic is laying the foundation for a seventh wave of research on children and disasters characterized by the integration of in-person and virtual worlds, and of in-person and virtual research methods. Rather than initiating this transition to a hybrid or blended model, the pandemic is accelerating the transition, and compelling more of the research community to engage than might have otherwise. The "bricolage" of methods originating in both in-person and virtual fields, adapted in various ways for both in-person and virtual fields, is better attuned to the spaces where children live their lives, and the ways in which they live their lives.

Keywords: *Research methods, children, COVID-19 pandemic, ethics, virtual research methods*

The repercussions of the global COVID-19 pandemic are far-reaching and extend to the ways in which researchers conduct disaster research (Asare et al., 2020; Ritchie et al., 2020; Ritchie et al., 2021; United Kingdom Alliance for Disaster Research, 2020). Research on children and disasters is no exception. As an interdisciplinary team of social scientists pursuing research questions about the social impacts of the pandemic on children, adolescents, and older adults, we have grappled with pandemic-driven shifts in data collection and analysis, and the repercussions for power dynamics and inequities in whose perspectives are represented. Applying discourses from feminist geography and other bodies of literature on researcher reflexivity and subjectivity (England, 1994; Soedirgo & Glas, 2020; Whitson, 2016), we integrate observations from our research team's experiences throughout this paper as part of a broader call for greater transparency about the research methodologies that shape our understanding of disasters (Peek et al., 2020). We explore the challenges, ethical considerations, shortcomings, and workarounds of children and disaster research during the pandemic as a means of inviting other scholars to join us in discussing the messiness and complexity of the research process.

Research on children and disasters has grown tremendously in the decade and a half since Anderson published a plea in the *International Journal of Mass Emergencies and Disasters* calling for disaster scholars in the social sciences to study children's experiences of disasters. As W. A. Anderson (2005) noted, it is critical to focus on the impact of disasters on children and youth as a group, and, among children, across income levels and racial groups and in countries of different income levels. Attention to youth employment and children's

own perceptions of disaster recovery are also noted as valuable. Anderson also advocates for a greater understanding of what is done on behalf of children in disasters, including legislation and school preparedness programs, and how the possible digital divide affects children receiving online risk communication. Finally, and notably, Anderson asks social scientists to consider what children and youth do for themselves and others, as they are not just victims and observers. Children, for example, may create their own youth culture, with their own disaster humour, and they may consume media, especially with their cell phones, which increases their risk awareness and makes them the "risk communicators" for their families (W. A. Anderson, 2005, p. 169).

Following W. A. Anderson's (2005) call, other scholars have agreed that it is necessary to study children's vulnerability, as disasters affect their growth and development as well as their capabilities, as they can help prepare their households and communities for disasters, often with creative solutions (for example, Peek, 2008). In the 2000s and 2010s, scholars from across a diverse range of disciplines studied children's experiences in disasters precipitated by a range of natural and technological hazards around the world. These studies typically adopt the definition of a child, set by the Convention on the Rights of the Child, as anyone below the age of 18 (United Nations [UN] General Assembly, 1989). However, researchers acknowledge the blurring of categories based on chronological age, stage of development, lived experiences, and cultural constructs of childhood and children, and that these categories vary across time and space (Berman et al., 2016; Cox et al., 2019; Peek et al., 2018). The research methods used in these child-focused studies largely mirror those commonly used by over 1,000 members of the internationally based Social Science Extreme Events Research Network (SSEER). These include case studies, surveys, in-depth interviews, qualitative content analysis, community-based participatory research, statistical analyses of primary or secondary data, focus groups, and observation (Peek et al., 2020). Additionally, disaster scholars have found that research on children and disasters has spurred numerous methodological advances, especially in qualitative, participatory, child-led, and creative methods (Peek et al., 2018).

Working with children requires child-centric approaches and contextually appropriate methods (Berman, 2020; Berman et al., 2016; Mudavanhu et al., 2015; Peek & Richardson, 2010). Strategies used by children and disaster researchers to adapt research methods to make them "child-friendly" include: devising assent/consent in a form and language that reflects the competency of the child (Berman, 2020); using age-appropriate wording in all research protocols (S. Anderson et al., 2020; Koller et al., 2010; Mooney et al., 2017); adopting methods that accommodate both children's interests and competencies (Delicado et al., 2017; Gibbs et al., 2013; Koller et al., 2010); creating safe spaces for children to risk talking about their feelings and perspectives by providing distance from the actual events or sensitive topic (S. Anderson et al., 2020; Mooney et al., 2017); having children engage with a metaphor instead of the actual disaster (for example, interactive theatre to tell the story of a torn dream cloth; Gibbs et al., 2013); using research designs that position the child as expert or co-researcher (Gibbs et al., 2013); speaking with children in their native language (Mudavanhu et al., 2015); interviewing children away from their teachers and parents (Mudavanhu et al., 2015); and providing specific training for researchers on interview methods with children (Koller et al., 2010).

Around the world, researchers have created, and in some cases co-created, innovative methods for centring children. In Zimbabwe, Mudavanhu et al. (2015) used focus groups because children were more relaxed with their friends than being isolated one-on-one with an adult researcher; moreover, the children discussed the questions and helped each other with answers, reminding one another about the details, as well as asking each other additional questions the research team had not thought to ask. Similarly, in the United States (U.S.) after Hurricane Katrina, focus groups made children more comfortable because they felt they had power in numbers (Peek & Fothergill 2009). In New Zealand and Australia, Gibbs et al. (2013): drew upon methods from studies with children and youth post-trauma; consulted internationally with child research and trauma experts in designing their studies and protocols; engaged in discussions with affected communities to develop an ethical framework for child research participation; built skills-training into the methodology (e.g., trained students to film, direct and edit videos, and to interview); put children into the driver's seat for certain parts of the research (e.g., designing the interview protocol); partnered with trusted community leaders and service providers; and carried out the pilot projects and main study in partnership with local communities, service organizations, local and state governments, and national emergency management agencies. The authors noted that such partnerships were key in tailoring the language

and targeting age-appropriate research materials, as well as vital to recruitment and data collection, interpretation, and dissemination beyond the usual child settings (Gibbs et al., 2013).

In recruiting child participants, researchers may use a sensitively staged approach in which the research team initiates contact with a school principal through a phone call, then follows up by email with a research brief and later a personal visit, then attends a staff and parent meeting and has parents complete written consent forms, and finally reaches out to prospective child participants to collaborate on the design and implementation of the study; this approach ensures all questions are adequately answered and yields progressive informed consent (Gibbs et al., 2013; Mooney et al., 2017). Researchers may also translate their study into language relevant to a gatekeeper who has key knowledge or connections, and who mediates a researcher's access to study sites and potential participants; for example, such translation may entail highlighting inquiry-based learning, key competencies, and child-centred pedagogy when pitching the proposed project to teachers and school administrators (Gibbs et al., 2013). To assuage reservations that the research might trigger further trauma, researchers have also provided gatekeepers with research evidence showing that enabling children to tell their stories through creative means can be an emotionally and psychologically healthy activity for children (Gibbs et al., 2013).

Recently, a team of disaster scholars reviewed the academic literature to assess the emerging subfield of children and disasters (Peek et al., 2018). Examining peer-reviewed research from the 1940s to 2016, they identified six major, often overlapping, waves of research:

1) research on children's behavioural and emotional responses, such as anxiety and depression, to disaster (the vast majority of the literature);
2) research on physical health outcomes, including death, injury, post-disaster abuse, and exposure to contaminants from technological disasters, such as oil spills and nuclear accidents;
3) research on children's vulnerability, much of it recent (but rarely explicitly intersectional and often treating children as a uniform category);
4) research on how institutions, such as the family and schools, play a role in children's disaster outcomes;
5) research focused on children's capacities, resilience, and strengths, including how they help adults, other children, and themselves in disasters, such as assisting relatives in evacuation; and
6) research on children's voices, perspectives, and actions and how they can contribute to disaster risk reduction (this final wave often uses creative and participatory methods and is tied to advocacy efforts).

The six waves taken together show the advancements, innovations, and policy implications for the field. In reflecting on these six waves of research, and analysing the research conducted on children in the pandemic, we consider whether we could be seeing the beginning of a *seventh wave* of research.

The possibility of a seventh wave raises several questions:
– What characterizes this wave?
– Why are these changes transpiring?
– How is COVID-19 impacting the seventh wave?
– Which changes will persist once the pandemic restrictions are lifted?

Our interest in examining the possible onset of a seventh wave of research on children and disasters is twofold. On a theoretical level, we want to understand the targeted ethical considerations and methodological innovations in children and disaster research catalysed by pandemic restrictions, and how these adaptations will shape the future directions of this field. On an empirical level, we want to analyse the challenges we are facing and the adaptations we are making in our own research. Brought together through the CONVERGE COVID-19 Working Groups for Public Health and Social Sciences Research[1], we are currently pursuing a research project on the COVID-19 pandemic experiences of children, adolescents, and older adults in Canada and the U.S. (Gibb et al., 2020; Gibb et al., Forthcoming).

Given these two angles, this paper tackles the aforementioned questions through two lenses. First, through a content analysis of selected literature on children and disaster research, and second, through our own challenges preparing for and carrying out our collective research. Our writing deliberately alternates between an analytic mode in which we discuss themes emerging from the literature, and a descriptive mode in which we illustrate how themes apply to our study. A focus on research methods, and their potential to frame a seventh wave of research on children and disasters, is warranted because the research methods we use frame what we know about hazards and disasters. It is critical that we include children in our understanding of hazards

1 More information about these working groups can be found at the CONVERGE website: https://converge.colorado.edu/resources/covid-19/working-groups/.

and disasters because their capabilities, vulnerabilities, growth and development, and potential to contribute to disaster preparedness and recovery at the household and community scales are all at stake.

Methodology

Like many of the methodological approaches to studying children and disasters during the pandemic, we adopted a remote, desk-based approach. We performed a content analysis to contrast pre-pandemic methodological approaches with those used during the pandemic. We aimed to capture the breadth of methodological tools and approaches to understand how and why researchers have innovated during the pandemic, and to identify which challenges remain unmet.

The types of documents reviewed for pre-pandemic versus pandemic research differed. The reasons for this approach are explained later in the discussion section. In reviewing the pre-pandemic literature, we drew upon journal articles and scholarly books. Within the journal articles, we focused on review articles that systematically studied the range of methodologies used by social scientists and interdisciplinary research teams to study children and disasters. For the pandemic literature review, we drew upon peer-reviewed journal articles and commentaries, and reports from the United Nations, international organizations, and NGOs. Additionally, we reviewed quick response research reports and working group reports on the CONVERGE website, and websites of children and disaster researchers with ongoing research projects. With these additional sources, we aimed to capture methodological adaptations and innovations that have not yet made their way through the scholarly publication and peer-review pipeline.

To identify appropriate sources, we selected articles, books, reports, and other grey literature with “disaster”, “child*”, “young person”, “teen*”, or “youth” in the title, abstract, or keywords. In April and May 2021, we conducted electronic database searches in Web of Science, Scopus, and Google Scholar. We prioritized studies where children and youth (age range 5-17 years) were the primary focus of the study. For pre-pandemic publications, we focused exclusively on social science studies as the breadth of research on children and disasters has already been reviewed (cf. Peek et al., 2018). We privileged literature that spoke to the social dimensions of disasters among children as context for our observations during the still-unfolding pandemic. We read pre-pandemic publications with the aim of identifying the often creative and participatory methods that characterize the sixth wave (Peek et al., 2018), which may undergo further transformation in a possible seventh wave. Conversely, in our review of literature published since the onset of the pandemic, we included studies from biomedical fields conducted and published in early to mid-2020. These studies may reveal the methodologies that characterize the very beginning of a possible seventh wave.

In the surveyed literature, we paid particular attention to the following aspects of the methodologies: What was the methodological approach, and why? Which method(s) were used, and why? What ethical concerns were featured in the methodology? How did researchers make their methodology child-friendly? What methodological challenges and innovations emerged from the research?

We then conducted a content analysis to identify key themes and trends. Two authors led the content analysis, and the emerging themes were then analysed and discussed among all authors synchronously in video calls and asynchronously in an online document. These themes and trends are explained in the following section, drawing upon the surveyed literature as well as our own experiences studying children and disasters.

Results and Discussion

Methodological Changes and Challenges

During the pandemic, in some cases, there was an amplification of what was already being done in research studies – or even a continuation of the status quo. This was particularly true for children and disaster researchers in psychology, psychiatry, or medical fields and other disciplines that relied primarily upon surveys that could easily be administered online or via patient lists. Indeed, the vast majority of early publications on children and disasters during the current pandemic has come from these fields, utilising positivist research paradigms and using quantitative methods (for example, Adibelli & Sümen, 2020; Davico et al., 2021; H. Dong et al., 2020; Y. Dong et al., 2020; Drouin et al., 2020; Duan et al., 2020; Dumas et al., 2020; Dunton et al., 2020; Ellis et al., 2020; Fitzpatrick et al., 2020; Gaiha et al., 2020; Li, Wang et al., 2020; Li, Zhang et al., 2020; Liu et al., 2021; Mantovani et al., 2021; Oosterhoff & Palmer, 2020; Oosterhoff et al., 2020; Patrick et al., 2020; Qin et al., 2021; Riiser et al., 2020; Ruiz-Roso et al., 2020; Russell et al., 2020; Saurabh & Ranjan, 2020; Senkalfa et al., 2020; Tso et al., 2020; J. Zhou et al., 2020; S.-J. Zhou et al., 2020). Empirical social science research on children

and disasters during the COVID-19 pandemic that uses interpretivist or constructivist research paradigms and employs qualitative methods has mostly not yet made it through the academic publication pipeline.

Even before the COVID-19 pandemic, there was a reticence among disaster scholars to directly engage children in research, which can largely be attributed to ethical and methodological challenges arising from vulnerability, undue risks and burdens, risk management, and decision-making capacity of participants (Ferreira et al., 2018), as well as difficulties obtaining institutional ethics approval, accessing disaster-affected communities, crafting research protocols and theory under time constraints, and ensuring trained researchers are the ones entering the field (Peek, 2008, p. 11). Consequently, much research on children and disasters, and interventions ensuing from this research, have been based on talking *about* children rather than *with* them. Scholars have criticized this approach (for example, Cox et al., 2019; Delicado et al., 2017; Gibbs et al., 2013; Mudavanhu et al., 2015; Muzenda-Mudavanhu, 2016; Pfefferbaum et al., 2018). Despite these difficulties, many social science researchers have used innovative techniques to engage children in disaster-related research directly, for example: through arts-based projects (Gibbs et al., 2013; Malboeuf-Hurtubise et al., 2021; Mort et al. 2020), partnerships for community group or school-led research projects (Gibbs et al., 2013; Mort et al. 2020; Oncu et al., 2009), participatory activities (Gibbs et al., 2013; Mort et al. 2020), focus groups and interactive workshops (S. Anderson et al., 2020; King & Tarrant, 2013; Mort et al., 2020; Mudavanhu et al., 2015), mobile methods (Gibbs et al., 2013), and interviews coupled with storytelling and play (Koller et al., 2010; Mooney et al., 2017). Such approaches foreground the concerns particular to this group as voiced by children themselves, and enable scholars to identify and understand children's agency, resilience, and rights throughout the disaster cycle – rather than just enumerate their vulnerabilities (Cox et al., 2019; Gibbs et al., 2013; Fothergill & Peek, 2015; Mooney et al., 2017).

The onset of the pandemic placed significant roadblocks on directly engaging children in research on children and disasters. Many of the current publications on children and the COVID-19 pandemic obtained their findings through online, email, or telephone surveys and interviews (for example, Adibelli & Sumen, 2020; Barnett et al., 2021; Casanova et al., 2020; Davico et al., 2021; H. Dong et al., 2020; Drouin et al., 2020; Duan et al., 2020; Dumas et al., 2020; Dunton et al., 2020; Ellis et al., 2020; Fitzpatrick et al., 2020; Gaiha et al., 2020; Li, Wang et al., 2020; Li, Zhang et al., 2020; Liu et al., 2021; Mantovani et al., 2021; May & Coulston, 2021; Oosterhoff & Palmer, 2020; Oosterhoff et al., 2020; O'Sullivan et al., 2021; Patrick et al., 2020; Qin et al., 2021; Raby et al., 2020; Riiser et al., 2020; Ritz et al., 2020; Ruiz-Roso et al., 2020; Terre des hommes, 2021; Tso et al., 2020; World Vision, 2020; J. Zhou et al., 2020; S.-J. Zhou et al., 2020), reviews of medical records and epidemiological reports (Y. Dong et al., 2020; Sinha et al., 2020), and reviews of policies, media, and organizational reports (Barnett et al., 2021; Liu et al., 2020; May & Coulston, 2021; World Vision, 2020). Additionally, scholars have written many commentaries about anticipated experiences and outcomes of the pandemic among children based on their own expertise and review of the literature (Buheji et al., 2020; Fegert et al., 2020; Guessoum et al., 2020; Imran et al., 2020; Marques de Miranda et al., 2020; Masten & Motti-Stefanidi, 2020; Racine et al., 2020). As such, at the time of our literature review (April/May 2021), the research on children and disasters during the COVID-19 pandemic was thus largely reflective of what Peek et al. (2018) characterize as the first four waves of children and disaster. What is missing is research on children's resiliency, strengths, and capacities (fifth wave), and especially children's voices, perspectives, and actions across the disaster lifecycle (sixth wave).

Few in-person social science studies on children and disasters have taken place during the pandemic, and when they have, only with extra COVID-19 safety protocols in place such as physical distancing, providing masks and hand sanitizer, conducting activities outside, and eliminating potential study sites with a confirmed COVID-19 case (cf. S. Anderson et al., 2020; World Vision, 2020). S. Anderson et al. (2020), for example, describe how the pandemic catalysed major changes to their study on girls' menstrual management in resettlement centres after Cyclone Idai in Mozambique:

> First, the methodology (originally designed to collect quantitative data) was adapted to a qualitative approach to avoid risks associated with large gatherings of people and the physical passing of surveys and pencils. Secondly, several additional questions were asked during the follow-up focus groups at the request of Mozambique's Ministry of Education and Human Development to understand 1) how COVID-19 had affected the community generally, 2) participants' level of knowledge about preventative measures to avoid transmission, and 3) if/how the

> pandemic had affected menstrual management in the communities (S. Anderson et al., 2020, p. 6).

As a workaround, some researchers have opted to interview or survey not-for-profit agencies, community organizations, social service agencies, government departments, teachers, school administrators, child care providers, parents, guardians, and other caregivers who often serve as gatekeepers to learn about the children who are their students and clients (Barnett et al., 2021; Drouin et al., 2020; Fitzpatrick et al., 2020; Mantovani et al., 2021; May & Coulston, 2021; Patrick et al., 2020; Russell et al., 2020; World Vision, 2020). While this approach may be the best or only possibility for research on children and disasters given the pandemic restrictions, there are limits to this approach. In several pre-pandemic research projects, scholars have found significant variation between the accounts of caregivers about their children and the accounts of children themselves (Peek, 2008; Pfefferbaum et al., 2013). It thus remains important to complement the perspectives of adults talking *about* children with the perspectives of the children themselves, as expressed in their own words and art. As pandemic-related restrictions are relaxed and methods that seek direct accounts from children become more feasible, a key research question will be how data collected via caregivers and gatekeepers compare to children's own reflections about their experiences. Such lines of inquiry could produce important insights into issues that went unnoticed or mischaracterized by adults.

To get closer to eliciting children's own expressions of their experiences while still abiding by institutional, ethical, and public health restrictions, other researchers requested caregivers to act as intermediaries. Researchers, for example, trained parents as interviewers (Idoiaga et al., 2020) and asked caregivers, especially mothers (Malta Campos & Vieria, 2021; O'Sullivan et al., 2021), to send in their children's pandemic artwork (Martyn, 2020), children's audio or written narratives (Malta Campos & Vieria, 2021), or to discuss their child's pandemic experiences (O'Sullivan et al., 2021). These studies also reflect the increasing use of "call-and-response" type research in which the research team solicits participant-created data. Pre-pandemic, these data may have been constructed in-person in a group research setting – such as drawing activities, group storytelling, or applied theatre in a research workshop with schoolchildren in their classroom (for example, Fothergill & Peek, 2006; Gibbs et al., 2013; Peek & Fothergill, 2009). Re-designed for the COVID-19 context, such data could be constructed by individual children in and around their homes or school classrooms, then submitted (usually electronically) to the research team. One particularly innovative pilot and feasibility study on the potential of an emotion-based directed drawing intervention and a mandala drawing intervention to improve child mental health during the pandemic used a video-conferencing platform, which enabled the research team to remotely facilitate the interventions with groups of students in their classrooms (Malboeuf-Hurtubise et al., 2021).

Unable to study other people's children, some researchers have begun studying their own children. Holiday (2021), for example, used a combination of in-person and digital ethnography of his own children to study social learning of COVID-19-related health measures via educational video games. In fact, the spark for our own research project began when one of the authors asked her 7-year-old daughter if she was interested in journaling about her pandemic life shortly after the initial COVID-19 school closures. Another author found that observations of and lengthy conversations with her high school-aged daughter were informative for the project.

The published large-scale studies on children's experiences of the pandemic have mostly been conducted by the UN and major international non-governmental organizations such as Save the Children and World Vision (Ritz et al., 2020; Terre des hommes, 2021; World Vision, 2020). Such studies have largely relied upon surveys administered online or by telephone. Several factors help explain why these organizations were able to quickly launch and conduct large-scale research projects: they have their own internal research ethics boards, they have country offices with local staff who continued their work during the pandemic, and they have contact lists of their program participants. These pre-established relationships, local know-how, and pre-existing list of potential research participants at multiple sites were highlighted as key elements in facilitating quick response research at such a large scale (Ritz et al., 2020; World Vision, 2020). While not mentioned specifically in any of the reports as a reason why the study could be conducted and published so quickly, it is likely that being able to rely upon a large team meant that the studies were not majorly hindered when some members of the team were pulled away to attend to caregiving or other responsibilities precipitated by the pandemic. The UN has also released policy briefs with child wellbeing-focused recommendations (UN, 2020) and COVID-19-focused updates to their earlier guidelines on conducting ethical research on children and disasters (Berman, 2020; Berman et al., 2016).

Other groups that work directly with children outside of academia, and that are not subject to university ethics boards, have been nimbler with engaging children directly. While not research projects per se, these initiatives set out to record children's experiences of the pandemic. For example, the Girl Guides of Canada (2021) contacted girls directly, as well as through their parents and guardians, in soliciting inputs for the Girl Guides of Canada Pandemic Time Capsule of girls' stories, videos, photos, and art. Major media outlets, including the Canadian Broadcasting Corporation, have similarly solicited children's narratives and artistic expressions about their experiences. Other media sources, such as *The New York Times*, have done in-depth reporting on children's experiences, often centring the children's voices ("Teens on a year that changed everything", 2021). These records may well become an important data source for future scholarly studies of children's pandemic experiences.

A major trend in research on children and disasters during the pandemic is a shift from in-person to virtual research methods. Researchers have modified their existing repertoire of in-person methodological tools to suit a virtual field. For example, in-person interviews are replaced by online video interviews or phone interviews (O'Sullivan et al., 2021; Raby et al., 2020; World Vision 2020), and in-person questionnaires are replaced by online or phone questionnaires (Mantovani et al., 2021; Ritz et al., 2020; Russell et al., 2020; World Vision, 2020). The exploration and increasing adoption of online interviews and app-based methods were already happening pre-pandemic in social science research more generally (cf. Gray et al., 2020; Kaufmann & Peil, 2020). Not surprisingly, this trend has accelerated during the pandemic (cf. Howlett, 2022), largely attributable to institutional restrictions designed to protect vulnerable populations and researchers alike from catching and transmitting COVID-19, as well as researchers' own convictions to conduct their research in the most ethical way possible. This pandemic-induced shift towards the increasing use of quantitative methods, technology-based methods such as online surveys, online video interviews, social media-based methods, and GIS and app-based methods, and the temporary halt of in-person fieldwork, are similarly reported among disaster researchers more generally (Ritchie et al., 2021).

Paralleling the shift from in-person to online methods is a shift in the locations of children and disaster research. This shift is transpiring in several ways. Researchers who usually conduct studies in another part of their country or in another part of the world from where they are based are starting projects in their own communities, neighbourhoods, and even homes (for example, Holiday, 2021). In this way, there is a geographical contraction of study sites. Yet, there is a simultaneous expansion of study sites with the enthusiastic uptake of virtual methods. Without budgetary, time, and travel constraints associated with in-person research projects, researchers have increased the geographical range of their projects to include participants all over their province or state, their country, or even multiple countries. There is also an opening up of virtual spaces. This opening is occurring directly, for example, by "entering" children's homes during online interviews (Raby et al., 2020). It is also occurring indirectly, as researchers' attention is focused on the online spaces that children frequent, such as social media websites and online video game worlds (Holiday, 2021). Yet another way in which the geographical shift is transpiring is attributable to the hazard itself. In contrast to all other disasters in living memory, which are localised to various degrees, the pandemic is truly a global disaster, acutely affecting the entire planet. As such, research projects on children and disasters are happening in locations that are otherwise largely exempt from disaster studies (because of the low incidence or absence of hazards in the location). Our own research project exemplifies all aspects of this shift.

The limitations on in-person research methods have posed important challenges. As the online schooling experiences of many children and teachers have shown, engaging children and young people online in a focused manner for a sustained period of time is extremely difficult (Ewing & Cooper, 2021; Yates et al., 2021). For researchers, this challenge may result in shortening online interviews (as compared to in-person interviews) and accepting that there may be distractions within the child's interview environment (and caused by the child themself – e.g., changing backdrops), and that it may be difficult or impossible to read body language (O'Sullivan et al., 2021). This is especially pronounced if the participant's camera is turned off, and the researcher may have to rely more upon verbal exchanges than show-and-tell or play acting as compared to in-person interviews.

The pandemic is exacerbating the exclusion of certain children's voices from children and disaster research. Unfortunately, recruitment of children marginalized because of their social locations is difficult in disaster research; this challenge has been greatly amplified during the pandemic. For example, among children

whose participation in research projects depends on having a translator physically present, or whose literacy levels – linguistic or digital – thwarts their participation (Ritz et al., 2020). This blind spot is critical because previous research has shown that existing inequalities linked to gender, sexuality, race, ethnicity, socioeconomic status, immigration status, disability, religion, linguistic status, and other social determinants of health are exacerbated during disasters (Cutter, 2006; Cutter & Finch, 2008; Enarson, 2000; Fothergill, 1996; Gibb, 2018). Early media and research reports of the COVID-19 pandemic indicate similar trends in which existing inequalities and exclusions are being amplified, including for children (Li, Zhang et al., 2020). Thus, to better understand the heterogeneity of children, studies should adopt an intersectional approach in explaining how other components of identity affect their experiences (Mullings & Schulz, 2006). This task, however, has proven difficult; some researchers have reported that recruitment in the pandemic has been so challenging that they have had to change their methodology entirely to accommodate a sample size of one (Marchezini et al., 2021). In our study, for example, one challenge of recruitment has been that parents are so overwhelmed with juggling their jobs and childcare that they do not have time to participate or respond to outreach.

Moreover, the reliance on Internet-mediated research methods is skewing which children, and which of their households, are engaging in children and disaster research right now. For example, reliable access to the Internet and a device to interact with a research team is highly uneven, which results in study participants generally coming from more privileged backgrounds (Chiou & Tucker, 2020). One report found that 17 million children in the U.S. did not have high-speed Internet service and 7 million did not have access to computers (Alliance for Excellent Education, 2020). These children were more likely to be children of colour. In a large scale study conducted by Save the Children and its partners in 46 countries with 31,683 parents and caregivers and 13,477 children, Ritz et al. (2020, p. 12-13) note that their sample is skewed: (1) towards people with stable Internet and/or phone access, and who are willing to absorb the cost of receiving phone calls or using their data plan; (2) towards people who can speak or read and write in one of their survey's 28 languages; and (3) towards people with time and interest (which biases the sample *against* the most marginalized and deprived, and persons with disabilities). Dunton et al. (2020) similarly report that their survey respondents were primarily college educated mothers in high income households and questioned whether their findings could be generalized to children who do not fit this demographic.

These challenges have also spurred researchers studying children and disasters to utilize innovative methodological alternatives that strive to privilege children's own voices while mitigating COVID-19 risks. Our own research project, for example, uses a mixed methods approach that relies upon methods that are done almost entirely remotely and within the confines of the child's own "bubble" or "pod". It uses journaling as a tool through which children are invited to express their everyday experiences and geographies during the pandemic in their own words, drawings, photographs, maps, and audio and video recordings. The journals will be complemented by surveys, interviews, focus groups, and participatory workshops – methods that have previously been used effectively to study the disaster experiences of children (Fothergill & Peek, 2006; Mort et al. 2020; Peek & Fothergill, 2009; Pfefferbaum et al. 2013). We have adapted these methods for pandemic circumstances; the survey is currently online, the interviews and focus groups are being conducted mostly online, and the workshops will be directed by the research team via videoconference. Additionally, we are using podcasting as a research method because the making of a podcast is highly participatory, foregrounds children's own narratives of their experiences, can be done independently with simple tools (e.g., telephone, smartphone, or computer), and the dissemination of a podcast can be a powerful tool for public education, building empathy and connection (Lord, 2021).

In addition to the aforementioned methodological shifts and innovations, we anticipate that the massive shift to online teaching and learning during the pandemic will shape the methodological approaches of children and disaster researchers in the future. Researchers, especially those who have spent the past 2 years experimenting with online teaching and learning, will borrow the successful pedagogical strategies and methods – the ones that truly engage young people – and rework them into highly engaging virtual methods. For example, they may incorporate innovations around bringing "play" into the classroom (cf. Cavanagh, 2021) and include asynchronous activities and assignments. Just as college and university instructors plan to incorporate their successful online teaching strategies into their physical classrooms, we expect that children and disaster researchers will similarly bring lessons

learned from their online research to their in-person research.

Ethical Considerations

Researchers who study children and disasters, and especially those in social science studies or those using a participatory approach, devote a considerable amount of time and energy to thinking through ethical issues and devising research protocols that "do no harm", and rightly so. It is critical to reflect on the ethical considerations of populations seen as vulnerable, such as Indigenous populations, those living in poverty, or those vulnerable due to age, and to understand past and current exploitation and experiences of discrimination and oppression (Rivera & Fothergill, 2021).

Children and youth are a vulnerable population in the disaster context, often enduring many losses, challenges, and long-lasting effects (W. A. Anderson, 2005; Bodstein et al., 2014; Fothergill & Peek, 2006; Muzenda-Mudavanhu, 2016). Their vulnerability can be psychological, physical, social, economic, and educational (Fothergill & Peek, 2015; Muzenda-Mudavanhu, 2016; Peek, 2008). Children may require forms of physical, social, mental, and emotional support distinct from those required by adults to cope with and recover from disasters (Fothergill & Peek, 2015; Peek, 2008; Peek & Richardson, 2010). This focus on children's vulnerability and the "children at risk discourse" (cf. Gibbs et al., 2013) is built into the ethics approval process at institutions, whereby studies involving children are subject to additional scrutiny (e.g., ineligible for expedited review) and require additional assent and consent protocols, safeguards, and justifications compared to research with adults. Most scholarly articles and books on children and disasters, in addition to noting their ethics approval, describe specific measures taken to ensure high ethical standards. Measures include, for example: avoiding taking children to places "that are uncomfortable or painful to revisit [in either…] the physical realm or in conversation" (Gibbs et al., 2013, p. 137); using an iterative and continual assent/consent procedure with all child and adult participants (Mooney et al., 2017; Mudavanhu et al., 2015); having the study reviewed or supervised by an experienced family therapist, early childhood educator, psychologist, or social worker (Koller et al., 2010; Mooney et al., 2017; Uttervall et al., 2014); ensuring the project "is perceived as a support to those involved rather than as an additional burden" (Pascal & Bertam, 2021, p. 27); informing participants of the support available to them from a social worker or child life specialist (Koller et al., 2010); and privileging surveys and research reports "that shared similar values [of the right of small children, their families and their teachers to be heard] and followed ethical procedures" in reporting upon other studies (Malta Campos & Vieria, 2021, p. 136).

The current COVID-19 crisis is no exception to this attention to ethics and categorization of children as a vulnerable population. In the pandemic, children's vulnerability is largely attributed to lapses in education due to school closures. This narrow framing is problematic because: (1) it dismisses their vulnerability beyond educational concerns; (2) it defines children as passive recipients of interventions, thereby ignoring their important contributions to their own and others' recovery; (3) it suggests an innate, rather than socially produced, vulnerability; and (4) it wrongly homogenizes all children as vulnerable (Gibb et al., 2020; ResiliencebyDesign Research Innovation Lab, 2019). As Berman (2020) argues, it is critical that researchers and policymakers differentiate among vulnerable cohorts of children and recognize that the causes and outcomes of vulnerability vary greatly among children at all scales, from the household up to the global scale.

In UN Children's Fund (UNICEF) discussion papers on the ethics of conducting research on children during humanitarian emergencies, Berman et al. (2016) and Berman (2020) foreground ethical considerations during an emergency and immediately post-emergency. These issues include: prioritizing a duty of care in which the research team weighs the harms and benefits of conducting research; examining institutional capacity and power relationships among all parties implicated in the research process; ensuring privacy, confidentiality, informed consent, and reciprocity; and ensuring appropriate communication of findings. In addition to these ethical considerations, Berman (2020) notes two extra COVID-19 factors for researchers to consider:

1. The spread of COVID-19 has been a protracted process and containment has been difficult. This has resulted in mandatory lockdowns and the potential for extended isolation of families.
2. In a number of countries, these lockdowns occur in contexts of overcrowding, inadequate sanitation and health infrastructure, and where incomes are earned on a daily basis. These conditions are leading, or are likely to lead, to greater social and economic strain in the poorest contexts (Berman, 2020, p. 4).

Unless data collection activities are absolutely necessary during the emergency phase, Berman (2020) strongly advocates that researchers wait until pandemic

restrictions are lifted before commencing their studies. Even after restrictions have been lifted, ethical concerns may remain about conducting research in certain settings. For instance, ethics boards may ban or avoid approving in-person research protocols, while individual researchers and participants will need to make their own calculations about the level of risk that is acceptable in the context of a dynamic virus threat.

Ethics have featured prominently in our deliberations - for our working group, our study, and this article. We have discussed, for example, ethical considerations of: conducting or not conducting research with children during the pandemic; various qualitative and quantitative research methods; the types, ordering, and wording of questions; recruiting family members and friends as participants; and claiming to centre children's voices then not attributing their real name to their contribution. We have grappled with cross-institutional differences in the ways and timelines in which requirements for research protocols responded to an evolving risk landscape. We sought and have received ethics approval from two of our host institutions, one in the U.S. and one in Canada. For various reasons, between the two institutions, it took nearly a year to obtain research ethics board (REB) and institutional review board (IRB) approval. While our experience is likely atypically long, other social scientists have noted the challenge of obtaining ethics approval rapidly enough in order to conduct quick response research (for example, Asare et al., 2020; Institute for Catastrophic Loss Reduction [ICLR] & the Natural Hazards Center [NHC], 2020; Peek, 2008; Peek et al., 2021). To facilitate the possibility for "timely, ethical, and scientifically rigorous" (Peek et al., 2021, p. 2) post-disaster research, researchers have developed strategies such as multi-institution authorization agreements and pre-approval of research projects in which the specific disaster and study site are inserted at the end (ICLR & NHC, 2020; Vindrola-Padros et al., 2020). While none of these examples were focused on children or composed of researchers based at institutions in multiple countries, we suggest researchers pursue these agreements and pre-approvals.

The difficulty of developing an ethical research project and obtaining institutional ethics approval to work with a population often characterized as vulnerable should not be a reason to abandon working with this age group (Packenham et al. 2017). Indeed, widely accepted ethical standards for human subjects research, such as the principle of beneficence outlined in the Belmont Report, deem it unethical to leave groups out of studies simply because it would be inconvenient to include them (Gordon, 2020). Thus, these individuals should be included in the research, and the difficulties involved emphasize the need for clearer guidance for researchers and ethics boards, the urgency for more methodological and ethics training for social science disaster researchers, and the importance of sharing experiences and drawing on each other's best practices (Peek, 2008; Peek et al., 2020; Peek et al., 2021). Otherwise, we risk further silencing children's experiences of disaster, and perpetuating what Robert Chambers (2017) describes as biases, blind spots, and neglected areas of research.

Why the Changes?

At risk of restating the obvious, the world was upended by COVID-19, which changed the way many people live their lives. The world of research on children and disasters was not exempt from this upheaval. The following discussion explores some of the justifications for the observed changes in the way researchers study children and disasters.

One, life for *everyone* changed. During the pandemic, around the world, public health restrictions were put in place to limit the spread of COVID-19. These measures included travel restrictions or travel bans, physical distancing, mask wearing, shelter-in-place mandates, and so on. These restrictions constituted one set of barriers to researching children and disasters during the pandemic in that researchers could not physically access study populations.

Two, these restrictions were compounded by institutional COVID-19-specific restrictions on research with human subjects. In non-pandemic times, REBs and IRBs are particularly attentive when scrutinizing proposed research on populations typically deemed vulnerable. While the need for such oversight and restrictions is valid, it creates challenges for university-based researchers that add time and layers of complexity to studies involving children, particularly in the context of disasters. During the pandemic, many REBs and IRBs in Canada and the U.S. imposed additional restrictions on conducting research with such populations, which effectively curtailed social science in-person research with children.

Three, these difficulties were further exacerbated by the impacts of the pandemic and of critical work, family, social, and political commitments in researchers' personal lives. Disaster researchers reported diverse personal effects of the pandemic ranging from a challenging work-life

balance, childcare and caregiving challenges, decreased productivity, increased productivity, languishing and emotional toll, strain on spousal relationships, and challenges with work from home logistics (Ritchie et al., 2021). For example, some college and university-based researchers had to switch to emergency online teaching in March 2020, and subsequently had to prepare and deliver online or bimodal courses over subsequent semesters. This meant that they devoted most of their energy to teaching. Other researchers were dealing with the medical, financial, and psychosocial impacts of the pandemic on themselves, their households, and their extended families. Other researchers had caregiving responsibilities, such as caring for and educating young children during childcare centre and school closures and tending to elderly relatives. During the early months of the pandemic in North America, there was a swelling of critical social movements – notably Black Lives Matter and Indigenous Lives Matter – in which some disaster researchers were personally and professionally involved (Ritchie et al., 2021). As a result of pandemic-induced challenges and broader social movements coming to the fore, some disaster researchers made a deliberate decision to not do research at this time to focus on other priorities.

Conclusion

Thus far, there is insufficient evidence to claim that a seventh wave of research on children and disasters has begun. It will only be in hindsight that researchers will be able to point to a start date. We contend, however, that the massive adoption of online methods during the COVID-19 pandemic is laying the foundation for a seventh wave of children and disaster research characterized by its integration of in-person and virtual worlds, and of in-person and virtual research methods. Rather than *initiating* this transition to a hybrid or blended model, the pandemic is *accelerating* the transition, and compelling more of the research community to engage than might have otherwise. This process is due to a confluence of factors:

1) the growing importance of the online world in children's everyday non-pandemic social lives with their peers;
2) the increasing integration of the online world in the educational lives of children (e.g., homework and in-class activities facilitated by blended-learning platforms, replacement of math worksheets with math-focused video games, assignments requiring the integration of online tools);
3) the importance of videoconferencing for communicating with out-of-town friends and family;
4) the pre-pandemic interest among researchers to explore digital research methods (for example, Cox et al., 2019; Delicado et al., 2017; Pfefferbaum et al., 2013);
5) the perspective of the next generation of disaster researchers - who will have been online their entire lives - integrating digital methods into their studies will likely seem "normal" and exclusively in-person research designs unusual (just as researchers in the 1980s and 1990s likely could not have imagined doing disaster research through videoconferencing);
6) the rising pressure from (youth) activists, institutions, funding agencies, and researchers themselves to reduce the carbon footprint of research, including travel (Fent et al., 2022);
7) the push for greater alignment among disaster reduction, climate change, and the UN's Sustainable Development Goals work, and with decolonization, Indigenization, and social justice efforts, which could result in more community-driven disaster research supported by – instead of led by – university-based researchers and their digital methods.

Taken together with the published studies on children and disasters during the COVID-19 pandemic discussed earlier, these factors suggest that the online world is being normalized as being on par with the physical world, as opposed to secondary or complementary to it. The seventh wave of children and disaster research will thus likely be characterised as a "bricolage" of methods originating in both in-person and virtual fields, adapted in various ways for both in-person and virtual fields. We see this as an exciting development, and one that is better attuned to the spaces where children live their lives, and the ways in which they live their lives – in an intertwining of virtual and in-person worlds.

Like W. A. Anderson (2005), we present a challenge to researchers entering a seventh wave of research on children and disasters. We invite researchers to build on the innovative research methods, characteristic of the sixth wave, that centre children's own voices, interests, and rights (Peek et al., 2018). Leveraging children's contributions to develop culturally sensitive approaches has already been done in risk reduction policy, for example, through photovoice and theatre/arts-based approaches that demonstrate the experiences of children from across social strata (Mort & Lloyd Williams, 2019). These methods could easily translate into innovative, ethical, and participatory ways that social science

researchers are currently using to engage with children despite the limitations of COVID-19.

Additionally, we encourage methodological approaches that recognize children as "vulnerability bearers" as opposed to "vulnerable populations" (Peek, 2019; RbD, 2019). We suggest engaging in both the physical and virtual worlds where children live their lives. We advocate for prioritizing approaches and methods that contribute to the broader anti-racism, decolonization, and Indigenization efforts of disaster scholars and practitioners (cf. Bonilla 2020a; 2020b; Chmutina et al., 2021; Rivera, 2022). And finally, we ask researchers to share their experiences so that we, and others in the field, may learn from one another, and especially from the children with whom we engage, in building more socially and environmentally just, child-centric research on children and disasters.

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Agency expert partners supporting bushfire disaster resilience education for primary school students: A case study in New South Wales, Australia

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Abstract

This research sits within the context of relationships spanning geography teaching, collaborations with expert partners, natural hazards, disaster resilience education, bushfire, and fire-fighter volunteers as expert partners. The research aims to investigate the situation of fire-fighters being actively involved in student classroom learning and the contribution that fire-fighters make to students' understanding of bushfire risk in Stage 3 (Years 5 and 6) Geography. This research will also show how expert partners support outcomes that increase the resilience of students and reduce current and future disaster risk. The case school was selected on the basis of bushfire risk level, intended delivery application of an exemplar unit of study, and intended collaboration with involvement of volunteer fire-fighters to assist student learning. Primary data will be collected from teachers, students, parents/carers, and New South Wales Rural Fire Service fire-fighters using semi-structured interviews, observations, and focus groups. The research will deliver findings for emergency services agencies to consider when developing and implementing natural hazards programmes targeted at children, particularly those programmes that are delivered by volunteer fire-fighters.

Keywords: *Geography, disaster resilience education, expert partners*

Context of Disaster Resilience Education

The New South Wales (NSW) Geography Syllabus Stage 3 expects students to investigate a recent Australian bushfire event and consider the impact of bushfire on people, place, and the environment (NSW Education Standards Authority, 2015). The syllabus emphasises inquiry learning where students rigorously investigate the physical and emotional effects of bushfires, identify problems and issues, and propose solutions.

A disaster occurs when the impact of a hazard is greater than the resources and capacities of a person or a community to mitigate it (United Nations Office for Disaster Risk Reduction, 2019), where hazards interact with social structures (Cedervall & Raju, 2020). According to the United Nations, disaster risk reduction is "the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events" (United Nations International Strategy for Disaster Reduction, 2009, p. 10-11). The Australian Curriculum and NSW Geography Syllabus provide the mechanisms for young people in Australia to learn about the concepts of disaster risk reduction.

In the context of disaster risk, resilience is about not just bouncing back but to move or bounce forward by actively reducing risks of future impacts (Haworth et al., 2018). Emergency management agencies including the NSW Royal Fire Service (RFS) create programmes to build more disaster-resilient populations that can recognize current and future risk, can reduce and manage those risks, and are better able to recover from disasters (Coalition of Australian Governments, 2011). The Sendai Framework states that "children and youth are agents of change and should be given the space and modalities to contribute to disaster risk reduction, in accordance with legislation, national practice and educational curricula" (United Nations, 2015, p.23). School disaster resilience education (DRE) is the key mechanism through which children can participate in disaster risk reduction activities (Amri et al., 2017). DRE can build students' understanding of the hazards and provide knowledge

and skills to enable them to plan, prepare, respond, and recover (Ronan et al., 2016). DRE can be readily applied in geography to bushfire hazards where risk and uncertainty are challenges but represent problems to be solved and are not insurmountable threats (Ronan, 2014). In Stage 3, geography students focus on real-life and authentic local problems related to bushfire (NSW Education Standards Authority, 2015).

The NSW RFS engages with communities and individuals at risk of being affected by bushfire through programmes and activities primarily delivered by volunteer fire-fighters. NSW RFS volunteers can be invited into classrooms as authentic experts to support teacher-led student learning delivering both syllabus and DRE outcomes. They can do this by sharing personal stories and physical and emotional experiences as well as providing information, facts, and data via geographical tools, and guiding students to examine problems as well as reflect on and refine solutions (Ermeling & Yarbo, 2016).

Research Aim and Importance

The aim of this research is to investigate and further understand the contribution and impact that volunteer fire-fighters have on students' understanding and interest in bushfire risk in Stage 3 Geography in the NSW Geography K-10 Syllabus (NSW Education Standards Authority, 2015).

The importance of this research. There is limited published research on the application of inquiry learning approaches in the context of teacher-led, syllabus-connected, classroom-based DRE. The extent to which fire agency experts engage as expert partners in the classroom and influence student learning outcomes is not measured, and there is little to no understanding of the enablers and barriers to consistent, sustained, and quality support from such experts. There is also a dearth of published research on DRE outcome effectiveness (Amri et al., 2017).

Engaging/observing as an insider-outsider, with lived experience as a fire-fighter, fire agency employee, school education programmes developer, and early career researcher, this research addresses a notable gap in our knowledge on how expert partners such as fire-fighters can support student learning in the classroom. It will also add to the body of knowledge where DRE and education practice converge. This work will show how experts support effective DRE outcomes that increase the resilience of students and reduce current and future disaster risk. This research project is not an evaluation of Stage 3 Geography classroom teaching or agency programme resources that fire-fighters bring, which tend to focus more on knowledge-based outcomes than skill or action-based disaster risk reduction and resilience outcomes (Ronan et al., 2016).

New Knowledge

The work considers the real-world challenges of bushfire risk and disaster risk reduction in a local context and is engaged wholly with educators and emergency services to deliver findings that will make a difference to young people in their local setting. The new knowledge generated by this research will reside in the social connections, interactions, collaborations, knowledge sharing between teachers, students, parents/carers, and the emergency service agency experts sharing the delivery of classroom disaster resilience education.

Most interest in this new knowledge is expected to lie with emergency services, teachers, and students. For emergency services, that knowledge will be around programme design and implementation for Stage 3 Geography as well as in skills and capability development for those expert partners supporting classroom teachers. For teachers, the contribution that experts can play in the classroom will be clearer, and particularly directed to the bushfire mitigation unit in Stage 3 Geography. For students, the value of collaboration with fire-fighter experts will be drawn out during the research, as will the process for sharing knowledge, taking guidance, and considering advice about bushfire.

A Case Study Approach

The case study will be an embedded single-case design to facilitate the study of the social phenomena of fire service experts supporting teachers and engaging with students whilst minimising disruption to the classroom and learning environment (Swanborn, 2010). This research primarily fits into the exploratory case study type (Yin, 2009) used to describe the phenomenon and the real-life context in which it occurred, seeking to make generalisations by extrapolating the study's findings to other cases or situations. Emerging literature about children and DRE recognises that qualitative data collection methods are important for understanding how young children are interpreting key safety concepts such as those put forward by teachers and fire service experts (Johnson et al., 2014).

This typical case will capture the circumstances and conditions of the everyday situation of learning about bushfire which is undertaken through Stage 3 Geography using inquiry learning. The case is not holistic;

rather, it has three embedded units of analysis in the exploratory single-case design to reflect the teachers of the Geography unit, the touchpoints of the experts collaborating with the Stage 3 student participants, and the NSW RFS volunteer fire-fighters as expert partners.

The case school. A school was selected as the case on the basis of four criteria: the school is located in an area of "extreme" bushfire risk identified in the local Blue Mountains Bushfire Risk Management Plan; teachers of the Stage 3 cohort intend to apply or adapt the approach set out in a particular exemplar of a bushfire unit of study; the teachers intend to utilise and involve volunteer fire-fighter experts at four points across the unit of study - planning, early implementation, midway, and at the end; and there are local NSW RFS volunteers who have the capacity to engage with the school at each point. The case school has a rich history of successful collaboration with the NSW RFS on bushfire safety across years K-6.

Data Collection

Primary qualitative data for the purpose of the research will be collected from first-hand sources of teachers, students, and NSW RFS experts using semi-structured interviews, observations, and focus group discussions. Research participants are expected to be three classroom teachers, 40 Year 5 and 6 students, 15 parents/carers, and four NSW RFS volunteer fire-fighters.

Semi-structured interviews are a common qualitative data collection method useful for gathering facts, opinions, and rich insights (Gibbs et al., 2018) and allow the interviewer to pursue unexpected lines of enquiry during the interview (Grix, 2010). Initial semi-structured interviews with teachers will be used to ascertain attitudes, opinions, experiences, and behaviours about DRE as well as students' capability to grasp DRE concepts and generate empathy (Fuller & Hartley, 2021; Leavy, 2017). Further interviews will be undertaken with teachers and expert partners across the unit of study to ascertain what works for teachers and experts. The interviews will also be used to establish teachers' views on how expert partners can address students' fears or anxiety about bushfires (Johnson et al., 2014). The principal questions will be adapted from studies of child-centred DRE and earlier research by the NSW RFS.

Student peer-to-peer interviews will occur at the end of the unit with a focus on establishing what DRE outcomes have been achieved through interactions with NSW RFS experts. Such an approach will position the youth as active co-researchers and aid in having their viewpoints taken into account (United Nations, 2015). The structure and guiding questions for semi-structured interviews with both children and adults regarding bushfire is well tested and reported. In that regard, I intend to adapt elements of semi-structured interview protocol and instruments from the work of Towers (2012).

Non-participant observation occurs when the researcher is an outsider to the classroom under study, watching and taking notes from a distance (Creswell, 2013). This non-participant observation of behaviours and interactions between students and the expert partners will occur in the natural setting of the Year 5 or Year 6 classroom at two time points – midway through the unit when group activity is ongoing, and at the showcase at the end of the unit of study. This observation will occur both live and via video recording; protocols have been developed for each data collection type by participant.

The purpose of a focus group is to spark a dialogue between group members guided by topics supplied by the facilitator (Grix, 2010). Focus groups will be conducted with students early, midway, and at the end of the unit of study, and in the following year after a bushfire season. A focus group will be conducted and recorded with parents/carers after the subsequent bushfire season to determine the contribution of students to household response.

Status of the Research

The ongoing COVID-19 pandemic has intermittently affected teaching and learning in NSW schools, methods of study for students, and restricted access to schools for the parent/carer community and others – including researchers. As of April 2022, the commencement of the bushfire unit of study has been delayed pending a conclusion to COVID-19 restrictions and students being back in the classroom after any further period of "learning from home". While the commencement of data collection has also been postponed, with the strong support forthcoming from the School Leadership Team the prospects are excellent for data collection in Term 3, 2022.

Despite these challenges, it is anticipated that this research will generate findings that will pave the way for longer term research and scaled implementation of approaches to DRE programming at the Stage 3 level that supports and integrates school-based and teacher-delivered disaster resilience education.

High Hopes for this Research

With data collection about to commence, I continue to have high hopes for the new knowledge to be found with

this research and its value for emergency services in collaborating with schools and students about bushfire particularly and natural hazards generally. This research also reflects the ethos of Central Queensland University (CQU) to deliver research that has true impact in the research strength area of community and disaster resilience (CQU, 2020).

The Influence of Professor Kevin Ronan in my PhD Journey

My association with Kevin Ronan goes back to 2013 when he and Dr. Briony Towers from RMIT University became leaders of the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) project "Child-Centred Disaster Risk Reduction (CC-DRR)". At the time, I was the NSW RFS End-User representative on this project. End-Users would gather at project workshops led by Prof. Ronan with colleagues from across Australia to reflect on collective actions, hear about agency CC-DRR activity, and chart the course for the research year ahead.

My interest in CC-DRR grew from the passion and leadership of Prof. Ronan and particular examples of young people taking charge and playing a leading role in responding to disasters – most particularly at Strathewen Public School following the 2009 Black Saturday bushfires and Kamaishi Junior High School following the 2011 Great East Japan earthquake and tsunami. Prof. Ronan advocated for my inclusion in the Doctoral Program at CQU and spoke for me as a 55-year-old without research experience but with a strong interest in disaster resilience education and an ongoing commitment to community engagement work with children and young people, as well as adults in my capacity as a senior NSW RFS volunteer in the Blue Mountains, NSW.

My application for the Doctoral Program was submitted in May 2017 and accepted in January 2018 with Prof. Ronan as my Principal Supervisor. In those early days, Prof. Ronan implored me to take heed of his two tenets of a successful and completed thesis. Firstly, I had to employ research pragmatism where the 100 ideas I had racing around in the Doctoral application had to be whittled down to 50 ideas in the post-acceptance Memorandum of Understanding. These ideas then had to be pared back to one with the final choice of working with a single case school at Confirmation. Secondly, there has to be those "get out of bed" moments of joy and excitement about the research and what it can deliver, to keep the project moving forward.

We spoke at length on the legacy that we both wanted to leave, the contributions that we were making and could make in our respective worlds, and the people we were and wanted to be. Prof. Ronan re-affirmed the important place of my work and the opportunity my impending retirement (at the time) from the paid workforce would bring. This research fell out of those conversations; I wanted to know whether my time spent as an NSW RFS volunteer community engager and expert partner in classrooms makes a difference to anyone. This research also reflects the ethos of CQU to deliver research with true impact in the research strength area of community and disaster resilience – an area in which Prof. Ronan was highly respected and influential.

Prof. Ronan's illness necessitated a transfer of Principal Supervisor (to Professor Ken Purnell), a shift to a different CQU School (Education and the Arts), and development of new understandings about education and research. During this period, I suffered a brain aneurysm which knocked me around a fair bit, tested my mettle for this research, and put my research plan back a year. Now having retired from the NSW RFS, I have drifted away somewhat from those past networks around CC-DRR and DRE that were central to my being. Still, the passion remains, rekindled regularly with visits to the CQU Rockhampton campus.

Conclusion

I am in the early stages of being a researcher, but an old stager when it comes to being an "expert partner" in engaging with schools and students. I want to know, as an NSW RFS volunteer fire-fighter, what difference do we make when it comes to disaster resilience education? Looking at the contribution that NSW RFS volunteer fire-fighters make in classrooms to the knowledge, skills, attitudes, and behaviours of young students is in its very early stages, but this research will go some way – a long way I hope – to finding out.

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