Children's perspectives on the impact of the Hazelwood mine fire and subsequent smoke
event.

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Abstract

The perceived impact of disasters among children and adolescents, and their capacity to respond and recover, has not been commonly examined in the literature. This is despite recent developments in trauma-informed practices and response protocols in schools. In this study, children's and adolescents' perspectives regarding the impact and complications of the 2014 Hazelwood coal mine fire and associated community-wide pollution event were investigated. A total of 69 young people were interviewed at their schools, with comments revealing that the smoke and the resultant response of schools, family members and the community, impacted the social, emotional and academic wellbeing of some children, while other children appeared to experience little impact from the event. Some reported awareness of the effects of the event on their parents and community, and demonstrated skills to regulate their emotions and participate in disaster risk reduction efforts. Implications regarding the consequences of the fire and the ensuing circumstances, and recommendations for trauma-informed practices and inclusion of children in disaster preparation, response and rehabilitation programs to reduce their vulnerability are discussed.

On 9 February 2014, the open-cut brown coal mine servicing the Hazelwood power station in the Latrobe Valley, Victoria, caught fire due to nearby bushfires spotting into the mine. The coal mine fire burned for 45 days, covering the town of Morwell, and other areas in the Latrobe Valley, with plumes of smoke and ash (Teague, Catford, & Petering, 2014). Exposure to these pollutants and the resultant community concern regarding their impact, coupled with impacts from enduring disadvantage and recent bushfires in the Latrobe Valley (e.g. the 2009 Black Saturday bushfires), had the potential to exacerbate physical, learning and mental health complications for children in the region. However, exposure to these and other critical events may have also increased the resilience of these children and their capacity to respond to trauma exposure (Towers, 2012; Wood et al., 2015). This study explores the experiences and concerns of children regarding the smoke and how they responded during and following the Hazelwood mine fire.

Increasing evidence has demonstrated the varied impacts of disasters on the physical, psychological, academic and social outcomes of children. Research has shown that repeated exposure to early adversity can change the developing brain and physiology of children, diminishing their executive functions and memory, language abilities, and emotional and behavioural regulation (De Bellis & Zisk, 2014). These difficulties can impair academic performance, lead to challenging school behaviour, increase risk-taking behaviour and reduce children's capacity to form relationships. Exposure to trauma in childhood has also been shown to initiate onset of Posttraumatic Stress Disorder (PTSD; McFarlane & Van Hooff, 2009), alcoholism, drug abuse, depression and suicide (Felitti et al., 1998) in adulthood. However, it is unclear whether the Hazelwood smoke event constituted a traumatic event and contributed to the development of emotional or behavioural concerns for children in Morwell and surrounding areas.

The prolonged nature and uncertain health implications of the Hazelwood event, coupled with the disproportionate vulnerability and disadvantage of towns surrounding the Hazelwood coal mine (Teague et al., 2014), means that the psychological impacts of this event are potentially elevated compared to other bushfire and disaster events. Research has shown that disadvantaged children are at greater risk for traumatic exposure and among the most heavily impacted and vulnerable to both the short- and long-term complications of disasters (Lawler & Patel, 2012; Peek & Stough, 2010; Salazar, Keller, Gowen, & Courtney, 2013). However, little is known about how children and families responded to the mine fire, particularly from the viewpoint of children. Interviews previously conducted with adults indicated concerns about the physical and mental health implications of the event and perceived failures of the emergency response, but also increased community engagement and social connectedness following the event (Wood et al., 2015). Similar to this earlier research, the current study employed a qualitative design, using semi-structured interviews, to capture the perceptions of children regarding the smoke event, how the smoke affected them and their family at the time, and what they considered to be the ongoing consequences of the smoke.

The importance of allowing children to express their opinion in matters concerning them has been detailed in Article 12 of the United Nations Convention on the Rights of the Child (United Nations, 1989), and has also been discussed extensively in contemporary sociological theories of childhood experiences and competencies (see Morrow, 2008). Prout and James (1997) outlined the ‘new’ sociology of childhood framework, arguing for children to be viewed as competent social actors, able to describe their experiences and participate in policy decisions impacting them. In this way, the framework differs from traditional developmental psychology perspectives that view childhood primarily as a period of transition to adulthood, and instead regards children as active participants capable of informing and shaping the structures and experiences around them (Morrow, 2008). Research

has also demonstrated that increasing children's access to information and resources, and involvement in disaster risk reduction (DRR) can reduce their vulnerability and increase their resilience in disasters (Peek, 2008). However, disaster research and interventions have been identified as rarely considering the experiences, concerns, preparedness, response and recovery of children (Anderson, 2005; Babugura, 2008; MacDonald, Harper, Willox, & Edge, 2012; Mudavanhu et al., 2015; Penrose & Takaki, 2006).

In South Asia, Non-Government Organisation leaders indicated that the majority of relief activities following the 2001 and 2005 earthquakes in India, the 2005 earthquake in Pakistan, the Tsunami of 2004 impacting India and Sri Lanka, and the 2004 floods in Nepal were not implemented from a child-centred point of view (Nikku, 2013). Forbes, Jones and Reupert (2012) found young people aged 18 to 27 years reported inadequate support and exclusion from community recovery efforts after the Black Saturday bushfires in Victoria. While these previous disaster responses failed to adequately consider the needs and experiences of children and young people, other Australian research has shown that children can learn from exposure to disaster events, with those having greater exposure to bushfires being more knowledgeable about bushfire hazards and management than those with limited involvement (Towers, 2012). Similarly, Ronan and Johnston (2005) documented that children in New Zealand who participated in school-based hazard reduction education programs tended to have greater knowledge, were more prepared and experienced less fear than their peers. Factors also considered to be critical for recovery of children following the Haiti earthquakes included involvement in recovery efforts and greater acknowledgement of the impact of the event on children (Lacroix, 2010).

The purpose of this study is to extend the literature within an Australian context and explore children's experiences, vulnerabilities and responses following the 2014 Hazelwood smoke event. Exploring the perceived consequences and coping strategies of children

following the Hazelwood smoke event is likely to provide a new and critical perspective for improved and developmentally sensitive disaster management strategies and trauma-informed practices in schools and communities. This support is likely to limit the progression of mental health difficulties and potential academic decline of children and adolescents exposed to critical events, and improve outcomes and functioning in whole communities. The research questions for this study included:

- What was the impact for children at the time of the smoke event and what are the ongoing effects?
- What do young people suggest may have been helpful in response to this event and for future events?

Method

Setting

This research involved schools in the Morwell and Traralgon, two townships in close proximity to the mine fire event. Six primary schools, catering for children in grades 3 and 5, and two secondary schools for adolescents in grades 7 and 9 were included. Schools included a mixture of government (i.e. public; $n = 5$) and non-government (i.e. Catholic or private; $n = 3$) schools. Being closest to the mine and having been shown to have had the highest level of exposure to the particulate matter from the smoke, Morwell was the primary target of the research to maximise understanding of the impacts of the event (Emmerson, Reisen, Luhar, Williamson, & Cope, 2016), with 7 of the 8 schools being located in Morwell. However, because the only secondary school in Morwell was a government school, it was necessary to include the closest non-government secondary school from Traralgon (located approximately 14 kilometres from Morwell and shown to have had considerable exposure to the smoke event).

Participants

Participants were 69 children and adolescents in grades 3, 5, 7 and 9 (36 female, *Mean age* = 11.3 years, *SD* = 2.3). A stratified random sampling approach was used to select participants from those with parental consent. This approach was used to ensure representation of children based on type of school attended (i.e. government vs. non-government) and gender. From the eight schools sampled, 30% of parents consented for their child to participate, of which almost half (49%) of the children were selected for interview, with 94% of students agreeing, resulting in the 69 completed interviews. Most participants were born in Australia (96%). Thirty-four (49%) students attended a government school and 35 (50%) attended a non-government school. There was a slightly higher representation of female than male students (54 % compared to 46%).

The majority of participants were selected from grade 3 ($n = 23$), followed by grade 5 ($n = 19$), grade 7 ($n = 15$) and grade 9 ($n = 12$). The distribution of year level was selected based on expected attrition rates for follow-up interviews to be conducted every two years until participants reach grade 9. As such, larger numbers of students were sampled in earlier grades to allow for attrition between each data collection round from 2015 to 2017, 2019 and 2021. The following data is based on the first data collection phase which occurred in November and December 2015 (approximately 20 months following the end of the smoke event in 2014).

Materials

A semi-structured interview schedule was developed by the researchers. The interview was designed to prompt details recalled by children about the fire and smoke and the perceived impact on children and significant others, children's views about the

management of the mine fire and how they coped at the time, as well as any potential changes at home and school during or since the event. Example questions included: ‘What was it like being at home during this time?’ and ‘What was it like being at school during this time?’ The second component of the interview schedule included questions linked to PTSD symptomology, including the experience of intrusive thoughts about the fire, avoidance of reminders linked to the event and heightened arousal and trouble sleeping following the event.

Procedure

Appropriate approvals from the Monash University Human Research Ethics Committee, Victorian Department of Education and Training, and Catholic Education Office of Sale were obtained, followed by consent from school principals. Information and consent forms were then distributed to parents in students’ school bags, via a secure online link, or mailed home by the school. Students with parent consent provided their own consent prior to the interview. Interviews were audio-recorded and transcribed. Identifying details were removed and transcripts coded with unique identifiers to ensure confidentiality. The interviews lasted approximately 30 to 40 minutes. Participants were interviewed close to two years after the event which allowed the researchers to explore the lasting impacts on children.

The methodology was developed with consideration given to the cognitive and emotional needs of children, and in line with previous literature on ethical and practical challenges of conducting post-disaster research with children (see Gibbs, MacDougall, & Harden, 2013; Morrow, 2008). This included use of a semi-structured interview to allow the children to lead and direct conversation, informed consent procedures that were conducted one-on-one with children, and use of trained interviewers and researchers experienced in child development and mental health. All children were advised in writing and orally of the

purpose of the research, their right to withdraw from the interview, of the limits of confidentiality if they or someone else was believed to be in danger, and their right to refuse for the interview to be audio-recorded. Adult influence was also minimised, and the safety of children and their confidentiality protected, by conducting the interviews at the child's school, away from teachers and parents, and during school hours.

Analysis

Qualitative responses were analysed using thematic analysis as outlined by Braun and Clarke (2006). This approach was deemed appropriate because of the exploratory nature of the study and to sit in line with earlier research into the impacts of the Hazelwood event on adults (see Woods et al., 2015). Initial codes were developed and collated into subthemes. Subthemes were then sorted into overarching themes. The authors and student researchers independently analysed the interview transcripts and collaborated on the final set of themes and subthemes.

Results

The following overarching themes were identified from the data (with subthemes listed within each theme):

1. Experience and feelings about the smoke event
2. Perceived health effects of the smoke
3. Impact on school attendance and learning
4. Impact on family relationships and friendships
5. Coping and support during and after the event

The description of each theme is illustrated with example quotes which include gender and age of the respondents.**1. Experience and feelings about the smoke event**

Experience of the smoke

Participants' impressions of the event were the unpleasant smell of the smoke, how the ash felt in their throat, the appearance of the sky during the day, such as the orange glow of the fire and daytime resembling night time because of the smoke, and the tendency for people to wear masks to prevent smoke inhalation. Some related the experience to the Black Saturday bushfires which occurred five years previously. Participants commented on how the smoke and ash covered and got into their home, school and family business. Participants also reflected on the prolonged and uncertain nature of the event, and recalled questioning how long the event would continue and what the health implications would be for them and their family. Whether or not it was safe to spend time outside was frequently mentioned by participants, as well as concerns about a lack of information about the event and available support and respite for the community.

...there was so much ash and that there and you wore masks but that didn't really help
(Female, 14).

It was like Black Saturday...it happened when I was younger and it reminded me of it (Male, 14).

Definitely more information about what's actually happening and probably more respite for people [was needed] (Male, 15).

It's like no one really wanted to help or anything (Male, 15).

Feelings about the event

While most participants described the event as unpleasant, there was diversity in how they felt about the event, with some saying that they hadn't had any concerns at the time or since then – usually expressed simply as “No” to the interview question. Other participants

commented in more detail about how the event made them feel, including feeling scared, worried and sad. Participants related these feelings to the potential danger of the fire and smoke, and concerns for their safety, the safety of family members, and the fire spreading to their home or school. A few worried that they would lose their home and possessions, similar to what was reported to occur on Black Saturday. A few participants who were related to family members in the firefighting authority reported feeling worried or uncertain about the safety of those family members, as well as worried about the safety of those working at the mine at the time. Anger and frustration about not being allowed outside and their family receiving little assistance during the event was also noted by participants, while others reported feeling that everything remained normal and that the event did not cause them or others to worry.

Well pretty worried because I was maybe, I was thinking that the house was going to burn down and we had, we didn't have enough time to get our stuff (Male, 11).

I worry about the people who were in the mines when it was happening (Female, 9).

I got worried because my mum worked near the fire at a nursing home (Male, 14).

Yeah I spent a lot of that time just really worried about [the fire] because a lot of my family were affected by Black Saturday and I was worried that it was going to happen again...I was worried that if the wind changed we could lose everything (Female, 15).

2. Perceived health effects of the smoke

Participants reported on the perceived short-term health effects of the smoke for them, their family and friends, particularly increased asthma, trouble breathing and coughing, which may have required medical attention. Pet health was also a topic mentioned in the interviews. Dogs especially were reported to be affected by the smoke, with one participant believing that her dog had died as a result of exposure to the smoke. Discussion of the possible long-

term impacts were also mentioned by the children; however, less frequently than statements about the short-term consequences. Again, there was a diversity of responses with some children unconcerned about the health impacts of the smoke event,

...there was a lot of smoke and lots of people had to go to hospital or see the doctor and it was bad for us to breathe in and people couldn't stand all the smoke (Male, 9).

Yeah my mum and my brother has [sic] asthma. They haven't had asthma for a few years but the smoke caused them to cough and find it hard for them to breathe. My sister doesn't have asthma but she was coughing a bit too... (Female, 13).

...our dogs were actually vomiting and getting like really sick from all the smoke (Female, 11).

Probably a little bit [worried] now because the research come out saying that the... particles... could get lodged in your lungs and you wouldn't know until later (Male, 15).

3. Impact on school attendance and learning

Absence from school

Participants discussed how they had been prevented from attending school because of concerns held by their parents regarding the potential health impacts of the smoke. Some children also reported not attending school because their family relocated homes during the event to avoid the smoke. This is despite indications that school attendance was helpful for some children.

...that's why we had the day off that day...because all the smoke going into [the students] lungs and that...they'll have bad coughs and they'll probably feel sick (Male, 11).

Mum took me out of school because she didn't want me getting like sick...most kids don't [sic] come to school because their parents say the smoke and all that affects them on the outside (Male, 9).

I just remember that everyone was panicking and lots of people were away because their houses were affected and they couldn't make it to school or something (Female, 15).

...at school, I was safe, I didn't have to worry about the fire and...the smoke that much (Male, 9).

School relocation

Two mainstream primary schools (one government and the other non-government), as well as one non-government specialist secondary school in the area, were relocated further from the mine to other schools and locations in surrounding Latrobe City townships. Participants referred to both positive and negative outcomes from the relocation. While participants reported that being relocated reduced their concerns about the effects of the fire, some reported difficulties in developing relationships with children at the relocation school and conflict among peers, while others enjoyed spending time with these children and being in a new place with different activities.

The smoke affected the school so we had to move to another school for a few days... we couldn't go outside here [at our school] because it was just too smelly (Male, 11).

When we first got off the bus everyone was like "Oh we have fresh air, this is good that we're moving schools". And all our, all the friends that we made at the new school, they supported us through this, through the few weeks, and it took our minds off the fire and how bad it was (Female, 13).

...we didn't actually do any like boring work like maths and stuff [at the relocation school], we actually got to do colouring in and free time and stuff, so it was good (Male, 10).

Changes to the school routine

Children from relocated schools cited difficulties in relation to adjusting to the new school setting due to changes in scheduled break times, managing bus timetables and transporting school materials to the relocation school. Travel to and from the original school site to the relocation site took place during school time so was suggested to have limited the allocated time and quality of learning. However, children who did not relocate to a new school also reported changes to their school routine, such as more excursions away from school, increased free time and alternative programs instead of normal classes, and reduced time outside while at school due to poor air quality at the time of the fire.

[I was worried that] some of my learning was going away (Male, 11).

It was like hard to go every day and be on time and all that... We lost an hour of school so we could go to the other school (Female, 11).

We went to a whole lot of different excursions and we went out of the school a lot. We went to the oval near our school, we walked there and helicopters were landing and they were doing a show with the helicopters and we got to sit in the helicopters and all that. It was fun (Female, 13).

Coming to school the next day, [in] most of the classes we had free time instead of normal classes because nobody wanted to learn (Female, 15).

4. Impact on family relationships and friendships

Impact on family relationships

Some children and adolescents were aware that their parents struggled to cope during the event and had been worried for the welfare of their children and about the potential dangers of the fire and smoke inhalation. Participants noticed that their parents were also worried at the time because they did not know if the event was going to escalate and how best to respond. It was also indicated by participants that they would attempt to hide their concerns from their parents and other family members at the time to avoid worrying them further. Loss of sleep and frustration about the event was also reported to increase family arguments and conflict towards each other. Positive changes reported to come out of children's experiences of the mine fire included improved relationships with parents and siblings, such as through spending more time as a family and engaging in more family-based activities.

I know my mum was scared because in the car she was nearly screaming and she was about to start crying...wherever I see her upset or start crying I start crying like I can't help it because I'm very emotional (Female, 9).

She [my mum] was so nervous, she did not know what to do. She hadn't been in a situation like that before so she was panicking a bit (Female, 15).

I'll try not to get worried myself so that then that [sic] wouldn't worry them [my parents] that I was worried that they were worried (Female, 10).

...towards the fire everybody [in my family] just got frustrated and stuff... so everyone would be yelling and tired...everybody would be yelling at everybody and it was horrible (Female, 15).

Evacuation of family

Some participants lived in areas requiring them to evacuate from their home, while others cited that they moved permanently from their home as a result of the event. Some helped to defend their home from the fire event which preceded the mine fire, while others recalled packing their belongings or the belongings of family members before evacuating the area. Participants described that the event caused family members to permanently move away from them or relocate to another home until the smoke subsided. This was reported to cause them and their family members to worry. Some commented that they felt pressure to assist family members to evacuate or remain calm at the time of the event.

Mum and dad, sometimes they'd just sit in the lounge room with a radio waiting for the announcement to see...if we had to go evacuate (Male, 11).

... I was a bit worried, like what was going to happen to their [my family's] houses and happen to them and how they were going to live... it was a very difficult situation for the family (Female, 15).

Well she [my aunt] was frantic, she couldn't do anything, she couldn't breathe...that's why we had to take her away. But most of us sort of tried to stay calm for her sake so she knew that we were going to be there to support her... (Female, 15).

Impact on friendships and activities

Relocation to a different school and having to stay indoors were perceived by participants as having limited their interactions with friends and engagement in activities. Others mentioned the physical impact of the smoke in relation to engaging in activities with peers. A few older participants commented that their friends and friendships changed as a result of the event due to friends moving away or isolating themselves from others because of

their difficulty coping with the event, while others reportedly found the event and evacuation enjoyable.

I felt sad because I really wanted to play my favourite sport (Male, 11).

Some of my friends would just like... shut down completely. One of my friends stopped going to school... (Female, 15).

They [my friends] were sort of excited at the new experiences going out everywhere and some people were actually kind of excited that they evacuated because it's a new and different exciting experience (Female, 13).

5. Coping and support during and after the event

Use of coping strategies

Participants were asked how they personally coped with the smoke from the mine fire. Many found that distracting themselves from the event, avoiding looking at the fire and smoke, spending time with and checking on friends, and engaging in calming activities were helpful. Calming activities included listening to music and engaging in breathing exercises, while distraction techniques included playing games, visualisation exercises and focusing on their school work. Some participants also described using helpful self-talk and positive thinking to manage during the event. Some indicated that they felt prepared for this type of event and knew about the circumstances leading to bushfires, while others reported that they are now more prepared for future events by having a fire plan and knowing how to check emergency alert applications.

...having fun and taking my mind off it instead of being worried about it (Male, 11).

I've got this really calm music that I listen to (Male, 9).

Well because they [my friends] were freaking out, I was telling them it's this far away so they wouldn't get scared (Female, 13).

I ate a lot and I was trying to keep in touch with my friends to make sure they were all okay which meant [that] I spent a lot of time online and just trying to avoid the situation (Female, 15)

...it's getting hotter each year and that's sort of why and there might be an accident fire, a major fire again because the heat is rising. Like each year the heat is getting hotter (Male, 9).

Reliance on parents and teachers

A common theme among participants was the support they received from their parents and teachers during the event, and the importance of their parents and teachers reactions in shaping their own feelings about the event. Some participants noticed that their parents and teachers attempted to remain calm, give them information about the event and maintain routines at school and home, while others reported that their parents and teachers were noticeably upset and anxious about the event, as indicated previously.

...what helped me was my mum and dad, they were like giving me advice what to do (Male, 10).

As long as my parents were, felt safe then yeah I felt safe (Female, 13).

...they like always like told us stuff like what happened on the news...it's just good that they keep us informed, rather than just keeping stuff from us (Female, 12).

Well a couple of the teachers were pretty normal...and then you had other ones that are really upset about it, like they're scared for our health and stuff, and that's why we went and had the day at Churchill (Female, 15).

Difficulty coping with the event

The smoke and ash caused other noticeable impacts on participants. Some described losing their appetite, reduced concentration and energy, increased thoughts and nightmares about the smoke and fire, and trouble sleeping at the time. Older children mentioned that the event caused them to feel low in energy and lacking motivation to complete school work and other activities, furthering their feelings of stress and anxiety. However, most participants indicated at the time of the interview that these effects had not continued, and that they had begun to feel less anxious as more safety precautions were reportedly implemented at the coal mine, and in some instances their own home. Previous experience with bushfires was also suggested to help children to be more resilient when faced with the mine fire. Others reported becoming more alert to other potential fire events and expressed increased arousal to cues that a similar event may occur.

Just after the fire I had some dreams about the fire and I thought there was going to be one near our house (Male, 8).

...since the fires I have trouble trying to concentrate (Female, 9).

If I see a little bit of smoke I always wonder is that a fire or it is just fog or something (Female, 11).

I just tried to put it in the back of my mind and continue on with my daily life, like it's something that's happening, we can't stop it, like we can't go back in time and not let it happen so I just sort of pushed it to the back of my mind and kept going (Female, 15).

Reporting and public perception of the event

Some students commented on the coverage of the event on the news and radio as either causing them to worry or making them feel comfortable that they knew how the event

was progressing. A few participants reported enjoying the interest surrounding the event or that the community had come together since the event. Others recalled at the time of the interview that they or their parents continued to check the Environmental Protection Authority Victoria website or emergency alert applications for updates about other events and air quality readings; however, that at times this information was difficult to access or that there was not enough information available to the community.

I remember [that] everyone in my house was happy because we made it in the news finally. Because Morwell never gets on the news so when we saw that we got onto Melbourne news, we were all just like finally got noticed (Female, 15).

Mum has a fire app so I'm a bit glad for that. So we don't have to wait for the news to come (Male, 9).

Like if I hear it's a bad day for fire I will keep an eye on the CFA [Country Fire Authority] websites and things like that to make sure there isn't a fire or something like that going on... (Female, 15).

Like they're [the community] more aware and like ready if there's another fire (Female, 13).

Recommendations for future responding

Participants indicated that they should have been better informed about the event and bushfires in general, and that this would have assisted them to cope better with the impacts and support others at the time. Others recommended that families should have been relocated from the area and schools closed to prevent smoke inhalation, as well as children being distracted or encouraged not to worry about the negative effects. Some participants also indicated that they did not agree with the lack of support and information for their family, and the decision of teachers to allow children outside during the event.

Kids in that sort of situation need to be informed a bit more about what's happening, so they can kind of understand a bit more... We were getting told about it, but I think a lot of kids still had a lot of questions (Male, 11).

I was only stressed because I was by myself with my Nan. If anything happened I didn't know how to deal with it as well as I probably should have but other than that I was pretty good (Female, 15).

If fire plans and things like that got discussed more at school and if like they have started doing it a bit more – like we have fire drills occasionally like more than we used to and yeah if the kids were a bit more prepared for it because not many people were (Female, 15).

Discussion

This study aimed to examine the impacts and support needs of children following a smoke event. The interviews with children revealed the perceived physical and psychological impacts of the smoke on children and families, consistent with research on the impacts on the general community and on older people (Wood et al., 2015; Walker, Carroll, & Chisholm, 2017). Regularly children spoke about how they and others had trouble breathing and experienced asthma from the smoke. The physical impacts of the smoke were indicated to reduce children's school attendance and resulted in eventual relocation for some to another school or evacuation from their home. While it appears that relocation to another school may have reduced psychological distress among children, relocation was suggested to impact learning and academic progress through reduced attendance and changes to the curriculum. Participants reported difficulty learning at the time due to increased travel time to school, changes to the school schedule, and reduced allocation and expected completion of classwork. Research has clearly demonstrated that increased school absenteeism and psychological distress, potentially due to changes in regular school routines, are associated

with lower average literacy and numeracy scores of children (Gottfried, 2009; Perfect, Turley, Carlson, Yohanna, & Saint Gilles, 2016).

Children reported on the psychological impacts of the event, including increased anxiety and worry during the event, trouble concentrating and sleeping at the time, and intrusive thoughts and dreams about the event re-occurring. These experiences are consistent with reports of heightened posttraumatic stress symptoms following exposure to traumatic events (McFarlane & Van Hooff, 2009). However, few children reported continuation of these symptoms by the time of the interview almost two years later, with some children indicating that the event served to strengthen their resilience for future events because they developed an understanding of what to expect and how to respond. This is clearly in line with earlier research conducted in various countries, including Australia (Lacroix, 2010; Ronan & Johnston, 2005; Towers, 2012). However, it is also important to note that some young people indicated a level of concern about the long-term implications of the smoke almost two years after the event.

The response of parents and teachers has also been shown to have a significant bearing on the wellbeing of children following critical events (Boksztzanin, 2008; Dyregrov, Bie Wilkander, & Vigerust, 1999; McFarlane, 1987). Children commented that it was difficult for their family to care for each other during the event due to family members relocating and increased family conflict and anxiety related to the event. These factors were suggested to result in greater distress and concern among participants. Despite this, some reported improved family relationships and greater engagement with family as a result of the smoke. Children indicated that this was a positive consequence of the mine fire, as well as being a useful distraction technique to cope with the effects of the smoke.

Participants spoke about other coping strategies to manage their circumstances and feelings about the event; however, it was unclear from the interviews what prompted children's use of these strategies and the success of these approaches for children. Reports from some participants indicated that they had great difficulty engaging with peers and participating in activities during the 45 day event which may have contributed to a loss of resilience at the time. In a review of the literature, Luthar, Cicchetti and Becker (2000) indicated that resilience is determined through individual developmental competencies, supportive family relationships, effective schools and wider community connectedness. This is demonstrated in the results of this study which identified previous exposure to emergency events, parental wellbeing and sustained school routines as potential determinants of children's ability to cope post-disaster.

Consistent with Peek (2008), results also indicate that children's vulnerability is reduced and resilience to events enhanced when they have access to parent and adult support, receive and provide support to peers, and are informed and have access to advice about disaster management activities. This was evident from responses of participants in relation to feeling confused and worried when making decisions that could impact the wellbeing of family members, and feeling concerned and responsible for the safety of friends, siblings and their home. While children appeared to readily accept and in some cases instigated these obligations to family and friends, it was indicated that in future children should be better informed of their role and the circumstances surrounding disaster events. This relates directly to previous suggestions for children to be more included in Disaster Risk Reduction (DRR) to increase their preparedness, response and timely recovery (Anderson, 2005; Babugura, 2008; MacDonald et al., 2012; Mudavanhu et al., 2015; Penrose & Takaki, 2006). Results are also consistent with earlier literature that children can and do assist in disaster response and risk minimisation activities (Mitchell, Haynes, Hall, Choong, & Oven, 2008; Nikku, 2013), and

that exclusion of children from DRR can restrict the development of resilient children and communities (Forbes et al., 2012; Nikku, 2013).

Implications

The implications of this study focus on the several factors proposed to have impacted the wellbeing and learning of children, as well as areas to increase children's resilience and participation in DRR activities. Factors that promote resilience and reduce vulnerability in children following adversity include the support and wellbeing of parents and teachers, engagement and relationships with peers and family, sustained school routines and learning, and information and inclusion in DRR. Reports from children indicated that they contributed to DRR through ensuring the safety and wellbeing of family members, managing fire hazards and preventing property damage, and prompting coping behaviours among peers. However, instances of children being required to take on these carer and emergency response activities with limited instruction and support from adults contributed to feelings of uncertainty and fear in children.

The Voice model (Lundy, 2007; Mudavanhu et al., 2015) has been used to describe how children's views and DRR contributions can be facilitated through space and voice, and audience and influence. Within this model, inclusion of children in DRR can be remedied by: inviting them to community meetings and giving them space in the agenda to share their experiences; urging parents, teachers and community leaders to facilitate groups and activities with children to gauge their needs and level of understanding; and implementation of peer leadership programs and curriculum in schools to enhance children's knowledge and capacity to support others. There was little evidence from the interviews that any of the above contributions of children were sought following the Hazelwood event.

Greater inclusion of children in DRR following critical events is also likely to inform trauma-informed approaches in schools through increased awareness of the impacts of events on students and increased knowledge of the roles and responsibilities of staff and students. Trauma-informed approaches in schools involve training and curriculum development to assist students and staff to identify and appropriately manage emotions, improve relationships and attachments with others, engage and support parents and families, identify individual goals and strategies to maximise learning, and approaches to minimise disruption and transition difficulties. Such approaches are likely to address many of the impacts identified in this study on children and adolescents, such as disruptions to school and learning, difficulties of families and teachers to cope following the event, and improved emotion regulation and relationships with others. Studies have also shown successful implementation of trauma-informed approaches in schools for vulnerable youth (Stokes & Turnbull, 2016); however, additional research regarding trauma-sensitive approaches and disaster management are warranted.

Limitations

Although a close to representative sample of male and female participants, from government and non-government schools, were involved in the study, less than one third of parents consented for their child to participate. Feedback from participating schools indicated that most parents did not consent because they did not feel their child was impacted by the event, while a much smaller group indicated that their children were impacted by the event and therefore may have become distressed by the questions. This confirmed comments received from parents by the researchers. A further limitation was the use of semi-structured interviews alone, rather than use of other techniques appropriate for children, such as drawings and pictures, focus groups and story writing. Use of a mixture of verbal and non-verbal data-collection methods, additional time for interviews and more flexibility in the

interview timetable could have minimised potential response biases, such as social desirability and researcher priming. Interviews with parents and key stakeholders could have also provided insights into the experiences of children and the community, and whether children are perceived to have a role in DRR and how this role can be facilitated by adults. A final limitation was that the interviews were completed approximately 18 months after the Hazelwood fire was extinguished. While this allowed the researchers to explore whether there were continuing difficulties of children and families sometime after the event, it is likely that some details about the event were forgotten or subject to recall biases.

Conclusion

The main aims of this study were to allow children to describe their perceptions and experiences of the Hazelwood mine fire and smoke, to detail the consequences of the event for children and families, and to describe what children may have done to minimise this impact and risk. This research provides further evidence for consideration of children in DRR activities and planning, coupled with increased implementation of trauma-informed practices in schools to increase the wellbeing and learning outcomes of children following trauma. Research and school- and community-wide interventions should focus on the factors indicated to have facilitated children's coping and learning following the Hazelwood event, and to minimise factors, such as a perceived lack of information, indicated to have contributed to feelings of uncertainty and fear among children.

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