The psychological impact and experiences of children following the Hazelwood mine fire and subsequent smoke event

Darryl Maybery^{a*}, Matthew Carroll^b, Emily Berger^c, Joanna F Dipnall^{d,e}, and Sarah Lee^a

^aMonash Rural Health, Monash University, Warragul, Australia

^bMonash Rural Health Churchill, Monash University, Churchill, Australia

^cFaculty of Education, Monash University, Clayton, Australia

^dSchool of Public Health and Preventive Medicine, Monash University, Melbourne Australia

^eIMPACT SRC, School of Medicine, Deakin University, Geelong, Australia;

*** Corresponding author**

Professor Darryl Maybery, Director of Research, Monash Rural Health, Monash University.

Monash Rural Health Warragul, West Gippsland Health Care Group, Cottage 13, Sargeant Street, Warragul, VIC 3820, Australia

darryl.maybery@monash.edu

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Abstract

Background: Children exposed to disasters often experience high levels of distress and are at risk of developing posttraumatic stress disorder (PTSD). **Objectives and Design:** This study used a mixed method design to establish the psychological impact of the 2014 Hazelwood mine fire and resultant smoke exposure on young people. 323 young people from Morwell and surrounding areas completed the Children's Revised Impact of Events Scale (CRIES). A stratified random sample of 69 Morwell participants then participated in an interview.

Results: Analysis of CRIES results indicated moderate levels of distress on average, with heightened levels of distress in approximately one quarter of participants. The interviews revealed that children who were negatively affected by the event reported concerns about the health impacts and ongoing intrusive thoughts about the fire. **Conclusions:** This highlights the need for emergency and public health responses to future events, including those with unclear health outcomes, to recognise and respond to potential distress in the community, particularly in younger age groups.

Background

In February 2014, the large open cut brown coal mine adjacent to the Hazelwood Power Station in the Latrobe Valley, Victoria, caught fire from bushfire embers spotting into the mine. The fire burnt for six weeks and resulted in the nearby town of Morwell and other areas of the Latrobe Valley being covered in plumes of smoke and ash for the duration of the fire. The smoke and ash caused considerable concern for residents about the immediate and long-term health impacts, with residents reporting a range of health and wellbeing outcomes and concerns about increased deaths during the mine fire period (Teague, Catford, & Petering, 2014; Wood et al., 2015). In response to these community concerns, the Hazelwood Health Study was established to investigate the impacts of mine fire and smoke on the community. As part of the Hazelwood Health Study, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) modelled the smoke plume and particulate matter deposition during the six week mine fire period and found that levels in the southern part of Morwell, closest to the mine, exceeded national air quality standard for 23 days of the 45 day fire period, with reduced exposure in nearby communities (Emmerson, Reisen, Luhar, Williamson, & COPE, 2016).

Australia regularly experiences major disasters such as the Ash Wednesday and Black Saturday bushfires (Bryant et al., 2014). In the aftermath of the 1983 Ash Wednesday bushfires, which killed 75 people across Victoria and South Australia, 42% of affected people had heightened distress one year after the fires, compared to 23% in the general population (McFarlane, 1988; McFarlane, Clayer, & Bookless, 1997). In a 20-year follow-up of children exposed to the Ash Wednesday bushfires, McFarlane and Van Hooff (2009) found evidence of long-term psychological distress mediated by exposure to other traumatic events. Research on the 2009 Black Saturday bushfires, which resulted in over 170 deaths, reported 15.6% of exposed people exhibited PTSD symptoms three years after the event (Bryant et al., 2014).

Research estimates between 40 to 60% of adults have been exposed to trauma of some type (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Yehuda & Wong, 2001) and around 8% develop PTSD following trauma (American Psychiatric Association, 2013), suggesting that trauma alone is insufficient to cause PTSD. Research with children has shown a similar relationship (Hizli, Taskintuna, Isikli, Kilic, & Zileli, 2009). PTSD symptoms in children following trauma has been associated with level of exposure to the traumatic event. Wang et al. (2012) found children who directly suffered losses as a result of the 2008 Wenchuan earthquake in China were more likely to have heightened PTSD symptoms than children who were less impacted. Similarly, Mels, Derluyn, Broekaert, and Rosseel (2010) found children displaced by war reported more PTSD symptoms than non-displaced children. Children who lost family as a result of an embassy bombing also reported more PTSD symptoms than those who lost friends or acquaintances (Pfefferbaum et al., 2006). The Children's Revised Impact of Event Scale (CRIES: Children and War Foundation, 2005) has commonly been used to assess the severity of PTSD symptoms associated with trauma in childhood.

Using the CRIES measure and exploring the impacts for children following prolonged traumatic exposure, similar to the Hazelwood smoke event, Kieffer-Kristensen, Teasdale, and Bilenberg (2011) found 46% of children of parents with acquired brain injuries had elevated CRIES scores indicative of PTSD risk. A study of young adults who witnessed bullying in childhood found mean scores on the adult Impact of Event Scale (IESR: Weiss & Marmar, 1997) were indicative of moderate distress (Janson, Carney, Hazler, & Oh, 2009). To the authors' knowledge, no studies to date have used a mixed methods approach to explore these impacts on children.

The mixed methods approach employs survey data collection (i.e. of the CRIES) to quantify the psychological impact of the event on children. Interviews then focused upon event impact symptomology with a subsample of participants to better understand the qualities of their experience. Employing a mixed approach builds upon past research by outlining the subjective experiences, perceptions and reactions of the young people's experience of the events in conjunction with quantifying the impact of the event. A qualitative understanding was also considered important as the study was initiated as a result of community concern about their interests not being attended to. The three aims of the study were to:

- (1) Quantify distress levels experienced by children and adolescents following the Hazelwood mine fire;
- (2) Determine differences in level of distress between young people more exposed compared to young people less exposed to the smoke; and
- (3) Understand the subjective experience of the impact of the event on a subsample of young people including an examination of interview responses of high scoring participants based on the CRIES.

Methods

The study was undertaken approximately 16 to 21 months after the event and initially involved quantitative data collection followed by interviews. The interviews were approximately three months after the quantitative data collection with a subsample of young people. Permission for the study was obtained from the Victorian Department of Education and Training, the Catholic Education Office of Sale and school principals. Ethics approval was obtained from the Monash University Human Research Ethics Committee (approval number 5834) and the study was funded by the Victorian Department of Health and Human Services.

Participating Schools and Students

Twenty schools from across the Latrobe Valley, covering government (primarily publicly funded) and non-government (publicly and privately funded) primary and secondary schools, were included in the study. For classification of smoke exposure, students attending school in Morwell with greater exposure to the smoke were distinguished from those attending school outside Morwell (non-Morwell). All seven schools in Morwell participated (six primary and one secondary) and 13 non-Morwell schools were selected for representation of primary and secondary, government and non-government schools. All non-Morwell schools were located within 15 kilometres of Morwell. Students in primary grades 3 and 5 (children aged approximately 8 to 11 years) and secondary grades 7 and 9 (children aged around 12 to 15 years) were invited to participate. A total of 2,138 students were eligible to participate.

Interviews were conducted with a stratified (i.e. school type, grade and gender) random sample of Morwell school children. Morwell participants were chosen to examine the experience of and understand the impact for those most highly exposed. Participants were selected from grade 3 ($n = 23$), grade 5 ($n = 19$), grade 7 ($n = 15$) and grade 9 ($n = 12$). Higher numbers were sampled in younger children with an expectation of follow-up interviews in future years.

Quantitative Materials

PTSD

The CRIES, adapted from the Impact of Events Scale (IES: Horowitz, Wilner, & Alvarez, 1979), assessed PTSD symptoms related to the Hazelwood smoke event among children. The CRIES is a widely used and highly validated measure of PTSD in children with Cronbach alphas ranging from 0.60 to 0.82 for each subscale and 0.89 for the total scale; and

test-retest reliability of 0.85 (Dow, Kenardy, Le Brocque, & Long, 2012; Smith, Perrin, Dyregrov, & Yule, 2003; Verlinden et al., 2014). The CRIES consists of 13 items measuring the frequency of subjective stress symptoms rated on a four-point scale (0 = not at all; 1 = rarely; 3 = sometimes; and 5 = often) after a traumatic event. There are three subscales: intrusive thoughts (4 items; e.g. thinking about the event when you don't mean to); avoidance of cues (4 items; e.g. staying away from reminders of the event); and increased arousal (5 items; e.g. difficulty sleeping as a result of the event). A total score (ranging from 0 to 65) is derived by adding the 13 items, with higher scores indicating higher subjective stress associated with the event. Similarly, subscale scores range from 0-20 for Intrusion and Avoidance and 0-25 for Arousal. While a total score of 30 or above has been considered as an effective cut-off score for identifying clinically significant cases of PTSD (Perrin, Meiser-Stedman, & Smith, 2005), a cut-off score as low as 22.5 has also been found to accurately identify cases of PTSD among children following a traumatic event (Dow et al., 2012).

Quantitative Data Management and Statistical Analysis

School enrolment data for grades 3, 5, 7 and 9 in the Latrobe Valley in 2015 were obtained from the Victorian Government Department of Education and Training. This information was used to calculate the post-stratified survey weights based on grade, gender and school type. 293 participants had complete data across the 13-item CRIES scale (90.7%). Two cases had missing data on all 13 CRIES items (0.6%). Little's Missing Completely At Random test was significant ($\chi^2(185) = 246.14$, $n=321$, $p=0.002$ (Little, 1988, 1995). Multiple imputation by chained equations on all CRIES scales was used to create 20 imputation sets (Royston & White, 2011). For each item in the scale, the imputation equation was reduced from including all other items to only include those items within the subscale and the sum scores for other subscales. Due to the presence of covariate-dependent missingness, age and gender were included in the imputation process. Weighted, imputed means and standard

errors were used to compare Morwell and non-Morwell students, and primary with secondary students. One limitation was that there was only one secondary school in Morwell, thereby affecting the standard errors for that group. Multiple linear regression was performed, with adjustment for the possible confounding effects of age, gender and school type.

The quantitative mean and regression results accounted for weighting and clustering effects of participants across grades within schools and stratification across school type. Statistical analysis and data transformations were performed using Stata version 15 (Stata Corporation, College Station, Texas, 2017). The Stata user-written ICE command was used for the MI (Royston & White, 2011; White, Royston, & Wood, 2011).

Qualitative Approach

The interviews were undertaken after the survey within the school setting. In order to better understand the qualities of the experience of children with post-trauma symptoms the interviews followed a semi-structured protocol designed to prompt recall of the event and the immediate and ongoing impacts, as well as the psychological effects based on CRIES subscales. Interviews were undertaken approximately 3 months following the CRIES measure and researchers were blind to the children's scores. Interview questions focused upon intrusion (Do you still worry or think about the event at all? If yes, what about?), avoidance (When you do think or worry about it, do you try not to think about it? If yes, how?), and arousal (Do you experience trouble sleeping, eating, temper, paying attention? If yes to any, can you tell me more about that?). Interviews also asked questions about the general long and short term effects of the fire of which responses are not included here.

Interviews were analysed using thematic analysis as outlined by Braun and Clarke (2006). Initial patterns in the data were identified and collated into subthemes. Subthemes were then sorted into overarching themes. Each theme and subtheme represented an idea or experience of children regarding the mine fire event. Interviews were independently, and then

collectively, analysed by three of the five authors. Finally, transcripts for those interviewees who scored higher than 30 on the CRIES were specifically examined for concordance of quantitative and qualitative information.

Results

Participants

2,138 students were available from the eligible grades in the 20 participating government and non-government schools across the Latrobe Valley. A final sample of 323 students completed the CRIES measure, representing an overall participation rate of 15.1%, with 25.0% from Morwell schools and 12.0% from non-Morwell schools. The 323 participants ranged from 8 (11.4%) to 16 (1.5%) years of age, included 158 (48.6%) males and 167 (51.4%) females, and 17 (5.3%) children from an Aboriginal or Torres Strait Islander background. The breakdown by school location and level (primary/secondary) has been summarised in Table 1.

Table 1: Participation rates for the student survey by school location and grade

Level	7 Morwell schools		13 non-Morwell schools		All schools	
	Eligible	Participants n (%)	Eligible	Participants n (%)	Eligible	Participants n (%)
Primary	336	105 (31.3)	578	98 (17.0)	914	203 (22.2)
Secondary	167	21 (12.6)	1057	99 (9.4)	1224	120 (9.8)
Total	503	126 (25.0)	1635	197 (12.0)	2138	323 (15.1)

For the qualitative component, almost all parents (92.8%) who provided consent for their child to complete the CRIES gave additional consent for their child to participate in an

interview. Almost half (49.0%) of these children from the selected schools were invited to do so, with 94.3% participating in the interviews, resulting in 69 completed interviews.

Quantitative Findings (CRIES results)

The results for the CRIES are shown in Table 2 with the distributions of students' CRIES total scores shown in Figure 1.

Table 2: CRIES results by location

CRIES Score	Morwell Weighted mean* (SE)	Non-Morwell Weighted mean* (SE)	Adj mean diff [^] (95% CI)	p-value
All Students	N=126	N=197		
Intrusion	6.20 (0.99)	4.10 (0.58)	0.86 (-0.24, 1.96)	0.119
Avoidance	7.18 (1.41)	5.05 (0.95)	0.26 (-1.07, 1.59)	0.682
Arousal	8.25 (0.45)	5.54 (0.56)	1.94 (0.47, 3.40)	0.013
CRIES total	21.63 (2.53)	14.70 (1.92)	3.05 (0.49, 5.62)	0.022
Primary Students	N=105	N=98		
Intrusion	7.25 (0.42)	6.21 (0.50)	1.09 (-0.20, 2.38)	0.092
Avoidance	8.83 (0.57)	8.39 (0.74)	0.53 (-1.30, 2.37)	0.548
Arousal	8.47 (0.58)	7.18 (0.63)	1.29 (-0.44, 3.01)	0.134
CRIES total	24.55 (0.95)	21.78 (1.44)	2.91 (-0.50, 6.32)	0.090
Secondary Students[†]	N=21	N=99		
Intrusion	3.07 (<0.01)	2.59 (0.29)	0.28 (-0.46, 1.03)	0.433
Avoidance	2.35 (<0.01)	2.66 (0.40)	-0.39 (-0.88, 0.10)	0.108
Arousal	7.63 (0.12)	4.37 (0.65)	2.50 (1.48, 3.51)	<0.001
CRIES total (scores 0-65)	13.05 (0.12)	9.62 (1.12)	2.39 (1.41, 3.36)	<0.001

*All weighted figures account for school clustering, stratification based on school type, and weighted according to enrolments by grade, gender and school type

[^] Adjusted for age, gender and school type.

[¥] The crude differences between weighted means are not provided as this information is potentially misleading. This is caused by unbalanced primary and secondary student proportions between Morwell and non-Morwell schools, primarily because of there being only one Morwell secondary school. The adjusted mean difference reported above compensates for this unbalance so more accurately reflects the differences between groups.

[†] SE <0.01 for Morwell weighted mean as only one Secondary school

Figure 1. Distribution of students' CRIES total scores categorised by school location and school level.

When Primary and Secondary students were combined, Morwell students reported significantly higher CRIES total scores (mean diff 3.05, 95% CI 0.49-5.62, $p=0.022$), and Arousal scores (mean diff 1.94, 95% CI 0.47-3.40, $p=0.013$), than non-Morwell students. Similarly, when the subgroup of Secondary students were assessed alone, Morwell students again achieved significantly higher CRIES total scores (mean diff 2.39, 95% CI 1.41-3.36, $p=0.001$), and Arousal scores (mean diff 2.50, 95% CI 1.48-3.51, $p=0.001$), than non-Morwell students.

While the distribution of CRIES total scores illustrated in Figure 1 highlights that students most commonly scored at the lower end of the scale, it is apparent that students from Morwell schools and at the primary school level had a tendency to score somewhat higher. Importantly, whilst other comparisons shown in Table 2 did not reach statistical significance, all were in the direction of higher scores amongst Morwell students, relative to non-Morwell students, with the exception of Avoidance in Secondary students. Whilst the differences in CRIES scores between grades were not statistically analysed, it is apparent that the primary school aged students consistently scored higher than secondary students, regardless of location.

Qualitative Findings

As indicated above, the interviews sought to examine the initial and ongoing (longer-term) impacts of the smoke event on children. It was apparent that there was a diversity of responses, with a number of children reporting minimal impacts, if any, and others reporting impacts at the time and ongoing. The following details themes arising from the interviews which were structured to parallel the CRIES subscale structure in terms of intrusive thoughts, avoidant behaviours, and increased arousal.

Intrusive thoughts

Participants reported experiencing intrusive recall of the event with one participant reporting that, “every time I try and forget about it, it just pops back into my head” (Male, 10). Another suggested that she is occasionally reminded of the event when it is a hot day and there is smoke around and when her mother drives her past the mine and she sees the blackened trees (Female, 11). Another said ‘I just think about it every now and then. I don’t really stop thinking about it.’ (Male, 11). Another reported still dreaming about the fire, ‘whenever I fall asleep I sometimes have dream about the fire and that happening so I can’t go to sleep’ (Female, 9). She also said that ‘I’m normally very good at concentrating and that, but since the fires I have trouble trying to concentrate on my work’

Avoidance behaviours

Many participants reported employing avoidance techniques at the time of the event to cope with their circumstance and how they were feeling. A considerable number were still employing this strategy to manage their longer-term experience of the event. One child suggested that when thoughts do pop into her mind she distracts herself from the thoughts by engaging in activities such as, ‘colour in, read a book, or listen to music, or just go and talk with my family – talk about one of my TV shows or stuff that we’re going to do on the weekend. And it sort of goes out of my mind because I’m thinking of what we’re going to do on the weekend’ (Female, 11). An adolescent reported using similar strategies, ‘sometimes it means I avoid watching the news or just do activities that get my mind off it’ (Female, 13). One child suggested drinking water to ‘extinguish’ the thoughts ‘I just forget about it, drink of water because that will extinguish it... I just drink water and think to myself it’s going to extinguish the fire if I drink water’. (Female 13).

This tendency to avoid thinking about the event manifested itself in the interviews themselves, with some children indicating during interview that they did not want to talk any

more about the event. One girl indicated that it's in the past and she doesn't want to and doesn't talk about it, 'it's a long time ago – it's passed. It's in the past ... I just try to not think about it' (Female, 9). Another child said, 'I don't want to think about it 'cos probably the memories are gonna come back' (Male, 14).

Increased arousal

While many participants did not report being more aroused since the event, there were a considerable number who described thoughts or behaviours indicative of hyperarousal. One child explained that he gets headaches when he thinks about it 'Because I get headaches when I think about it because of all the smoke' (Male, 11). One of the adolescents said she sometimes has difficulties paying attention when she is thinking about the fire and that she is on the lookout more since the event, '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' (Female, 15). Another child stated that since the event she can't get to sleep, she used to sleep very well at night but now she dreams about the fire and reported having difficulty distinguishing the dream from waking reality, 'you are like laying down and then you are like what the heck when you wake up – then you just look out the window and it's like oh good' (Female, 9). Another child indicated that she was not so worried for herself but when she thinks about what happened to her mum and family this makes her upset, 'just the word, it pops into my head and it's like, "Oh no, I remember what happened to my mum, to my family, and it just makes me sort of upset"' (Female, 11). Another child reported actively trying to prevent future fires, '...ever since last year, oh actually 2 years ago ...just looking out for any trees or glass in a tree, and I pick it up... bottles that can magnify the sun's rays and start a fire' (Male, 14).

Mixed-Method comparison between CRIES survey and interview findings

In order to look at the concordance between the responses to the CRIES and the interviews, the interview transcripts of all 13 students who scored above the cut-off of 30 and who participated in the interviews on the CRIES were subjected to further analysis. There was reasonably clear concordance between the responses to the survey and issues reported during the interview. All had vivid memories of the event and reported some form of ongoing impacts. All but two students reported symptoms from two or more of the PTSD domain areas of hyperarousal, intrusive thoughts and avoidance behaviours. Of the two reporting fewer symptoms, one did say that he did not want to think about it and was resistant to further probing in the interviews so his verbal responses may reflect avoidance rather than lack of an impact. One high scoring student was excluded from this mixed method comparison because it was apparent at interview that she was from a non-English speaking background and struggled to comprehend the interview questions, bringing into question the accuracy of her responses to the CRIES survey. A number of students talked about the intersection between the event and pre-existing issues, such as mental health diagnoses, family breakdowns and health issues, highlighting the importance of understanding the impacts of the Hazelwood event within the context of existing stressors.

Discussion

This study explored the impacts of the Hazelwood smoke event on children and adolescents, comparing students in schools in the most exposed community (Morwell) with those from less exposed schools located elsewhere in the Latrobe Valley region. Participants from Morwell schools reported higher overall distress compared to participants from less exposed schools. Of particular note were increases in total CRIES and Arousal subscale symptoms in 'all' Morwell students and Morwell secondary students, whereas younger

students, regardless of location, had higher CRIES scores than their secondary school counterparts.

The finding that age was associated with distress level, with younger students having higher CRIES scores regardless of their proximity to the event, adds to the somewhat contradictory research literature to date. The stronger age effect in this instance may reflect the unusual nature of the Hazelwood event, where the response may have been more to do with fear and concern (of both parent and child) in relation to a perceived threat, rather than to direct physical harm or property loss. Older children, perhaps, are better able to process the multiples sources of information (including from family, teachers, and the local media) in order to assess their personal risk level. This is supported by the Pfefferbaum et al. (2000) finding that the level of distress experienced by primary-aged children was influenced by their exposure to media about the event. This increased potential for distress in younger children highlights the need to provide targeted support to these younger groups to help them understand, including providing them with age-appropriate information about the event and access to appropriate mental health programs.

The average CRIES score reported here for Morwell students (21.63) is lower than levels reported for children impacted by previous traumatic events or from clinically referred samples such as 37.8 and 42.48 for two clinical samples (Perrin et al., 2005; Verlinden et al., 2014), 25.76 for the Wenchuan earthquake in China (Wang et al., 2012), 27.84 for a major Chinese debris flood (Chen, Zhang, Liu, Liu, & Dyregrov, 2012), and 29.87 for children of parents with acquired brain injury (Kieffer-Kristensen et al., 2011). Two of the above studies provided CRIES averages for mildly traumatic exposures which are more comparable to the current study at 21.3 (Perrin et al., 2005) and 21.53 (Wang et al., 2012), suggesting that the Hazelwood event was equivalent to other mild exposures. While the average score for Morwell students was indicative of mild exposure, there was considerable variation in

individual responses to the event, with approximately one quarter of students scoring above the previously published cut-off of 30 found to be indicative of PTSD (Perrin et al., 2005).

The qualitative findings from the current study provided the opportunity to shed more light on the individual experiences of the students, by allowing a more detailed examination of their experiences. Like the survey results, it was clear that there was a diversity of responses in the interviews with some students reporting little or no impacts and others talking about ongoing issues. The interview schedule was structured in parallel with the CRIES, including questions specifically about intrusive thoughts, avoidant behaviours and hyperarousal. There was clear concordance between the interviews and survey with some students talking about intrusive thoughts such as dreaming about the event, ways to avoid thinking about the event (such as not watching the news or distracting themselves with other activities, and increased arousal, especially on hot days or when smoke is evident.

A clear theme from the qualitative analysis was the role of adults in moderating the impact of the event, with students talking about the important role of parents, teachers and others in providing reassurance and safety – perhaps countering any alarm generated by media stories and other coverage of the event. In contrast, where parents struggled to cope with the event, this distress was reported to have been passed on to their children.

This concordance between the qualitative and quantitative components of the study in terms of the diversity of responses and the types of impacts experienced provides considerable strength to the study – giving confidence that student's response to the survey were consistent with the qualities of their experience. To better assess this, we conducted a targeted mixed methods analysis of 13 students scoring above CRIES cut-off of 30 for likely PTSD diagnosis (Perrin et al., 2005), with all 13 talking about responses from at least one of the three PTSD symptom clusters assessed by the CRIES, and ten reporting two or more. Also apparent from this targeted analysis was the potential for existing factors such as prior

mental health issues, traumatic exposures, and family issues to influence how students responded to the event – with some talking about an increased impact of the event. It is important that any analysis of the impacts of a community-wide event take into consideration the existing characteristics of the community, with McFarlane and Williams (2012) noting that it is “important to have an overview of the wider panoply of risks and effects...” (p. 4), particularly with reference to things such as pre-existing mental health conditions, traumatic exposures or social problems.

Limitations

The overall participation rate for the study was 15% with 25% from those in Morwell schools. This means that we did not have access to almost 85% of students, and raises the possibility that the sample is biased. Having said this, the participation rate is comparable to previous studies of students in disaster-impacted communities which range from 15-22% (Pullins, McCammon, Lamson, Wuensch, & Mega, 2005; Salloum & Overstreet, 2012), and comparable to other research recruiting students via schools where active parental consent is required (Stein et al., 2007). These response rates possibly reflect the competing pressures between the ongoing impacts of the event and the common wish to move beyond the event. In addition, anecdotal evidence suggests that the lower participation rate outside of Morwell was due, in part, to the event not being seen as significant for those localities.

Older students were less likely to participate than their younger counterparts, with participation rates dropping from 22.2% in primary students to 9.8% in secondary students. This was due in part to there only being one government and no non-government secondary schools in Morwell, with considerable numbers of students having to attend schools in other townships, where, as noted above, the impact of the event was less salient. It is also

consistent with other disaster research recruiting students via schools where older students were less likely to participate (Pullins et al., 2005).

Conclusions

It is clear from these combined results that the Hazelwood smoke event was a distressing event for many and continues to trouble some students almost two years later. As noted above, approximately one quarter of the children scored above a previously published CRIES cut-off for possible PTSD (Perrin et al., 2005) and these children were reporting ongoing impacts in the interviews. This finding lends support to the belief held by many in the community about the severity of the event and the level of concern raised. The findings here suggest that the Hazelwood event could be considered a moderate exposure event that was comparable to other events without lethal outcomes such as the Pfefferbaum et al. (2000) study. This highlights the need for emergency and public health responses to future events which are seen as less severe, including those with unclear health outcomes, to recognise and respond to potential distress in the community, particularly in younger age groups.

The use of the CRIES measure made it possible to compare the level of psychological impact associated with the Hazelwood event to other more traditional disaster events and highlights the importance of using consistent and validated measures across different studies. Much of the earlier research made use of earlier variants of the scale including the adult variants, making comparison to these earlier studies more challenging. It is important that research going forward continues to use measures that enable comparisons with previous events.

While the current study provides evidence of moderate distress in school-aged children some 1.5-2 years after the Hazelwood smoke event, it is important to recognise that this is just one point in time. It is important to follow up with these students to monitor

changes over time, with research showing that long-term effects from disaster events occurring 20 years after the event (McFarlane & Van Hooff, 2009). Ongoing monitoring of the cohort has the potential to provide a hugely informative and unique body of data that will inform future emergency responses.

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